LOVE DESIGN STUDIO

November 2022

Land West of Thaxted Road, Saffron Walden

Energy and Sustainability Statement

Contents

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Section Zero

0 Executive Summary

Executive Summary

An assessment of the site's sustainability and energy credentials has been carried out to support an outline planning application for the Land West of Thaxted Road, Saffron Walden.

The proposed scheme involves the development of the site for up to 170 dwellings, associated landscaping and open space, with access from Thaxted Road.

The energy strategy follows the energy hierarchy; avoiding unnecessary energy use, use energy more efficiently, use renewable energy, and offset emissions, as per the Energy Efficiency and Renewable Energy Supplementary Planning Document (2007).

The proposed energy strategy capitalises on passive design measures to maximise the fabric energy efficiency and energy demand. The scheme will benefit from Mechanical Ventilation with Heat Recovery to minimise heat losses. The scheme should then makes use of Air Source Heat Pumps (ASHPs) for space heating and domestic hot water. Heat-pump solutions for space heating and hot water will remove the need for on-site combustion.

The scheme could look to utilise window reveals, balconies and external shutters where feasible, to reduce the requirement for active cooling.

The proposed energy strategy has been set out within this report and the scheme is currently demonstrating a combined on-site regulated **CO_2 reduction of 59%** (Part L 2021 Baseline).

The site-wide results summary for the carbon emissions are set out on this page. Further detail may be found in the body of the report.

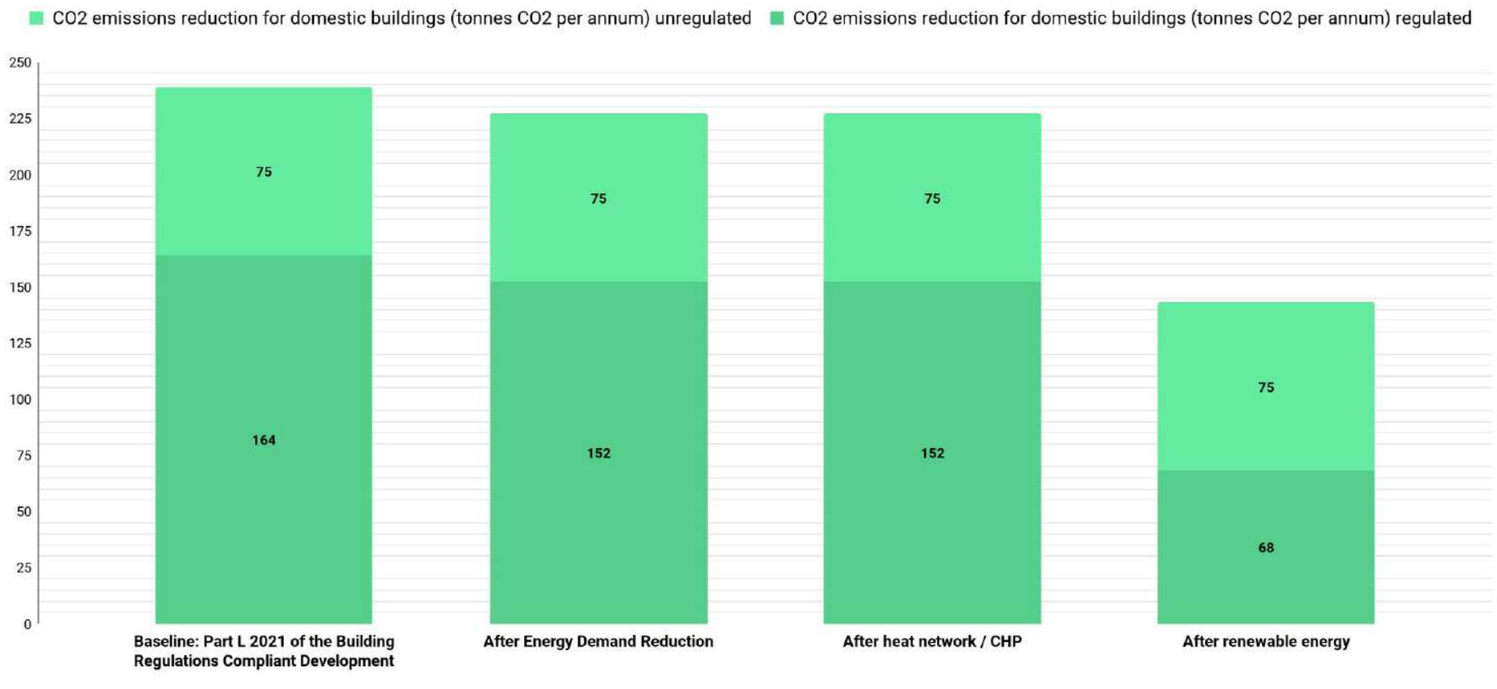

Figure 1: Total site-wide savings at each stage of the energy hierarchy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	13	8%
Savings from heat network / CHP	0	0%
Savings from renewable energy	84	51%
Cumulative savings	**97**	**59%**

Table 1: Total site-wide savings at each stage of the energy hierarchy

Emissions within this report are based on the following CO_2 emission rates:

- Natural Gas 0.210 kgCO_2/kWh
- Grid electricity 0.136 kgCO_2/kWh

These represent the SAP 10.2 carbon factor figures. For the assessment of demand reduction measures (Be Lean stage) space heating and domestic hot water is assumed to be from gas boilers with an 89.5% efficient gas boiler, to standardize a benchmark target. However, the Be Green stage of the energy hierarchy results considers ASHPs as an alternative method for space heating and hot water.

Section One

1 Introduction

Site Overview

Love Design Studio have prepared this Energy and Sustainability Statement to support and outline planning application for the Land West of Thaxted Road, Saffron Walden, comprising the development of the site for up to 170 dwellings, associated landscaping and open space, with access from Thaxted Road.

The purpose of this statement is to outline the potential sustainability credentials of the scheme and demonstrate the alignment of the proposed energy strategy with relevant national, regional and local planning policy requirements.

FIgure 2: Site boundary (Red)

Planning Policy - National

National Planning Policy Framework (2021)

The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.

Planning law requires that applications for planning permission be determined in accordance with the development plan unless material considerations indicate otherwise. The National Planning Policy Framework must be considered in preparing the development plan and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.

The purpose of the planning system is to contribute to the achievement of sustainable development. In summary the framework advises:

"Plans should take a proactive approach to mitigating and adapting to climate change, considering the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

New development should be planned for in ways that:

- *Avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and*
- *Can help to reduce greenhouse gas emissions, such as through its location, orientation, and design. Any local requirements for the sustainability of buildings should reflect the government's policy for national technical standards.*

To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- *Provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);*
- *Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and*
- *Identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.*

Planning Policy - Local

Uttlesford District Council

The Local Planning Authority, Uttlesford District Council, have a statutory guide to development within the borough and use policies and guides to do so. The current development framework within Uttlesford is comprised of the Local Plan (2005) and various Supplementary Planning Documents (SPD); those of which relevant to energy and sustainability will be discussed below. The Local Plan documents include a variety of overarching spatial policies to guide future development and land use in the District and have full weight in the determination of planning applications.

Furthermore, Uttlesford District Council declared a climate and ecological emergency in 2019 and has committed to become net-zero carbon by 2030. The Council is therefore committed to mitigating carbon emissions throughout the area.

The policies and requirements of new development within the borough which relate to this proposal, found in the Local Plan (2005), Energy Efficiency and Renewable Energy SPD (2007) and Interim Climate Change Planning Policy (2021) are expanded on in the following sections.

Local Plan (2005)

The Local Plan is the principal planning document that sets out the vision, spatial strategy and core policies that are used for shaping future development in Uttlesford. The Local Plan document does not stipulate any CO2 reduction targets; therefore. other documents that form part of the Local Plan will be relied upon to achieve compliance in this report.

The scheme will look to adhere to the following policies pertaining to sustainability:

- Policy GEN2 – Design
- Policy GEN3 – Flood Protection
- Policy ENV10 - Noise Sensitive Development and Disturbance from Aircraft
- Policy ENV11 - Noise Generators
- Policy ENV12 –Protection of Water Resources
- Policy ENV13 – Exposure to Poor Air Quality
- Policy ENV14 – Contaminated Land
- Policy ENV15 - Renewable Energy

Energy Efficiency and Renewable Energy - Supplementary Planning Document (2007)

This SPD is intended to support the Local Plan. It sets targets and guidance for new residential and commercial development to achieve regarding energy efficiency and low carbon / renewable energy.

A key target that this scheme will adhere to is following the energy hierarchy:

1) Avoiding Unnecessary Energy Use - maximise passive design
2) Use Energy more Efficiently - good building fabric and energy efficient appliances
3) Use Renewable Energy - incorporate low-carbon and/or renewable energy sources
4) Offsetting Emissions - developers should seek to offset the emissions from their development via an offsetting contribution that would be put towards decarbonising the existing building stock

Sustainable Standards for New Development

Following the adoption of the Essex Urban Place Supplement and the Energy Efficiency and Renewable Energy SPD, both in 2007, Uttlesford published a ‘Sustainability Standards for New Development’ in 2009 that sets out key energy and sustainability policies that new developments must adhere to.

The requirements relevant to the proposed scheme are listed below:

- Code for Sustainable Homes level 3 (or equivalent)
- 100% of a development’s annual energy needs are met by on-site renewable or low-carbon technologies for development sites (or combination of adjacent development sites) over 50ha

It is worth noting that although the Code for Sustainable Homes (CfSH) was scrapped in 2016, this scheme will still employ key principles of the CfSH with an objective of demonstrating its proposed sustainability credentials.

Planning Policy - Local

Interim Climate Change Planning Policy

Following the declaration of a climate and ecological emergency in 2019, Uttlesford District Council published their 'Interim Climate Change Planning Policy' to bridge the gap between the existing Local Plan (2005) and a new local plan which is undergoing consultation.

Although this policy document is non-binding, considerations regarding the energy and sustainability criteria contained in Interim Policies 1-12 of the document have been made.

In particular with the following recommendations under Interim Policy 12 have been acknowledged:

- Code for Sustainable Homes Level 4 (or equivalent)
- At least 19% reduction on the dwelling emission rate (DER) against Target Emission Rate (TER) as defined in the 2013 Building Regulations
- Mitigate indoor air quality issues and overheating risks

Section Two

2 Energy

Methodology and Assumptions

The scheme looks to meet operational energy targets, in reference to the Energy Efficiency and Renewable Energy Supplementary Planning Document (2007):

1. Avoiding Unnecessary Energy Use - maximise passive design
2. Use Energy more Efficiently - good building fabric and energy efficient appliances
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On the 15th June 2022, Part L (2013) Building Regulations were replaced by Part L (2021). The aim of this update is to improve the energy efficiency of new buildings. Some of the changes are listed below:

- 31% lower CO2 emissions required under part L (2021) in comparison to its 2013 counterpart
- Air tightness testing now mandatory
- Improvements to thermal bridging and building fabric targets

To achieve compliance with Part L 2021, the following assumptions, definitions, and methodology have been applied:

- SAP compliant software has been used to calculate the domestic carbon dioxide emissions for the scheme using SAP 10.2 carbon factors
- Completed checklists at this stage represent anticipated targets, post-construction testing will be required to confirm airtightness, ventilation and thermal bridging.
- Building fabric will be selected based on the U-values provided by the manufacturer to achieve a high level of building efficiency.
- Renewable technology, for the purpose of the report, includes for the provision of low carbon technologies, including heat-pump technology and photovoltaic solar panels.
- Drawings used to model the scheme are based on information received from KIER on 30th September 2022.
- A full copy of the SAP calculations is contained in the appendices

Passive Design

Passive Design Measures Summary

Overleaf sets out the inputs used for the SAP and SBEM calculations to generate carbon emission reduction findings.

In summary, the scheme benefits from:

- Being airtight, reducing draughts and heat loss.
- A well-insulated building fabric shell.
- Mechanical Ventilation with Heat Recovery, Approved Installer
- 100% efficient lighting.

For the assessment of demand reduction measures space heating and domestic hot water is assumed to be from a gas boiler, to standardise a benchmark target. However, the subsequent sections of this report have set out an alternative method for space heating and hot water as a preferred solution.

The proposed scheme Dwelling Fabric Energy Efficiency score will provide an improvement on the Target Fabric Energy efficiency score under Part L (2021) Building Regulations.

See appendix A for the full proposed passive design considerations.

Table 2: SAP Model inputs

Whole Scheme Technical Information			
Building Fabric	**Input**	**Unit**	**Comment**
External Wall U-value	0.14	W/m²K	Include unheated areas
Roof U-value	0.10	W/m²K	-
Ground Floor U-value	0.10	W/m²K	-
Windows U-value	1.2	W/m²K	-
Doors U-Value	1.0	W/m²K	-
Technical Information			
Building Fabric	**Input**	**Unit**	**Comment**
Windows g-value	0.50	-	-
Frame-Factor	0.7	-	-
Thermal Mass Parameter	Medium (250 kJ/m²K)		Default value
Thermal Bridge Y-value	<0.1	-	Thermal Bridging calculations to be carried out Post-Planning.
Ventilation Method	Nuaire MRXB0XAB-EC03		Mechanical Ventilation with Heat Recovery, Approved Installer
Air permeability	3.0 @50Pa ($m^3/(h.m^2)$)		A low air permeability required to improve MVHR efficiency

Table 3: Scheme overheating mitigation measures

Overheating Mitigation Measures	
1. Minimising Internal Heat	Pipe lengths minimised, insulated pipework.
2. Reducing heat entering	Balconies, internal blinds, ~300mm window reveals, shutters
3. Use of thermal mass	-
4. Passive ventilation	Openable windows, dual aspect where possible
5. Mechanical Ventilation	Mechanical Ventilation with Heat Recovery, Approved Installer
6. Active cooling	None

Heating Infrastructure

Heating Infrastructure

Once demand for energy has been minimised, planning applications should demonstrate how their energy systems will exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly to reduce CO_2 emissions.

As well as carbon dioxide emissions, all combustion processes can emit oxides of nitrogen (NO_x) and solid or liquid fuelled appliances (such as those using biomass or biodiesel) can also emit particulate matter. These pollutants contribute to poor air quality and can have negative impacts on the health of residents and occupants of the development. It is important that these impacts are considered in determining the heating strategy of a development.

As stated in the Energy Efficiency and Renewable Energy Supplementary Planning Document, heat networks are most suitable for large mixed use developments that have constant energy demand throughout the day. However, this current scheme is residential only.

In consideration of the above, individual efficient space heating and domestic hot water systems are advised. Therefore, there are no CO_2 savings at this stage of the energy hierarchy.

Existing Networks, Planned Networks and Supplying Heat Beyond the Site Boundary

Where a heat network exists in the vicinity of the proposed development, the applicant should look to prioritise connection and provide evidence of active two-way correspondence with the network operator.

Applicants should investigate the potential for connecting the development to an existing heat network system by contacting the local borough, local heat network operators and nearby developments.

If there is not an existing network, the applicant must investigate whether a network is being planned for the area. Applicants should also investigate opportunities for expanding their heat network to supply heat to local developments and buildings outside the boundaries of their site, particularly if this has the potential to facilitate an area-wide heat network.

Renewable Energy

Renewable Energy

Energy assessments should explain how the opportunities for producing, storing, and using renewable energy on-site will be maximised.

The capacity for renewable technologies at the proposed site has been discussed with the wider design team. The following technologies were considered:

- Biomass
- Air Source Heat Pumps (ASHPs)
- Ground Source Heat Pumps (GSHPs)
- Photovoltaic Solar Panels
- Solar Thermal Hot Water
- Wind Technology

Of the above technologies it was decided that ASHPs are the most feasible and applicable for the proposed scheme. A summary of the chosen technology is set out in the following sections.

Photovoltaic solar panels are also a preferred on-site renewable generation technology as electricity is off-set on-site and can be utilised by the tenants themselves.

The proposed scheme will benefit from roof areas that are predominantly south and/or south west facing, making it suitable for PV panels. However, this is to be further reviewed at the point of a full planning application submission, including details of the potential amount of carbon that could be offset on-site from the installation of Solar Panels.

A summary of the input details is set out on this page for reference use.

Table 4: Area-weighted Fabric Energy Efficiency ratings for the scheme

Technical Information		
Domestic Be Green Stage		
Space Heating System	Individual ASHPs	175.1% default efficiency, MCS certified
Heating Emitter	Underfloor	-
Domestic Hot Water System	Same as space heating	-
Storage	Yes	~180 litres, 80mm foam insulation
Space Cooling System	No	-
Low/Zero Carbon Technologies used	ASHPs	175.1% default efficiency, MCS certified
	Photovoltaic Solar Panels	To be considered at later design stage

Renewable Energy

Air Source Heat Pumps (ASHPs)

Where heat pumps are proposed, a high specification of energy efficiency will be expected to ensure the system operates efficiently and to reduce peak electricity demand. This applies to any type of heat pump proposals including ASHPs, ground source heat pumps (GSHPs), water source heat pumps (WSHPs) or hybrid and ambient loop types of systems.

The details of the ASHPs will be provided at the detailed design stage; therefore, conservative efficiencies have been used for the purpose of this report based on default SAP figures for the residential uses.

Specifically, for ASHPs, evidence that the heat pump complies with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) product criteria are typically required for the relevant ASHP technology as well as evidence that the heat pump complies with other relevant issues as outlined in the Microgeneration Certification Scheme Heat Pump Product Certification.

Refrigerant pipe-runs will be minimised and will be in accordance with the specific supplier guidance. Individual ASHPs have been proposed for this site. As such, a fully insulated hot water cylinder should be supplied.

As this is an outline application details regarding the location of the condensers have been omitted, however, in accordance with standard practice it is likely that the condensers will be located on flat roofs where available, or externally to the rear of each dwelling. In any event, the condensers will be situated as far away from any sensitive noise receptors as the site allows.

Further detail will be mapped out at the detailed design stage.

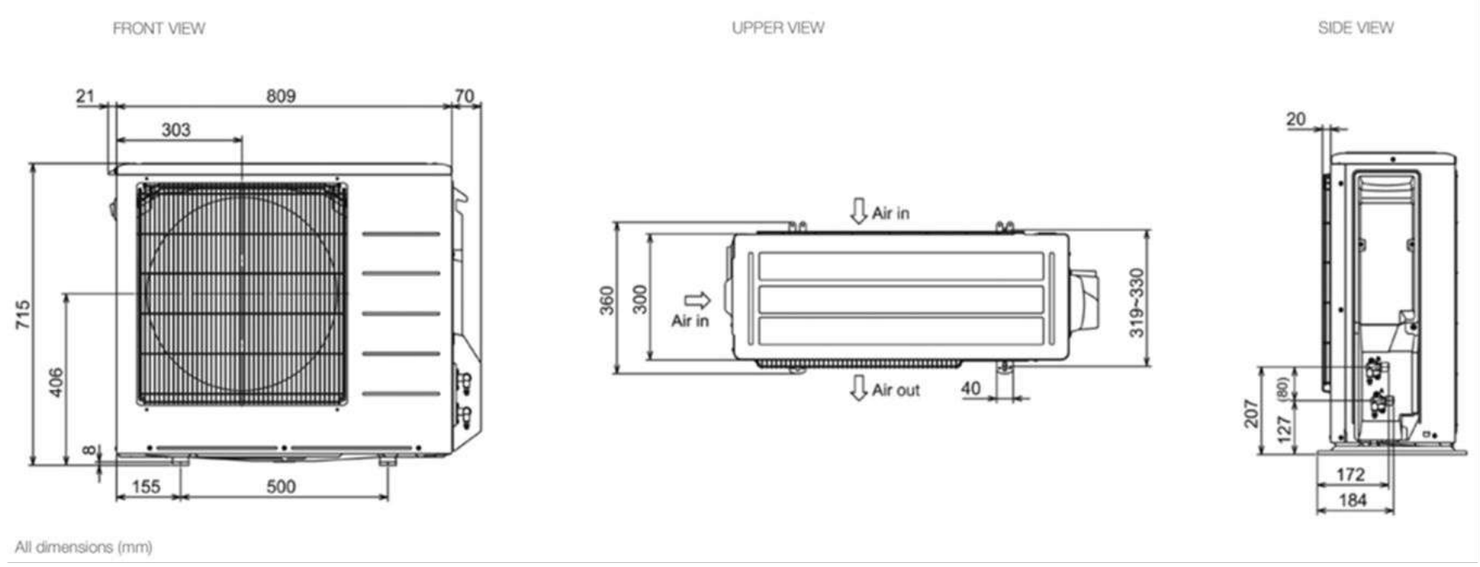

Figure 4: ©Mitsubishi QUHZ-W40VA example dimensions

Carbon Emission Results Summary

The overall energy strategy capitalises on passive design measures to maximise the fabric energy efficiency and energy demand.

Following the energy hierarchy process, the applicant has opted for an individual ASHP solution per dwelling for space heating and domestic hot water and mechanical ventilation with heat recovery.

Overall. the scheme meets a combined on-site regulated **CO_2 reduction of 59%** (Part L 2021 Baseline).

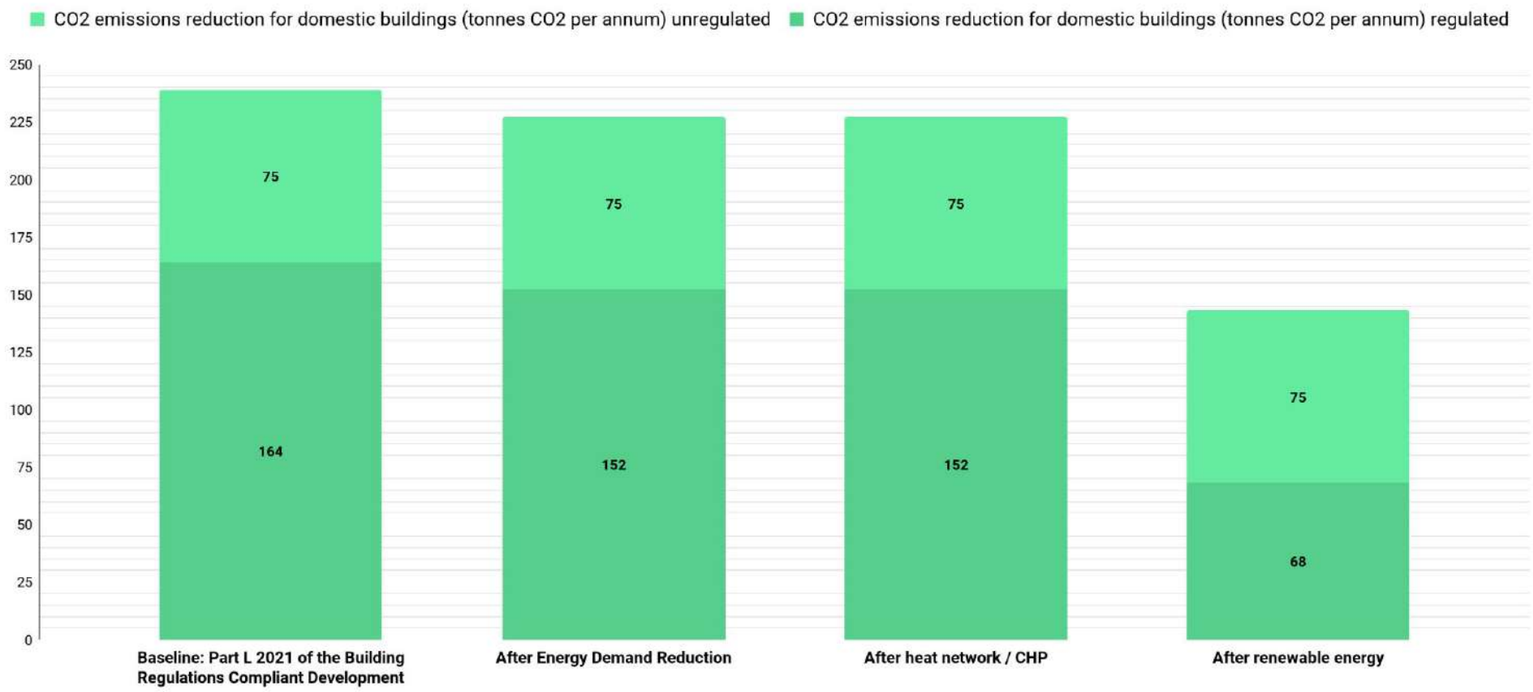

Figure 6: Total site-wide savings at each stage of the energy hierarchy

Table 5: Carbon dioxide emissions after each stage of the Energy Hierarchy for domestic buildings (SAP 10)

	Carbon dioxide emissions from domestic buildings (tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	164	75
After energy demand reduction	152	75
After heat network / CHP	152	75
After renewable energy	68	75

Table 6: Total site-wide savings at each stage of the energy hierarchy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	13	8%
Savings from heat network / CHP	0	0%
Savings from renewable energy	84	51%
Cumulative savings	**97**	**59%**

Section Three

3 Sustainability

Sustainability and Climate Change Appraisal

The following section sets out the sustainability credentials of the scheme in similar format to that of the, now defunct, Code for Sustainable Homes.

In a statement made on 25 March 2015, the Secretary of State for Communities and Local Government, Eric Pickles, confirmed that from 27 March 2015, changes to the 2008 Climate Change Act would mean local authorities in England could no longer require code level 3, 4, 5 or 6 as part of the conditions imposed on planning permissions. Applicants should work towards to the relevant Building Regulations standard; however, energy requirements for dwellings in the UK are now typically set by the Building Regulations equivalent to code level 4.

For the purpose of this assessment, we have used the Code as a method for assessing and demonstrating the residential part of the scheme's sustainability credentials and summarised the scheme's aspirations against each category.

Energy Display Devices

The scheme will be provided with the ability to display energy consumption data and record energy use; this is to promote the specification of equipment to display energy consumption data, thus empowering dwelling occupants to reduce energy use.

Drying Space

To promote a reduced energy means of drying clothes. Space will look to be made available for the ability to dry clothes to avoid utilising heat energy.

Energy Labelled White Goods

Where white goods will be provided, the scheme will look to have them classified as energy efficient with at least an A-rating, where feasible. This is to promote the provision or purchase of energy efficient white goods, thus reducing the CO_2 emissions from appliance use in the dwelling.

External Lighting

All external space lighting, including lighting in common areas, will be provided by dedicated energy efficient fittings with appropriate control systems in-line with Building Regulations standards; this is to promote the provision of energy efficient external lighting, thus reducing CO_2 emissions associated with the dwelling.

The external lighting will also be designed to minimise lightspill to hedgerows or other foraging habitats.

Cycle Storage

Cycle parking should be provided for each dwelling, for example, within garden sheds or garages for the houses and cycle stores for the apartments. This is to promote the wider use of bicycles as transport by providing adequate and secure cycle storage facilities, thus reducing the need for short car journeys and the associated CO2 emissions.

Sustainable Transport

The development will look to provide direct and safe pedestrian and cycle paths from the site to the local area. Located to the east of the site are existing bus stops along Thaxted Road that provide regular bus services to nearby towns. As part of the development, access to the bus stop and, through contributions, improvements to the bus service are proposed.

New residents will also be supplied with a guide containing information of travel routes to encourage sustainable transport.

Home Office

The scheme should promote working from home by providing occupants with the necessary space and services, thus reducing the need to commute.

Sustainability and Climate Change Appraisal

Water and Surface Water Run-Off

Indoor Water Use

The water consumption targets for the dwellings will be 110 l/p/day, as prompted in the interim climate change policy. Consumption of potable water should be reduced in the home from all sources, including borehole well water, using water efficient fittings, appliances, and water

External Water Use

Space should be made available for the provision of water butts in private amenity spaces; this is to promote the recycling of rainwater and reduce the number of mains potable water used for external water uses.

Management of Surface Water Run-off from Developments

It is proposed that hard landscaping will be minimised and permeable surfaces maximised to reduce surface water run-off.

Flood Risk

Saffron Walden has been identified as a Tier 2 area of local flood risk by the Lead Local Flood Authority due to its surface water risk and flood history. To minimise flood risk as a major development, the scheme will incorporate appropriate SuDS measures and closely follow guidance within the Uttlesford Strategic Flood Risk Assessment (2016).

Materials

Environmental Impact of Materials

To specify materials with lower environmental impacts over their life cycle; where feasible, key elements of the building Envelope will achieve an equivalent rating of A+ to D in the 2008 version of The Green Guide:

- Roof
- External walls
- Internal walls (including separating walls)
- Upper and ground floors (including separating floors)
- Windows.

Responsible Sourcing of Materials - Basic Building Elements

To promote the specification of responsibly sourced materials for the basic building elements; materials in the following Building Elements will be responsibly sourced:

a) Frame
b) Ground floor
c) Upper floors (including separating floors)
d) Roof
e) External walls
f) Internal walls (including separating walls)
g) Foundation/substructure (excluding sub-base materials)
h) Staircase

Responsible Sourcing of Materials - Finishing Elements

To promote the specification of responsibly sourced materials for the finishing elements; materials in the following Finishing Elements will be responsibly sourced:

a) Staircase
b) Windows
c) External & internal doors
d) Skirting
e) Panelling
f) Furniture
g) Fascias
h) Any other significant use

Sustainability and Climate Change Appraisal

Waste

Storage of Non-recyclable Waste and Recyclable Household Waste

The scheme should provide adequate internal and external storage space for non-recyclable waste and recyclable household waste. Space for recycling containers will:

- be located in an adequate external space
- be sized according to the frequency of collection, based on guidance from the
- recycling scheme operator
- store recyclable waste in identifiably different bins

Construction Site Waste Management

A compliant Site Waste Management Plan (SWMP) should be carried out setting out target benchmarks for waste, procedures for minimising hazardous waste and monitoring/measuring/reporting of hazardous and non-hazardous waste groups; this is to promote resource efficiency via the effective and appropriate management of construction site waste.

The SWMP should look to include procedures to sort and divert waste from landfill, through either:

a. Re-use on site (in situ or for new applications)
b. Re-use on other sites
c. Salvage/reclaim for re-use
d. Return to the supplier via a 'take-back' scheme
e. Recovery and recycling using an approved waste management contractor
f. Compost

according to the defined waste groups (in line with the waste streams generated by the scope of the works).

Composting

Space for individual home composting facilities should be provided to promote the provision of compost facilities to reduce the amount of household waste sent to landfill.

Pollution

Global Warming Potential (GWP) of Insulants

To promote the reduction of emissions of gases with high GWP associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials; where feasible, insulating materials in the elements of the dwelling listed below will have a low GWP (in manufacture AND installation):

- Roofs: including loft access
- Walls: internal and external including lintels and all acoustic insulation
- Floors: including ground and upper floors
- Hot water cylinder: pipe insulation and other thermal stores
- Cold water storage tanks: where provided
- External doors

NOx Emissions

To promote the reduction of nitrogen oxide (NOX) emissions into the atmosphere; there will be no combustion boilers provided on-site within the dwellings.

Health and Wellbeing

Daylight

Living/kitchen spaces will look to meet at least a 1.5% Average Daylight Factor (ADF) and bedrooms meet at least a 1% ADF, where feasible; this is to promote good daylighting and thereby improve quality of life and reduce the need for energy to light the home.

Sound Insulation

Building materials will be chosen as such to improve the sound insulation between dwellings and to the main road; in-line with BS8223; this is to promote the provision of improved sound insulation to reduce the likelihood of noise complaints from neighbours.

Private Space

The scheme will look to improve quality of life by promoting the provision of an inclusive outdoor space which is at least partially private outdoor space (private or semi-private) has been provided that is:

- Of a minimum size that allows all occupants to use the space.
- Provided with inclusive access and usability.
- Accessible only to occupants of designated dwellings.

Sustainability and Climate Change Appraisal

Management

Home User Guide

The scheme will look to provide a Home User Guide to the owner/tenants prior to handover to promote the provision of guidance enabling occupants to understand and operate their home efficiently and make the best use of local facilities.

Considerate Constructors Scheme

There is a commitment to meet best practice under a nationally or locally recognised certification scheme such as the Considerate Constructors Scheme; this is to promote the environmentally and socially considerate, and accountable management of construction sites.

Construction Site Impacts

To promote construction sites managed in a manner that mitigates environmental impacts; where feasible, there will be procedures that will typically cover one or more of the following items:

- Monitor, report and set targets for CO_2 production or energy use arising from site activities
- Monitor and report CO_2 or energy use arising from commercial transport to and from site
- Monitor, report and set targets for water consumption from site activities
- Adopt best practice policies in respect of air (dust) pollution arising from site activities
- · Adopt best practice policies in respect of water (ground and surface) pollution occurring on the site

Where feasible, 80% of site timber is reclaimed, re-used or responsibly sourced

Security

The principles of Secure by Design should be carried out for the scheme, to promote the design of developments where people feel safe and secure- where crime and disorder, or the fear of crime, does not undermine quality of life or community cohesion.

Ecology

To minimise reductions and promote an improvement in ecological value and enhance the ecological value of the site, the scheme will look to promote:

- development on land that already has a limited value to wildlife, and discourage the development of ecologically valuable sites.
- the protection of existing ecological features from substantial damage during the clearing of the site and the completion of construction works.
- the most efficient use of a building's footprint by ensuring that land and material use is optimised across the development.

Ecological surveys have been conducted to demonstrate that the proposed development has no significant ecological constraints.

Section Four

4 Conclusion

Conclusion

An assessment of the site's sustainability and energy credentials has been carried out to support an outline planning application for the Land West of Thaxted Road, Saffron Walden.

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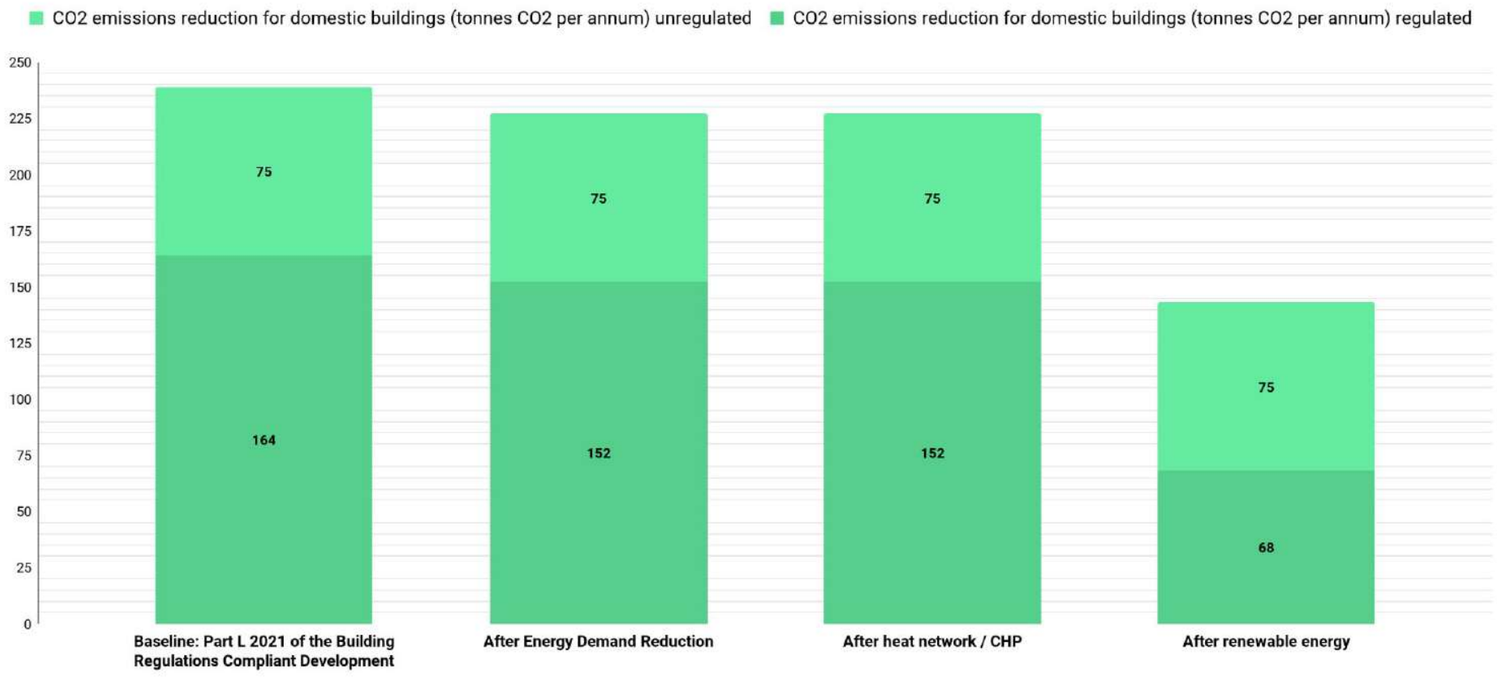

Figure 1: Total site-wide savings at each stage of the energy hierarchy

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Section Five

5 Appendices

Appendix A - Be Lean Considerations

Demand Reduction

Passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading are set out in this document. Active design measures, including high efficiency lighting and efficient low-energy extract systems, are also set out below. Building fabric details are set out in the tables at the end of this section.

Building Insulation

Standard insulation materials are typically constructed from petrochemicals and include fibreglass, mineral wool, polystyrene, polyurethane foam, and multi-foils. These materials are typically inexpensive to both buy and install. However, these insulation materials contain many additives, and their process embodied energy is higher than natural insulation. Natural insulation products are typically defined as low impact to nature, generally being organic resources that have low embodied energy. They can be reused and recycled and are usually biodegradable. They tend to be more absorbent than standard man-made insulation materials reducing condensation issues. Thermal conductivity can be defined as the rate at which heat is transferred by conduction through a unit cross-section area of a material; the lower the thermal conductivity of the insulation materials the lower the rate of heat transfer through the wall, roof, or floor. This scheme will provide building insulation U-values improved upon the Building Regulations standard. At the detailed design stage both standard and natural insulation materials will be considered on merit, feasibility, and pricing.

Thermal Mass

Thermal mass is related to materials and the ability to absorb and store heat. High density materials like concrete, bricks and tiles require more energy to heat up; they are therefore considered to have high thermal mass. Lightweight materials such as timber have low thermal mass. For residential uses thermal mass is not commonly deemed to be the most reliable form of controlling heat build-up within spaces as heat may build up during the day in bedrooms during summer and may then be exhausted during the occupants sleeping period; therefore, for the SAP calculations the assumption of the thermal mass parameter is ‘medium’ (250 kJ/m²K).

Orientation & Site Layout

Orientation of dwellings is key in maximising the benefits of solar gain in the winter and improving daylight & sunlight access given the constraints of the site. Single aspect, south and southwest facing spaces should be minimised unless overheating mitigation measures are present.

Dual aspect facades, where feasible, promote better daylight and sunlight access. Facades also have significant opportunity for daylight and sunlight access to each dwelling.

Thermal Bridge Summary

Thermal Bridges (Linear) occur at junctions between elements, such as a wall and a floor or a window and a wall. At these locations heat can transfer more easily through the construction, resulting in greater heat loss from the dwelling and localised ‘cold spots’ in the building envelope. Improving junction details to reduce linear thermal bridging will help achieve Building Regulations compliance and in achieving healthy, low energy homes.

Accredited Construction Details (ACDs) to be implemented in the design and construction of the dwellings. ACD checklists to be completed and signed towards the end of construction.

Thermal junctions complied with are as follows:

- E5 Ground floor (normal)
- E6 Intermediate floor within a dwelling
- E14 Flat Roof
- E16 Corner (normal)
- E18 Party wall between dwellings

Lighting

Poorly lit areas can strain the eyes and increase the reliance of subsidiary lighting such as inefficient unregulated lamps. Health and wellbeing are proven to be linked to access to daylight and sunlight. Furthermore, inefficient lighting can lead to increased energy bills.

Within the property, all fixed light fittings will be low-energy lamps, including storage and infrequently accessed areas. The lux levels within each space will be designed to match relevant Building Regulations and industry guidance to reduce the requirement for additional unregulated lighting.

Appendix A - Be Lean Considerations

Materials

All construction materials will be considered, with particular focus given to minimising embodied carbon through the material's life cycle, from cradle to gate.

Natural Ventilation

Natural ventilation is a method of supplying fresh air to a space through passive means, typically by utilising differences in pressure and/or temperatures within a space.

The key for residential uses is to minimise the complexity of ventilation strategies; otherwise, the occupant may not manage the strategy appropriately.

All windows to habitable rooms will look to be 50-75% openable to allow for maximum dispersion of heat and pollution build-up such as CO_2.

Solar Shading

The scheme should utilise window reveals, balconies, and internal blinds, where feasible, to reduce the requirement for active cooling.

The scheme should adhere and comply with the requirements of the newly adopted Part O Building Regulations which governs overheating. In Particular, the scheme will adopt key principles of Table 1.2 (Limiting Solar Gains) and Table 1.4 (Removing Excess Heat) of the approved document.

Lateral hot-water pipework runs will be minimised to avoid heat loss; where there is hot water pipework and/or heat exchangers, these will be fully insulated.

Mechanical Ventilation with Heat Recovery

Although passive ventilation should be maximised during temperate conditions, as this requires no fan power, there is the potential for heat to be lost to the atmosphere when fresh air is required (from opening windows) simultaneously with heating during colder seasons; therefore, it is advantageous to provide a form of heat recovery that allows for an efficient system that captures the heat exhausting from a room being heated in colder conditions.

The dwellings will have mechanical ventilation heat recovery (MVHR) systems offering fresh air supply to bedroom and living room spaces and extract from the kitchen and bathrooms; meaning windows will not be required to be open to meet the minimum background ventilation rates. The heat recovery aspect will lower space heating consumption. A summer by-pass mode will allow for extracting of heat build-up during hotter periods.

© Titon image of a typical MVHR unit

Appendix B - SAP Inputs

Item	Comment		
General			
Description	Up to 170 dwellings, associated landscaping and open space, with access from Thaxted Road		
Calculation method	Elmhurst Design SAP 10 & Approved Document Part L 2021		
Technical Information			
Building Fabric	**Input**	**Unit**	**Comment**
External Wall U-value	0.14	W/m^{2}K	
Roof U-value	0.10	W/m^{2}K	-
Ground Floor U-value	0.10	W/m^{2}K	-
Windows U-value	1.2	W/m^{2}K	Not including frame
Windows g-value	0.63	-	-
Window Frame-Factor	0.70	-	-
Thermal Mass Parameter	Medium	TMP	Default value
Thermal Bridging Y-value	<0.1	-	Thermal Bridging calculations TBD
Ventilation Method	Nuaire MRXB0XAB-EC03	-	Mechanical Ventilation with Heat Recovery, Approved Installer
Air permeability	3.0	@50Pa (m^3/(h.m^2))	-
Be Lean Stage			
Space Heating System	Gas Boiler		89.5% efficiency
Heating Emitter	Radiators		-
Domestic Hot Water System	Same as space heating		-
Storage	Yes		~180 litres, 80mm foam insulation
Space Cooling System	No		-
Be Clean Stage			
Space Heating System	Gas Boiler		89.5% efficiency
Heating Emitter	Radiators		-
Domestic Hot Water System	Same as space heating		-
Storage	Yes		~180 litres, 80mm foam insulation
Space Cooling System	No		-
Be Green Stage			
Space Heating System	ASHPs		175.1% default efficiency, MCS certified
Heating Emitter	Underfloor		-
Domestic Hot Water System	Same as space heating		-
Storage	Yes		~180 litres, 80mm foam insulation
Low/Zero Carbon Technologies used	ASHPs		175.1% default efficiency, MCS certified

Appendix C - SAP DER/TER Worksheets

Full SAP Calculation Printout

Property Reference	Plot 1B_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	1B
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	83 B	DER	17.81	TER	15.44
Environmental	88 B	% DER<TER	-15.35		
CO_2 Emissions (t/year)	0.84	DFEE	41.00	TFEE	44.25
Compliance Check	See BREL	% DFEE < TFEE	7.35		
% DPER < TPER	-22.06	DPER	99.26	TPER	81.32

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000	(1b)	x 2.5000	(2b) =	125.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		125.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			12.6000	1.1450	14.4275			(27)
Door			2.6000	1.0000	2.6000			(26)
Heatloss Floor 1			50.0000	0.1100	5.5000			(28a)
External Wall 1	75.0000	15.2000	59.8000	0.1400	8.3720			(29a)
External Roof 1	43.8200		43.8200	0.1100	4.8202			(30)
Total net area of external elements Aum(A, m2)			168.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.7197			(33)
Party Ceiling 1			50.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												8.4410	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	44.1607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.1700	21.1489	21.1281	21.0307	21.0125	20.9276	20.9276	20.9119	20.9603	21.0125	21.0493	21.0879	(38)
Heat transfer coeff	65.3307	65.3096	65.2888	65.1914	65.1731	65.0883	65.0883	65.0726	65.1210	65.1731	65.2100	65.2486	(39)
Average = Sum(39)m / 12 =												65.1913	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3066	1.3062	1.3058	1.3038	1.3035	1.3018	1.3018	1.3015	1.3024	1.3035	1.3042	1.3050	(40)
HLP (average)												1.3038	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(64)
										Total per year (kWh/year) = Sum(64)m =		2229.8208	(64)
12Total per year (kWh/year)												2230	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	96.7373	86.0602	92.4749	83.5397	82.5571	76.0832	76.2005	78.1985	77.9431	84.9105	87.8773	95.9508	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	130.0232	128.0657	124.2942	116.0273	110.9639	105.6711	102.4200	105.1055	108.2543	114.1271	122.0518	128.9662	(72)
Total internal gains	402.8713	410.3983	394.8201	380.8322	362.9469	347.4054	335.1825	336.3402	345.8144	360.4082	381.1548	395.3179	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.2000	10.6334	0.7600	0.7000	0.7700	16.4652 (74)
East	4.2000	19.6403	0.7600	0.7000	0.7700	30.4118 (76)
South	4.2000	46.7521	0.7600	0.7000	0.7700	72.3927 (78)

Solar gains	119.2696	209.5182	302.4678	399.4647	468.6808	474.2926	453.5483	400.7620	335.9981	235.9267	144.0419	101.2893 (83)
Total gains	522.1410	619.9166	697.2879	780.2970	831.6277	821.6980	788.7308	737.1022	681.8125	596.3349	525.1966	496.6072 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1484	53.1656	53.1825	53.2620	53.2769	53.3464	53.3464	53.3592	53.3196	53.2769	53.2468	53.2153	
alpha	4.5432	4.5444	4.5455	4.5508	4.5518	4.5564	4.5564	4.5573	4.5546	4.5518	4.5498	4.5477	
util living area	0.9814	0.9607	0.9196	0.8243	0.6722	0.4954	0.3608	0.4021	0.6217	0.8681	0.9631	0.9849	(86)
MIT	19.7939	20.0496	20.3632	20.6963	20.9018	20.9802	20.9962	20.9939	20.9469	20.6661	20.1646	19.7342	(87)
Th 2	19.8357	19.8360	19.8363	19.8378	19.8381	19.8395	19.8395	19.8397	19.8389	19.8381	19.8375	19.8369	(88)
util rest of house	0.9757	0.9495	0.8975	0.7811	0.6053	0.4106	0.2668	0.3027	0.5315	0.8238	0.9504	0.9802	(89)
MIT 2	18.4835	18.8011	19.1812	19.5606	19.7658	19.8297	19.8384	19.8379	19.8086	19.5415	18.9506	18.4095	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.8111	19.1132	19.4767	19.8445	20.0498	20.1173	20.1279	20.1269	20.0932	19.8227	19.2541	18.7407	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6611	18.9632	19.3267	19.6945	19.8998	19.9673	19.9779	19.9769	19.9432	19.6727	19.1041	18.5907	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9678	0.9386	0.8859	0.7751	0.6090	0.4201	0.2782	0.3146	0.5401	0.8164	0.9399	0.9732	(94)
Useful gains	505.3326	581.8494	617.7107	604.8070	506.4941	345.2352	219.3898	231.9214	368.2293	486.8361	493.6294	483.3046	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	938.2224	918.4621	837.4416	703.7096	534.4067	349.3473	219.8606	232.7557	380.5151	591.2936	782.7874	938.9719	(97)
Space heating kWh	322.0701	226.2037	163.4798	71.2099	20.7670	0.0000	0.0000	0.0000	0.0000	77.7164	208.1937	339.0165	(98a)
Space heating requirement - total per year (kWh/year)												1428.6571	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	322.0701	226.2037	163.4798	71.2099	20.7670	0.0000	0.0000	0.0000	0.0000	77.7164	208.1937	339.0165	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1428.6571	
Space heating per m2										(98c) / (4) =		28.5731	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	322.0701	226.2037	163.4798	71.2099	20.7670	0.0000	0.0000	0.0000	0.0000	77.7164	208.1937	339.0165	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	359.8548	252.7416	182.6590	79.5641	23.2034	0.0000	0.0000	0.0000	0.0000	86.8339	232.6187	378.7894	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	245.9823	217.7572	231.6592	204.1850	198.3319	179.1285	176.9713	183.6855	185.3783	206.2403	218.7609	243.3396	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	17.2610	13.8474	12.4680	9.1346	7.0558	5.7647	6.4366	8.3665	10.8673	14.2584	16.1049	17.7407 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1596.2649 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2491.4199 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	139.3060 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4312.9908 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1596.2649	0.2100	335.2156	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2491.4199	0.2100	523.1982	(264)
Space and water heating			858.4138	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.3060	0.1443	20.1062	(268)
Total CO2, kg/year			890.4492	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1596.2649	1.1300	1803.7793	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2491.4199	1.1300	2815.3045	(278)
Space and water heating			4619.0838	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.3060	1.5338	213.6722	(282)
Total Primary energy kWh/year			4962.8568	(286)
Dwelling Primary energy Rate (DPER)			99.2600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000 (1b)	x	2.5000 (2b)	=	125.0000 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	125.0000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4100	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3485	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4443	0.4356	0.4269	0.3834	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			9.9000	1.1450	11.3359			(27)
Heatloss Floor 1			50.0000	0.1300	6.5000			(28a)
External Wall 1	75.0000	12.5000	62.5000	0.1800	11.2500			(29a)
External Roof 1	43.8200		43.8200	0.1100	4.8202			(30)
Total net area of external elements Aum(A, m2)			168.8200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.5061			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total	
	E5 Ground floor (normal)	30.0000	0.1600	4.8000	
	E16 Corner (normal)	5.0000	0.0900	0.4500	
	E18 Party wall between dwellings	5.0000	0.0600	0.3000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5500 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 42.0561 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.6971	24.5390	24.3840	23.6560	23.5198	22.8857	22.8857	22.7683	23.1300	23.5198	23.7953	24.0834	(38)
Heat transfer coeff	66.7532	66.5951	66.4401	65.7121	65.5759	64.9418	64.9418	64.8244	65.1860	65.5759	65.8514	66.1395	(39)
Average = Sum(39)m / 12 =												65.7114	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3351	1.3319	1.3288	1.3142	1.3115	1.2988	1.2988	1.2965	1.3037	1.3115	1.3170	1.3228	(40)
HLP (average)												1.3142	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual)											Total = Sum(45)m =	1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	219.0524	193.8975	206.2332	181.6793	176.4053	159.2538	157.2875	163.2967	164.8474	183.4833	194.7248	216.6872	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053	(64)
										Total per year (kWh/year) = Sum(64)m =		1993.6012	(64)
12Total per year (kWh/year)												1994	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	95.8559	85.2640	91.5935	82.6867	81.6757	75.2302	75.3190	77.3171	77.0901	84.0291	87.0243	95.0694	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.8666	82.8880	74.8666	77.3621	74.8666	77.3621	74.8666	74.8666	77.3621	74.8666	77.3621	74.8666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	128.8385	126.8810	123.1095	114.8427	109.7792	104.4864	101.2353	103.9208	107.0696	112.9424	120.8671	127.7815	(72)
Total internal gains													
	402.2906	409.8823	394.2393	380.2716	362.3662	346.8448	334.6017	335.7595	345.2538	359.8275	380.5942	394.7372	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3000	10.6334	0.6300	0.7000	0.7700	10.7240	(74)
East	3.3000	19.6403	0.6300	0.7000	0.7700	19.8077	(76)
South	3.3000	46.7521	0.6300	0.7000	0.7700	47.1505	(78)

Solar gains	77.6822	136.4625	197.0021	260.1777	305.2592	308.9143	295.4032	261.0226	218.8408	153.6628	93.8167	65.9713	(83)
Total gains	479.9728	546.3448	591.2414	640.4493	667.6254	655.7591	630.0049	596.7821	564.0947	513.4903	474.4109	460.7085	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.0158	52.1393	52.2610	52.8399	52.9497	53.4667	53.4667	53.5635	53.2664	52.9497	52.7281	52.4985	
alpha	4.4677	4.4760	4.4841	4.5227	4.5300	4.5644	4.5644	4.5709	4.5511	4.5300	4.5152	4.4999	
util living area													
	0.9867	0.9754	0.9535	0.8951	0.7803	0.6024	0.4468	0.4890	0.7168	0.9137	0.9745	0.9888	(86)
MIT	19.6701	19.8809	20.1703	20.5382	20.8148	20.9570	20.9911	20.9867	20.9052	20.5568	20.0575	19.6373	(87)
Th 2	19.8135	19.8159	19.8183	19.8297	19.8318	19.8417	19.8417	19.8436	19.8379	19.8318	19.8275	19.8230	(88)
util rest of house													
	0.9825	0.9678	0.9389	0.8625	0.7171	0.5063	0.3327	0.3714	0.6247	0.8795	0.9653	0.9852	(89)
MIT 2	18.3124	18.5788	18.9398	19.3867	19.6862	19.8192	19.8392	19.8394	19.7800	19.4209	18.8125	18.2777	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6518	18.9043	19.2474	19.6746	19.9683	20.1036	20.1272	20.1262	20.0613	19.7049	19.1237	18.6176	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6518	18.9043	19.2474	19.6746	19.9683	20.1036	20.1272	20.1262	20.0613	19.7049	19.1237	18.6176	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9767	0.9600	0.9300	0.8574	0.7252	0.5290	0.3613	0.4009	0.6439	0.8750	0.9578	0.9801	(94)
Useful gains	468.7962	524.5152	549.8516	549.1490	484.1483	346.8666	227.6170	239.2313	363.2165	449.3124	454.4001	451.5213	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	958.0308	932.6205	846.9377	708.0214	542.2013	357.4147	229.0614	241.5488	388.5947	597.0602	791.7786	953.5709	(97)
Space heating kWh	363.9906	274.2468	221.0321	114.3881	43.1915	0.0000	0.0000	0.0000	0.0000	109.9244	242.9125	373.5249	(98a)
Space heating requirement - total per year (kWh/year)												1743.2107	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	363.9906	274.2468	221.0321	114.3881	43.1915	0.0000	0.0000	0.0000	0.0000	109.9244	242.9125	373.5249	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1743.2107	
Space heating per m2											(98c) / (4) =	34.8642	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	363.9906	274.2468	221.0321	114.3881	43.1915	0.0000	0.0000	0.0000	0.0000	109.9244	242.9125	373.5249	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	394.3560	297.1254	239.4714	123.9308	46.7947	0.0000	0.0000	0.0000	0.0000	119.0947	263.1771	404.6857	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4383	85.0925	84.4723	83.2774	81.5638	79.8000	79.8000	79.8000	79.8000	83.1632	84.8027	85.5132	(217)
Fuel for water heating, kWh/month	228.2648	202.8946	217.8016	196.0369	195.2261	181.1531	179.8428	186.2789	187.5247	199.0796	205.6786	225.8192	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5558	12.4794	11.2363	8.2322	6.3588	5.1952	5.8007	7.5400	9.7937	12.8499	14.5139	15.9881	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.8352	-33.8370	-48.9962	-55.5471	-60.3374	-56.5344	-55.8866	-52.5672	-46.7392	-38.9466	-26.3060	-20.5837	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.7698	-26.9391	-53.6635	-80.7536	-106.8963	-107.3989	-106.0856	-89.7273	-65.6754	-38.5203	-17.0530	-10.0883	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1888.6357	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2405.6008	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												125.5442	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1235.6876	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3270.0931	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1888.6357	0.2100	396.6135	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2405.6008	0.2100	505.1762	(264)
Space and water heating			901.7897	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.5442	0.1443	18.1199	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.1166	0.1344	-69.9046	
PV Unit electricity exported	-715.5710	0.1259	-90.0556	
Total			-159.9602	(269)
Total CO2, kg/year			771.8787	(272)
Target Carbon Dioxide Emission Rate (TER)			15.4400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1888.6357	1.1300	2134.1583	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2405.6008	1.1300	2718.3289	(278)
Space and water heating			4852.4873	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.5442	1.5338	192.5639	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.1166	1.4967	-778.4666	
PV Unit electricity exported	-715.5710	0.4620	-330.5653	
Total			-1109.0318	(283)
Total Primary energy kWh/year			4066.1201	(286)
Target Primary Energy Rate (TPER)			81.3200	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 1BF-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	1BF-AFF
Property	1 Bedroom Flat, 1BF-AFF, Saffron Walden, CB11		

SAP Rating	84 B	DER	15.95	TER	13.44
Environmental	89 B	% DER<TER	-18.68		
CO_2 Emissions (t/year)	0.76	DFEE	33.75	TFEE	35.22
Compliance Check	See BREL	% DFEE < TFEE	4.18		
% DPER < TPER	-26.41	DPER	89.23	TPER	70.59

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.5000	(2b) =	125.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		125.0000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Door			2.6000	1.0000	2.6000			(26)
External Wall 1	50.0000	17.3000	32.7000	0.1400	4.5780			(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000			(30)
Total net area of external elements Aum(A, m2)			100.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.5101			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)
Party Floor 1			50.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												5.0000	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	34.5101	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.1700	21.1489	21.1281	21.0307	21.0125	20.9276	20.9276	20.9119	20.9603	21.0125	21.0493	21.0879	(38)
Heat transfer coeff													
	55.6801	55.6589	55.6382	55.5408	55.5225	55.4377	55.4377	55.4219	55.4703	55.5225	55.5594	55.5980	(39)
Average = Sum(39)m / 12 =												55.5407	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1136	1.1132	1.1128	1.1108	1.1105	1.1088	1.1088	1.1084	1.1094	1.1105	1.1112	1.1120	(40)
HLP (average)												1.1108	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901	(42)
Hot water usage for mixer showers													
	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths													
	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses													
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(64)
										Total per year (kWh/year) = Sum(64)m =		2229.8208	(64)
12Total per year (kWh/year)												2230	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	96.7373	86.0602	92.4749	83.5397	82.5571	76.0832	76.2005	78.1985	77.9431	84.9105	87.8773	95.9508	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	130.0232	128.0657	124.2942	116.0273	110.9639	105.6711	102.4200	105.1055	108.2543	114.1271	122.0518	128.9662	(72)
Total internal gains													
	402.8713	410.3983	394.8201	380.8322	362.9469	347.4054	335.1825	336.3402	345.8144	360.4082	381.1548	395.3179	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.2000	10.6334	0.7600	0.7000	0.7700	16.4652 (74)
East	4.2000	19.6403	0.7600	0.7000	0.7700	30.4118 (76)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)

Solar gains	92.4945	180.1954	298.4045	443.1086	553.4857	572.0115	542.2978	458.2388	349.1572	213.9361	115.1116	76.2490 (83)
Total gains	495.3659	590.5937	693.2246	823.9408	916.4326	919.4169	877.4803	794.5791	694.9716	574.3443	496.2664	471.5670 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.3602	62.3839	62.4072	62.5167	62.5372	62.6329	62.6329	62.6507	62.5960	62.5372	62.4957	62.4523	
alpha	5.1573	5.1589	5.1605	5.1678	5.1691	5.1755	5.1755	5.1767	5.1731	5.1691	5.1664	5.1635	
util living area	0.9815	0.9570	0.8940	0.7423	0.5504	0.3842	0.2777	0.3202	0.5391	0.8401	0.9611	0.9853	(86)
MIT	20.0424	20.2858	20.5964	20.8695	20.9742	20.9966	20.9995	20.9990	20.9826	20.7951	20.3623	19.9865	(87)
Th 2	19.9897	19.9901	19.9904	19.9920	19.9923	19.9937	19.9937	19.9939	19.9932	19.9923	19.9917	19.9911	(88)
util rest of house	0.9761	0.9455	0.8691	0.6973	0.4952	0.3246	0.2143	0.2505	0.4653	0.7949	0.9485	0.9809	(89)
MIT 2	18.9094	19.2105	19.5801	19.8770	19.9740	19.9920	19.9935	19.9936	19.9834	19.8124	19.3114	18.8403	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	19.1926	19.4793	19.8342	20.1252	20.2240	20.2432	20.2450	20.2450	20.2332	20.0581	19.5741	19.1269	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0426	19.3293	19.6842	19.9752	20.0740	20.0932	20.0950	20.0950	20.0832	19.9081	19.4241	18.9769	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9693	0.9362	0.8604	0.6965	0.4997	0.3305	0.2207	0.2576	0.4720	0.7907	0.9395	0.9749	(94)
Useful gains	480.1686	552.9115	596.4472	573.9030	457.9757	303.8585	193.6958	204.6458	328.0590	454.1210	466.2513	459.7507	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	820.8721	803.1203	733.5441	615.1225	464.9462	304.5279	193.7566	204.7818	331.8887	516.8072	684.7207	821.5643	(97)
Space heating kWh	253.4835	168.1403	102.0001	29.6780	5.1861	0.0000	0.0000	0.0000	0.0000	46.6385	157.2980	269.1893	(98a)
Space heating requirement - total per year (kWh/year)												1031.6137	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	253.4835	168.1403	102.0001	29.6780	5.1861	0.0000	0.0000	0.0000	0.0000	46.6385	157.2980	269.1893	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1031.6137	
Space heating per m2										(98c) / (4) =		20.6323	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	253.4835	168.1403	102.0001	29.6780	5.1861	0.0000	0.0000	0.0000	0.0000	46.6385	157.2980	269.1893	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	283.2217	187.8663	113.9666	33.1598	5.7945	0.0000	0.0000	0.0000	0.0000	52.1101	175.7519	300.7701	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	245.9823	217.7572	231.6592	204.1850	198.3319	179.1285	176.9713	183.6855	185.3783	206.2403	218.7609	243.3396	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	17.2610	13.8474	12.4680	9.1346	7.0558	5.7647	6.4366	8.3665	10.8673	14.2584	16.1049	17.7407 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1152.6410 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2491.4199 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	139.3060 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3869.3669 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1152.6410	0.2100	242.0546	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2491.4199	0.2100	523.1982	(264)
Space and water heating			765.2528	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.3060	0.1443	20.1062	(268)
Total CO2, kg/year			797.2882	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1152.6410	1.1300	1302.4844	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2491.4199	1.1300	2815.3045	(278)
Space and water heating			4117.7889	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.3060	1.5338	213.6722	(282)
Total Primary energy kWh/year			4461.5618	(286)
Dwelling Primary energy Rate (DPER)			89.2300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000 (1b)	x	2.5000 (2b)	=	125.0000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	125.0000	(5)

2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1600 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4100 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3485 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4443	0.4356	0.4269	0.3834	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			9.8700	1.1450	11.3015			(27)
External Wall 1	50.0000	12.4700	37.5300	0.1800	6.7554			(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000			(30)
Total net area of external elements Aum(A, m2)			100.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.1569			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	30.0000	0.0700	2.1000
E14 Flat roof	30.0000	0.0800	2.4000
E16 Corner (normal)	5.0000	0.0900	0.4500
E18 Party wall between dwellings	5.0000	0.0600	0.3000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.2500 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	31.4069 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.6971	24.5390	24.3840	23.6560	23.5198	22.8857	22.8857	22.7683	23.1300	23.5198	23.7953	24.0834	(38)
Heat transfer coeff	56.1040	55.9459	55.7909	55.0629	54.9267	54.2926	54.2926	54.1752	54.5369	54.9267	55.2023	55.4903	(39)
Average = Sum(39)m / 12 =												55.0623	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1221	1.1189	1.1158	1.1013	1.0985	1.0859	1.0859	1.0835	1.0907	1.0985	1.1040	1.1098	(40)
HLP (average)												1.1012	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)

Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	219.0524	193.8975	206.2332	181.6793	176.4053	159.2538	157.2875	163.2967	164.8474	183.4833	194.7248	216.6872	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053	(64)
										Total per year (kWh/year) = Sum(64)m =		1993.6012	(64)
12Total per year (kWh/year)												1994	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	95.8559	85.2640	91.5935	82.6867	81.6757	75.2302	75.3190	77.3171	77.0901	84.0291	87.0243	95.0694	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.8919	82.9161	74.8919	77.3883	74.8919	77.3883	74.8919	74.8919	77.3883	74.8919	77.3883	74.8919	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	128.8385	126.8810	123.1095	114.8427	109.7792	104.4864	101.2353	103.9208	107.0696	112.9424	120.8671	127.7815	(72)
Total internal gains													
	402.3159	409.9104	394.2647	380.2978	362.3915	346.8710	334.6271	335.7848	345.2800	359.8528	380.6204	394.7625	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.8200	10.6334	0.6300	0.7000	0.7700	9.1642	(74)
East	2.8200	19.6403	0.6300	0.7000	0.7700	16.9265	(76)
West	4.2300	19.6403	0.6300	0.7000	0.7700	25.3898	(80)

Solar gains	51.4805	100.2930	166.0857	246.6249	308.0585	318.3696	301.8315	255.0461	194.3335	119.0723	64.0687	42.4386	(83)
Total gains	453.7965	510.2033	560.3503	626.9228	670.4500	665.2406	636.4586	590.8309	539.6135	478.9251	444.6891	437.2011	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8890	62.0639	62.2363	63.0592	63.2155	63.9538	63.9538	64.0924	63.6674	63.2155	62.9000	62.5735	
alpha	5.1259	5.1376	5.1491	5.2039	5.2144	5.2636	5.2636	5.2728	5.2445	5.2144	5.1933	5.1716	
util living area													
	0.9873	0.9759	0.9482	0.8632	0.7080	0.5140	0.3740	0.4192	0.6617	0.9032	0.9744	0.9893	(86)
MIT	19.9465	20.1314	20.4010	20.7294	20.9218	20.9880	20.9981	20.9967	20.9583	20.6998	20.2779	19.9208	(87)
Th 2	19.9828	19.9854	19.9879	19.9998	20.0020	20.0124	20.0124	20.0143	20.0084	20.0020	19.9975	19.9928	(88)
util rest of house													
	0.9835	0.9688	0.9331	0.8280	0.6481	0.4384	0.2908	0.3308	0.5804	0.8690	0.9656	0.9861	(89)
MIT 2	18.7839	19.0179	19.3523	19.7441	19.9423	20.0062	20.0119	20.0132	19.9832	19.7236	19.2135	18.7589	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0746	19.2963	19.6145	19.9904	20.1872	20.2516	20.2584	20.2591	20.2270	19.9677	19.4796	19.0494	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0746	19.2963	19.6145	19.9904	20.1872	20.2516	20.2584	20.2591	20.2270	19.9677	19.4796	19.0494	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9788	0.9626	0.9265	0.8276	0.6597	0.4570	0.3116	0.3529	0.5991	0.8676	0.9597	0.9819	(94)
Useful gains	444.1957	491.1319	519.1387	518.8399	442.3268	304.0052	198.3276	208.5027	323.3006	415.5137	426.7592	429.3021	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	828.9126	805.4138	731.6679	610.6717	466.1732	306.8420	198.6254	209.0680	334.1481	514.5353	683.3816	823.9965	(97)
Space heating kWh	286.2294	211.1975	158.1217	66.1189	17.7417	0.0000	0.0000	0.0000	0.0000	73.6721	184.7681	293.6526	(98a)
Space heating requirement - total per year (kWh/year)												1291.5020	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	286.2294	211.1975	158.1217	66.1189	17.7417	0.0000	0.0000	0.0000	0.0000	73.6721	184.7681	293.6526	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1291.5020	
Space heating per m2											(98c) / (4) =	25.8300	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	286.2294	211.1975	158.1217	66.1189	17.7417	0.0000	0.0000	0.0000	0.0000	73.6721	184.7681	293.6526	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	310.1077	228.8163	171.3128	71.6348	19.2218	0.0000	0.0000	0.0000	0.0000	79.8180	200.1821	318.1502	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.9189	84.5129	83.7220	82.2016	80.6191	79.8000	79.8000	79.8000	79.8000	82.3709	84.1892	84.9970	(217)
Fuel for water heating, kWh/month	229.6611	204.2861	219.7535	198.6025	197.5138	181.1531	179.8428	186.2789	187.5247	200.9946	207.1774	227.1907	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5611	12.4837	11.2402	8.2350	6.3610	5.1970	5.8027	7.5426	9.7970	12.8542	14.5188	15.9936	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.8353	-33.8373	-48.9966	-55.5475	-60.3378	-56.5348	-55.8870	-52.5677	-46.7396	-38.9469	-26.3061	-20.5838	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.7696	-26.9389	-53.6632	-80.7532	-106.8959	-107.3985	-106.0852	-89.7268	-65.6750	-38.5200	-17.0528	-10.0882	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1399.2438	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2419.9791	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.5867	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1235.6876	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2795.1219	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1399.2438	0.2100	293.8412	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2419.9791	0.2100	508.1956	(264)
Space and water heating			802.0368	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.5867	0.1443	18.1260	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.1204	0.1344	-69.9051	
PV Unit electricity exported	-715.5672	0.1259	-90.0551	
Total			-159.9602	(269)
Total CO2, kg/year			672.1319	(272)
Target Carbon Dioxide Emission Rate (TER)			13.4400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1399.2438	1.1300	1581.1455	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2419.9791	1.1300	2734.5764	(278)
Space and water heating			4315.7218	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.5867	1.5338	192.6291	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.1204	1.4967	-778.4723	
PV Unit electricity exported	-715.5672	0.4620	-330.5634	
Total			-1109.0357	(283)
Total Primary energy kWh/year			3529.4161	(286)
Target Primary Energy Rate (TPER)			70.5900	(287)

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Full SAP Calculation Printout

Property Reference	Plot 1BH-BUN_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	1BH-BUN
Property	1 Bedroom Flat, 4B5, Saffron Walden, CB11		

SAP Rating	84 B	DER	16.20	TER	13.66
Environmental	87 B	% DER<TER	-18.59		
CO_2 Emissions (t/year)	1.13	DFEE	47.42	TFEE	45.37
Compliance Check	See BREL	% DFEE < TFEE	-4.53		
% DPER < TPER	-25.91	DPER	90.24	TPER	71.67

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			37.0000 (1b)	x	2.5000 (2b)	=	92.5000 (1b)	-
First floor			37.0000 (1c)	x	2.7500 (2c)	=	101.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.0000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.2500	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		0 * 10	=	0.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5)	=	0.0000 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.1500 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			37.0000	0.1100	4.0700			(28a)
External Wall 1	132.0000	45.1000	86.9000	0.1400	12.1660			(29a)
External Roof 1	37.0000		37.0000	0.1100	4.0700			(30)
Total net area of external elements Aum(A, m2)			206.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.1930			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 10.3000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.4930 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.8983	32.8654	32.8331	32.6817	32.6534	32.5215	32.5215	32.4971	32.5723	32.6534	32.7107	32.7706	(38)
Heat transfer coeff	114.3913	114.3584	114.3261	114.1747	114.1464	114.0145	114.0145	113.9901	114.0653	114.1464	114.2037	114.2636	(39)

Average = Sum(39)m / 12 = 114.1746

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5458	1.5454	1.5449	1.5429	1.5425	1.5407	1.5407	1.5404	1.5414	1.5425	1.5433	1.5441	(40)
HLP (average)												1.5429	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3392 (42)

Hot water usage for mixer showers	63.4403	62.4869	61.0976	58.4395	56.4779	54.2903	53.0469	54.4256	55.9370	58.2858	61.0010	63.1972 (42a)
Hot water usage for baths	27.4046	26.9976	26.4245	25.3677	24.5764	23.6990	23.2251	23.7942	24.4139	25.3527	26.4313	27.3120 (42b)
Hot water usage for other uses	38.5857	37.1826	35.7795	34.3763	32.9732	31.5701	31.5701	32.9732	34.3763	35.7795	37.1826	38.5857 (42c)

Average daily hot water use (litres/day) 118.9761 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.4306	126.6671	123.3016	118.1836	114.0275	109.5594	107.8421	111.1931	114.7272	119.4180	124.6149	129.0949	(44)
Energy conte	204.9864	180.3722	189.5099	161.7874	153.5030	134.7161	130.4256	137.6802	141.4701	162.0491	177.5367	202.1314	(45)

Energy content (annual) Total = Sum(45)m = 1976.1681

Distribution loss (46)m = 0.15 x (45)m	30.7480	27.0558	28.4265	24.2681	23.0254	20.2074	19.5638	20.6520	21.2205	24.3074	26.6305	30.3197 (46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)

If cylinder contains dedicated solar storage

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	255.3308	225.8446	239.8543	210.5078	203.8474	183.4365	180.7701	188.0247	190.1906	212.3935	226.2571	252.4758 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	255.3308	225.8446	239.8543	210.5078	203.8474	183.4365	180.7701	188.0247	190.1906	212.3935	226.2571	252.4758 (64)

Total per year (kWh/year) = Sum(64)m = 2568.9333 (64)
12Total per year (kWh/year) 2569 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

	108.4335	96.3517	103.2876	92.7706	91.3153	83.7694	83.6421	86.0542	86.0152	94.1569	98.0073	107.4842 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	104.1289	115.2856	104.1289	107.5999	104.1289	107.5999	104.1289	104.1289	107.5999	104.1289	107.5999	104.1289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	206.4473	208.5895	203.1911	191.6984	177.1909	163.5559	154.4469	152.3047	157.7031	169.1958	183.7033	197.3383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	(71)
Water heating gains (Table 5)	145.7440	143.3805	138.8274	128.8481	122.7356	116.3464	112.4221	115.6643	119.4655	126.5549	136.1212	144.4680	(72)
Total internal gains	517.4081	528.3435	507.2353	489.2343	465.1434	445.5902	429.0859	430.1858	442.8564	460.9676	488.5123	507.0232	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190 (77)
Southwest	6.3000	36.7938	0.7600	0.7000	0.7700	85.4595 (79)
Northwest	12.6000	11.2829	0.7600	0.7000	0.7700	52.4128 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	343.7333	614.5206	917.8850	1266.4866	1536.4825	1577.2370	1499.0407	1289.6823	1037.3572	699.9566	416.9973	290.7449	(83)
Total gains	861.1414	1142.8642	1425.1203	1755.7209	2001.6259	2022.8272	1928.1266	1719.8681	1480.2136	1160.9242	905.5096	797.7681	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.9238	44.9367	44.9494	45.0090	45.0202	45.0722	45.0722	45.0819	45.0522	45.0202	44.9976	44.9740	
alpha	3.9949	3.9958	3.9966	4.0006	4.0013	4.0048	4.0048	4.0055	4.0035	4.0013	3.9998	3.9983	
util living area	0.9768	0.9378	0.8554	0.6948	0.5098	0.3568	0.2593	0.3031	0.5110	0.8089	0.9516	0.9823	(86)
MIT	19.5553	19.9604	20.4071	20.7815	20.9444	20.9893	20.9977	20.9958	20.9585	20.6646	20.0189	19.4646	(87)
Th 2	19.6533	19.6536	19.6540	19.6555	19.6558	19.6571	19.6571	19.6573	19.6566	19.6558	19.6552	19.6546	(88)
util rest of house	0.9696	0.9206	0.8208	0.6390	0.4430	0.2837	0.1806	0.2155	0.4199	0.7511	0.9348	0.9767	(89)
MIT 2	18.0558	18.5525	19.0745	19.4715	19.6186	19.6524	19.6566	19.6562	19.6352	19.3753	18.6364	17.9433	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.4307	18.9045	19.4077	19.7990	19.9501	19.9866	19.9918	19.9911	19.9660	19.6976	18.9820	18.3236	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2807	18.7545	19.2577	19.6490	19.8001	19.8366	19.8418	19.8411	19.8160	19.5476	18.8320	18.1736	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9592	0.9061	0.8090	0.6387	0.4504	0.2936	0.1915	0.2276	0.4311	0.7458	0.9213	0.9678	(94)
Useful gains	826.0305	1035.5318	1152.9580	1121.4352	901.4811	593.8678	369.2174	391.4405	638.0754	865.8608	834.2152	772.0597	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1599.2719	1584.3737	1458.5353	1227.2642	924.5931	597.0500	369.6178	392.2537	651.9992	1021.3411	1339.8415	1596.6760	(97)
Space heating kWh	575.2916	368.8218	227.3495	76.1969	17.1953	0.0000	0.0000	0.0000	0.0000	115.6773	364.0509	613.5145	(98a)
Space heating requirement - total per year (kWh/year)												2358.0978	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	575.2916	368.8218	227.3495	76.1969	17.1953	0.0000	0.0000	0.0000	0.0000	115.6773	364.0509	613.5145	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2358.0978	
Space heating per m2										(98c) / (4) =		31.8662	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 89.5000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	575.2916	368.8218	227.3495	76.1969	17.1953	0.0000	0.0000	0.0000	0.0000	115.6773	364.0509	613.5145	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	642.7839	412.0914	254.0218	85.1362	19.2127	0.0000	0.0000	0.0000	0.0000	129.2484	406.7608	685.4911	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.3308	225.8446	239.8543	210.5078	203.8474	183.4365	180.7701	188.0247	190.1906	212.3935	226.2571	252.4758	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	285.2858	252.3404	267.9937	235.2043	227.7625	204.9570	201.9777	210.0834	212.5034	237.3112	252.8013	282.0959	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	26.4229	21.1974	19.0859	13.9832	10.8010	8.8245	9.8530	12.8074	16.6355	21.8267	24.6532	27.1573 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2634.7461 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2870.3165 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	213.2479 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5804.3106 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2634.7461	0.2100	553.2967	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2870.3165	0.2100	602.7665	(264)
Space and water heating			1156.0632	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	213.2479	0.1443	30.7783	(268)
Total CO2, kg/year			1198.7707	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.2000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2634.7461	1.1300	2977.2631	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2870.3165	1.1300	3243.4577	(278)
Space and water heating			6220.7208	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	213.2479	1.5338	327.0868	(282)
Total Primary energy kWh/year			6677.9084	(286)
Dwelling Primary energy Rate (DPER)			90.2400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	37.0000 (1b)	x	2.5000 (2b)	=	92.5000 (1b)	-
First floor	37.0000 (1c)	x	2.7500 (2c)	=	101.7500 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 74.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 194.2500 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1544	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4044	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3438	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4383	0.4297	0.4211	0.3782	0.3696	0.3266	0.3266	0.3180	0.3438	0.3696	0.3867	0.4039	(22b)
Effective ac	0.5961	0.5923	0.5887	0.5715	0.5683	0.5533	0.5533	0.5506	0.5591	0.5683	0.5748	0.5816	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			13.3000	1.1450	15.2290			(27)
Heatloss Floor 1			37.0000	0.1300	4.8100			(28a)
External Wall 1	132.0000	18.5000	113.5000	0.1800	20.4300			(29a)
External Roof 1	37.0000		37.0000	0.1100	4.0700			(30)
Total net area of external elements Aum(A, m2)			206.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.7390			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	25.0000	0.1600	4.0000	
E6 Intermediate floor within a dwelling	25.0000	0.0000	0.0000	
E14 Flat roof	25.0000	0.0800	2.0000	
E16 Corner (normal)	21.0000	0.0900	1.8900	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.8900	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	57.6290	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.2089	37.9697	37.7354	36.6345	36.4286	35.4698	35.4698	35.2922	35.8391	36.4286	36.8452	37.2808	(38)
Heat transfer coeff	95.8379	95.5988	95.3644	94.2635	94.0576	93.0988	93.0988	92.9212	93.4681	94.0576	94.4742	94.9098	(39)
Average = Sum(39)m / 12 =												94.2626	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2951	1.2919	1.2887	1.2738	1.2710	1.2581	1.2581	1.2557	1.2631	1.2710	1.2767	1.2826	(40)
HLP (average)												1.2738	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3392 (42)
Hot water usage for mixer showers

63.4403	62.4869	61.0976	58.4395	56.4779	54.2903	53.0469	54.4256	55.9370	58.2858	61.0010	63.1972	(42a)

Hot water usage for baths

27.4046	26.9976	26.4245	25.3677	24.5764	23.6990	23.2251	23.7942	24.4139	25.3527	26.4313	27.3120	(42b)

Hot water usage for other uses

38.5857	37.1826	35.7795	34.3763	32.9732	31.5701	31.5701	32.9732	34.3763	35.7795	37.1826	38.5857	(42c)

Average daily hot water use (litres/day) 118.9761 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	129.4306	126.6671	123.3016	118.1836	114.0275	109.5594	107.8421	111.1931	114.7272	119.4180	124.6149	129.0949 (44)
Energy conte	204.9864	180.3722	189.5099	161.7874	153.5030	134.7161	130.4256	137.6802	141.4701	162.0491	177.5367	202.1314 (45)
Energy content (annual)										Total = Sum(45)m =		1976.1681
Distribution loss (46)m = 0.15 x (45)m												
	30.7480	27.0558	28.4265	24.2681	23.0254	20.2074	19.5638	20.6520	21.2205	24.3074	26.6305	30.3197 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	254.2291	224.8495	238.7526	209.4416	202.7457	182.3703	179.6683	186.9229	189.1243	211.2918	225.1909	251.3740 (62)
WWHRS	-29.0022	-25.6498	-26.8590	-22.2403	-20.7272	-17.7364	-16.6250	-17.6791	-18.3508	-21.6335	-24.5082	-28.4652 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	225.2268	199.1997	211.8936	187.2013	182.0185	164.6339	163.0433	169.2438	170.7736	189.6583	200.6827	222.9089 (64)
										Total per year (kWh/year) = Sum(64)m =		2286.4842 (64)
12Total per year (kWh/year)												2286 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	107.5521	95.5556	102.4062	91.9177	90.4339	82.9165	82.7607	85.1728	85.1622	93.2755	97.1543	106.6028 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	106.3783	117.7759	106.3783	109.9242	106.3783	109.9242	106.3783	106.3783	109.9242	106.3783	109.9242	106.3783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	206.4473	208.5895	203.1911	191.6984	177.1909	163.5559	154.4469	152.3047	157.7031	169.1958	183.7033	197.3383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	(71)
Water heating gains (Table 5)													
	144.5593	142.1958	137.6427	127.6634	121.5509	115.1617	111.2374	114.4796	118.2808	125.3702	134.9365	143.2833	(72)
Total internal gains													
	518.4727	529.6492	508.3000	490.3739	466.2080	446.7298	430.1506	431.2504	443.9961	462.0323	489.6520	508.0878	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.8000	11.2829	0.6300	0.7000	0.7700	9.6550	(75)
Southeast	4.2000	36.7938	0.6300	0.7000	0.7700	47.2276	(77)
Southwest	2.1000	36.7938	0.6300	0.7000	0.7700	23.6138	(79)
Northwest	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(81)

Solar gains	94.9789	169.8018	253.6261	349.9502	424.5544	435.8155	414.2086	356.3596	286.6382	193.4091	115.2229	80.3374	(83)
Total gains	613.4517	699.4509	761.9261	840.3242	890.7624	882.5453	844.3592	787.6100	730.6342	655.4413	604.8749	588.4252	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6207	53.7548	53.8869	54.5162	54.6356	55.1982	55.1982	55.3037	54.9801	54.6356	54.3946	54.1450	
alpha	4.5747	4.5837	4.5925	4.6344	4.6424	4.6799	4.6799	4.6869	4.6653	4.6424	4.6263	4.6097	
util living area													
	0.9923	0.9851	0.9698	0.9222	0.8152	0.6360	0.4765	0.5281	0.7686	0.9426	0.9849	0.9936	(86)
MIT	19.6003	19.7996	20.0903	20.4820	20.7894	20.9510	20.9897	20.9837	20.8816	20.4892	19.9841	19.5716	(87)
Th 2	19.8447	19.8472	19.8497	19.8614	19.8636	19.8738	19.8738	19.8757	19.8699	19.8636	19.8591	19.8545	(88)
util rest of house													
	0.9898	0.9803	0.9597	0.8959	0.7568	0.5399	0.3590	0.4063	0.6810	0.9173	0.9791	0.9915	(89)
MIT 2	18.2463	18.5004	18.8673	19.3516	19.6931	19.8473	19.8708	19.8703	19.7939	19.3724	18.7450	18.2168	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.5848	18.8252	19.1730	19.6342	19.9672	20.1232	20.1505	20.1487	20.0658	19.6516	19.0548	18.5555	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.5848	18.8252	19.1730	19.6342	19.9672	20.1232	20.1505	20.1487	20.0658	19.6516	19.0548	18.5555	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9745	0.9519	0.8895	0.7627	0.5623	0.3885	0.4368	0.6978	0.9114	0.9734	0.9880	(94)
Useful gains	604.7474	681.5834	725.3078	747.4997	679.4019	496.2422	328.0387	344.0461	509.8569	597.3733	588.7638	581.3912	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1369.0264	1331.2334	1208.5575	1011.8415	777.5914	514.2075	330.5479	348.3313	557.6132	851.3741	1129.4191	1362.4764	(97)
Space heating kWh													
	568.6236	436.5648	359.5378	190.3261	73.0530	0.0000	0.0000	0.0000	0.0000	188.9766	389.2718	581.1274	(98a)
Space heating requirement - total per year (kWh/year)												2787.4811	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	568.6236	436.5648	359.5378	190.3261	73.0530	0.0000	0.0000	0.0000	0.0000	188.9766	389.2718	581.1274	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2787.4811	
Space heating per m2											(98c) / (4) =	37.6687	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	568.6236	436.5648	359.5378	190.3261	73.0530	0.0000	0.0000	0.0000	0.0000	188.9766	389.2718	581.1274	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	616.0602	472.9846	389.5317	206.2038	79.1473	0.0000	0.0000	0.0000	0.0000	204.7418	421.7462	629.6071	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	225.2268	199.1997	211.8936	187.2013	182.0185	164.6339	163.0433	169.2438	170.7736	189.6583	200.6827	222.9089	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0467	85.7692	85.2354	84.0969	82.1856	79.8000	79.8000	79.8000	79.8000	84.0517	85.5191	86.1076	(217)
Fuel for water heating, kWh/month													
	261.7495	232.2509	248.5981	222.6017	221.4724	206.3081	204.3149	212.0850	214.0020	225.6447	234.6643	258.8723	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.1033	17.7321	15.9658	11.6972	9.0353	7.3819	8.2423	10.7136	13.9159	18.2585	20.6229	22.7176	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.6454	-48.8588	-70.2591	-79.0406	-85.2786	-79.6250	-78.6446	-74.2200	-66.4184	-55.8887	-38.0952	-29.9515	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-19.5299	-41.0898	-81.6773	-122.6846	-162.2271	-162.9963	-161.0743	-136.3759	-99.9552	-58.7623	-26.0760	-15.4430	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3020.0229	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2742.5640	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												178.3863	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1828.8177	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4198.1555 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3020.0229	0.2100	634.2048	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2742.5640	0.2100	575.9384	(264)
Space and water heating			1210.1432	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	178.3863	0.1443	25.7467	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-740.9259	0.1346	-99.7094	
PV Unit electricity exported	-1087.8918	0.1259	-136.9593	
Total			-236.6687	(269)
Total CO2, kg/year			1011.1505	(272)
Target Carbon Dioxide Emission Rate (TER)			13.6600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3020.0229	1.1300	3412.6258	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2742.5640	1.1300	3099.0973	(278)
Space and water heating			6511.7232	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	178.3863	1.5338	273.6149	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-740.9259	1.4974	-1109.4345	
PV Unit electricity exported	-1087.8918	0.4621	-502.7348	
Total			-1612.1693	(283)
Total Primary energy kWh/year			5303.2696	(286)
Target Primary Energy Rate (TPER)			71.6700	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 2B_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2B
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	85 B	DER	14.31	TER	12.03
Environmental	89 B	% DER<TER	-18.95		
CO_2 Emissions (t/year)	0.94	DFEE	32.14	TFEE	36.67
Compliance Check	See BREL	% DFEE < TFEE	12.36		
% DPER < TPER	-27.46	DPER	80.16	TPER	62.89

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000	(1b)	x 2.5000	(2b) =	175.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		175.0000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			12.6000	1.1450	14.4275			(27)
Door			2.6000	1.0000	2.6000			(26)
Heatloss Floor 1			70.0000	0.1100	7.7000			(28a)
External Wall 1	85.0000	15.2000	69.8000	0.1400	9.7720			(29a)
Total net area of external elements Aum(A, m2)			155.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4995			(33)
Party Ceiling 1			70.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 7.7500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 42.2495 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6381	29.6084	29.5794	29.4430	29.4174	29.2986	29.2986	29.2766	29.3444	29.4174	29.4691	29.5231	(38)
Heat transfer coeff	71.8875	71.8579	71.8289	71.6925	71.6669	71.5481	71.5481	71.5261	71.5939	71.6669	71.7186	71.7725	(39)

Average = Sum(39)m / 12 = 71.6923

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0270	1.0265	1.0261	1.0242	1.0238	1.0221	1.0221	1.0218	1.0228	1.0238	1.0246	1.0253	(40)
HLP (average)												1.0242	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)
Hot water usage for mixer showers
61.8798 60.9498 59.5947 57.0020 55.0887 52.9549 51.7420 53.0869 54.5611 56.8521 59.5005 61.6427 (42a)
Hot water usage for baths
26.7336 26.3365 25.7774 24.7465 23.9746 23.1187 22.6564 23.2116 23.8161 24.7319 25.7840 26.6432 (42b)
Hot water usage for other uses
37.6326 36.2641 34.8957 33.5272 32.1587 30.7903 30.7903 32.1587 33.5272 34.8957 36.2641 37.6326 (42c)
Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)

Energy content (annual) Total = Sum(45)m = 1927.5450

Distribution loss (46)m = 0.15 x (45)m
29.9914 26.3901 27.7271 23.6710 22.4589 19.7102 19.0825 20.1439 20.6984 23.7093 25.9753 29.5737 (46)
Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss
27.0820 24.4612 27.0820 26.2084 27.0820 26.2084 27.0820 27.0820 26.2084 27.0820 26.2084 27.0820 (56)
If cylinder contains dedicated solar storage
27.0820 24.4612 27.0820 26.2084 27.0820 26.2084 27.0820 27.0820 26.2084 27.0820 26.2084 27.0820 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month
250.2871 221.4066 235.1916 206.5272 200.0706 180.1220 177.5610 184.6371 186.7096 208.4063 221.8888 247.5023 (62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)
PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h
250.2871 221.4066 235.1916 206.5272 200.0706 180.1220 177.5610 184.6371 186.7096 208.4063 221.8888 247.5023 (64)

Total per year (kWh/year) = Sum(64)m = 2520.3101 (64)

12Total per year (kWh/year) 2520 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month
106.7565 94.8760 101.7372 91.4471 90.0595 82.6674 82.5751 84.9278 84.8578 92.8311 96.5548 105.8305 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
101.6389 112.5288 101.6389 105.0269 101.6389 105.0269 101.6389 101.6389 105.0269 101.6389 105.0269 101.6389 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
197.2971 199.3444 194.1852 183.2019 169.3374 156.3068 147.6015 145.5542 150.7134 161.6967 175.5612 188.5918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
34.2306 34.2306 34.2306 34.2306 34.2306 34.2306 34.2306 34.2306 34.2306 34.2306 34.2306 34.2306 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-89.8450 -89.8450 -89.8450 -89.8450 -89.8450 -89.8450 -89.8450 -89.8450 -89.8450 -89.8450 -89.8450 -89.8450 (71)
Water heating gains (Table 5)
143.4899 141.1846 136.7436 127.0098 121.0477 114.8158 110.9880 114.1503 117.8580 124.7730 134.1039 142.2453 (72)
Total internal gains
502.1177 512.7497 492.2596 474.9305 451.7159 432.8413 416.9203 418.0353 430.2901 447.8005 474.3838 492.1679 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.2000	11.2829	0.7600	0.7000	0.7700	17.4709 (75)
Southeast	4.2000	36.7938	0.7600	0.7000	0.7700	56.9730 (77)
Northwest	4.2000	11.2829	0.7600	0.7000	0.7700	17.4709 (81)

Solar gains	91.9149	168.1714	260.9278	374.9753	467.1683	484.5362	458.5110	386.5591	299.9224	194.1773	112.2065	77.2923 (83)
Total gains	594.0327	680.9210	753.1874	849.9057	918.8842	917.3775	875.4313	804.5944	730.2125	641.9778	586.5903	569.4603 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.6210	67.6489	67.6763	67.8051	67.8292	67.9418	67.9418	67.9627	67.8984	67.8292	67.7804	67.7294	
alpha	5.5081	5.5099	5.5118	5.5203	5.5219	5.5295	5.5295	5.5308	5.5266	5.5219	5.5187	5.5153	
util living area	0.9894	0.9771	0.9472	0.8552	0.6868	0.4937	0.3588	0.4072	0.6491	0.9023	0.9772	0.9915	(86)
MIT	20.0401	20.2299	20.4860	20.7795	20.9444	20.9922	20.9989	20.9978	20.9687	20.7397	20.3361	19.9953	(87)
Th 2	20.0609	20.0613	20.0616	20.0632	20.0635	20.0649	20.0649	20.0652	20.0644	20.0635	20.0629	20.0623	(88)
util rest of house	0.9862	0.9705	0.9324	0.8201	0.6295	0.4240	0.2830	0.3254	0.5719	0.8689	0.9694	0.9889	(89)
MIT 2	18.9611	19.1996	19.5151	19.8554	20.0213	20.0609	20.0646	20.0645	20.0454	19.8214	19.3369	18.9055	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.2308	19.4572	19.7578	20.0864	20.2521	20.2937	20.2982	20.2978	20.2762	20.0510	19.5867	19.1779	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0808	19.3072	19.6078	19.9364	20.1021	20.1437	20.1482	20.1478	20.1262	19.9010	19.4367	19.0279	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9636	0.9237	0.8148	0.6319	0.4300	0.2898	0.3327	0.5772	0.8621	0.9625	0.9850	(94)
Useful gains	583.1395	656.1312	695.7199	692.5016	580.6718	394.4509	253.6737	267.6572	421.4864	553.4656	564.6221	560.9004	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1062.5567	1035.2686	941.5190	791.2302	602.1531	396.6424	253.8656	268.0669	431.4423	666.5716	884.7689	1064.2391	(97)
Space heating kWh	356.6864	254.7804	182.8745	71.0846	15.9821	0.0000	0.0000	0.0000	0.0000	84.1509	230.5058	374.4840	(98a)
Space heating requirement - total per year (kWh/year)												1570.5486	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	356.6864	254.7804	182.8745	71.0846	15.9821	0.0000	0.0000	0.0000	0.0000	84.1509	230.5058	374.4840	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1570.5486	
Space heating per m2											(98c) / (4) =	22.4364	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	356.6864	254.7804	182.8745	71.0846	15.9821	0.0000	0.0000	0.0000	0.0000	84.1509	230.5058	374.4840	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	398.5323	284.6708	204.3290	79.4241	17.8571	0.0000	0.0000	0.0000	0.0000	94.0233	257.5483	418.4178	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	279.6504	247.3817	262.7839	230.7566	223.5426	201.2536	198.3922	206.2984	208.6141	232.8562	247.9204	276.5388	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.5331	20.4836	18.4432	13.5123	10.4373	8.5273	9.5212	12.3761	16.0753	21.0916	23.8229	26.2427	(232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1754.8029 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2815.9890 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	206.0666 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4862.8584 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1754.8029	0.2100	368.5086	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2815.9890	0.2100	591.3577	(264)
Space and water heating			959.8663	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	206.0666	0.1443	29.7418	(268)
Total CO2, kg/year			1001.5373	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1754.8029	1.1300	1982.9272	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2815.9890	1.1300	3182.0676	(278)
Space and water heating			5164.9948	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	206.0666	1.5338	316.0718	(282)
Total Primary energy kWh/year			5611.1674	(286)
Dwelling Primary energy Rate (DPER)			80.1600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000 (1b)	x	2.5000 (2b)	=	175.0000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 70.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1143	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3643	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3096	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3096	0.3329	0.3483	0.3638	(22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			12.6000	1.1450	14.4275			(27)
Heatloss Floor 1			70.0000	0.1300	9.1000			(28a)
External Wall 1	85.0000	15.2000	69.8000	0.1800	12.5640			(29a)
Total net area of external elements Aum(A, m2)			155.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.6915			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	34.0000	0.1600	5.4400
E16 Corner (normal)	5.0000	0.0900	0.4500
E18 Party wall between dwellings	5.0000	0.0600	0.3000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1900 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 44.8815 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.3755	33.2008	33.0295	32.2249	32.0743	31.3736	31.3736	31.2438	31.6435	32.0743	32.3789	32.6973	(38)
Heat transfer coeff	78.2570	78.0823	77.9110	77.1064	76.9558	76.2550	76.2550	76.1253	76.5250	76.9558	77.2604	77.5787	(39)

Average = Sum(39)m / 12 = 77.1056

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1180	1.1155	1.1130	1.1015	1.0994	1.0894	1.0894	1.0875	1.0932	1.0994	1.1037	1.1083	(40)
HLP (average)												1.1015	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)

Hot water usage for other uses

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)

Energy content (annual) Total = Sum(45)m = 1927.5450

Distribution loss (46)m = 0.15 x (45)m

	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	249.1853	220.4115	234.0898	205.4609	198.9689	179.0558	176.4593	183.5353	185.6434	207.3045	220.8226	246.4005 (62)
WWHRS	-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355 (64)
										Total per year (kWh/year) = Sum(64)m =		2244.4896 (64)
12Total per year (kWh/year)												2244 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	105.8751	94.0799	100.8558	90.5941	89.1781	81.8144	81.6937	84.0464	84.0048	91.9497	95.7018	104.9491 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	101.6389	112.5288	101.6389	105.0269	101.6389	105.0269	101.6389	101.6389	105.0269	101.6389	105.0269	101.6389	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)													
	142.3052	139.9999	135.5589	125.8251	119.8630	113.6311	109.8033	112.9656	116.6733	123.5883	132.9192	141.0606	(72)
Total internal gains													
	500.9331	511.5650	491.0749	473.7458	450.5312	431.6566	415.7356	416.8506	429.1054	446.6158	473.1991	490.9832	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(75)
Southeast	4.2000	36.7938	0.6300	0.7000	0.7700	47.2276	(77)
Northwest	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(81)

Solar gains	76.1926	139.4052	216.2954	310.8347	387.2579	401.6550	380.0815	320.4371	248.6199	160.9628	93.0133	64.0713	(83)
Total gains	577.1257	650.9702	707.3703	784.5805	837.7892	833.3116	795.8171	737.2878	677.7253	607.5786	566.2124	555.0545	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1173	62.2563	62.3932	63.0442	63.1676	63.7481	63.7481	63.8567	63.5232	63.1676	62.9186	62.6604	
alpha	5.1412	5.1504	5.1595	5.2029	5.2112	5.2499	5.2499	5.2571	5.2349	5.2112	5.1946	5.1774	
util living area													
	0.9916	0.9835	0.9646	0.9019	0.7665	0.5705	0.4190	0.4699	0.7201	0.9301	0.9827	0.9931	(86)
MIT	19.8684	20.0493	20.3103	20.6518	20.8863	20.9804	20.9968	20.9943	20.9381	20.6364	20.2007	19.8394	(87)
Th 2	19.9862	19.9882	19.9902	19.9996	20.0013	20.0095	20.0095	20.0111	20.0064	20.0013	19.9978	19.9941	(88)
util rest of house													
	0.9890	0.9784	0.9536	0.8729	0.7084	0.4887	0.3261	0.3715	0.6380	0.9026	0.9764	0.9909	(89)
MIT 2	18.6880	18.9179	19.2453	19.6606	19.9114	19.9991	20.0086	20.0091	19.9674	19.6540	19.1186	18.6569	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.9831	19.2008	19.5116	19.9084	20.1551	20.2444	20.2556	20.2554	20.2101	19.8996	19.3891	18.9525	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9831	19.2008	19.5116	19.9084	20.1551	20.2444	20.2556	20.2554	20.2101	19.8996	19.3891	18.9525	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9854	0.9731	0.9470	0.8699	0.7180	0.5086	0.3494	0.3962	0.6559	0.8992	0.9713	0.9877	(94)
Useful gains	568.6713	633.4825	669.8949	682.5022	601.5126	423.8235	278.0225	292.0966	444.5246	546.3309	549.9627	548.2303	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1149.0535	1116.6357	1013.7436	848.8205	650.6715	430.4157	278.7584	293.4945	467.5730	715.6609	949.4621	1144.4830	(97)
Space heating kWh													
	431.8043	324.6789	255.8234	119.7492	36.5742	0.0000	0.0000	0.0000	0.0000	125.9815	287.6396	443.6120	(98a)
Space heating requirement - total per year (kWh/year)												2025.8632	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	431.8043	324.6789	255.8234	119.7492	36.5742	0.0000	0.0000	0.0000	0.0000	125.9815	287.6396	443.6120	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2025.8632	
Space heating per m2											(98c) / (4) =	28.9409	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	431.8043	324.6789	255.8234	119.7492	36.5742	0.0000	0.0000	0.0000	0.0000	125.9815	287.6396	443.6120	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	467.8270	351.7648	277.1651	129.7391	39.6254	0.0000	0.0000	0.0000	0.0000	136.4914	311.6355	480.6197	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5352	85.1903	84.5262	83.1239	81.1978	79.8000	79.8000	79.8000	79.8000	83.2030	84.9084	85.6123	(217)
Fuel for water heating, kWh/month													
	258.2522	229.3602	245.9492	221.0769	220.1433	202.7013	200.8060	208.3848	210.2056	223.7937	231.9173	255.3786	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	21.1186	16.9421	15.2545	11.1761	8.6327	7.0530	7.8751	10.2363	13.2959	17.4450	19.7041	21.7055	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.8736	-46.4122	-66.8180	-75.2641	-81.2912	-75.9416	-75.0150	-70.7566	-63.2542	-53.1420	-36.1687	-28.4144	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.3733	-38.6743	-76.9056	-115.5570	-152.8359	-153.5650	-151.7461	-128.4557	-94.1262	-55.3116	-24.5337	-14.5264	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2194.8680	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2707.9691	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	170.4389	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1729.9627	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3429.3133	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2194.8680	0.2100	460.9223	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2707.9691	0.2100	568.6735	(264)
Space and water heating			1029.5958	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.4389	0.1443	24.5996	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.3517	0.1345	-94.9025	
PV Unit electricity exported	-1024.6110	0.1259	-128.9835	
Total			-223.8860	(269)
Total CO2, kg/year			842.2386	(272)
Target Carbon Dioxide Emission Rate (TER)			12.0300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2194.8680	1.1300	2480.2009	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2707.9691	1.1300	3060.0050	(278)
Space and water heating			5540.2059	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.4389	1.5338	261.4248	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.3517	1.4973	-1056.0935	
PV Unit electricity exported	-1024.6110	0.4621	-473.4580	
Total			-1529.5516	(283)
Total Primary energy kWh/year			4402.1800	(286)
Target Primary Energy Rate (TPER)			62.8900	(287)

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Full SAP Calculation Printout

Property Reference	Plot 2BF-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2BF-AFF
Property	1 Bedroom Flat, 2BF-AFF, Saffron Walden, CB11		

SAP Rating	85 B	DER	13.44	TER	10.97
Environmental	89 B	% DER<TER	-22.52		
CO_2 Emissions (t/year)	0.88	DFEE	28.70	TFEE	32.09
Compliance Check	See BREL	% DFEE < TFEE	10.56		
% DPER < TPER	-32.06	DPER	75.46	TPER	57.14

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000	(1b)	x 2.5000	(2b) =	175.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		175.0000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Door			2.6000	1.0000	2.6000			(26)
External Wall 1	60.0000	17.3000	42.7000	0.1400	5.9780			(29a)
External Roof 1	70.0000		70.0000	0.1100	7.7000			(30)
Total net area of external elements Aum(A, m2)			130.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.1101			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)
Party Floor 1			70.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												6.5000	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	39.6101	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6381	29.6084	29.5794	29.4430	29.4174	29.2986	29.2986	29.2766	29.3444	29.4174	29.4691	29.5231	(38)
Heat transfer coeff	69.2481	69.2185	69.1895	69.0530	69.0275	68.9087	68.9087	68.8867	68.9545	69.0275	69.0791	69.1331	(39)
Average = Sum(39)m / 12 =												69.0529	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9893	0.9888	0.9884	0.9865	0.9861	0.9844	0.9844	0.9841	0.9851	0.9861	0.9868	0.9876	(40)
HLP (average)												0.9865	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461	(42)
Hot water usage for mixer showers	61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)
Hot water usage for baths	26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)
Hot water usage for other uses	37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)
Average daily hot water use (litres/day)												116.0487	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)
Energy content (annual)										Total = Sum(45)m =		1927.5450	
Distribution loss (46)m = 0.15 x (45)m	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(64)
										Total per year (kWh/year) = Sum(64)m =		2520.3101	(64)
12Total per year (kWh/year)												2520	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	106.7565	94.8760	101.7372	91.4471	90.0595	82.6674	82.5751	84.9278	84.8578	92.8311	96.5548	105.8305	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.7867	110.4781	99.7867	103.1129	99.7867	103.1129	99.7867	99.7867	103.1129	99.7867	103.1129	99.7867	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	143.4899	141.1846	136.7436	127.0098	121.0477	114.8158	110.9880	114.1503	117.8580	124.7730	134.1039	142.2453	(72)
Total internal gains	500.2655	510.6989	490.4073	473.0165	449.8637	430.9273	415.0680	416.1830	428.3761	445.9482	472.4698	490.3157	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.2000	11.2829	0.7600	0.7000	0.7700	17.4709 (75)
Southwest	6.3000	36.7938	0.7600	0.7000	0.7700	85.4595 (79)
Northwest	4.2000	11.2829	0.7600	0.7000	0.7700	17.4709 (81)

Solar gains	120.4014	216.6944	327.3192	457.2374	559.3087	576.0103	546.7018	467.3802	371.8102	247.8056	146.3268	101.6709 (83)
Total gains	620.6669	727.3934	817.7265	930.2538	1009.1724	1006.9376	961.7698	883.5633	800.1863	693.7538	618.7966	591.9865 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.1984	70.2285	70.2580	70.3968	70.4228	70.5442	70.5442	70.5668	70.4974	70.4228	70.3702	70.3152	
alpha	5.6799	5.6819	5.6839	5.6931	5.6949	5.7029	5.7029	5.7045	5.6998	5.6949	5.6913	5.6877	
util living area	0.9863	0.9674	0.9224	0.8014	0.6176	0.4357	0.3150	0.3580	0.5817	0.8648	0.9692	0.9893	(86)
MIT	20.1413	20.3519	20.6071	20.8579	20.9705	20.9965	20.9995	20.9991	20.9838	20.8138	20.4311	20.0913	(87)
Th 2	20.0923	20.0926	20.0930	20.0946	20.0949	20.0963	20.0963	20.0966	20.0958	20.0949	20.0943	20.0937	(88)
util rest of house	0.9823	0.9585	0.9030	0.7621	0.5636	0.3752	0.2504	0.2880	0.5108	0.8254	0.9592	0.9861	(89)
MIT 2	19.1127	19.3752	19.6838	19.9648	20.0732	20.0945	20.0962	20.0963	20.0863	19.9273	19.4785	19.0508	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.3698	19.6194	19.9146	20.1881	20.2975	20.3200	20.3220	20.3220	20.3107	20.1489	19.7166	19.3109	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2198	19.4694	19.7646	20.0381	20.1475	20.1700	20.1720	20.1720	20.1607	19.9989	19.5666	19.1609	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9771	0.9509	0.8948	0.7594	0.5668	0.3802	0.2558	0.2939	0.5160	0.8207	0.9518	0.9817	(94)
Useful gains	606.4843	691.6963	731.6964	706.4668	571.9975	382.8504	246.0677	259.6700	412.9218	569.3637	588.9873	581.1320	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1033.1710	1008.4686	917.7706	769.1170	583.1109	383.8222	246.1448	259.8404	417.9098	648.7829	861.1849	1034.2948	(97)
Space heating kWh	317.4549	212.8710	138.4392	45.1082	8.2683	0.0000	0.0000	0.0000	0.0000	59.0879	195.9823	337.1531	(98a)
Space heating requirement - total per year (kWh/year)												1314.3649	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	317.4549	212.8710	138.4392	45.1082	8.2683	0.0000	0.0000	0.0000	0.0000	59.0879	195.9823	337.1531	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1314.3649	
Space heating per m2										(98c) / (4) =		18.7766	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	317.4549	212.8710	138.4392	45.1082	8.2683	0.0000	0.0000	0.0000	0.0000	59.0879	195.9823	337.1531	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	354.6982	237.8447	154.6806	50.4002	9.2384	0.0000	0.0000	0.0000	0.0000	66.0200	218.9746	376.7074	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	279.6504	247.3817	262.7839	230.7566	223.5426	201.2536	198.3922	206.2984	208.6141	232.8562	247.9204	276.5388	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	25.0678	20.1103	18.1071	13.2660	10.2471	8.3719	9.3477	12.1505	15.7823	20.7072	23.3888	25.7645 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1468.5641 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2815.9890 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	202.3112 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4572.8643 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1468.5641	0.2100	308.3985	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2815.9890	0.2100	591.3577	(264)
Space and water heating			899.7561	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	202.3112	0.1443	29.1998	(268)
Total CO2, kg/year			940.8852	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1468.5641	1.1300	1659.4774	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2815.9890	1.1300	3182.0676	(278)
Space and water heating			4841.5450	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	202.3112	1.5338	310.3117	(282)
Total Primary energy kWh/year			5281.9575	(286)
Dwelling Primary energy Rate (DPER)			75.4600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.0000 (1b)	x	2.5000 (2b)	=	175.0000 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

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2. Ventilation rate

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			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1143 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3643 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3096 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3096	0.3329	0.3483	0.3638	(22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
External Wall 1	60.0000	17.3000	42.7000	0.1800	7.6860			(29a)
External Roof 1	70.0000		70.0000	0.1100	7.7000			(30)
Total net area of external elements Aum(A, m2)			130.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8181			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	35.0000	0.0700	2.4500
E14 Flat roof	35.0000	0.0800	2.8000
E16 Corner (normal)	5.0000	0.0900	0.4500
E18 Party wall between dwellings	5.0000	0.0600	0.3000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0000 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 40.8181 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.3755	33.2008	33.0295	32.2249	32.0743	31.3736	31.3736	31.2438	31.6435	32.0743	32.3789	32.6973	(38)
Heat transfer coeff	74.1936	74.0188	73.8475	73.0429	72.8924	72.1916	72.1916	72.0619	72.4616	72.8924	73.1969	73.5153	(39)

Average = Sum(39)m / 12 = 73.0422

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0599	1.0574	1.0550	1.0435	1.0413	1.0313	1.0313	1.0295	1.0352	1.0413	1.0457	1.0502	(40)
HLP (average)												1.0435	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers

61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427 (42a)

Hot water usage for baths

26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432 (42b)

Hot water usage for other uses

37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326 (42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)

Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)
Energy content (annual)											Total = Sum(45)m =	1927.5450	
Distribution loss (46)m = 0.15 x (45)m													
	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	249.1853	220.4115	234.0898	205.4609	198.9689	179.0558	176.4593	183.5353	185.6434	207.3045	220.8226	246.4005	(62)
WWHRS	-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
										Total per year (kWh/year) = Sum(64)m =		2244.4896	(64)
12Total per year (kWh/year)												2244	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.8751	94.0799	100.8558	90.5941	89.1781	81.8144	81.6937	84.0464	84.0048	91.9497	95.7018	104.9491	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	99.7867	110.4781	99.7867	103.1129	99.7867	103.1129	99.7867	99.7867	103.1129	99.7867	103.1129	99.7867	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)													
	142.3052	139.9999	135.5589	125.8251	119.8630	113.6311	109.8033	112.9656	116.6733	123.5883	132.9192	141.0606	(72)
Total internal gains													
	499.0808	509.5142	489.2226	471.8318	448.6790	429.7426	413.8833	414.9983	427.1914	444.7635	471.2851	489.1310	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(75)
Southwest	6.3000	36.7938	0.6300	0.7000	0.7700	70.8414	(79)
Northwest	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(81)

Solar gains	99.8064	179.6283	271.3304	379.0257	463.6375	477.4822	453.1870	387.4336	308.2111	205.4178	121.2972	84.2798	(83)
Total gains	598.8872	689.1425	760.5530	850.8575	912.3165	907.2248	867.0703	802.4320	735.4025	650.1813	592.5823	573.4107	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.5193	65.6740	65.8263	66.5514	66.6889	67.3362	67.3362	67.4575	67.0854	66.6889	66.4114	66.1238	
alpha	5.3680	5.3783	5.3884	5.4368	5.4459	5.4891	5.4891	5.4972	5.4724	5.4459	5.4274	5.4083	
util living area													
	0.9895	0.9771	0.9483	0.8602	0.6986	0.5030	0.3654	0.4112	0.6512	0.9018	0.9771	0.9915	(86)
MIT	19.9935	20.1926	20.4553	20.7628	20.9367	20.9911	20.9987	20.9976	20.9670	20.7317	20.3156	19.9604	(87)
Th 2	20.0337	20.0358	20.0378	20.0473	20.0490	20.0573	20.0573	20.0589	20.0541	20.0490	20.0454	20.0417	(88)
util rest of house													
	0.9863	0.9705	0.9336	0.8255	0.6406	0.4317	0.2876	0.3281	0.5732	0.8681	0.9692	0.9889	(89)
MIT 2	18.8816	19.1332	19.4585	19.8231	20.0007	20.0527	20.0569	20.0581	20.0342	19.7998	19.2978	18.8457	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.1596	19.3981	19.7077	20.0580	20.2347	20.2873	20.2924	20.2930	20.2674	20.0328	19.5522	19.1244	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1596	19.3981	19.7077	20.0580	20.2347	20.2873	20.2924	20.2930	20.2674	20.0328	19.5522	19.1244	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9649	0.9276	0.8259	0.6524	0.4494	0.3071	0.3489	0.5914	0.8675	0.9639	0.9855	(94)
Useful gains	588.3335	664.9292	705.4706	702.7264	595.2378	407.6642	266.2746	279.9685	434.9376	564.0183	571.2058	565.0916	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1102.4855	1073.1317	975.3577	815.0142	622.1139	410.5767	266.5594	280.5343	446.8969	687.5791	911.4649	1097.1700	(97)
Space heating kWh													
	382.5291	274.3121	200.7960	80.8472	19.9959	0.0000	0.0000	0.0000	0.0000	91.9293	244.9866	395.8663	(98a)
Space heating requirement - total per year (kWh/year)												1691.2624	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	382.5291	274.3121	200.7960	80.8472	19.9959	0.0000	0.0000	0.0000	0.0000	91.9293	244.9866	395.8663	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1691.2624	
Space heating per m2											(98c) / (4) =	24.1609	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	382.5291	274.3121	200.7960	80.8472	19.9959	0.0000	0.0000	0.0000	0.0000	91.9293	244.9866	395.8663	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	414.4411	297.1962	217.5471	87.5918	21.6640	0.0000	0.0000	0.0000	0.0000	99.5983	265.4243	428.8909	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.2792	84.8205	83.9820	82.3500	80.6221	79.8000	79.8000	79.8000	79.8000	82.5659	84.5507	85.3742	(217)
Fuel for water heating, kWh/month													
	259.0275	230.3600	247.5431	223.1544	221.7153	202.7013	200.8060	208.3848	210.2056	225.5207	232.8983	256.0909	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	20.7337	16.6333	14.9765	10.9724	8.4754	6.9245	7.7315	10.0498	13.0536	17.1271	19.3450	21.3099	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.8628	-46.3936	-66.7895	-75.2326	-81.2599	-75.9138	-74.9840	-70.7210	-63.2183	-53.1142	-36.1539	-28.4051	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.3841	-38.6929	-76.9341	-115.5884	-152.8672	-153.5928	-151.7771	-128.4913	-94.1621	-55.3395	-24.5486	-14.5357	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1832.3537	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2718.4078	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	167.3328	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1729.9627	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3074.1316	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1832.3537	0.2100	384.7943	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2718.4078	0.2100	570.8656	(264)
Space and water heating			955.6599	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	167.3328	0.1443	24.1513	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.0487	0.1345	-94.8620	
PV Unit electricity exported	-1024.9140	0.1259	-129.0243	
Total			-223.8863	(269)
Total CO2, kg/year			767.8541	(272)
Target Carbon Dioxide Emission Rate (TER)			10.9700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1832.3537	1.1300	2070.5597	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2718.4078	1.1300	3071.8008	(278)
Space and water heating			5142.3605	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	167.3328	1.5338	256.6606	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.0487	1.4973	-1055.6411	
PV Unit electricity exported	-1024.9140	0.4621	-473.6077	
Total			-1529.2488	(283)
Total Primary energy kWh/year			3999.8731	(286)
Target Primary Energy Rate (TPER)			57.1400	(287)

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Full SAP Calculation Printout

Property Reference	Plot 2BH_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2BH
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	85 B	DER	14.28	TER	11.93
Environmental	88 B	% DER<TER	-19.70		
CO_2 Emissions (t/year)	1.07	DFEE	37.05	TFEE	39.49
Compliance Check	See BREL	% DFEE < TFEE	6.17		
% DPER < TPER	-28.11	DPER	79.85	TPER	62.33

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		40.0000 (1b)	x	2.5000 (2b)	=	100.0000 (1b)	-
First floor		40.0000 (1c)	x	2.7500 (2c)	=	110.0000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	210.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			2.6000	1.0000	2.6000			(26)
Heatloss Floor 1			40.0000	0.1100	4.4000			(28a)
External Wall 1	95.0000	27.8000	67.2000	0.1400	9.4080			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			175.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.6630			(33)

Party Wall 1						42.0000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												8.7500	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	58.4130	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.5657	35.5301	35.4953	35.3316	35.3009	35.1584	35.1584	35.1320	35.2133	35.3009	35.3629	35.4277	(38)
Heat transfer coeff	93.9786	93.9431	93.9082	93.7445	93.7139	93.5713	93.5713	93.5449	93.6262	93.7139	93.7759	93.8406	(39)
Average = Sum(39)m / 12 =												93.7444	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1747	1.1743	1.1739	1.1718	1.1714	1.1696	1.1696	1.1693	1.1703	1.1714	1.1722	1.1730	(40)
HLP (average)												1.1718	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4629	(42)
Hot water usage for mixer showers	65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)
Hot water usage for baths	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)												122.8659	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156	(44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400	(45)
Energy content (annual)											Total = Sum(45)m =	2040.7768	
Distribution loss (46)m = 0.15 x (45)m	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(64)
										Total per year (kWh/year) = Sum(64)m =		2633.5419	(64)
12Total per year (kWh/year)												2634	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	110.6619	98.3124	105.3476	94.5294	92.9839	85.2338	85.0599	87.5509	87.5531	95.9185	99.9373	109.6816	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.6826	122.5414	110.6826	114.3720	110.6826	114.3720	110.6826	110.6826	114.3720	110.6826	114.3720	110.6826	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)	148.7391	146.2983	141.5963	131.2908	124.9784	118.3803	114.3278	117.6760	121.6015	128.9227	138.8018	147.4215	(72)
Total internal gains	541.8052	553.5003	531.2012	512.3691	486.9467	466.5450	449.1207	450.1918	463.5450	482.3928	511.3818	530.8052	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southeast	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (77)
Northwest	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	183.8298	336.3427	521.8556	749.9505	934.3366	969.0724	917.0220	773.1182	599.8448	388.3546	224.4130	154.5847	(83)
Total gains	725.6350	889.8430	1053.0568	1262.3196	1421.2833	1435.6174	1366.1426	1223.3100	1063.3897	870.7474	735.7948	685.3899	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1151	59.1375	59.1594	59.2627	59.2821	59.3724	59.3724	59.3892	59.3376	59.2821	59.2429	59.2020	
alpha	4.9410	4.9425	4.9440	4.9508	4.9521	4.9582	4.9582	4.9593	4.9558	4.9521	4.9495	4.9468	
util living area	0.9880	0.9687	0.9188	0.7846	0.5909	0.4139	0.3008	0.3505	0.5862	0.8752	0.9734	0.9908	(86)
MIT	19.8628	20.1323	20.4741	20.8079	20.9578	20.9939	20.9990	20.9979	20.9698	20.7163	20.2163	19.8024	(87)
Th 2	19.9403	19.9406	19.9410	19.9426	19.9429	19.9444	19.9444	19.9446	19.9438	19.9429	19.9423	19.9417	(88)
util rest of house	0.9843	0.9598	0.8974	0.7403	0.5311	0.3471	0.2289	0.2707	0.5051	0.8343	0.9641	0.9879	(89)
MIT 2	18.6469	18.9838	19.3979	19.7702	19.9126	19.9414	19.9441	19.9440	19.9266	19.6875	19.0948	18.5716	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.9508	19.2709	19.6669	20.0296	20.1739	20.2045	20.2078	20.2075	20.1874	19.9447	19.3752	18.8793	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8008	19.1209	19.5169	19.8796	20.0239	20.0545	20.0578	20.0575	20.0374	19.7947	19.2252	18.7293	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9787	0.9508	0.8873	0.7374	0.5358	0.3542	0.2367	0.2793	0.5125	0.8276	0.9557	0.9832	(94)
Useful gains	710.1984	846.0521	934.3253	930.8954	761.5068	508.4289	323.3567	341.6931	545.0091	720.6353	703.2327	673.8476	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1362.7693	1335.9581	1222.3986	1029.2795	780.0666	510.3838	323.5522	342.1376	555.8958	861.6732	1137.0484	1363.4420	(97)
Space heating kWh	485.5127	329.2169	214.3265	70.8365	13.8085	0.0000	0.0000	0.0000	0.0000	104.9322	312.3473	513.0582	(98a)
Space heating requirement - total per year (kWh/year)												2044.0389	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	485.5127	329.2169	214.3265	70.8365	13.8085	0.0000	0.0000	0.0000	0.0000	104.9322	312.3473	513.0582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2044.0389	
Space heating per m2											(98c) / (4) =	25.5505	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	485.5127	329.2169	214.3265	70.8365	13.8085	0.0000	0.0000	0.0000	0.0000	104.9322	312.3473	513.0582	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	542.4723	367.8401	239.4710	79.1470	15.4285	0.0000	0.0000	0.0000	0.0000	117.2427	348.9914	573.2494	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	292.7740	258.9292	274.9162	241.1141	233.3697	209.8779	206.7420	215.1128	217.6714	243.2309	259.2867	289.4798	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.4546	22.8273	20.5535	15.0584	11.6315	9.5030	10.6107	13.7921	17.9146	23.5049	26.5488	29.2454 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2283.8424 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2942.5049 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	229.6449 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5541.9922 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2283.8424	0.2100	479.6069	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2942.5049	0.2100	617.9260	(264)
Space and water heating			1097.5329	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	229.6449	0.1443	33.1449	(268)
Total CO2, kg/year			1142.6071	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2283.8424	1.1300	2580.7419	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2942.5049	1.1300	3325.0306	(278)
Space and water heating			5905.7724	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	229.6449	1.5338	352.2371	(282)
Total Primary energy kWh/year			6388.1103	(286)
Dwelling Primary energy Rate (DPER)			79.8500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.0000 (1b)	x	2.5000 (2b)	=	100.0000 (1b)	-
First floor	40.0000 (1c)	x	2.7500 (2c)	=	110.0000 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 80.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 210.0000 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1429	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3929	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3339	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4258	0.4174	0.4091	0.3673	0.3590	0.3172	0.3172	0.3089	0.3339	0.3590	0.3757	0.3924	(22b)
Effective ac	0.5906	0.5871	0.5837	0.5675	0.5644	0.5503	0.5503	0.5477	0.5558	0.5644	0.5706	0.5770	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			17.4000	1.1450	19.9237			(27)
Heatloss Floor 1			40.0000	0.1300	5.2000			(28a)
External Wall 1	95.0000	20.0000	75.0000	0.1800	13.5000			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			175.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.6237			(33)
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	26.0000	0.1600	4.1600
E6 Intermediate floor within a dwelling	26.0000	0.0000	0.0000
E14 Flat roof	26.0000	0.0800	2.0800
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8150 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 53.4387 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.9310	40.6871	40.4481	39.3252	39.1151	38.1370	38.1370	37.9559	38.5138	39.1151	39.5401	39.9844	(38)
Heat transfer coeff	94.3697	94.1258	93.8867	92.7638	92.5537	91.5757	91.5757	91.3946	91.9524	92.5537	92.9787	93.4231	(39)
Average = Sum(39)m / 12 =												92.7628	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1796	1.1766	1.1736	1.1595	1.1569	1.1447	1.1447	1.1424	1.1494	1.1569	1.1622	1.1678	(40)
HLP (average)												1.1595	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4629 (42)
Hot water usage for mixer showers

65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)

Hot water usage for baths

28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)

Hot water usage for other uses

39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)

Average daily hot water use (litres/day) 122.8659 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156	(44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7768	
Distribution loss (46)m = 0.15 x (45)m													
	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	260.9310	230.7465	244.9482	214.7309	207.7641	186.7745	183.9324	191.4242	193.7497	216.5899	230.9954	257.9827	(62)
WWHRS	-29.9502	-26.4882	-27.7369	-22.9672	-21.4046	-18.3161	-17.1684	-18.2569	-18.9505	-22.3406	-25.3092	-29.3955	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	230.9808	204.2583	217.2113	191.7637	186.3595	168.4584	166.7639	173.1673	174.7991	194.2493	205.6862	228.5871	(64)
										Total per year (kWh/year) = Sum(64)m =		2342.2850	(64)
12Total per year (kWh/year)												2342	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	109.7805	97.5163	104.4662	93.6764	92.1025	84.3809	84.1785	86.6695	86.7001	95.0371	99.0843	108.8002	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	110.7673	122.6352	110.7673	114.4595	110.7673	114.4595	110.7673	110.7673	114.4595	110.7673	114.4595	110.7673	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)													
	147.5544	145.1136	140.4116	130.1061	123.7937	117.1956	113.1431	116.4913	120.4168	127.7380	137.6171	146.2368	(72)
Total internal gains													
	540.7052	552.4094	530.1012	511.2719	485.8468	465.4478	448.0207	449.0918	462.4478	481.2928	510.2847	529.7053	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.8000	11.2829	0.6300	0.7000	0.7700	19.9996	(75)
Southeast	5.8000	36.7938	0.6300	0.7000	0.7700	65.2191	(77)
Northwest	5.8000	11.2829	0.6300	0.7000	0.7700	19.9996	(81)

Solar gains	105.2184	192.5120	298.6937	429.2480	534.7848	554.6664	524.8744	442.5084	343.3322	222.2819	128.4469	88.4794	(83)
Total gains	645.9236	744.9213	828.7949	940.5199	1020.6315	1020.1143	972.8951	891.6003	805.7800	703.5748	638.7316	618.1846	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.8701	59.0227	59.1730	59.8893	60.0252	60.6663	60.6663	60.7865	60.4177	60.0252	59.7508	59.4666	
alpha	4.9247	4.9348	4.9449	4.9926	5.0017	5.0444	5.0444	5.0524	5.0278	5.0017	4.9834	4.9644	
util living area													
	0.9927	0.9845	0.9645	0.8974	0.7554	0.5591	0.4113	0.4659	0.7215	0.9338	0.9847	0.9940	(86)
MIT	19.7541	19.9571	20.2502	20.6276	20.8798	20.9788	20.9963	20.9932	20.9288	20.5911	20.1130	19.7245	(87)
Th 2	19.9363	19.9388	19.9412	19.9525	19.9546	19.9645	19.9645	19.9663	19.9607	19.9546	19.9503	19.9459	(88)
util rest of house													
	0.9903	0.9796	0.9532	0.8669	0.6949	0.4752	0.3160	0.3641	0.6366	0.9068	0.9790	0.9921	(89)
MIT 2	18.5067	18.7653	19.1332	19.5922	19.8606	19.9534	19.9634	19.9641	19.9161	19.5634	18.9733	18.4758	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.8186	19.0632	19.4125	19.8510	20.1154	20.2097	20.2216	20.2214	20.1693	19.8203	19.2582	18.7880	(92)

Temperature adjustment												0.0000	
adjusted MIT	18.8186	19.0632	19.4125	19.8510	20.1154	20.2097	20.2216	20.2214	20.1693	19.8203	19.2582	18.7880	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9742	0.9461	0.8635	0.7049	0.4956	0.3399	0.3896	0.6549	0.9026	0.9739	0.9891	(94)
Useful gains	637.4108	725.7176	784.1569	812.1488	719.4073	505.5756	330.6915	347.3837	527.7036	635.0186	622.0308	611.4535	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1370.1143	1333.1261	1212.3109	1015.8588	778.8760	513.7157	331.6522	349.2555	558.0868	853.3757	1130.4547	1362.8557	(97)
Space heating kWh	545.1314	408.1785	318.5466	146.6712	44.2447	0.0000	0.0000	0.0000	0.0000	162.4577	366.0652	559.0432	(98a)
Space heating requirement - total per year (kWh/year)												2550.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	545.1314	408.1785	318.5466	146.6712	44.2447	0.0000	0.0000	0.0000	0.0000	162.4577	366.0652	559.0432	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2550.3385	
Space heating per m2											(98c) / (4) =	31.8792	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	545.1314	408.1785	318.5466	146.6712	44.2447	0.0000	0.0000	0.0000	0.0000	162.4577	366.0652	559.0432	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	590.6082	442.2302	345.1209	158.9071	47.9358	0.0000	0.0000	0.0000	0.0000	176.0105	396.6036	605.6807	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	230.9808	204.2583	217.2113	191.7637	186.3595	168.4584	166.7639	173.1673	174.7991	194.2493	205.6862	228.5871	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9162	85.5809	84.9172	83.4661	81.3825	79.8000	79.8000	79.8000	79.8000	83.6618	85.3376	85.9855	(217)
Fuel for water heating, kWh/month	268.8444	238.6728	255.7920	229.7503	228.9919	211.1008	208.9773	217.0017	219.0465	232.1841	241.0265	265.8437	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.0153	18.4637	16.6245	12.1798	9.4080	7.6865	8.5823	11.1556	14.4901	19.0118	21.4738	23.6549	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.2584	-52.4461	-75.2785	-84.5221	-91.0460	-84.9455	-83.8821	-79.2210	-71.0005	-59.8942	-40.9264	-32.2205	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.3095	-44.7957	-88.9771	-133.5591	-176.5277	-177.3478	-175.2734	-148.4502	-108.8629	-64.0529	-28.4478	-16.8547	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2763.0970	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2817.2319	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												185.7463	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1977.1002	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3874.9750 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2763.0970	0.2100	580.2504	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2817.2319	0.2100	591.6187	(264)
Space and water heating			1171.8691	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	185.7463	0.1443	26.8089	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-792.6414	0.1346	-106.7035	
PV Unit electricity exported	-1184.4589	0.1259	-149.1376	
Total			-255.8411	(269)
Total CO2, kg/year			954.7662	(272)
Target Carbon Dioxide Emission Rate (TER)			11.9300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2763.0970	1.1300	3122.2996	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2817.2319	1.1300	3183.4721	(278)
Space and water heating			6305.7717	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	185.7463	1.5338	284.9039	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-792.6414	1.4975	-1187.0007	
PV Unit electricity exported	-1184.4589	0.4622	-547.4384	
Total			-1734.4392	(283)
Total Primary energy kWh/year			4986.3372	(286)
Target Primary Energy Rate (TPER)			62.3300	(287)

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Full SAP Calculation Printout

Property Reference	Plot 2BH-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2BH-AFF
Property	1 Bedroom Flat, 2BH-AFF, Saffron Walden, CB11		

SAP Rating	85 B	DER	13.53	TER	11.35
Environmental	89 B	% DER<TER	-19.21		
CO_2 Emissions (t/year)	1.02	DFEE	34.23	TFEE	36.48
Compliance Check	See BREL	% DFEE < TFEE	6.17		
% DPER < TPER	-28.01	DPER	75.82	TPER	59.23

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)
Ground floor		40.0000 (1b)	x	2.5000 (2b)	=	100.0000 (1b) -
First floor		40.0000 (1c)	x	2.7500 (2c)	=	110.0000 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	210.0000 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.3000	1.1450	31.2595			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			40.0000	0.1100	4.4000			(28a)
External Wall 1	100.0000	32.5000	67.5000	0.1400	9.4500			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			180.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.7095			(33)

Party Wall 1						53.0000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												9.0000	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	63.7095	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.5657	35.5301	35.4953	35.3316	35.3009	35.1584	35.1584	35.1320	35.2133	35.3009	35.3629	35.4277	(38)
Heat transfer coeff	99.2752	99.2397	99.2048	99.0411	99.0105	98.8679	98.8679	98.8415	98.9228	99.0105	99.0724	99.1372	(39)
Average = Sum(39)m / 12 =												99.0410	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2409	1.2405	1.2401	1.2380	1.2376	1.2358	1.2358	1.2355	1.2365	1.2376	1.2384	1.2392	(40)
HLP (average)												1.2380	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4629	(42)
Hot water usage for mixer showers	65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)
Hot water usage for baths	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)												122.8659	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156	(44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400	(45)
Energy content (annual)											Total = Sum(45)m =	2040.7768	
Distribution loss (46)m = 0.15 x (45)m	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(64)
										Total per year (kWh/year) = Sum(64)m =		2633.5419	(64)
12Total per year (kWh/year)												2634	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	110.6619	98.3124	105.3476	94.5294	92.9839	85.2338	85.0599	87.5509	87.5531	95.9185	99.9373	109.6816	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.6826	122.5414	110.6826	114.3720	110.6826	114.3720	110.6826	110.6826	114.3720	110.6826	114.3720	110.6826	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)	148.7391	146.2983	141.5963	131.2908	124.9784	118.3803	114.3278	117.6760	121.6015	128.9227	138.8018	147.4215	(72)
Total internal gains	541.8052	553.5003	531.2012	512.3691	486.9467	466.5450	449.1207	450.1918	463.5450	482.3928	511.3818	530.8052	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	8.4000	19.6403	0.7600	0.7000	0.7700	60.8235 (76)
South	12.6000	46.7521	0.7600	0.7000	0.7700	217.1782 (78)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.6193	563.9034	795.9867	1012.1892	1146.5228	1140.9521	1099.0815	1000.3677	872.1108	630.7086	390.1498	275.1940	(83)
Total gains	865.4245	1117.4036	1327.1879	1524.5583	1633.4695	1607.4971	1548.2022	1450.5594	1335.6557	1113.1014	901.5316	805.9992	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9611	55.9812	56.0009	56.0934	56.1108	56.1917	56.1917	56.2067	56.1605	56.1108	56.0757	56.0390	
alpha	4.7307	4.7321	4.7334	4.7396	4.7407	4.7461	4.7461	4.7471	4.7440	4.7407	4.7384	4.7359	
util living area													
	0.9774	0.9365	0.8571	0.7143	0.5468	0.3908	0.2805	0.3126	0.5005	0.7922	0.9491	0.9831	(86)
MIT	19.9296	20.2732	20.6032	20.8557	20.9637	20.9939	20.9990	20.9983	20.9814	20.8049	20.3124	19.8488	(87)
Th 2	19.8874	19.8877	19.8881	19.8897	19.8900	19.8914	19.8914	19.8917	19.8909	19.8900	19.8894	19.8888	(88)
util rest of house													
	0.9708	0.9203	0.8259	0.6656	0.4872	0.3244	0.2101	0.2377	0.4244	0.7390	0.9330	0.9781	(89)
MIT 2	18.6910	19.1112	19.4955	19.7650	19.8646	19.8885	19.8912	19.8912	19.8808	19.7256	19.1686	18.5910	(90)
Living area fraction									fLA = Living area / (4) =			0.2469	(91)
MIT	18.9968	19.3981	19.7690	20.0343	20.1359	20.1614	20.1647	20.1645	20.1525	19.9920	19.4510	18.9015	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8468	19.2481	19.6190	19.8843	19.9859	20.0114	20.0147	20.0145	20.0025	19.8420	19.3010	18.7515	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9089	0.8174	0.6653	0.4925	0.3316	0.2179	0.2461	0.4323	0.7365	0.9222	0.9710	(94)
Useful gains	832.9315	1015.6606	1084.8533	1014.3445	804.4860	533.0844	337.4087	356.9170	577.3531	819.8128	831.4023	782.5869	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1444.1363	1423.8965	1301.4666	1087.8932	820.3918	535.0153	337.6003	357.2649	583.8944	915.0562	1208.7804	1442.5992	(97)
Space heating kWh													
	454.7364	274.3345	161.1603	52.9550	11.8339	0.0000	0.0000	0.0000	0.0000	70.8611	271.7123	491.0492	(98a)
Space heating requirement - total per year (kWh/year)												1788.6427	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	454.7364	274.3345	161.1603	52.9550	11.8339	0.0000	0.0000	0.0000	0.0000	70.8611	271.7123	491.0492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1788.6427	
Space heating per m2											(98c) / (4) =	22.3580	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	454.7364	274.3345	161.1603	52.9550	11.8339	0.0000	0.0000	0.0000	0.0000	70.8611	271.7123	491.0492	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	508.0853	306.5190	180.0674	59.1676	13.2223	0.0000	0.0000	0.0000	0.0000	79.1744	303.5891	548.6583	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month													
	292.7740	258.9292	274.9162	241.1141	233.3697	209.8779	206.7420	215.1128	217.6714	243.2309	259.2867	289.4798	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.4546	22.8273	20.5535	15.0584	11.6315	9.5030	10.6107	13.7921	17.9146	23.5049	26.5488	29.2454 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1998.4834 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2942.5049 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	229.6449 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5256.6333 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1998.4834	0.2100	419.6815	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2942.5049	0.2100	617.9260	(264)
Space and water heating			1037.6076	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	229.6449	0.1443	33.1449	(268)
Total CO2, kg/year			1082.6817	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1998.4834	1.1300	2258.2863	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2942.5049	1.1300	3325.0306	(278)
Space and water heating			5583.3168	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	229.6449	1.5338	352.2371	(282)
Total Primary energy kWh/year			6065.6547	(286)
Dwelling Primary energy Rate (DPER)			75.8200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.0000 (1b)	x	2.5000 (2b)	=	100.0000 (1b)	-
First floor	40.0000 (1c)	x	2.7500 (2c)	=	110.0000 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 80.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 210.0000 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1429	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3929	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3339	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4258	0.4174	0.4091	0.3673	0.3590	0.3172	0.3172	0.3089	0.3339	0.3590	0.3757	0.3924	(22b)
Effective ac	0.5906	0.5871	0.5837	0.5675	0.5644	0.5503	0.5503	0.5477	0.5558	0.5644	0.5706	0.5770	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			14.8200	1.1450	16.9695			(27)
Heatloss Floor 1			40.0000	0.1300	5.2000			(28a)
External Wall 1	100.0000	20.0200	79.9800	0.1800	14.3964			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			180.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1659			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	20.0000	0.1600	3.2000
E6 Intermediate floor within a dwelling	20.0000	0.0000	0.0000
E14 Flat roof	20.0000	0.0800	1.6000
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3750 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.9310	40.6871	40.4481	39.3252	39.1151	38.1370	38.1370	37.9559	38.5138	39.1151	39.5401	39.9844	(38)
Heat transfer coeff	93.4719	93.2280	92.9889	91.8660	91.6559	90.6779	90.6779	90.4968	91.0546	91.6559	92.0809	92.5253	(39)

Average = Sum(39)m / 12 = 91.8650

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1653	1.1624	1.1483	1.1457	1.1335	1.1335	1.1312	1.1382	1.1457	1.1510	1.1566	(40)
HLP (average)												1.1483	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4629 (42)
Hot water usage for mixer showers

65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)

Hot water usage for baths

28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)

Hot water usage for other uses

39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)

Average daily hot water use (litres/day) 122.8659 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156	(44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7768	
Distribution loss (46)m = 0.15 x (45)m													
	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	260.9310	230.7465	244.9482	214.7309	207.7641	186.7745	183.9324	191.4242	193.7497	216.5899	230.9954	257.9827	(62)
WWHRS	-29.9502	-26.4882	-27.7369	-22.9672	-21.4046	-18.3161	-17.1684	-18.2569	-18.9505	-22.3406	-25.3092	-29.3955	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	230.9808	204.2583	217.2113	191.7637	186.3595	168.4584	166.7639	173.1673	174.7991	194.2493	205.6862	228.5871	(64)
										Total per year (kWh/year) = Sum(64)m =		2342.2850	(64)
12Total per year (kWh/year)												2342	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	109.7805	97.5163	104.4662	93.6764	92.1025	84.3809	84.1785	86.6695	86.7001	95.0371	99.0843	108.8002	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	112.5489	124.6077	112.5489	116.3005	112.5489	116.3005	112.5489	112.5489	116.3005	112.5489	116.3005	112.5489	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)													
	147.5544	145.1136	140.4116	130.1061	123.7937	117.1956	113.1431	116.4913	120.4168	127.7380	137.6171	146.2368	(72)
Total internal gains													
	542.4868	554.3819	531.8829	513.1129	487.6284	467.2888	449.8024	450.8734	464.2888	483.0744	512.1257	531.4869	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5600	19.6403	0.6300	0.7000	0.7700	27.3706	(76)
South	6.8400	46.7521	0.6300	0.7000	0.7700	97.7302	(78)
West	3.4200	19.6403	0.6300	0.7000	0.7700	20.5279	(80)

Solar gains	145.6287	253.7565	358.1940	455.4851	515.9352	513.4285	494.5867	450.1654	392.4499	283.8189	175.5674	123.8373	(83)
Total gains	688.1155	808.1384	890.0769	968.5981	1003.5636	980.7173	944.3890	901.0389	856.7387	766.8933	687.6931	655.3242	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4356	59.5911	59.7443	60.4745	60.6132	61.2669	61.2669	61.3895	61.0134	60.6132	60.3334	60.0437	
alpha	4.9624	4.9727	4.9830	5.0316	5.0409	5.0845	5.0845	5.0926	5.0676	5.0409	5.0222	5.0029	
util living area													
	0.9903	0.9782	0.9532	0.8860	0.7598	0.5743	0.4194	0.4571	0.6854	0.9107	0.9791	0.9923	(86)
MIT	19.8254	20.0507	20.3316	20.6603	20.8794	20.9770	20.9961	20.9940	20.9449	20.6583	20.1873	19.7899	(87)
Th 2	19.9454	19.9478	19.9502	19.9616	19.9637	19.9736	19.9736	19.9754	19.9698	19.9637	19.9594	19.9549	(88)
util rest of house													
	0.9873	0.9716	0.9391	0.8535	0.6999	0.4896	0.3232	0.3578	0.6011	0.8776	0.9716	0.9898	(89)
MIT 2	18.6035	18.8888	19.2385	19.6357	19.8690	19.9613	19.9724	19.9735	19.9361	19.6450	19.0724	18.5654	(90)
Living area fraction									fLA = Living area / (4) =			0.2469	(91)
MIT	18.9052	19.1756	19.5084	19.8887	20.1184	20.2121	20.2252	20.2254	20.1852	19.8952	19.3476	18.8677	(92)

Temperature adjustment												0.0000	
adjusted MIT	18.9052	19.1756	19.5084	19.8887	20.1184	20.2121	20.2252	20.2254	20.1852	19.8952	19.3476	18.8677	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9654	0.9318	0.8510	0.7095	0.5098	0.3470	0.3824	0.6197	0.8751	0.9657	0.9863	(94)
Useful gains	676.5268	780.1541	829.4103	824.2408	712.0168	500.0136	327.7179	344.5510	530.9347	671.0835	664.1177	646.3328	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1365.1721	1330.8880	1209.6363	1009.4861	771.6006	508.8913	328.7211	346.1893	554.0835	851.9589	1127.7726	1357.1357	(97)
Space heating kWh	512.3521	370.0932	282.8881	133.3766	44.3303	0.0000	0.0000	0.0000	0.0000	134.5712	333.8315	528.8374	(98a)
Space heating requirement - total per year (kWh/year)												2340.2805	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	512.3521	370.0932	282.8881	133.3766	44.3303	0.0000	0.0000	0.0000	0.0000	134.5712	333.8315	528.8374	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2340.2805	
Space heating per m2											(98c) / (4) =	29.2535	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	512.3521	370.0932	282.8881	133.3766	44.3303	0.0000	0.0000	0.0000	0.0000	134.5712	333.8315	528.8374	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	555.0944	400.9677	306.4877	144.5034	48.0285	0.0000	0.0000	0.0000	0.0000	145.7977	361.6810	572.9549	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	230.9808	204.2583	217.2113	191.7637	186.3595	168.4584	166.7639	173.1673	174.7991	194.2493	205.6862	228.5871	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.7933	85.3757	84.6532	83.2617	81.3851	79.8000	79.8000	79.8000	79.8000	83.2532	85.1393	85.8770	(217)
Fuel for water heating, kWh/month	269.2294	239.2466	256.5895	230.3145	228.9848	211.1008	208.9773	217.0017	219.0465	233.3235	241.5879	266.1797	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.3854	18.7607	16.8919	12.3757	9.5594	7.8101	8.7204	11.3351	14.7231	19.3176	21.8191	24.0354	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.2693	-52.4648	-75.3070	-84.5535	-91.0772	-84.9732	-83.9130	-79.2565	-71.0364	-59.9221	-40.9413	-32.2298	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.2986	-44.7770	-88.9486	-133.5277	-176.4966	-177.3201	-175.2425	-148.4147	-108.8269	-64.0250	-28.4329	-16.8454	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2535.5151	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2821.5822	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	188.7339	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1977.1002	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3654.7310 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2535.5151	0.2100	532.4582	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2821.5822	0.2100	592.5323	(264)
Space and water heating			1124.9904	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	188.7339	0.1443	27.2401	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-792.9442	0.1346	-106.7439	
PV Unit electricity exported	-1184.1560	0.1259	-149.0969	
Total			-255.8408	(269)
Total CO2, kg/year			908.3191	(272)
Target Carbon Dioxide Emission Rate (TER)			11.3500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2535.5151	1.1300	2865.1321	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2821.5822	1.1300	3188.3879	(278)
Space and water heating			6053.5200	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	188.7339	1.5338	289.4864	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-792.9442	1.4975	-1187.4530	
PV Unit electricity exported	-1184.1560	0.4622	-547.2888	
Total			-1734.7417	(283)
Total Primary energy kWh/year			4738.3654	(286)
Target Primary Energy Rate (TPER)			59.2300	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 2BH-BUN_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2BH-BUN
Property	1 Bedroom Flat, 2BH-BUN, Saffron Walden, CB11		

SAP Rating	84 B	DER	15.27	TER	12.76
Environmental	87 B	% DER<TER	-19.67		
CO_2 Emissions (t/year)	1.2	DFEE	44.80	TFEE	44.01
Compliance Check	See BREL	% DFEE < TFEE	-1.79		
% DPER < TPER	-27.40	DPER	85.11	TPER	66.81

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		42.0000 (1b)	x	2.5000 (2b)	=	105.0000 (1b)	-
First floor		42.0000 (1c)	x	2.7500 (2c)	=	115.5000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.5000	(5)

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2. Ventilation rate

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				m3 per hour	
Number of open chimneys			0 * 80 =	0.0000	(6a)
Number of open flues			0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire			0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler			0 * 20 =	0.0000	(6d)
Number of flues attached to other heater			0 * 35 =	0.0000	(6e)
Number of blocked chimneys			0 * 20 =	0.0000	(6f)
Number of intermittent extract fans			0 * 10 =	0.0000	(7a)
Number of passive vents			0 * 10 =	0.0000	(7b)
Number of flueless gas fires			0 * 40 =	0.0000	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				3.0000	(17)
Infiltration rate				0.1500	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			42.0000	0.1100	4.6200			(28a)
External Wall 1	140.0000	45.1000	94.9000	0.1400	13.2860			(29a)
External Roof 1	42.0000		42.0000	0.1100	4.6200			(30)
Total net area of external elements Aum(A, m2)			224.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.4130			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 11.2000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 84.6130 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.3440	37.3066	37.2700	37.0981	37.0660	36.9163	36.9163	36.8886	36.9739	37.0660	37.1310	37.1991	(38)
Heat transfer coeff													
	121.9570	121.9197	121.8831	121.7112	121.6790	121.5293	121.5293	121.5016	121.5870	121.6790	121.7441	121.8121	(39)

Average = Sum(39)m / 12 = 121.7110

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4519	1.4514	1.4510	1.4489	1.4486	1.4468	1.4468	1.4464	1.4475	1.4486	1.4493	1.4501	(40)
HLP (average)												1.4489	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5344 (42)

Hot water usage for mixer showers

66.7131	65.7106	64.2496	61.4544	59.3916	57.0911	55.7836	57.2334	58.8228	61.2927	64.1480	66.4575	(42a)

Hot water usage for baths

28.8121	28.3842	27.7816	26.6705	25.8386	24.9161	24.4179	25.0162	25.6677	26.6548	27.7887	28.7146	(42b)

Hot water usage for other uses

40.5847	39.1089	37.6331	36.1573	34.6815	33.2057	33.2057	34.6815	36.1573	37.6331	39.1089	40.5847	(42c)

Average daily hot water use (litres/day) 125.1158 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	136.1099	133.2036	129.6643	124.2822	119.9116	115.2129	113.4071	116.9311	120.6478	125.5806	131.0456	135.7569	(44)
Energy conte	215.5648	189.6801	199.2892	170.1361	161.4241	141.6677	137.1560	144.7851	148.7708	170.4117	186.6985	212.5624	(45)
Energy content (annual)										Total = Sum(45)m =		2078.1466	
Distribution loss (46)m = 0.15 x (45)m													
	32.3347	28.4520	29.8934	25.5204	24.2136	21.2502	20.5734	21.7178	22.3156	25.5618	28.0048	31.8844	(46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

265.9092	235.1525	249.6336	218.8565	211.7685	190.3881	187.5005	195.1296	197.4912	220.7562	235.4189	262.9069	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

265.9092	235.1525	249.6336	218.8565	211.7685	190.3881	187.5005	195.1296	197.4912	220.7562	235.4189	262.9069	(64)

Total per year (kWh/year) = Sum(64)m = 2670.9117 (64)

12Total per year (kWh/year) 2671 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

111.9508	99.4466	106.5392	95.5466	93.9491	86.0809	85.8799	88.4166	88.4426	96.9374	101.0536	110.9526	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

114.7966	127.0962	114.7966	118.6232	114.7966	118.6232	114.7966	114.7966	118.6232	114.7966	118.6232	114.7966	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

227.5971	229.9588	224.0073	211.3372	195.3435	180.3117	170.2695	167.9078	173.8593	186.5294	202.5231	217.5549	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	(71)

Water heating gains (Table 5)

150.4715	147.9860	143.1978	132.7036	126.2756	119.5567	115.4300	118.8395	122.8370	130.2923	140.3522	149.1298	(72)

Total internal gains

556.8811	569.0569	546.0176	526.6798	500.4316	479.5074	461.5120	462.5597	476.3353	495.6341	525.5143	545.4971	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419	(75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190	(77)
Southwest	6.3000	36.7938	0.7600	0.7000	0.7700	85.4595	(79)
Northwest	12.6000	11.2829	0.7600	0.7000	0.7700	52.4128	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	343.7333	614.5206	917.8850	1266.4866	1536.4825	1577.2370	1499.0407	1289.6823	1037.3572	699.9566	416.9973	290.7449	(83)
Total gains	900.6144	1183.5775	1463.9026	1793.1664	2036.9141	2056.7444	1960.5527	1752.2421	1513.6924	1195.5907	942.5116	836.2420	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.8311	47.8457	47.8601	47.9277	47.9403	47.9994	47.9994	48.0104	47.9766	47.9403	47.9147	47.8880	
alpha	4.1887	4.1897	4.1907	4.1952	4.1960	4.2000	4.2000	4.2007	4.1984	4.1960	4.1943	4.1925	
util living area	0.9814	0.9486	0.8750	0.7209	0.5336	0.3742	0.2719	0.3172	0.5325	0.8298	0.9600	0.9860	(86)
MIT	19.6055	19.9836	20.4116	20.7822	20.9458	20.9901	20.9980	20.9962	20.9601	20.6691	20.0471	19.5215	(87)
Th 2	19.7238	19.7241	19.7245	19.7260	19.7263	19.7277	19.7277	19.7279	19.7271	19.7263	19.7257	19.7251	(88)
util rest of house	0.9756	0.9341	0.8441	0.6678	0.4678	0.3016	0.1937	0.2304	0.4430	0.7766	0.9460	0.9815	(89)
MIT 2	18.1679	18.6348	19.1405	19.5394	19.6894	19.7232	19.7272	19.7269	19.7060	19.4437	18.7234	18.0632	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.5273	18.9720	19.4583	19.8501	20.0035	20.0399	20.0449	20.0442	20.0196	19.7500	19.0543	18.4278	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3773	18.8220	19.3083	19.7001	19.8535	19.8899	19.8949	19.8942	19.8696	19.6000	18.9043	18.2778	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9670	0.9210	0.8324	0.6666	0.4746	0.3109	0.2040	0.2418	0.4534	0.7705	0.9340	0.9741	(94)
Useful gains	870.8613	1090.0808	1218.5197	1195.3962	966.6262	639.5260	400.0200	423.7175	686.3191	921.2601	880.2638	814.6228	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1716.8275	1697.3614	1561.1120	1314.4932	992.1054	642.8770	400.4237	424.5521	701.5029	1095.1159	1437.1047	1714.8403	(97)
Space heating kWh	629.3988	408.0926	254.8886	85.7498	18.9565	0.0000	0.0000	0.0000	0.0000	129.3487	400.9254	669.7618	(98a)
Space heating requirement - total per year (kWh/year)												2597.1223	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	629.3988	408.0926	254.8886	85.7498	18.9565	0.0000	0.0000	0.0000	0.0000	129.3487	400.9254	669.7618	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2597.1223	
Space heating per m2										(98c) / (4) =		30.9181	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	629.3988	408.0926	254.8886	85.7498	18.9565	0.0000	0.0000	0.0000	0.0000	129.3487	400.9254	669.7618	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	703.2389	455.9694	284.7918	95.8099	21.1805	0.0000	0.0000	0.0000	0.0000	144.5237	447.9614	748.3372	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	265.9092	235.1525	249.6336	218.8565	211.7685	190.3881	187.5005	195.1296	197.4912	220.7562	235.4189	262.9069	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	297.1052	262.7403	278.9202	244.5324	236.6129	212.7242	209.4977	218.0219	220.6605	246.6549	263.0379	293.7507	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	29.7368	23.8560	21.4797	15.7369	12.1557	9.9313	11.0888	14.4136	18.7219	24.5641	27.7451	30.5633 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2901.8127 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2984.2589 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	239.9934 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6212.0650 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2901.8127	0.2100	609.3807	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2984.2589	0.2100	626.6944	(264)
Space and water heating			1236.0750	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	239.9934	0.1443	34.6385	(268)
Total CO2, kg/year			1282.6428	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2901.8127	1.1300	3279.0483	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2984.2589	1.1300	3372.2126	(278)
Space and water heating			6651.2609	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	239.9934	1.5338	368.1099	(282)
Total Primary energy kWh/year			7149.4716	(286)
Dwelling Primary energy Rate (DPER)			85.1100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.0000 (1b)	x	2.5000 (2b)	=	105.0000 (1b)	-
First floor	42.0000 (1c)	x	2.7500 (2c)	=	115.5000 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 84.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 220.5000 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1361	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3861	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3281	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4184	0.4102	0.4020	0.3610	0.3528	0.3117	0.3117	0.3035	0.3281	0.3528	0.3692	0.3856	(22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			15.7700	1.1450	18.0573			(27)
Heatloss Floor 1			42.0000	0.1300	5.4600			(28a)
External Wall 1	140.0000	20.9700	119.0300	0.1800	21.4254			(29a)
External Roof 1	42.0000		42.0000	0.1100	4.6200			(30)
Total net area of external elements Aum(A, m2)			224.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.7627			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
E5 Ground floor (normal)	26.5000	0.1600	4.2400	
E6 Intermediate floor within a dwelling	26.5000	0.0000	0.0000	
E14 Flat roof	26.5000	0.0800	2.1200	
E16 Corner (normal)	21.0000	0.0900	1.8900	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.2500	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	63.0127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.7512	42.5039	42.2614	41.1229	40.9099	39.9182	39.9182	39.7346	40.3002	40.9099	41.3408	41.7913	(38)
Heat transfer coeff	105.7638	105.5165	105.2741	104.1355	103.9225	102.9308	102.9308	102.7472	103.3128	103.9225	104.3534	104.8040	(39)
Average = Sum(39)m / 12 =												104.1345	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2591	1.2561	1.2533	1.2397	1.2372	1.2254	1.2254	1.2232	1.2299	1.2372	1.2423	1.2477	(40)
HLP (average)												1.2397	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5344 (42)
Hot water usage for mixer showers

66.7131	65.7106	64.2496	61.4544	59.3916	57.0911	55.7836	57.2334	58.8228	61.2927	64.1480	66.4575	(42a)

Hot water usage for baths

28.8121	28.3842	27.7816	26.6705	25.8386	24.9161	24.4179	25.0162	25.6677	26.6548	27.7887	28.7146	(42b)

Hot water usage for other uses

40.5847	39.1089	37.6331	36.1573	34.6815	33.2057	33.2057	34.6815	36.1573	37.6331	39.1089	40.5847	(42c)

Average daily hot water use (litres/day) 125.1158 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	136.1099	133.2036	129.6643	124.2822	119.9116	115.2129	113.4071	116.9311	120.6478	125.5806	131.0456	135.7569 (44)
Energy conte	215.5648	189.6801	199.2892	170.1361	161.4241	141.6677	137.1560	144.7851	148.7708	170.4117	186.6985	212.5624 (45)
Energy content (annual)										Total = Sum(45)m =		2078.1466
Distribution loss (46)m = 0.15 x (45)m												
	32.3347	28.4520	29.8934	25.5204	24.2136	21.2502	20.5734	21.7178	22.3156	25.5618	28.0048	31.8844 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	264.8074	234.1574	248.5318	217.7903	210.6668	189.3219	186.3987	194.0278	196.4250	219.6544	234.3527	261.8051 (62)
WWHRS	-30.4985	-26.9731	-28.2447	-23.3877	-21.7965	-18.6514	-17.4827	-18.5911	-19.2975	-22.7496	-25.7725	-29.9337 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	234.3090	207.1843	220.2872	194.4026	188.8703	170.6705	168.9160	175.4367	177.1275	196.9048	208.5802	231.8714 (64)
									Total per year (kWh/year) = Sum(64)m =			2374.5605 (64)
12Total per year (kWh/year)												2375 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000 (64a)
Heat gains from water heating, kWh/month												
	111.0694	98.6504	105.6578	94.6936	93.0677	85.2279	84.9985	87.5352	87.5896	96.0560	100.2006	110.0711 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	116.5089	128.9920	116.5089	120.3925	116.5089	120.3925	116.5089	116.5089	120.3925	116.5089	120.3925	116.5089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	227.5971	229.9588	224.0073	211.3372	195.3435	180.3117	170.2695	167.9078	173.8593	186.5294	202.5231	217.5549	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	(71)
Water heating gains (Table 5)													
	149.2869	146.8013	142.0131	131.5189	125.0909	118.3720	114.2453	117.6548	121.6523	129.1076	139.1675	147.9451	(72)
Total internal gains													
	557.4087	569.7679	546.5452	527.2645	500.9592	480.0921	462.0395	463.0873	476.9199	496.1617	526.0990	546.0247	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.3200	11.2829	0.6300	0.7000	0.7700	11.4481	(75)
Southeast	4.9800	36.7938	0.6300	0.7000	0.7700	55.9985	(77)
Southwest	2.4900	36.7938	0.6300	0.7000	0.7700	27.9992	(79)
Northwest	4.9800	11.2829	0.6300	0.7000	0.7700	17.1721	(81)

Solar gains	112.6179	201.3364	300.7281	414.9410	503.4002	516.7526	491.1331	422.5407	339.8710	229.3279	136.6215	95.2572 (83)
Total gains	670.0266	771.1043	847.2733	942.2055	1004.3594	996.8447	953.1726	885.6280	816.7909	725.4895	662.7204	641.2819 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1543	55.2836	55.4109	56.0167	56.1316	56.6724	56.6724	56.7736	56.4628	56.1316	55.8998	55.6595	
alpha	4.6770	4.6856	4.6941	4.7344	4.7421	4.7782	4.7782	4.7849	4.7642	4.7421	4.7267	4.7106	
util living area													
	0.9933	0.9864	0.9709	0.9215	0.8096	0.6268	0.4679	0.5210	0.7659	0.9447	0.9865	0.9945	(86)
MIT	19.6227	19.8254	20.1184	20.5080	20.8074	20.9572	20.9913	20.9859	20.8903	20.5033	20.0000	19.5920	(87)
Th 2	19.8730	19.8753	19.8776	19.8884	19.8904	19.8998	19.8998	19.9015	19.8961	19.8904	19.8863	19.8821	(88)
util rest of house													
	0.9911	0.9819	0.9612	0.8952	0.7513	0.5329	0.3547	0.4030	0.6796	0.9205	0.9812	0.9927	(89)
MIT 2	18.2947	18.5533	18.9230	19.4037	19.7347	19.8767	19.8972	19.8968	19.8256	19.4105	18.7847	18.2620	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6267	18.8713	19.2218	19.6798	20.0029	20.1468	20.1707	20.1691	20.0917	19.6837	19.0886	18.5945	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.6267	18.8713	19.2218	19.6798	20.0029	20.1468	20.1707	20.1691	20.0917	19.6837	19.0886	18.5945	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9876	0.9765	0.9538	0.8894	0.7579	0.5550	0.3831	0.4325	0.6965	0.9148	0.9760	0.9897	(94)
Useful gains	661.7213	752.9955	808.0998	837.9631	761.1757	553.2172	365.1510	383.0667	568.8732	663.6732	646.8365	634.6776	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1515.2447	1474.2015	1339.2782	1122.5613	862.8567	570.9379	367.5388	387.2642	619.0244	944.0038	1251.0466	1508.6003	(97)
Space heating kWh	635.0214	484.6505	395.1967	204.9107	75.6507	0.0000	0.0000	0.0000	0.0000	208.5660	435.0313	650.1985	(98a)

Space heating requirement - total per year (kWh/year) 3089.2258

Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh	635.0214	484.6505	395.1967	204.9107	75.6507	0.0000	0.0000	0.0000	0.0000	208.5660	435.0313	650.1985	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 3089.2258

Space heating per m2 (98c) / (4) = 36.7765 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.3000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	635.0214	484.6505	395.1967	204.9107	75.6507	0.0000	0.0000	0.0000	0.0000	208.5660	435.0313	650.1985	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	687.9972	525.0818	428.1654	222.0051	81.9618	0.0000	0.0000	0.0000	0.0000	225.9653	471.3232	704.4404	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	234.3090	207.1843	220.2872	194.4026	188.8703	170.6705	168.9160	175.4367	177.1275	196.9048	208.5802	231.8714	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1803	85.8988	85.3546	84.1780	82.1821	79.8000	79.8000	79.8000	79.8000	84.1890	85.6688	86.2431	(217)
Fuel for water heating, kWh/month	271.8823	241.1959	258.0847	230.9422	229.8193	213.8728	211.6741	219.8455	221.9643	233.8841	243.4728	268.8579	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.2082	19.4208	17.4862	12.8112	9.8957	8.0849	9.0272	11.7339	15.2412	19.9972	22.5868	24.8811	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.9974	-54.8283	-78.5994	-88.1299	-94.8223	-88.4212	-87.3095	-82.5119	-74.0341	-62.5571	-42.8118	-33.7317	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-22.4989	-47.2756	-93.8690	-140.8553	-186.1302	-186.9868	-184.8038	-156.5429	-114.8224	-67.5873	-30.0312	-17.7972	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3346.9402	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2845.4958	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												195.3744	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2075.9552	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4397.8552 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3346.9402	0.2100	702.8574	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2845.4958	0.2100	597.5541	(264)
Space and water heating			1300.4116	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	195.3744	0.1443	28.1986	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-826.7548	0.1346	-111.3200	
PV Unit electricity exported	-1249.2005	0.1259	-157.3007	
Total			-268.6207	(269)
Total CO2, kg/year			1071.9187	(272)
Target Carbon Dioxide Emission Rate (TER)			12.7600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3346.9402	1.1300	3782.0424	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2845.4958	1.1300	3215.4103	(278)
Space and water heating			6997.4527	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	195.3744	1.5338	299.6718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-826.7548	1.4976	-1238.1773	
PV Unit electricity exported	-1249.2005	0.4622	-577.4031	
Total			-1815.5805	(283)
Total Primary energy kWh/year			5611.6448	(286)
Target Primary Energy Rate (TPER)			66.8100	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3B1_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3B1
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	84 B	DER	14.99	TER	12.61
Environmental	87 B	% DER<TER	-18.87		
CO_2 Emissions (t/year)	1.26	DFEE	41.88	TFEE	44.82
Compliance Check	See BREL	% DFEE < TFEE	6.55		
% DPER < TPER	-26.57	DPER	83.54	TPER	66.00

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			45.0000 (1b)	x	2.5000 (2b)	=	112.5000 (1b)	-
First floor			45.0000 (1c)	x	2.7500 (2c)	=	123.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.2500	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		0 * 10	=	0.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5)	=	0.0000 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.1500 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			45.0000	0.1100	4.9500			(28a)
External Wall 1	147.0000	30.4000	116.6000	0.1400	16.3240			(29a)
External Roof 1	45.0000		45.0000	0.1100	4.9500			(30)
Total net area of external elements Aum(A, m2)			237.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.2790			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												11.8500	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	72.1290	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.0114	39.9714	39.9322	39.7480	39.7136	39.5532	39.5532	39.5235	39.6149	39.7136	39.7833	39.8561	(38)
Heat transfer coeff													
	112.1404	112.1004	112.0611	111.8770	111.8425	111.6821	111.6821	111.6524	111.7439	111.8425	111.9122	111.9851	(39)
Average = Sum(39)m / 12 =												111.8768	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2460	1.2456	1.2451	1.2431	1.2427	1.2409	1.2409	1.2406	1.2416	1.2427	1.2435	1.2443	(40)
HLP (average)												1.2431	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6257	(42)
Hot water usage for mixer showers													
	68.2445	67.2189	65.7244	62.8650	60.7548	58.4016	57.0640	58.5472	60.1730	62.6997	65.6205	67.9830	(42a)
Hot water usage for baths													
	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)
Hot water usage for other uses													
	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)
Average daily hot water use (litres/day)												127.9884	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	139.2350	136.2620	132.6413	127.1357	122.6647	117.8581	116.0109	119.6159	123.4179	128.4640	134.0545	138.8739	(44)
Energy conte	220.5143	194.0352	203.8648	174.0424	165.1303	144.9203	140.3051	148.1094	152.1866	174.3245	190.9852	217.4430	(45)
Energy content (annual)										Total = Sum(45)m =		2125.8611	
Distribution loss (46)m = 0.15 x (45)m													
	33.0771	29.1053	30.5797	26.1064	24.7695	21.7380	21.0458	22.2164	22.8280	26.1487	28.6478	32.6165	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	270.8587	239.5076	254.2092	222.7628	215.4747	193.6407	190.6495	198.4539	200.9071	224.6689	239.7057	267.7875	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	270.8587	239.5076	254.2092	222.7628	215.4747	193.6407	190.6495	198.4539	200.9071	224.6689	239.7057	267.7875	(64)
										Total per year (kWh/year) = Sum(64)m =		2718.6263	(64)
12Total per year (kWh/year)												2719	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.5965	100.8946	108.0606	96.8454	95.1814	87.1623	86.9270	89.5219	89.5784	98.2384	102.4789	112.5754	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.5873	133.5073	120.5873	124.6068	120.5873	124.6068	120.5873	120.5873	124.6068	120.5873	124.6068	120.5873	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	239.0777	241.5586	235.3069	221.9977	205.1972	189.4071	178.8584	176.3775	182.6292	195.9384	212.7389	228.5290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													
	152.6835	150.1408	145.2427	134.5075	127.9320	121.0588	116.8374	120.3252	124.4144	132.0409	142.3318	151.3110	(72)
Total internal gains													
	577.7343	590.5926	566.5227	546.4979	519.1022	497.4586	478.6688	479.6758	494.0363	513.9524	545.0634	565.8130	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (79)
Northwest	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (81)

Solar gains	183.8298	336.3427	521.8556	749.9505	934.3366	969.0724	917.0220	773.1182	599.8448	388.3546	224.4130	154.5847 (83)
Total gains	761.5642	926.9353	1088.3783	1296.4484	1453.4389	1466.5310	1395.6908	1252.7940	1093.8811	902.3071	769.4764	720.3977 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7337	55.7536	55.7731	55.8649	55.8821	55.9624	55.9624	55.9773	55.9315	55.8821	55.8473	55.8110	
alpha	4.7156	4.7169	4.7182	4.7243	4.7255	4.7308	4.7308	4.7318	4.7288	4.7255	4.7232	4.7207	
util living area	0.9914	0.9785	0.9446	0.8427	0.6665	0.4789	0.3504	0.4064	0.6589	0.9119	0.9815	0.9933	(86)
MIT	19.6916	19.9490	20.3012	20.6940	20.9164	20.9854	20.9973	20.9947	20.9411	20.6013	20.0627	19.6349	(87)
Th 2	19.8834	19.8837	19.8841	19.8857	19.8860	19.8874	19.8874	19.8877	19.8869	19.8860	19.8854	19.8847	(88)
util rest of house	0.9887	0.9719	0.9281	0.8026	0.6017	0.3994	0.2627	0.3100	0.5700	0.8779	0.9746	0.9912	(89)
MIT 2	18.3894	18.7138	19.1483	19.6023	19.8243	19.8802	19.8867	19.8861	19.8521	19.5157	18.8621	18.3184	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.7149	19.0226	19.4365	19.8752	20.0973	20.1565	20.1643	20.1632	20.1243	19.7871	19.1622	18.6476	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5649	18.8726	19.2865	19.7252	19.9473	20.0065	20.0143	20.0132	19.9743	19.6371	19.0122	18.4976	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9839	0.9638	0.9171	0.7961	0.6054	0.4081	0.2728	0.3210	0.5774	0.8687	0.9670	0.9872	(94)
Useful gains	749.3373	893.4034	998.1617	1032.0653	879.9507	598.4406	380.7217	402.1412	631.6269	783.8046	744.1167	711.1693	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1599.6758	1566.3350	1432.8750	1211.0951	922.4002	603.8103	381.3203	403.4266	656.4183	1010.7294	1333.1258	1601.1126	(97)
Space heating kWh	632.6519	452.2101	323.4267	128.9014	31.5824	0.0000	0.0000	0.0000	0.0000	168.8321	424.0865	662.1178	(98a)
Space heating requirement - total per year (kWh/year)												2823.8088	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	632.6519	452.2101	323.4267	128.9014	31.5824	0.0000	0.0000	0.0000	0.0000	168.8321	424.0865	662.1178	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2823.8088	
Space heating per m2										(98c) / (4) =		31.3757	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	632.6519	452.2101	323.4267	128.9014	31.5824	0.0000	0.0000	0.0000	0.0000	168.8321	424.0865	662.1178	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	706.8736	505.2626	361.3706	144.0239	35.2876	0.0000	0.0000	0.0000	0.0000	188.6392	473.8396	739.7965	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	270.8587	239.5076	254.2092	222.7628	215.4747	193.6407	190.6495	198.4539	200.9071	224.6689	239.7057	267.7875	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	302.6354	267.6063	284.0326	248.8970	240.7539	216.3584	213.0162	221.7362	224.4772	251.0267	267.8275	299.2039	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	31.5514	25.3117	22.7904	16.6972	12.8974	10.5373	11.7655	15.2932	19.8643	26.0631	29.4382	32.4283	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3155.0936	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	89.5000	
Water heating fuel used	3037.5712	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	254.6381	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6533.3029	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3155.0936	0.2100	662.5697	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3037.5712	0.2100	637.8900	(264)
Space and water heating			1300.4596	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	254.6381	0.1443	36.7521	(268)
Total CO2, kg/year			1349.1410	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3155.0936	1.1300	3565.2558	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3037.5712	1.1300	3432.4555	(278)
Space and water heating			6997.7113	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	254.6381	1.5338	390.5724	(282)
Total Primary energy kWh/year			7518.3844	(286)
Dwelling Primary energy Rate (DPER)			83.5400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			45.0000 (1b)	x	2.5000 (2b)	=	112.5000 (1b)	-
First floor			45.0000 (1c)	x	2.7500 (2c)	=	123.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000							(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2500 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1270	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3770	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3204	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4086	0.4005	0.3925	0.3525	0.3445	0.3044	0.3044	0.2964	0.3204	0.3445	0.3605	0.3765	(22b)
Effective ac	0.5835	0.5802	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5650	0.5709	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			17.2800	1.1450	19.7863			(27)
Heatloss Floor 1			45.0000	0.1300	5.8500			(28a)
External Wall 1	147.0000	22.4800	124.5200	0.1800	22.4136			(29a)
External Roof 1	45.0000		45.0000	0.1100	4.9500			(30)
Total net area of external elements Aum(A, m2)			237.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.1999			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E5 Ground floor (normal)	28.0000	0.1600	4.4800	
E6 Intermediate floor within a dwelling	28.0000	0.0000	0.0000	
E14 Flat roof	28.0000	0.0800	2.2400	
E16 Corner (normal)	21.0000	0.0900	1.8900	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.6100 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 66.8099 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4879	45.2353	44.9876	43.8244	43.6067	42.5936	42.5936	42.4060	42.9838	43.6067	44.0470	44.5073	(38)
Heat transfer coeff	112.2978	112.0451	111.7975	110.6342	110.4166	109.4034	109.4034	109.2158	109.7937	110.4166	110.8569	111.3172	(39)

Average = Sum(39)m / 12 = 110.6332

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2478	1.2449	1.2422	1.2293	1.2269	1.2156	1.2156	1.2135	1.2199	1.2269	1.2317	1.2369	(40)
HLP (average)												1.2293	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6257 (42)

Hot water usage for mixer showers

68.2445	67.2189	65.7244	62.8650	60.7548	58.4016	57.0640	58.5472	60.1730	62.6997	65.6205	67.9830	(42a)

Hot water usage for baths

29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)

Hot water usage for other uses

41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)

Average daily hot water use (litres/day) 127.9884 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	139.2350	136.2620	132.6413	127.1357	122.6647	117.8581	116.0109	119.6159	123.4179	128.4640	134.0545	138.8739 (44)
Energy conte	220.5143	194.0352	203.8648	174.0424	165.1303	144.9203	140.3051	148.1094	152.1866	174.3245	190.9852	217.4430 (45)
Energy content (annual)										Total = Sum(45)m =		2125.8611
Distribution loss (46)m = 0.15 x (45)m												
	33.0771	29.1053	30.5797	26.1064	24.7695	21.7380	21.0458	22.2164	22.8280	26.1487	28.6478	32.6165 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	269.7569	238.5125	253.1074	221.6966	214.3730	192.5745	189.5478	197.3521	199.8408	223.5672	238.6394	266.6857 (62)
WWHRS	-31.1985	-27.5922	-28.8930	-23.9245	-22.2968	-19.0795	-17.8840	-19.0179	-19.7404	-23.2718	-26.3641	-30.6208 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	238.5584	210.9202	224.2145	197.7720	192.0762	173.4950	171.6637	178.3343	180.1004	200.2954	212.2753	236.0649 (64)
										Total per year (kWh/year) = Sum(64)m =		2415.7703 (64)
12Total per year (kWh/year)												2416 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	112.7151	100.0985	107.1792	95.9924	94.3000	86.3094	86.0456	88.6405	88.7254	97.3570	101.6259	111.6939 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	122.0169	135.0901	122.0169	126.0841	122.0169	126.0841	122.0169	122.0169	126.0841	122.0169	126.0841	122.0169	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	239.0777	241.5586	235.3069	221.9977	205.1972	189.4071	178.8584	176.3775	182.6292	195.9384	212.7389	228.5290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													
	151.4988	148.9561	144.0580	133.3228	126.7473	119.8741	115.6527	119.1405	123.2297	130.8562	141.1471	150.1263	(72)
Total internal gains													
	577.9792	590.9906	566.7676	546.7904	519.3471	497.7511	478.9137	479.9207	494.3289	514.1973	545.3560	566.0579	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.7600	11.2829	0.6300	0.7000	0.7700	19.8617	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)
Northwest	5.7600	11.2829	0.6300	0.7000	0.7700	19.8617	(81)

Solar gains	104.4927	191.1843	296.6337	426.2877	531.0966	550.8412	521.2546	439.4567	340.9644	220.7490	127.5611	87.8692 (83)
Total gains	682.4720	782.1749	863.4013	973.0781	1050.4438	1048.5923	1000.1683	919.3773	835.2933	734.9463	672.9170	653.9271 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6556	55.7811	55.9047	56.4925	56.6038	57.1280	57.1280	57.2261	56.9249	56.6038	56.3790	56.1459	
alpha	4.7104	4.7187	4.7270	4.7662	4.7736	4.8085	4.8085	4.8151	4.7950	4.7736	4.7586	4.7431	
util living area													
	0.9945	0.9889	0.9755	0.9290	0.8173	0.6325	0.4738	0.5325	0.7847	0.9537	0.9890	0.9955	(86)
MIT	19.5997	19.7936	20.0877	20.4896	20.8022	20.9566	20.9911	20.9849	20.8799	20.4745	19.9726	19.5705	(87)
Th 2	19.8820	19.8842	19.8864	19.8967	19.8986	19.9075	19.9075	19.9092	19.9041	19.8986	19.8947	19.8906	(88)
util rest of house													
	0.9927	0.9853	0.9672	0.9047	0.7602	0.5389	0.3601	0.4133	0.7005	0.9326	0.9847	0.9941	(89)
MIT 2	18.2718	18.5197	18.8921	19.3900	19.7377	19.8840	19.9049	19.9042	19.8254	19.3841	18.7565	18.2407	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6037	18.8381	19.1910	19.6649	20.0038	20.1521	20.1765	20.1744	20.0890	19.6567	19.0605	18.5732	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6037	18.8381	19.1910	19.6649	20.0038	20.1521	20.1765	20.1744	20.0890	19.6567	19.0605	18.5732	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9897	0.9805	0.9603	0.8985	0.7662	0.5609	0.3886	0.4431	0.7163	0.9267	0.9801	0.9915	(94)
Useful gains	675.4556	766.9367	829.1047	874.3165	804.9017	588.1046	388.6543	407.3957	598.3249	681.0554	659.5039	648.3450	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1606.2785	1561.7010	1418.8193	1190.9661	916.8819	607.4205	391.2780	412.2206	657.5572	1000.0130	1325.9085	1599.9812	(97)
Space heating kWh													
	692.5323	534.0817	438.7476	227.9877	83.3133	0.0000	0.0000	0.0000	0.0000	237.3045	479.8113	708.0174	(98a)
Space heating requirement - total per year (kWh/year)												3401.7957	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	692.5323	534.0817	438.7476	227.9877	83.3133	0.0000	0.0000	0.0000	0.0000	237.3045	479.8113	708.0174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3401.7957	
Space heating per m2											(98c) / (4) =	37.7977	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	692.5323	534.0817	438.7476	227.9877	83.3133	0.0000	0.0000	0.0000	0.0000	237.3045	479.8113	708.0174	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	750.3058	578.6367	475.3495	247.0073	90.2636	0.0000	0.0000	0.0000	0.0000	257.1013	519.8389	767.0827	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.5584	210.9202	224.2145	197.7720	192.0762	173.4950	171.6637	178.3343	180.1004	200.2954	212.2753	236.0649	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3061	86.0523	85.5374	84.3794	82.3242	79.8000	79.8000	79.8000	79.8000	84.4410	85.8309	86.3645	(217)
Fuel for water heating, kWh/month													
	276.4098	245.1069	262.1246	234.3841	233.3168	217.4122	215.1175	223.4765	225.6897	237.2016	247.3180	273.3357	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.3527	20.3389	18.3129	13.4168	10.3635	8.4671	9.4540	12.2886	15.9617	20.9426	23.6546	26.0573	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.5553	-58.3087	-83.4217	-93.3380	-100.2505	-93.4092	-92.2224	-87.2329	-78.4013	-66.4229	-45.5738	-35.9569	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-24.3335	-51.0883	-101.3659	-152.0033	-200.7701	-201.6708	-199.3276	-168.8972	-123.9450	-73.0176	-32.4722	-19.2527	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3685.5858	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2890.8935	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												204.6108	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2224.2377	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)

Total delivered energy for all uses 4642.8523 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3685.5858	0.2100	773.9730	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2890.8935	0.2100	607.0876	(264)
Space and water heating			1381.0606	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	204.6108	0.1443	29.5317	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-876.0937	0.1347	-118.0038	
PV Unit electricity exported	-1348.1441	0.1259	-169.7847	
Total			-287.7885	(269)
Total CO2, kg/year			1134.7331	(272)
Target Carbon Dioxide Emission Rate (TER)			12.6100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3685.5858	1.1300	4164.7119	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2890.8935	1.1300	3266.7096	(278)
Space and water heating			7431.4216	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	204.6108	1.5338	313.8388	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-876.0937	1.4978	-1312.2210	
PV Unit electricity exported	-1348.1441	0.4623	-623.2288	
Total			-1935.4498	(283)
Total Primary energy kWh/year			5939.9114	(286)
Target Primary Energy Rate (TPER)			66.0000	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3B2_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3B2
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	86 B	DER	12.75	TER	10.62
Environmental	89 B	% DER<TER	-20.06		
CO_2 Emissions (t/year)	1.11	DFEE	32.73	TFEE	36.52
Compliance Check	See BREL	% DFEE < TFEE	10.38		
% DPER < TPER	-29.12	DPER	71.44	TPER	55.33

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)
Ground floor			46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b) -
First floor			46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			46.5000	0.1100	5.1150			(28a)
External Wall 1	102.0000	30.4000	71.6000	0.1400	10.0240			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			195.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.3090			(33)

Party Wall 1						49.0000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												9.7500	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	64.0590	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.3451	41.3038	41.2633	41.0729	41.0373	40.8716	40.8716	40.8409	40.9354	41.0373	41.1094	41.1847	(38)
Heat transfer coeff	105.4041	105.3627	105.3222	105.1319	105.0963	104.9306	104.9306	104.8999	104.9944	105.0963	105.1683	105.2436	(39)
Average = Sum(39)m / 12 =												105.1317	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1334	1.1329	1.1325	1.1305	1.1301	1.1283	1.1283	1.1280	1.1290	1.1301	1.1308	1.1317	(40)
HLP (average)												1.1304	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6646	(42)
Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)
Average daily hot water use (litres/day)												129.2112	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)											Total = Sum(45)m =	2146.1718	
Distribution loss (46)m = 0.15 x (45)m	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
											Total per year (kWh/year) = Sum(64)m =	2738.9369	(64)
12Total per year (kWh/year)												2739	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month	114.2971	101.5110	108.7082	97.3983	95.7059	87.6227	87.3727	89.9924	90.0619	98.7922	103.0856	113.2661	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	123.3171	136.5297	123.3171	127.4277	123.3171	127.4277	123.3171	123.3171	127.4277	123.3171	127.4277	123.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	153.6251	151.0581	146.1132	135.2754	128.6370	121.6982	117.4364	120.9576	125.0859	132.7853	143.1745	152.2394	(72)
Total internal gains	587.4011	600.5837	576.0330	555.6953	527.7655	505.7897	486.6299	487.6140	502.2461	522.4454	554.1260	575.2279	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	6.3000	11.2829	0.7600	0.7000	0.7700	26.2064 (75)
Southeast	10.5000	36.7938	0.7600	0.7000	0.7700	142.4325 (77)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	282.5850	490.0515	693.6311	898.1973	1041.4295	1049.4581	1005.3143	896.0780	764.1003	547.8454	340.0569	240.8081	(83)
Total gains	869.9861	1090.6352	1269.6641	1453.8927	1569.1950	1555.2478	1491.9442	1383.6919	1266.3465	1070.2908	894.1829	816.0360	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2721	61.2962	61.3198	61.4308	61.4516	61.5486	61.5486	61.5667	61.5112	61.4516	61.4095	61.3655	
alpha	5.0848	5.0864	5.0880	5.0954	5.0968	5.1032	5.1032	5.1044	5.1007	5.0968	5.0940	5.0910	
util living area	0.9858	0.9595	0.9024	0.7755	0.6006	0.4284	0.3089	0.3477	0.5574	0.8446	0.9666	0.9894	(86)
MIT	19.9564	20.2486	20.5589	20.8328	20.9596	20.9939	20.9991	20.9983	20.9785	20.7813	20.3088	19.8889	(87)
Th 2	19.9737	19.9740	19.9744	19.9760	19.9764	19.9778	19.9778	19.9781	19.9772	19.9764	19.9757	19.9751	(88)
util rest of house	0.9815	0.9485	0.8785	0.7315	0.5418	0.3615	0.2374	0.2710	0.4808	0.7996	0.9554	0.9861	(89)
MIT 2	18.7895	19.1523	19.5237	19.8263	19.9471	19.9748	19.9775	19.9775	19.9651	19.7840	19.2339	18.7055	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0812	19.4264	19.7825	20.0779	20.2002	20.2295	20.2329	20.2327	20.2184	20.0333	19.5026	19.0013	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9312	19.2764	19.6325	19.9279	20.0502	20.0795	20.0829	20.0827	20.0684	19.8833	19.3526	18.8513	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9755	0.9391	0.8693	0.7293	0.5461	0.3682	0.2448	0.2789	0.4878	0.7950	0.9467	0.9812	(94)
Useful gains	848.6946	1024.1999	1103.7588	1060.3521	856.9787	572.7084	365.2544	385.9053	617.7810	850.8685	846.4869	800.6669	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1542.1889	1514.7360	1383.1460	1159.3875	877.5773	574.9721	365.4649	386.3189	626.6530	975.6411	1288.5897	1541.9603	(97)
Space heating kWh	515.9597	329.6403	207.8641	71.3055	15.3254	0.0000	0.0000	0.0000	0.0000	92.8308	318.3141	551.5223	(98a)
Space heating requirement - total per year (kWh/year)												2102.7621	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	515.9597	329.6403	207.8641	71.3055	15.3254	0.0000	0.0000	0.0000	0.0000	92.8308	318.3141	551.5223	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2102.7621	
Space heating per m2										(98c) / (4) =		22.6103	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	515.9597	329.6403	207.8641	71.3055	15.3254	0.0000	0.0000	0.0000	0.0000	92.8308	318.3141	551.5223	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	576.4913	368.3132	232.2503	79.6709	17.1233	0.0000	0.0000	0.0000	0.0000	103.7216	355.6582	616.2260	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	304.9894	269.6776	286.2088	250.7548	242.5166	217.9053	214.5140	223.3173	226.1018	252.8877	269.8663	301.5251	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	32.4110	26.0013	23.4113	17.1521	13.2488	10.8244	12.0860	15.7098	20.4055	26.7731	30.2402	33.3118 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2349.4548 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3060.2647 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	261.5750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5757.2946 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2349.4548	0.2100	493.3855	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3060.2647	0.2100	642.6556	(264)
Space and water heating			1136.0411	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	261.5750	0.1443	37.7534	(268)
Total CO2, kg/year			1185.7237	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2349.4548	1.1300	2654.8840	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3060.2647	1.1300	3458.0991	(278)
Space and water heating			6112.9831	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	261.5750	1.5338	401.2125	(282)
Total Primary energy kWh/year			6644.2964	(286)
Dwelling Primary energy Rate (DPER)			71.4400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor	46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 93.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 244.1250 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1229 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3729 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3170 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4041	0.3962	0.3883	0.3487	0.3407	0.3011	0.3011	0.2932	0.3170	0.3407	0.3566	0.3724	(22b)
Effective ac	0.5817	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			18.0000	1.1450	20.6107			(27)
Heatloss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	102.0000	23.2000	78.8000	0.1800	14.1840			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			195.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1547			(33)
Party Wall 1			49.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	28.6000	0.1600	4.5760
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E14 Flat roof	28.6000	0.0800	2.2880
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4390 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5937 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8589	46.6034	46.3531	45.1770	44.9570	43.9327	43.9327	43.7430	44.3272	44.9570	45.4021	45.8675	(38)
Heat transfer coeff	106.4526	106.1971	105.9467	104.7707	104.5507	103.5264	103.5264	103.3367	103.9209	104.5507	104.9958	105.4612	(39)
Average = Sum(39)m / 12 =												104.7696	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1447	1.1419	1.1392	1.1266	1.1242	1.1132	1.1132	1.1111	1.1174	1.1242	1.1290	1.1340	(40)
HLP (average)												1.1266	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6646 (42)
Hot water usage for mixer showers

68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)

Hot water usage for baths

29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)

Hot water usage for other uses

41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)

Average daily hot water use (litres/day) 129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m													
	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	271.8638	240.3663	255.0551	223.3594	215.9506	193.9590	190.8882	198.7672	201.2949	225.2327	240.4642	268.7632	(62)
WWHRS	-31.4965	-27.8558	-29.1690	-24.1531	-22.5098	-19.2618	-18.0548	-19.1995	-19.9290	-23.4941	-26.6159	-30.9132	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	240.3673	212.5105	225.8862	199.2063	193.4408	174.6973	172.8334	179.5677	181.3659	201.7386	213.8482	237.8500	(64)
										Total per year (kWh/year) = Sum(64)m =		2433.3121	(64)
12Total per year (kWh/year)												2433	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.4157	100.7149	107.8268	96.5453	94.8245	86.7697	86.4913	89.1110	89.2089	97.9108	102.2327	112.3847	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	124.6525	138.0082	124.6525	128.8076	124.6525	128.8076	124.6525	124.6525	128.8076	124.6525	128.8076	124.6525	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	152.4404	149.8734	144.9285	134.0907	127.4523	120.5135	116.2517	119.7729	123.9012	131.6006	141.9898	151.0547	(72)
Total internal gains													
	587.5519	600.8775	576.1837	555.8906	527.9163	505.9850	486.7806	487.7647	502.4414	522.5961	554.3213	575.3786	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.5000	11.2829	0.6300	0.7000	0.7700	15.5170	(75)
Southeast	7.5000	36.7938	0.6300	0.7000	0.7700	84.3351	(77)
Southwest	6.0000	36.7938	0.6300	0.7000	0.7700	67.4680	(79)

Solar gains	167.3201	290.1621	410.7026	531.8274	616.6359	621.3896	595.2519	530.5725	452.4278	324.3821	201.3495	142.5837	(83)
Total gains	754.8719	891.0395	986.8863	1087.7179	1144.5521	1127.3746	1082.0325	1018.3372	954.8692	846.9783	755.6708	717.9624	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6686	60.8146	60.9583	61.6426	61.7723	62.3835	62.3835	62.4980	62.1466	61.7723	61.5104	61.2390	
alpha	5.0446	5.0543	5.0639	5.1095	5.1182	5.1589	5.1589	5.1665	5.1431	5.1182	5.1007	5.0826	
util living area													
	0.9923	0.9819	0.9592	0.8931	0.7616	0.5715	0.4182	0.4619	0.6992	0.9214	0.9829	0.9939	(86)
MIT	19.8131	20.0363	20.3190	20.6571	20.8835	20.9788	20.9965	20.9942	20.9427	20.6446	20.1707	19.7768	(87)
Th 2	19.9645	19.9668	19.9689	19.9792	19.9811	19.9901	19.9901	19.9917	19.9866	19.9811	19.9772	19.9732	(88)
util rest of house													
	0.9899	0.9763	0.9466	0.8622	0.7025	0.4882	0.3237	0.3632	0.6157	0.8913	0.9766	0.9920	(89)
MIT 2	18.6020	18.8853	19.2387	19.6481	19.8894	19.9788	19.9890	19.9898	19.9512	19.6454	19.0655	18.5621	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.9048	19.1730	19.5088	19.9004	20.1379	20.2288	20.2409	20.2409	20.1991	19.8952	19.3418	18.8658	(92)

Temperature adjustment												0.0000	
adjusted MIT	18.9048	19.1730	19.5088	19.9004	20.1379	20.2288	20.2409	20.2409	20.1991	19.8952	19.3418	18.8658	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9864	0.9707	0.9397	0.8595	0.7123	0.5084	0.3474	0.3879	0.6343	0.8883	0.9714	0.9891	(94)
Useful gains	744.5942	864.9461	927.4006	934.9225	815.2293	573.2104	375.8596	395.0401	605.6527	752.3433	734.0931	710.1065	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1554.7172	1515.7549	1378.2355	1152.5148	882.1904	582.7270	376.9268	396.9080	633.8210	971.8202	1285.3411	1546.6699	(97)
Space heating kWh	602.7315	437.3435	335.4211	156.6664	49.8190	0.0000	0.0000	0.0000	0.0000	163.2908	396.8985	622.4032	(98a)
Space heating requirement - total per year (kWh/year)												2764.5741	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	602.7315	437.3435	335.4211	156.6664	49.8190	0.0000	0.0000	0.0000	0.0000	163.2908	396.8985	622.4032	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2764.5741	
Space heating per m2											(98c) / (4) =	29.7266	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.7315	437.3435	335.4211	156.6664	49.8190	0.0000	0.0000	0.0000	0.0000	163.2908	396.8985	622.4032	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	653.0136	473.8283	363.4032	169.7361	53.9751	0.0000	0.0000	0.0000	0.0000	176.9131	430.0092	674.3263	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	240.3673	212.5105	225.8862	199.2063	193.4408	174.6973	172.8334	179.5677	181.3659	201.7386	213.8482	237.8500	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0337	85.6414	84.9446	83.5268	81.4915	79.8000	79.8000	79.8000	79.8000	83.5898	85.4265	86.1147	(217)
Fuel for water heating, kWh/month	279.3875	248.1398	265.9216	238.4939	237.3755	218.9189	216.5832	225.0221	227.2755	241.3436	250.3300	276.2014	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.9003	20.7782	18.7085	13.7066	10.5874	8.6500	9.6582	12.5541	16.3065	21.3950	24.1656	26.6202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.8192	-60.0204	-85.7816	-95.8731	-102.8808	-95.8218	-94.5986	-89.5222	-80.5282	-68.3177	-46.9357	-37.0573	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-25.2659	-53.0232	-105.1655	-157.6463	-208.1737	-209.0941	-206.6697	-175.1456	-128.5630	-75.7707	-33.7119	-19.9926	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2995.2049	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2924.9930	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	209.0305	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2298.3790	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3916.8494 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2995.2049	0.2100	628.9930	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2924.9930	0.2100	614.2485	(264)
Space and water heating			1243.2416	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	209.0305	0.1443	30.1696	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.1566	0.1347	-121.2663	
PV Unit electricity exported	-1398.2224	0.1259	-176.1051	
Total			-297.3714	(269)
Total CO2, kg/year			987.9690	(272)
Target Carbon Dioxide Emission Rate (TER)			10.6200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2995.2049	1.1300	3384.5816	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2924.9930	1.1300	3305.2421	(278)
Space and water heating			6689.8236	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	209.0305	1.5338	320.6180	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.1566	1.4979	-1348.3430	
PV Unit electricity exported	-1398.2224	0.4623	-646.4297	
Total			-1994.7728	(283)
Total Primary energy kWh/year			5145.7696	(286)
Target Primary Energy Rate (TPER)			55.3300	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3B4_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3B4
Property	1 Bedroom Flat, 3B4, Saffron Walden, CB11		

SAP Rating	85 B	DER	13.80	TER	11.56
Environmental	88 B	% DER<TER	-19.38		
CO_2 Emissions (t/year)	1.31	DFEE	41.11	TFEE	42.79
Compliance Check	See BREL	% DFEE < TFEE	3.91		
% DPER < TPER	-27.48	DPER	77.00	TPER	60.40

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)
Ground floor		51.0000 (1b)	x	2.5000 (2b)	=	127.5000 (1b) -
First floor		51.0000 (1c)	x	2.7500 (2c)	=	140.2500 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	267.7500 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			37.8000	1.1450	43.2824			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			51.0000	0.1100	5.6100			(28a)
External Wall 1	153.0000	43.0000	110.0000	0.1400	15.4000			(29a)
External Roof 1	51.0000		51.0000	0.1100	5.6100			(30)
Total net area of external elements Aum(A, m2)			255.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.1024			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 12.7500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 87.8524 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.3462	45.3009	45.2565	45.0477	45.0087	44.8269	44.8269	44.7932	44.8969	45.0087	45.0877	45.1703	(38)
Heat transfer coeff	133.1987	133.1534	133.1089	132.9002	132.8611	132.6794	132.6794	132.6457	132.7494	132.8611	132.9401	133.0227	(39)

Average = Sum(39)m / 12 = 132.9000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3059	1.3054	1.3050	1.3029	1.3026	1.3008	1.3008	1.3004	1.3015	1.3026	1.3033	1.3041	(40)
HLP (average)												1.3029	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7573 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.4504	69.3917	67.8489	64.8970	62.7187	60.2894	58.9085	60.4396	62.1180	64.7264	67.7416	70.1805	(42a)
Hot water usage for baths	30.4192	29.9674	29.3312	28.1582	27.2799	26.3060	25.7799	26.4116	27.0995	28.1416	29.3388	30.3164	(42b)
Hot water usage for other uses	42.8674	41.3085	39.7497	38.1909	36.6321	35.0733	35.0733	36.6321	38.1909	39.7497	41.3085	42.8674	(42c)

Average daily hot water use (litres/day) 132.1266 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.7369	140.6676	136.9299	131.2462	126.6307	121.6686	119.7617	123.4834	127.4084	132.6177	138.3889	143.3642	(44)
Energy conte	227.6442	200.3088	210.4561	179.6695	170.4692	149.6058	144.8414	152.8982	157.1073	179.9610	197.1604	224.4737	(45)

Energy content (annual) Total = Sum(45)m = 2194.5956

Distribution loss (46)m = 0.15 x (45)m	34.1466	30.0463	31.5684	26.9504	25.5704	22.4409	21.7262	22.9347	23.5661	26.9941	29.5741	33.6710	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	277.9886	245.7812	260.8005	228.3899	220.8137	198.3262	195.1859	203.2427	205.8277	230.3054	245.8808	274.8181	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	277.9886	245.7812	260.8005	228.3899	220.8137	198.3262	195.1859	203.2427	205.8277	230.3054	245.8808	274.8181	(64)

Total per year (kWh/year) = Sum(64)m = 2787.3607 (64)
12Total per year (kWh/year) 2787 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	115.9672	102.9806	110.2522	98.7164	96.9566	88.7203	88.4353	91.1142	91.2145	100.1126	104.5322	114.9130	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	130.8986	144.9234	130.8986	135.2619	130.8986	135.2619	130.8986	130.8986	135.2619	130.8986	135.2619	130.8986	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.5211	262.2141	255.4278	240.9805	222.7434	205.6032	194.1524	191.4594	198.2457	212.6930	230.9300	248.0703	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	(71)
Water heating gains (Table 5)	155.8699	153.2449	148.1884	137.1062	130.3180	123.2226	118.8647	122.4653	126.6868	134.5599	145.1836	154.4530	(72)
Total internal gains	613.6489	627.7417	601.8741	580.7078	551.3193	528.4469	508.2749	509.1826	524.5537	545.5107	578.7347	600.7812	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.3000	10.6334	0.7600	0.7000	0.7700	24.6977 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	8.4000	46.7521	0.7600	0.7000	0.7700	144.7855 (78)
West	10.5000	19.6403	0.7600	0.7000	0.7700	76.0294 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	336.7478	611.5251	921.1127	1256.1032	1492.4254	1514.0816	1446.6124	1268.7535	1038.6730	700.1978	410.6473	283.2475	(83)
Total gains	950.3967	1239.2668	1522.9868	1836.8110	2043.7446	2042.5285	1954.8873	1777.9361	1563.2266	1245.7086	989.3821	884.0287	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1787	53.1968	53.2146	53.2981	53.3138	53.3869	53.3869	53.4004	53.3587	53.3138	53.2821	53.2490	
alpha	4.5452	4.5465	4.5476	4.5532	4.5543	4.5591	4.5591	4.5600	4.5572	4.5543	4.5521	4.5499	
util living area	0.9879	0.9633	0.9018	0.7615	0.5788	0.4113	0.2978	0.3415	0.5636	0.8597	0.9721	0.9911	(86)
MIT	19.6863	20.0291	20.4310	20.7860	20.9462	20.9906	20.9983	20.9969	20.9642	20.6822	20.0941	19.6111	(87)
Th 2	19.8362	19.8366	19.8369	19.8385	19.8388	19.8402	19.8402	19.8405	19.8397	19.8388	19.8382	19.8376	(88)
util rest of house	0.9840	0.9527	0.8764	0.7132	0.5150	0.3387	0.2197	0.2563	0.4778	0.8139	0.9621	0.9882	(89)
MIT 2	18.3490	18.7767	19.2592	19.6499	19.8009	19.8358	19.8398	19.8396	19.8199	19.5585	18.8654	18.2549	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.6833	19.0898	19.5522	19.9340	20.0873	20.1245	20.1294	20.1289	20.1060	19.8394	19.1725	18.5939	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5333	18.9398	19.4022	19.7840	19.9373	19.9745	19.9794	19.9789	19.9560	19.6894	19.0225	18.4439	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9779	0.9421	0.8653	0.7107	0.5206	0.3472	0.2291	0.2665	0.4867	0.8070	0.9525	0.9831	(94)
Useful gains	929.3995	1167.4866	1317.7723	1305.4848	1063.8902	709.2464	447.9584	473.8810	760.8476	1005.2881	942.4358	869.1189	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1895.8548	1869.4436	1717.3930	1446.4800	1094.4106	713.0857	448.3783	474.7258	777.3816	1207.6304	1584.9823	1894.7675	(97)
Space heating kWh	719.0428	471.7151	297.3178	101.5166	22.7072	0.0000	0.0000	0.0000	0.0000	150.5427	462.6335	763.0826	(98a)
Space heating requirement - total per year (kWh/year)												2988.5581	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	719.0428	471.7151	297.3178	101.5166	22.7072	0.0000	0.0000	0.0000	0.0000	150.5427	462.6335	763.0826	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2988.5581	
Space heating per m2										(98c) / (4) =		29.2996	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	719.0428	471.7151	297.3178	101.5166	22.7072	0.0000	0.0000	0.0000	0.0000	150.5427	462.6335	763.0826	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	803.3997	527.0560	332.1986	113.4264	25.3712	0.0000	0.0000	0.0000	0.0000	168.2041	516.9089	852.6062	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	277.9886	245.7812	260.8005	228.3899	220.8137	198.3262	195.1859	203.2427	205.8277	230.3054	245.8808	274.8181	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	310.6018	274.6159	291.3972	255.1843	246.7192	221.5935	218.0848	227.0868	229.9751	257.3245	274.7272	307.0593	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	34.8118	27.9273	25.1454	18.4226	14.2302	11.6262	12.9812	16.8735	21.9170	28.7563	32.4802	35.7793 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	3339.1711 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3114.3695 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	280.9509 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6820.4915 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3339.1711	0.2100	701.2259	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3114.3695	0.2100	654.0176	(264)
Space and water heating			1355.2435	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	280.9509	0.1443	40.5499	(268)
Total CO2, kg/year			1407.7227	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3339.1711	1.1300	3773.2633	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3114.3695	1.1300	3519.2376	(278)
Space and water heating			7292.5009	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	280.9509	1.5338	430.9319	(282)
Total Primary energy kWh/year			7853.5336	(286)
Dwelling Primary energy Rate (DPER)			77.0000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.0000 (1b)	x	2.5000 (2b)	=	127.5000 (1b)	-
First floor	51.0000 (1c)	x	2.7500 (2c)	=	140.2500 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 102.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 267.7500 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1494	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3994	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3395	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4328	0.4244	0.4159	0.3734	0.3649	0.3225	0.3225	0.3140	0.3395	0.3649	0.3819	0.3989	(22b)
Effective ac	0.5937	0.5900	0.5865	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5796	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			20.3400	1.1450	23.2901			(27)
Heatloss Floor 1			51.0000	0.1300	6.6300			(28a)
External Wall 1	153.0000	25.5400	127.4600	0.1800	22.9428			(29a)
External Roof 1	51.0000		51.0000	0.1100	5.6100			(30)
Total net area of external elements Aum(A, m2)			255.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.6729			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	29.0000	0.1600	4.6400	
E6 Intermediate floor within a dwelling	29.0000	0.0000	0.0000	
E14 Flat roof	29.0000	0.0800	2.3200	
E16 Corner (normal)	21.0000	0.0900	1.8900	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.8500 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	72.5229 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.4557	52.1343	51.8193	50.3396	50.0627	48.7739	48.7739	48.5352	49.2703	50.0627	50.6228	51.2083	(38)
Heat transfer coeff	124.9786	124.6572	124.3422	122.8624	122.5856	121.2968	121.2968	121.0581	121.7932	122.5856	123.1457	123.7312	(39)
Average = Sum(39)m / 12 =												122.8611	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2253	1.2221	1.2190	1.2045	1.2018	1.1892	1.1892	1.1868	1.1941	1.2018	1.2073	1.2131	(40)
HLP (average)												1.2045	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7573 (42)
Hot water usage for mixer showers

70.4504	69.3917	67.8489	64.8970	62.7187	60.2894	58.9085	60.4396	62.1180	64.7264	67.7416	70.1805	(42a)

Hot water usage for baths

30.4192	29.9674	29.3312	28.1582	27.2799	26.3060	25.7799	26.4116	27.0995	28.1416	29.3388	30.3164	(42b)

Hot water usage for other uses

42.8674	41.3085	39.7497	38.1909	36.6321	35.0733	35.0733	36.6321	38.1909	39.7497	41.3085	42.8674	(42c)

Average daily hot water use (litres/day) 132.1266 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	143.7369	140.6676	136.9299	131.2462	126.6307	121.6686	119.7617	123.4834	127.4084	132.6177	138.3889	143.3642 (44)
Energy conte	227.6442	200.3088	210.4561	179.6695	170.4692	149.6058	144.8414	152.8982	157.1073	179.9610	197.1604	224.4737 (45)
Energy content (annual)										Total = Sum(45)m =		2194.5956

Distribution loss (46)m = 0.15 x (45)m

	34.1466	30.0463	31.5684	26.9504	25.5704	22.4409	21.7262	22.9347	23.5661	26.9941	29.5741	33.6710 (46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	276.8869	244.7861	259.6988	227.3237	219.7119	197.2600	194.0841	202.1409	204.7615	229.2036	244.8146	273.7163 (62)
WWHRS	-32.2070	-28.4841	-29.8269	-24.6979	-23.0175	-19.6963	-18.4621	-19.6326	-20.3785	-24.0240	-27.2163	-31.6106 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	244.6799	216.3020	229.8718	202.6258	196.6944	177.5637	175.6220	182.5083	184.3830	205.1796	217.5983	242.1058 (64)
										Total per year (kWh/year) = Sum(64)m =		2475.1345 (64)
12Total per year (kWh/year)												2475 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

	115.0858	102.1845	109.3708	97.8635	96.0752	87.8673	87.5539	90.2328	90.3615	99.2312	103.6792	114.0316 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	131.8615	145.9895	131.8615	136.2569	131.8615	136.2569	131.8615	131.8615	136.2569	131.8615	136.2569	131.8615 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	259.5211	262.2141	255.4278	240.9805	222.7434	205.6032	194.1524	191.4594	198.2457	212.6930	230.9300	248.0703 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914 (71)

Water heating gains (Table 5)

	154.6853	152.0602	147.0037	135.9215	129.1333	122.0379	117.6800	121.2806	125.5021	133.3752	143.9989	153.2683 (72)

Total internal gains

	613.4271	627.6232	601.6523	580.5182	551.0975	528.2572	508.0532	508.9608	524.3640	545.2890	578.5451	600.5594 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3900	10.6334	0.6300	0.7000	0.7700	11.0165	(74)
East	6.7800	19.6403	0.6300	0.7000	0.7700	40.6957	(76)
South	4.5200	46.7521	0.6300	0.7000	0.7700	64.5819	(78)
West	5.6500	19.6403	0.6300	0.7000	0.7700	33.9131	(80)

Solar gains	150.2073	272.7724	410.8648	560.2881	665.7003	675.3601	645.2653	565.9308	463.3028	312.3251	183.1703	126.3433 (83)
Total gains	763.6344	900.3955	1012.5171	1140.8063	1216.7978	1203.6173	1153.3185	1074.8917	987.6668	857.6141	761.7154	726.9027 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6764	56.8225	56.9665	57.6526	57.7828	58.3967	58.3967	58.5118	58.1587	57.7828	57.5200	57.2478	
alpha	4.7784	4.7882	4.7978	4.8435	4.8522	4.8931	4.8931	4.9008	4.8772	4.8522	4.8347	4.8165	
util living area	0.9948	0.9880	0.9715	0.9180	0.8010	0.6160	0.4570	0.5079	0.7567	0.9470	0.9888	0.9959	(86)
MIT	19.6237	19.8409	20.1496	20.5428	20.8278	20.9636	20.9930	20.9886	20.9030	20.5182	20.0031	19.5924	(87)
Th 2	19.8998	19.9023	19.9048	19.9164	19.9185	19.9287	19.9287	19.9305	19.9248	19.9185	19.9142	19.9096	(88)
util rest of house	0.9931	0.9841	0.9620	0.8913	0.7427	0.5248	0.3487	0.3950	0.6713	0.9237	0.9845	0.9945	(89)
MIT 2	18.3150	18.5925	18.9822	19.4668	19.7800	19.9090	19.9266	19.9268	19.8626	19.4508	18.8089	18.2819	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.6422	18.9046	19.2740	19.7358	20.0420	20.1727	20.1932	20.1922	20.1227	19.7177	19.1075	18.6095	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.6422	18.9046	19.2740	19.7358	20.0420	20.1727	20.1932	20.1922	20.1227	19.7177	19.1075	18.6095	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9792	0.9549	0.8861	0.7501	0.5465	0.3759	0.4233	0.6885	0.9183	0.9800	0.9921	(94)
Useful gains	756.1491	881.6824	966.8362	1010.8168	912.6622	657.7330	433.5174	454.9859	679.9709	787.5448	746.4466	721.1535	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1792.4672	1745.7722	1588.3496	1331.3149	1022.6044	675.9482	435.8437	459.0797	733.5283	1117.6938	1478.6669	1782.9019	(97)
Space heating kWh	771.0207	580.6684	462.4060	230.7586	81.7970	0.0000	0.0000	0.0000	0.0000	245.6309	527.1986	789.9408	(98a)
Space heating requirement - total per year (kWh/year)												3689.4208	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	771.0207	580.6684	462.4060	230.7586	81.7970	0.0000	0.0000	0.0000	0.0000	245.6309	527.1986	789.9408	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3689.4208	
Space heating per m2											(98c) / (4) =	36.1708	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	771.0207	580.6684	462.4060	230.7586	81.7970	0.0000	0.0000	0.0000	0.0000	245.6309	527.1986	789.9408	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	835.3420	629.1098	500.9815	250.0093	88.6208	0.0000	0.0000	0.0000	0.0000	266.1223	571.1794	855.8405	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	244.6799	216.3020	229.8718	202.6258	196.6944	177.5637	175.6220	182.5083	184.3830	205.1796	217.5983	242.1058	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.4512	86.1626	85.5945	84.3521	82.2484	79.8000	79.8000	79.8000	79.8000	84.4644	85.9674	86.5111	(217)
Fuel for water heating, kWh/month	283.0265	251.0393	268.5590	240.2144	239.1467	222.5109	220.0777	228.7071	231.0564	242.9186	253.1173	279.8550	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	27.3982	21.9799	19.7904	14.4993	11.1997	9.1502	10.2167	13.2801	17.2495	22.6323	25.5632	28.1597	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.5503	-65.0409	-92.6579	-103.2064	-110.4444	-102.7424	-101.4135	-96.1099	-86.6838	-73.8499	-50.9439	-40.3096	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-28.1238	-58.9424	-116.7680	-174.8471	-230.7122	-231.6816	-229.0098	-194.1709	-142.6420	-84.1826	-37.5083	-22.2612	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3997.2057	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2960.2290	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												221.1193	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2520.8028	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4743.7512 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3997.2057	0.2100	839.4132	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2960.2290	0.2100	621.6481	(264)
Space and water heating			1461.0613	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	221.1193	0.1443	31.9144	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-969.9529	0.1348	-130.7404	
PV Unit electricity exported	-1550.8499	0.1260	-195.3764	
Total			-326.1168	(269)
Total CO2, kg/year			1178.7881	(272)
Target Carbon Dioxide Emission Rate (TER)			11.5600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3997.2057	1.1300	4516.8424	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2960.2290	1.1300	3345.0587	(278)
Space and water heating			7861.9011	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	221.1193	1.5338	339.1602	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-969.9529	1.4982	-1453.1584	
PV Unit electricity exported	-1550.8499	0.4624	-717.1712	
Total			-2170.3295	(283)
Total Primary energy kWh/year			6160.8326	(286)
Target Primary Energy Rate (TPER)			60.4000	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3BC_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3BC
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	85 B	DER	13.33	TER	10.97
Environmental	88 B	% DER<TER	-21.51		
CO_2 Emissions (t/year)	1.17	DFEE	37.51	TFEE	38.31
Compliance Check	See BREL	% DFEE < TFEE	2.09		
% DPER < TPER	-30.41	DPER	74.56	TPER	57.17

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		47.0000	(1b)	x 2.5000	(2b) =	117.5000	(1b) -
First floor		47.0000	(1c)	x 2.7500	(2c) =	129.2500	(1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.7500	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			37.8000	1.1450	43.2824			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			47.0000	0.1100	5.1700			(28a)
External Wall 1	105.0000	43.0000	62.0000	0.1400	8.6800			(29a)
External Roof 1	47.0000		47.0000	0.1100	5.1700			(30)
Total net area of external elements Aum(A, m2)			199.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.5024			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 9.9500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 77.4524 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.7897	41.7479	41.7069	41.5146	41.4786	41.3111	41.3111	41.2800	41.3756	41.4786	41.5514	41.6275	(38)
Heat transfer coeff													
	119.2421	119.2003	119.1594	118.9670	118.9310	118.7635	118.7635	118.7325	118.8280	118.9310	119.0039	119.0800	(39)

Average = Sum(39)m / 12 = 118.9669

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2685	1.2681	1.2677	1.2656	1.2652	1.2634	1.2634	1.2631	1.2641	1.2652	1.2660	1.2668	(40)
HLP (average)												1.2656	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6766 (42)

Hot water usage for mixer showers

69.0977	68.0593	66.5462	63.6510	61.5145	59.1318	57.7775	59.2792	60.9253	63.4836	66.4409	68.8330	(42a)

Hot water usage for baths

29.8375	29.3944	28.7704	27.6198	26.7582	25.8029	25.2869	25.9066	26.5813	27.6035	28.7778	29.7366	(42b)

Hot water usage for other uses

42.0412	40.5124	38.9836	37.4549	35.9261	34.3973	34.3973	35.9261	37.4549	38.9836	40.5124	42.0412	(42c)

Average daily hot water use (litres/day) 129.5891 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.9764	137.9661	134.3002	128.7257	124.1988	119.3321	117.4617	121.1119	124.9615	130.0707	135.7311	140.6108	(44)
Energy conte	223.2722	196.4619	206.4143	176.2190	167.1954	146.7327	142.0598	149.9618	154.0900	176.5047	193.3738	220.1625	(45)

Energy content (annual) Total = Sum(45)m = 2152.4482

Distribution loss (46)m = 0.15 x (45)m

33.4908	29.4693	30.9622	26.4328	25.0793	22.0099	21.3090	22.4943	23.1135	26.4757	29.0061	33.0244	(46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

273.6166	241.9343	256.7588	224.9394	217.5399	195.4531	192.4042	200.3062	202.8104	226.8492	242.0943	270.5070	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

273.6166	241.9343	256.7588	224.9394	217.5399	195.4531	192.4042	200.3062	202.8104	226.8492	242.0943	270.5070	(64)

Total per year (kWh/year) = Sum(64)m = 2745.2133 (64)

12Total per year (kWh/year) 2745 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

114.5135	101.7015	108.9083	97.5692	95.8680	87.7650	87.5104	90.1378	90.2113	98.9634	103.2731	113.4796	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

124.2035	137.5110	124.2035	128.3436	124.2035	128.3436	124.2035	124.2035	128.3436	124.2035	128.3436	124.2035	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)

Water heating gains (Table 5)

153.9161	151.3415	146.3821	135.5127	128.8549	121.8958	117.6215	121.1530	125.2934	133.0153	143.4349	152.5263	(72)
Total internal gains												
590.5161	603.8044	579.0983	558.6606	530.5584	508.4758	489.1963	490.1725	504.8923	525.1823	557.0464	578.2613	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	6.3000	11.2829	0.7600	0.7000	0.7700	26.2064 (75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190 (77)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (79)
Northwest	10.5000	11.2829	0.7600	0.7000	0.7700	43.6774 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	354.7489	627.4811	920.2038	1243.5232	1487.1792	1517.9171	1446.1668	1258.0451	1031.1716	710.1245	429.1346	300.8558	(83)
Total gains	945.2650	1231.2855	1499.3021	1802.1838	2017.7376	2026.3929	1935.3632	1748.2176	1536.0639	1235.3069	986.1810	879.1171	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7439	54.7631	54.7819	54.8705	54.8871	54.9645	54.9645	54.9789	54.9347	54.8871	54.8535	54.8184	
alpha	4.6496	4.6509	4.6521	4.6580	4.6591	4.6643	4.6643	4.6653	4.6623	4.6591	4.6569	4.6546	
util living area	0.9833	0.9505	0.8760	0.7203	0.5326	0.3727	0.2696	0.3115	0.5201	0.8238	0.9616	0.9877	(86)
MIT	19.8147	20.1640	20.5374	20.8421	20.9649	20.9945	20.9991	20.9982	20.9765	20.7551	20.2117	19.7357	(87)
Th 2	19.8656	19.8659	19.8663	19.8679	19.8682	19.8696	19.8696	19.8698	19.8690	19.8682	19.8676	19.8669	(88)
util rest of house	0.9782	0.9370	0.8470	0.6711	0.4730	0.3080	0.2005	0.2354	0.4405	0.7734	0.9487	0.9838	(89)
MIT 2	18.5314	18.9631	19.4038	19.7312	19.8438	19.8670	19.8693	19.8693	19.8563	19.6576	19.0309	18.4331	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.8522	19.2634	19.6872	20.0090	20.1241	20.1489	20.1518	20.1515	20.1363	19.9320	19.3261	18.7587	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7022	19.1134	19.5372	19.8590	19.9741	19.9989	20.0018	20.0015	19.9863	19.7820	19.1761	18.6087	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9710	0.9259	0.8374	0.6707	0.4787	0.3154	0.2086	0.2443	0.4490	0.7691	0.9383	0.9778	(94)
Useful gains	917.8592	1140.0010	1255.4671	1208.7260	965.9703	639.1401	403.7909	427.1643	689.6162	950.0374	925.3729	859.6012	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1717.3531	1694.2368	1553.5039	1303.7538	984.0472	641.1889	404.0053	427.6176	699.4582	1092.0271	1437.1024	1715.7890	(97)
Space heating kWh	594.8235	372.4465	221.7393	68.4200	13.4492	0.0000	0.0000	0.0000	0.0000	105.6403	368.4452	637.0037	(98a)
Space heating requirement - total per year (kWh/year)												2381.9678	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	594.8235	372.4465	221.7393	68.4200	13.4492	0.0000	0.0000	0.0000	0.0000	105.6403	368.4452	637.0037	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2381.9678	
Space heating per m2											(98c) / (4) =	25.3401	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	594.8235	372.4465	221.7393	68.4200	13.4492	0.0000	0.0000	0.0000	0.0000	105.6403	368.4452	637.0037	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	664.6072	416.1413	247.7534	76.4470	15.0271	0.0000	0.0000	0.0000	0.0000	118.0339	411.6706	711.7360	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.6166	241.9343	256.7588	224.9394	217.5399	195.4531	192.4042	200.3062	202.8104	226.8492	242.0943	270.5070	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	305.7169	270.3176	286.8813	251.3290	243.0613	218.3834	214.9768	223.8058	226.6038	253.4628	270.4964	302.2424	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	32.6906	26.2256	23.6133	17.3001	13.3631	10.9178	12.1903	15.8454	20.5816	27.0041	30.5011	33.5992 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2661.4166 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3067.2775 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	263.8321 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6078.5261 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2661.4166	0.2100	558.8975	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3067.2775	0.2100	644.1283	(264)
Space and water heating			1203.0257	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	263.8321	0.1443	38.0791	(268)
Total CO2, kg/year			1253.0341	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2661.4166	1.1300	3007.4007	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3067.2775	1.1300	3466.0235	(278)
Space and water heating			6473.4242	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	263.8321	1.5338	404.6745	(282)
Total Primary energy kWh/year			7008.1995	(286)
Dwelling Primary energy Rate (DPER)			74.5600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.0000 (1b)	x	2.5000 (2b)	=	117.5000 (1b)	-
First floor	47.0000 (1c)	x	2.7500 (2c)	=	129.2500 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 94.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 246.7500 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1216	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3716	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4027	0.3948	0.3869	0.3474	0.3395	0.3001	0.3001	0.2922	0.3158	0.3395	0.3553	0.3711	(22b)
Effective ac	0.5811	0.5779	0.5748	0.5604	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5689	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			18.3600	1.1450	21.0229			(27)
Heatloss Floor 1			47.0000	0.1300	6.1100			(28a)
External Wall 1	105.0000	23.5600	81.4400	0.1800	14.6592			(29a)
External Roof 1	47.0000		47.0000	0.1100	5.1700			(30)
Total net area of external elements Aum(A, m2)			199.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1621			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
E5 Ground floor (normal)	29.0000	0.1600	4.6400	
E6 Intermediate floor within a dwelling	29.0000	0.0000	0.0000	
E14 Flat roof	29.0000	0.0800	2.3200	
E16 Corner (normal)	21.0000	0.0900	1.8900	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.8500	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	61.0121	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3162	47.0598	46.8085	45.6281	45.4073	44.3792	44.3792	44.1889	44.7752	45.4073	45.8541	46.3211	(38)
Heat transfer coeff	108.3283	108.0719	107.8206	106.6402	106.4194	105.3913	105.3913	105.2010	105.7873	106.4194	106.8662	107.3332	(39)

Average = Sum(39)m / 12 = 106.6392

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1524	1.1497	1.1470	1.1345	1.1321	1.1212	1.1212	1.1192	1.1254	1.1321	1.1369	1.1418	(40)
HLP (average)												1.1345	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6766 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
69.0977	68.0593	66.5462	63.6510	61.5145	59.1318	57.7775	59.2792	60.9253	63.4836	66.4409	68.8330	(42a)

Hot water usage for baths

29.8375	29.3944	28.7704	27.6198	26.7582	25.8029	25.2869	25.9066	26.5813	27.6035	28.7778	29.7366	(42b)

Hot water usage for other uses

42.0412	40.5124	38.9836	37.4549	35.9261	34.3973	34.3973	35.9261	37.4549	38.9836	40.5124	42.0412	(42c)

Average daily hot water use (litres/day) 129.5891 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	140.9764	137.9661	134.3002	128.7257	124.1988	119.3321	117.4617	121.1119	124.9615	130.0707	135.7311	140.6108 (44)
Energy conte	223.2722	196.4619	206.4143	176.2190	167.1954	146.7327	142.0598	149.9618	154.0900	176.5047	193.3738	220.1625 (45)
Energy content (annual)										Total = Sum(45)m =		2152.4482
Distribution loss (46)m = 0.15 x (45)m												
	33.4908	29.4693	30.9622	26.4328	25.0793	22.0099	21.3090	22.4943	23.1135	26.4757	29.0061	33.0244 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	272.5148	240.9391	255.6570	223.8732	216.4381	194.3869	191.3025	199.2045	201.7442	225.7474	241.0280	269.4052 (62)
WWHRS	-31.5886	-27.9372	-29.2542	-24.2237	-22.5756	-19.3181	-18.1076	-19.2556	-19.9872	-23.5628	-26.6937	-31.0036 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	240.9262	213.0019	226.4028	199.6495	193.8625	175.0688	173.1948	179.9488	181.7569	202.1846	214.3343	238.4016 (64)
										Total per year (kWh/year) = Sum(64)m =		2438.7329 (64)
12Total per year (kWh/year)												2439 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	113.6321	100.9054	108.0269	96.7162	94.9866	86.9120	86.6290	89.2564	89.3583	98.0820	102.4202	112.5982 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	125.4097	138.8465	125.4097	129.5900	125.4097	129.5900	125.4097	125.4097	129.5900	125.4097	129.5900	125.4097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)													
	152.7314	150.1568	145.1975	134.3280	127.6702	120.7111	116.4368	119.9683	124.1087	131.8306	142.2502	151.3416	(72)
Total internal gains													
	590.5376	603.9551	579.1198	558.7223	530.5799	508.5375	489.2178	490.1940	504.9540	525.2038	557.1081	578.2828	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0600	11.2829	0.6300	0.7000	0.7700	10.5515	(75)
Southeast	6.1200	36.7938	0.6300	0.7000	0.7700	68.8174	(77)
Southwest	4.0800	36.7938	0.6300	0.7000	0.7700	45.8783	(79)
Northwest	5.1000	11.2829	0.6300	0.7000	0.7700	17.5859	(81)

Solar gains	142.8331	252.6437	370.5031	500.6817	598.7853	611.1614	582.2724	506.5287	415.1823	285.9186	172.7831	121.1340 (83)
Total gains	733.3707	856.5988	949.6229	1059.4040	1129.3652	1119.6988	1071.4903	996.7227	920.1362	811.1224	729.8912	699.4168 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2592	60.4022	60.5429	61.2131	61.3401	61.9385	61.9385	62.0506	61.7066	61.3401	61.0837	60.8179	
alpha	5.0173	5.0268	5.0362	5.0809	5.0893	5.1292	5.1292	5.1367	5.1138	5.0893	5.0722	5.0545	
util living area													
	0.9936	0.9854	0.9665	0.9059	0.7761	0.5838	0.4294	0.4793	0.7270	0.9353	0.9860	0.9949	(86)
MIT	19.7684	19.9783	20.2633	20.6219	20.8705	20.9761	20.9959	20.9929	20.9302	20.6017	20.1246	19.7353	(87)
Th 2	19.9582	19.9604	19.9626	19.9728	19.9747	19.9836	19.9836	19.9852	19.9801	19.9747	19.9708	19.9668	(88)
util rest of house													
	0.9915	0.9808	0.9558	0.8773	0.7177	0.4990	0.3320	0.3768	0.6435	0.9090	0.9807	0.9932	(89)
MIT 2	18.5408	18.8081	19.1662	19.6039	19.8718	19.9708	19.9823	19.9829	19.9361	19.5925	19.0033	18.5048	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.8477	19.1006	19.4405	19.8584	20.1215	20.2221	20.2357	20.2354	20.1846	19.8448	19.2836	18.8124	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.8477	19.1006	19.4405	19.8584	20.1215	20.2221	20.2357	20.2354	20.1846	19.8448	19.2836	18.8124	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9884	0.9757	0.9490	0.8737	0.7267	0.5195	0.3564	0.4025	0.6615	0.9049	0.9760	0.9906	(94)
Useful gains	724.8405	835.7939	901.1923	925.5578	820.7081	581.6384	381.9100	401.1701	608.6249	734.0057	712.3400	692.8274	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1575.9245	1534.6886	1395.2547	1168.6095	896.2095	592.5209	383.1727	403.4862	643.6768	983.8244	1302.0136	1568.3966	(97)
Space heating kWh	633.2065	469.6572	367.5824	174.9972	56.1731	0.0000	0.0000	0.0000	0.0000	185.8651	424.5650	651.4235	(98a)
Space heating requirement - total per year (kWh/year)												2963.4700	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	633.2065	469.6572	367.5824	174.9972	56.1731	0.0000	0.0000	0.0000	0.0000	185.8651	424.5650	651.4235	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2963.4700	
Space heating per m2											(98c) / (4) =	31.5263	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	633.2065	469.6572	367.5824	174.9972	56.1731	0.0000	0.0000	0.0000	0.0000	185.8651	424.5650	651.4235	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	686.0309	508.8377	398.2475	189.5961	60.8592	0.0000	0.0000	0.0000	0.0000	201.3706	459.9837	705.7676	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	240.9262	213.0019	226.4028	199.6495	193.8625	175.0688	173.1948	179.9488	181.7569	202.1846	214.3343	238.4016	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1229	85.7814	85.1400	83.7656	81.6594	79.8000	79.8000	79.8000	79.8000	83.8715	85.5627	86.1955	(217)
Fuel for water heating, kWh/month	279.7470	248.3080	265.9182	238.3432	237.4040	219.3844	217.0361	225.4998	227.7656	241.0648	250.4997	276.5825	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.0577	20.9044	18.8221	13.7899	10.6517	8.7025	9.7168	12.6303	16.4055	21.5250	24.3124	26.7819	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2376	-60.5855	-86.5590	-96.7061	-103.7434	-96.6124	-95.3770	-90.2727	-81.2266	-68.9420	-47.3858	-37.4218	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-25.5796	-53.6736	-106.4414	-159.5393	-210.6558	-211.5822	-209.1307	-177.2410	-130.1129	-76.6958	-34.1289	-20.2416	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3210.6934	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2927.5532	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												210.3002	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2323.0928	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4111.4541 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3210.6934	0.2100	674.2456	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2927.5532	0.2100	614.7862	(264)
Space and water heating			1289.0318	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	210.3002	0.1443	30.3528	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-908.0701	0.1347	-122.3397	
PV Unit electricity exported	-1415.0226	0.1260	-178.2259	
Total			-300.5656	(269)
Total CO2, kg/year			1030.7483	(272)
Target Carbon Dioxide Emission Rate (TER)			10.9700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3210.6934	1.1300	3628.0836	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2927.5532	1.1300	3308.1351	(278)
Space and water heating			6936.2187	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	210.3002	1.5338	322.5655	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-908.0701	1.4979	-1360.2240	
PV Unit electricity exported	-1415.0226	0.4623	-654.2148	
Total			-2014.4389	(283)
Total Primary energy kWh/year			5374.4462	(286)
Target Primary Energy Rate (TPER)			57.1700	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 3BH-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3BH-AFF
Property	1 Bedroom Flat, 3BH-AFF, Saffron Walden, CB11		

SAP Rating	86 B	DER	12.89	TER	10.58
Environmental	89 B	% DER<TER	-21.83		
CO_2 Emissions (t/year)	1.06	DFEE	32.82	TFEE	35.06
Compliance Check	See BREL	% DFEE < TFEE	6.39		
% DPER < TPER	-31.23	DPER	72.25	TPER	55.06

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		44.0000	(1b)	x 2.5000	(2b) =	110.0000	(1b) -
First floor		44.0000	(1c)	x 2.7500	(2c) =	121.0000	(1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.0000	(5)

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2. Ventilation rate

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				m3 per hour	
Number of open chimneys			0 * 80 =	0.0000	(6a)
Number of open flues			0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire			0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler			0 * 20 =	0.0000	(6d)
Number of flues attached to other heater			0 * 35 =	0.0000	(6e)
Number of blocked chimneys			0 * 20 =	0.0000	(6f)
Number of intermittent extract fans			0 * 10 =	0.0000	(7a)
Number of passive vents			0 * 10 =	0.0000	(7b)
Number of flueless gas fires			0 * 40 =	0.0000	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				3.0000	(17)
Infiltration rate				0.1500	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.3000	1.1450	31.2595			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			44.0000	0.1100	4.8400			(28a)
External Wall 1	100.0000	32.5000	67.5000	0.1400	9.4500			(29a)
External Roof 1	44.0000		44.0000	0.1100	4.8400			(30)
Total net area of external elements Aum(A, m2)			188.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.5895			(33)

Party Wall 1 53.0000 0.0000 0.0000 (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 9.4000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 64.9895 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.1222	39.0831	39.0448	38.8647	38.8310	38.6742	38.6742	38.6452	38.7346	38.8310	38.8992	38.9704	(38)
Heat transfer coeff	104.1118	104.0727	104.0343	103.8543	103.8206	103.6637	103.6637	103.6347	103.7241	103.8206	103.8887	103.9600	(39)

Average = Sum(39)m / 12 = 103.8541

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1831	1.1826	1.1822	1.1802	1.1798	1.1780	1.1780	1.1777	1.1787	1.1798	1.1806	1.1814	(40)
HLP (average)												1.1802	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5973 (42)

Hot water usage for mixer showers

67.7687	66.7502	65.2662	62.4267	60.3312	57.9944	56.6662	58.1390	59.7535	62.2625	65.1630	67.5090	(42a)

Hot water usage for baths

29.2660	28.8313	28.2193	27.0907	26.2457	25.3087	24.8025	25.4103	26.0721	27.0747	28.2265	29.1670	(42b)

Hot water usage for other uses

41.2294	39.7301	38.2309	36.7316	35.2324	33.7331	33.7331	35.2324	36.7316	38.2309	39.7301	41.2294	(42c)

Average daily hot water use (litres/day) 127.0959 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	138.2640	135.3117	131.7163	126.2491	121.8093	117.0362	115.2018	118.7817	122.5572	127.5681	133.1196	137.9054	(44)
Energy conte	218.9764	192.6820	202.4431	172.8287	163.9788	143.9097	139.3266	147.0766	151.1253	173.1088	189.6533	215.9266	(45)

Energy content (annual) Total = Sum(45)m = 2111.0357

Distribution loss (46)m = 0.15 x (45)m

32.8465	28.9023	30.3665	25.9243	24.5968	21.5865	20.8990	22.0615	22.6688	25.9663	28.4480	32.3890	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

269.3208	238.1544	252.7875	221.5491	214.3232	192.6301	189.6711	197.4210	199.8457	223.4532	238.3737	266.2710	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

269.3208	238.1544	252.7875	221.5491	214.3232	192.6301	189.6711	197.4210	199.8457	223.4532	238.3737	266.2710	(64)

Total per year (kWh/year) = Sum(64)m = 2703.8009 (64)
12Total per year (kWh/year) 2704 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.0852	100.4447	107.5879	96.4419	94.7985	86.8263	86.6017	89.1785	89.2255	97.8342	102.0361	112.0711	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	118.7069	131.4255	118.7069	122.6638	118.7069	122.6638	118.7069	118.7069	122.6638	118.7069	122.6638	118.7069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	235.3498	237.7919	231.6377	218.5360	201.9975	186.4537	176.0694	173.6272	179.7815	192.8831	209.4216	224.9655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	(71)
Water heating gains (Table 5)	151.9962	149.4713	144.6074	133.9470	127.4173	120.5921	116.4001	119.8636	123.9243	131.4976	141.7168	150.6332	(72)
Total internal gains	571.0131	583.6489	559.9121	540.1070	513.0819	491.6697	473.1366	474.1579	488.3297	508.0478	538.7624	559.2658	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	8.4000	19.6403	0.7600	0.7000	0.7700	60.8235 (76)
South	12.6000	46.7521	0.7600	0.7000	0.7700	217.1782 (78)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.6193	563.9034	795.9867	1012.1892	1146.5228	1140.9521	1099.0815	1000.3677	872.1108	630.7086	390.1498	275.1940	(83)
Total gains	894.6324	1147.5523	1355.8989	1552.2962	1659.6047	1632.6219	1572.2181	1474.5255	1360.4405	1138.7564	928.9122	834.4598	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6976	58.7196	58.7413	58.8431	58.8622	58.9513	58.9513	58.9678	58.9170	58.8622	58.8236	58.7833	
alpha	4.9132	4.9146	4.9161	4.9229	4.9241	4.9301	4.9301	4.9312	4.9278	4.9241	4.9216	4.9189	
util living area	0.9811	0.9451	0.8720	0.7332	0.5642	0.4035	0.2897	0.3225	0.5153	0.8083	0.9561	0.9860	(86)
MIT	19.9575	20.2843	20.6050	20.8565	20.9646	20.9943	20.9991	20.9985	20.9823	20.8071	20.3266	19.8811	(87)
Th 2	19.9336	19.9339	19.9343	19.9359	19.9362	19.9376	19.9376	19.9379	19.9371	19.9362	19.9356	19.9349	(88)
util rest of house	0.9755	0.9309	0.8433	0.6863	0.5055	0.3378	0.2200	0.2485	0.4404	0.7580	0.9420	0.9818	(89)
MIT 2	18.7606	19.1626	19.5393	19.8104	19.9111	19.9349	19.9374	19.9375	19.9273	19.7713	19.2229	18.6658	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0598	19.4430	19.8057	20.0719	20.1745	20.1998	20.2028	20.2027	20.1911	20.0302	19.4988	18.9697	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9098	19.2930	19.6557	19.9219	20.0245	20.0498	20.0528	20.0527	20.0411	19.8802	19.3488	18.8197	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9683	0.9204	0.8348	0.6857	0.5105	0.3448	0.2275	0.2565	0.4479	0.7551	0.9321	0.9757	(94)
Useful gains	866.2448	1056.1973	1131.9492	1064.3534	847.2282	562.9643	357.7459	378.2040	609.3632	859.8685	865.8403	814.1667	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1521.0534	1497.9172	1368.6453	1144.6703	864.2524	564.9421	357.9334	378.5486	616.2324	963.4792	1272.5167	1519.8607	(97)
Space heating kWh	487.1776	296.8358	176.1019	57.8282	12.6660	0.0000	0.0000	0.0000	0.0000	77.0864	292.8070	525.0363	(98a)
Space heating requirement - total per year (kWh/year)												1925.5392	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	487.1776	296.8358	176.1019	57.8282	12.6660	0.0000	0.0000	0.0000	0.0000	77.0864	292.8070	525.0363	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1925.5392	
Space heating per m2										(98c) / (4) =		21.8811	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.1776	296.8358	176.1019	57.8282	12.6660	0.0000	0.0000	0.0000	0.0000	77.0864	292.8070	525.0363	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	544.3326	331.6601	196.7619	64.6125	14.1520	0.0000	0.0000	0.0000	0.0000	86.1300	327.1587	586.6328	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	269.3208	238.1544	252.7875	221.5491	214.3232	192.6301	189.6711	197.4210	199.8457	223.4532	238.3737	266.2710	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	300.9171	266.0943	282.4441	247.5409	239.4673	215.2292	211.9230	220.5821	223.2913	249.6684	266.3394	297.5095	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	30.9609	24.8380	22.3639	16.3847	12.6560	10.3401	11.5453	15.0070	19.4926	25.5753	28.8872	31.8214 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2151.4404 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3021.0065 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	249.8723 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5508.3192 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2151.4404	0.2100	451.8025	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3021.0065	0.2100	634.4114	(264)
Space and water heating			1086.2139	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	249.8723	0.1443	36.0643	(268)
Total CO2, kg/year			1134.2074	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2151.4404	1.1300	2431.1277	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3021.0065	1.1300	3413.7374	(278)
Space and water heating			5844.8651	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	249.8723	1.5338	383.2624	(282)
Total Primary energy kWh/year			6358.2283	(286)
Dwelling Primary energy Rate (DPER)			72.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0000 (1b)	x	2.5000 (2b)	=	110.0000 (1b)	-
First floor	44.0000 (1c)	x	2.7500 (2c)	=	121.0000 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 88.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 231.0000 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1299	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3799	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3229	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3633	0.3794	(22b)
Effective ac	0.5847	0.5815	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			16.7700	1.1450	19.2023			(27)
Heatloss Floor 1			44.0000	0.1300	5.7200			(28a)
External Wall 1	100.0000	21.9700	78.0300	0.1800	14.0454			(29a)
External Roof 1	44.0000		44.0000	0.1100	4.8400			(30)
Total net area of external elements Aum(A, m2)			188.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.0077			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	19.0000	0.1600	3.0400
E6 Intermediate floor within a dwelling	19.0000	0.0000	0.0000
E14 Flat roof	19.0000	0.0800	1.5200
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1350 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 55.1427 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.5749	44.3240	44.0782	42.9233	42.7072	41.7013	41.7013	41.5151	42.0888	42.7072	43.1443	43.6013	(38)
Heat transfer coeff	99.7176	99.4667	99.2208	98.0660	97.8499	96.8440	96.8440	96.6578	97.2315	97.8499	98.2870	98.7440	(39)
Average = Sum(39)m / 12 =												98.0649	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1332	1.1303	1.1275	1.1144	1.1119	1.1005	1.1005	1.0984	1.1049	1.1119	1.1169	1.1221	(40)
HLP (average)												1.1144	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5973 (42)
Hot water usage for mixer showers

67.7687	66.7502	65.2662	62.4267	60.3312	57.9944	56.6662	58.1390	59.7535	62.2625	65.1630	67.5090	(42a)

Hot water usage for baths

29.2660	28.8313	28.2193	27.0907	26.2457	25.3087	24.8025	25.4103	26.0721	27.0747	28.2265	29.1670	(42b)

Hot water usage for other uses

41.2294	39.7301	38.2309	36.7316	35.2324	33.7331	33.7331	35.2324	36.7316	38.2309	39.7301	41.2294	(42c)

Average daily hot water use (litres/day) 127.0959 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	138.2640	135.3117	131.7163	126.2491	121.8093	117.0362	115.2018	118.7817	122.5572	127.5681	133.1196	137.9054	(44)
Energy conte	218.9764	192.6820	202.4431	172.8287	163.9788	143.9097	139.3266	147.0766	151.1253	173.1088	189.6533	215.9266	(45)
Energy content (annual)										Total = Sum(45)m =		2111.0357	
Distribution loss (46)m = 0.15 x (45)m													
	32.8465	28.9023	30.3665	25.9243	24.5968	21.5865	20.8990	22.0615	22.6688	25.9663	28.4480	32.3890	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	268.2191	237.1593	251.6857	220.4829	213.2214	191.5639	188.5693	196.3192	198.7795	222.3514	237.3075	265.1692	(62)
WWHRS	-30.9810	-27.3999	-28.6915	-23.7577	-22.1414	-18.9465	-17.7593	-18.8853	-19.6028	-23.1095	-26.1803	-30.4073	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	237.2381	209.7594	222.9942	196.7251	191.0801	172.6174	170.8100	177.4339	179.1767	199.2419	211.1272	234.7620	(64)
										Total per year (kWh/year) = Sum(64)m =		2402.9660	(64)
12Total per year (kWh/year)												2403	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	112.2038	99.6486	106.7065	95.5889	93.9171	85.9733	85.7202	88.2971	88.3725	96.9528	101.1831	111.1897	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.2317	133.1137	120.2317	124.2394	120.2317	124.2394	120.2317	120.2317	124.2394	120.2317	124.2394	120.2317	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	235.3498	237.7919	231.6377	218.5360	201.9975	186.4537	176.0694	173.6272	179.7815	192.8831	209.4216	224.9655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	(71)
Water heating gains (Table 5)													
	150.8115	148.2866	143.4227	132.7623	126.2326	119.4074	115.2154	118.6789	122.7396	130.3129	140.5321	149.4485	(72)
Total internal gains													
	571.3532	584.1524	560.2522	540.4980	513.4220	492.0606	473.4767	474.4980	488.7207	508.3879	539.1533	559.6059	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.1600	19.6403	0.6300	0.7000	0.7700	30.9720	(76)
South	7.7400	46.7521	0.6300	0.7000	0.7700	110.5894	(78)
West	3.8700	19.6403	0.6300	0.7000	0.7700	23.2290	(80)

Solar gains	164.7904	287.1455	405.3248	515.4174	583.8215	580.9848	559.6639	509.3977	444.0880	321.1635	198.6684	140.1317	(83)
Total gains	736.1435	871.2979	965.5770	1055.9154	1097.2435	1073.0455	1033.1405	983.8957	932.8086	829.5514	737.8217	699.7376	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2842	61.4387	61.5910	62.3163	62.4539	63.1026	63.1026	63.2242	62.8512	62.4539	62.1762	61.8884	
alpha	5.0856	5.0959	5.1061	5.1544	5.1636	5.2068	5.2068	5.2149	5.1901	5.1636	5.1451	5.1259	
util living area													
	0.9912	0.9790	0.9530	0.8822	0.7507	0.5631	0.4100	0.4479	0.6773	0.9102	0.9802	0.9930	(86)
MIT	19.8567	20.0850	20.3657	20.6873	20.8941	20.9809	20.9969	20.9952	20.9519	20.6779	20.2120	19.8197	(87)
Th 2	19.9738	19.9762	19.9784	19.9891	19.9911	20.0004	20.0004	20.0022	19.9968	19.9911	19.9871	19.9828	(88)
util rest of house													
	0.9884	0.9727	0.9390	0.8496	0.6914	0.4814	0.3182	0.3529	0.5947	0.8774	0.9731	0.9908	(89)
MIT 2	18.6641	18.9532	19.3024	19.6896	19.9082	19.9903	19.9995	20.0006	19.9675	19.6904	19.1243	18.6236	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.9622	19.2362	19.5682	19.9390	20.1547	20.2379	20.2489	20.2492	20.2136	19.9372	19.3962	18.9226	(92)

Temperature adjustment												0.0000	
adjusted MIT	18.9622	19.2362	19.5682	19.9390	20.1547	20.2379	20.2489	20.2492	20.2136	19.9372	19.3962	18.9226	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9846	0.9667	0.9321	0.8478	0.7016	0.5013	0.3412	0.3767	0.6135	0.8754	0.9677	0.9876	(94)
Useful gains	724.8181	842.3268	900.0239	895.1677	769.8626	537.9242	352.4975	370.6032	572.2747	726.1520	713.9854	691.0879	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1462.0819	1425.9700	1296.6421	1082.5506	827.2897	546.0005	353.3704	372.0582	594.4380	913.6478	1208.5595	1453.7721	(97)
Space heating kWh													
	548.5243	392.2082	295.0839	134.9157	42.7257	0.0000	0.0000	0.0000	0.0000	139.4969	356.0933	567.4370	(98a)
Space heating requirement - total per year (kWh/year)												2476.4851	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	548.5243	392.2082	295.0839	134.9157	42.7257	0.0000	0.0000	0.0000	0.0000	139.4969	356.0933	567.4370	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2476.4851	
Space heating per m2											(98c) / (4) =	28.1419	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	548.5243	392.2082	295.0839	134.9157	42.7257	0.0000	0.0000	0.0000	0.0000	139.4969	356.0933	567.4370	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	594.2841	424.9276	319.7009	146.1709	46.2901	0.0000	0.0000	0.0000	0.0000	151.1342	385.7999	614.7746	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	237.2381	209.7594	222.9942	196.7251	191.0801	172.6174	170.8100	177.4339	179.1767	199.2419	211.1272	234.7620	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8758	85.4422	84.6888	83.2317	81.3059	79.8000	79.8000	79.8000	79.8000	83.2757	85.2224	85.9628	(217)
Fuel for water heating, kWh/month													
	276.2571	245.4988	263.3100	236.3583	235.0139	216.3125	214.0476	222.3483	224.5322	239.2556	247.7366	273.0973	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.9818	20.0413	18.0450	13.2205	10.2119	8.3432	9.3156	12.1088	15.7282	20.6362	23.3086	25.6761	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.7073	-57.1573	-81.8298	-91.6228	-98.4663	-91.7710	-90.6090	-85.6808	-76.9628	-65.1458	-44.6590	-35.2188	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-23.7174	-49.8087	-98.8514	-148.2665	-195.8649	-196.7516	-194.4621	-164.7576	-120.8870	-71.1959	-31.6527	-18.7639	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2683.0824	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2893.7682	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												201.6172	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2174.8102	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3689.6576 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2683.0824	0.2100	563.4473	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2893.7682	0.2100	607.6913	(264)
Space and water heating			1171.1386	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	201.6172	0.1443	29.0996	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-859.8305	0.1347	-115.7998	
PV Unit electricity exported	-1314.9797	0.1259	-165.5996	
Total			-281.3995	(269)
Total CO2, kg/year			930.7680	(272)
Target Carbon Dioxide Emission Rate (TER)			10.5800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2683.0824	1.1300	3031.8831	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2893.7682	1.1300	3269.9581	(278)
Space and water heating			6301.8412	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	201.6172	1.5338	309.2472	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-859.8305	1.4978	-1287.8115	
PV Unit electricity exported	-1314.9797	0.4623	-607.8666	
Total			-1895.6781	(283)
Total Primary energy kWh/year			4845.5111	(286)
Target Primary Energy Rate (TPER)			55.0600	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3BSP1_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3BSP1
Property	1 Bedroom Flat, 3BSP1, Saffron Walden, CB11		

SAP Rating	85 B	DER	13.37	TER	11.19
Environmental	88 B	% DER<TER	-19.48		
CO_2 Emissions (t/year)	1.33	DFEE	38.53	TFEE	42.08
Compliance Check	See BREL	% DFEE < TFEE	8.43		
% DPER < TPER	-27.63	DPER	74.60	TPER	58.45

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		53.5000 (1b)	x	2.5000 (2b)	=	133.7500 (1b)	-
First floor		53.5000 (1c)	x	2.7500 (2c)	=	147.1250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8750	(5)

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2. Ventilation rate

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				m3 per hour	
Number of open chimneys			0 * 80 =	0.0000	(6a)
Number of open flues			0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire			0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler			0 * 20 =	0.0000	(6d)
Number of flues attached to other heater			0 * 35 =	0.0000	(6e)
Number of blocked chimneys			0 * 20 =	0.0000	(6f)
Number of intermittent extract fans			0 * 10 =	0.0000	(7a)
Number of passive vents			0 * 10 =	0.0000	(7b)
Number of flueless gas fires			0 * 40 =	0.0000	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				3.0000	(17)
Infiltration rate				0.1500	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			29.4000	1.1450	33.6641			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			53.5000	0.1100	5.8850			(28a)
External Wall 1	155.0000	34.6000	120.4000	0.1400	16.8560			(29a)
External Roof 1	53.5000		53.5000	0.1100	5.8850			(30)
Total net area of external elements Aum(A, m2)			262.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.4901			(33)

Party Wall 1 53.0000 0.0000 0.0000 (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 13.1000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 80.5901 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.5691	47.5215	47.4749	47.2560	47.2150	47.0243	47.0243	46.9890	47.0978	47.2150	47.2979	47.3845	(38)
Heat transfer coeff	128.1592	128.1117	128.0650	127.8461	127.8051	127.6144	127.6144	127.5791	127.6879	127.8051	127.8880	127.9746	(39)

Average = Sum(39)m / 12 = 127.8459

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1977	1.1973	1.1969	1.1948	1.1944	1.1927	1.1927	1.1923	1.1933	1.1944	1.1952	1.1960	(40)
HLP (average)												1.1948	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7956 (42)

Hot water usage for mixer showers

71.0923	70.0239	68.4671	65.4883	63.2901	60.8387	59.4453	60.9903	62.6840	65.3161	68.3588	70.8199	(42a)

Hot water usage for baths

30.6952	30.2394	29.5974	28.4138	27.5274	26.5447	26.0138	26.6513	27.3454	28.3970	29.6050	30.5915	(42b)

Hot water usage for other uses

43.2594	41.6863	40.1133	38.5402	36.9671	35.3941	35.3941	36.9671	38.5402	40.1133	41.6863	43.2594	(42c)

Average daily hot water use (litres/day) 133.3308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.0469	141.9496	138.1777	132.4423	127.7847	122.7774	120.8532	124.6088	128.5696	133.8264	139.6502	144.6708	(44)
Energy conte	229.7189	202.1344	212.3741	181.3069	172.0228	150.9692	146.1614	154.2917	158.5392	181.6011	198.9573	226.5195	(45)

Energy content (annual) Total = Sum(45)m = 2214.5962

Distribution loss (46)m = 0.15 x (45)m

34.4578	30.3202	31.8561	27.1960	25.8034	22.6454	21.9242	23.1438	23.7809	27.2402	29.8436	33.9779	(46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

280.0633	247.6068	262.7185	230.0273	222.3672	199.6896	196.5059	204.6361	207.2596	231.9455	247.6777	276.8639	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

280.0633	247.6068	262.7185	230.0273	222.3672	199.6896	196.5059	204.6361	207.2596	231.9455	247.6777	276.8639	(64)

Total per year (kWh/year) = Sum(64)m = 2807.3613 (64)

12Total per year (kWh/year) 2807 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

116.6571	103.5876	110.8899	99.2609	97.4731	89.1736	88.8742	91.5775	91.6906	100.6579	105.1296	115.5933	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.7582	149.1966	134.7582	139.2502	134.7582	139.2502	134.7582	134.7582	139.2502	134.7582	139.2502	134.7582	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1732	269.9457	262.9593	248.0860	229.3112	211.6655	199.8771	197.1047	204.0911	218.9644	237.7392	255.3849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	(71)
Water heating gains (Table 5)	156.7971	154.1482	149.0456	137.8623	131.0123	123.8522	119.4546	123.0881	127.3481	135.2929	146.0134	155.3673	(72)
Total internal gains	626.6621	641.2240	614.6966	593.1320	563.0152	539.7014	519.0235	519.8845	535.6229	556.9490	590.9362	613.4439	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.3000	10.6334	0.7600	0.7000	0.7700	24.6977 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	8.4000	46.7521	0.7600	0.7000	0.7700	144.7855 (78)
West	2.1000	19.6403	0.7600	0.7000	0.7700	15.2059 (80)

Solar gains	275.9243	492.5414	725.1636	970.3230	1142.1910	1155.5544	1105.2799	975.5539	810.7760	559.0137	334.8076	233.2292 (83)
Total gains	902.5865	1133.7654	1339.8601	1563.4550	1705.2062	1695.2558	1624.3033	1495.4384	1346.3988	1115.9627	925.7438	846.6731 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9791	58.0006	58.0217	58.1211	58.1397	58.2266	58.2266	58.2427	58.1931	58.1397	58.1021	58.0627	
alpha	4.8653	4.8667	4.8681	4.8747	4.8760	4.8818	4.8818	4.8828	4.8795	4.8760	4.8735	4.8708	
util living area	0.9913	0.9748	0.9333	0.8253	0.6557	0.4746	0.3444	0.3899	0.6232	0.8935	0.9796	0.9935	(86)
MIT	19.7629	20.0490	20.3976	20.7451	20.9300	20.9879	20.9980	20.9963	20.9583	20.6700	20.1348	19.6997	(87)
Th 2	19.9218	19.9222	19.9225	19.9241	19.9245	19.9259	19.9259	19.9261	19.9253	19.9245	19.9238	19.9232	(88)
util rest of house	0.9885	0.9672	0.9146	0.7841	0.5927	0.3981	0.2610	0.3002	0.5384	0.8559	0.9722	0.9914	(89)
MIT 2	18.5073	18.8670	19.2935	19.6901	19.8729	19.9199	19.9253	19.9250	19.9011	19.6227	18.9803	18.4281	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.8212	19.1625	19.5695	19.9538	20.1371	20.1869	20.1935	20.1928	20.1654	19.8845	19.2689	18.7460	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6712	19.0125	19.4195	19.8038	19.9871	20.0369	20.0435	20.0428	20.0154	19.7345	19.1189	18.5960	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9839	0.9589	0.9041	0.7790	0.5965	0.4062	0.2702	0.3101	0.5458	0.8480	0.9646	0.9876	(94)
Useful gains	888.0438	1087.1153	1211.3382	1217.8553	1017.2337	688.5653	438.8937	463.6829	734.8911	946.2998	892.9646	836.1930	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1841.8041	1807.9719	1654.5407	1394.0139	1059.1400	693.8236	439.4362	464.7488	755.3279	1167.4416	1537.0738	1842.3182	(97)
Space heating kWh	709.5976	484.4156	329.7426	126.8342	31.1783	0.0000	0.0000	0.0000	0.0000	164.5295	463.7586	748.5571	(98a)
Space heating requirement - total per year (kWh/year)												3058.6137	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	709.5976	484.4156	329.7426	126.8342	31.1783	0.0000	0.0000	0.0000	0.0000	164.5295	463.7586	748.5571	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3058.6137	
Space heating per m2											(98c) / (4) =	28.5852	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	89.5000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	709.5976	484.4156	329.7426	126.8342	31.1783	0.0000	0.0000	0.0000	0.0000	164.5295	463.7586	748.5571	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	792.8465	541.2465	368.4275	141.7142	34.8361	0.0000	0.0000	0.0000	0.0000	183.8319	518.1661	836.3767	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	280.0633	247.6068	262.7185	230.0273	222.3672	199.6896	196.5059	204.6361	207.2596	231.9455	247.6777	276.8639	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	312.9199	276.6556	293.5402	257.0138	248.4550	223.1168	219.5596	228.6437	231.5749	259.1570	276.7348	309.3451	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	36.0411	28.9135	26.0334	19.0732	14.7327	12.0367	13.4397	17.4694	22.6910	29.7718	33.6272	37.0428 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	3417.4455 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3136.7166 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	290.8726 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6931.0347 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3417.4455	0.2100	717.6636	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3136.7166	0.2100	658.7105	(264)
Space and water heating			1376.3740	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	290.8726	0.1443	41.9819	(268)
Total CO2, kg/year			1430.2852	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3417.4455	1.1300	3861.7134	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3136.7166	1.1300	3544.4897	(278)
Space and water heating			7406.2032	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	290.8726	1.5338	446.1502	(282)
Total Primary energy kWh/year			7982.4541	(286)
Dwelling Primary energy Rate (DPER)			74.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.5000 (1b)	x	2.5000 (2b)	=	133.7500 (1b)	-

First floor	53.5000 (1c) x	2.7500 (2c) =	147.1250 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	280.8750 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1424 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3924 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3336 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4253	0.4169	0.4086	0.3669	0.3586	0.3169	0.3169	0.3085	0.3336	0.3586	0.3752	0.3919	(22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			21.5600	1.1450	24.6870			(27)
Heatloss Floor 1			53.5000	0.1300	6.9550			(28a)
External Wall 1	155.0000	26.7600	128.2400	0.1800	23.0832			(29a)
External Roof 1	53.5000		53.5000	0.1100	5.8850			(30)
Total net area of external elements Aum(A, m2)			262.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.8102			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	31.0000	0.1600	4.9600
E6 Intermediate floor within a dwelling	31.0000	0.0000	0.0000
E14 Flat roof	31.0000	0.0800	2.4800
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.0150 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	74.8252 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.7262	54.4008	54.0817	52.5832	52.3029	50.9977	50.9977	50.7560	51.5005	52.3029	52.8700	53.4630	(38)
Heat transfer coeff	129.5515	129.2260	128.9069	127.4085	127.1281	125.8230	125.8230	125.5813	126.3257	127.1281	127.6953	128.2882	(39)
Average = Sum(39)m / 12 =												127.4071	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2108	1.2077	1.2047	1.1907	1.1881	1.1759	1.1759	1.1737	1.1806	1.1881	1.1934	1.1990	(40)
HLP (average)												1.1907	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7956 (42)

Hot water usage for mixer showers

71.0923	70.0239	68.4671	65.4883	63.2901	60.8387	59.4453	60.9903	62.6840	65.3161	68.3588	70.8199	(42a)

Hot water usage for baths

30.6952	30.2394	29.5974	28.4138	27.5274	26.5447	26.0138	26.6513	27.3454	28.3970	29.6050	30.5915	(42b)

Hot water usage for other uses

43.2594	41.6863	40.1133	38.5402	36.9671	35.3941	35.3941	36.9671	38.5402	40.1133	41.6863	43.2594	(42c)

Average daily hot water use (litres/day) 133.3308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	145.0469	141.9496	138.1777	132.4423	127.7847	122.7774	120.8532	124.6088	128.5696	133.8264	139.6502	144.6708	(44)
Energy conte	229.7189	202.1344	212.3741	181.3069	172.0228	150.9692	146.1614	154.2917	158.5392	181.6011	198.9573	226.5195	(45)
Energy content (annual)										Total = Sum(45)m =		2214.5962	
Distribution loss (46)m = 0.15 x (45)m													
	34.4578	30.3202	31.8561	27.1960	25.8034	22.6454	21.9242	23.1438	23.7809	27.2402	29.8436	33.9779	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	278.9615	246.6116	261.6167	228.9611	221.2654	198.6234	195.4041	203.5343	206.1933	230.8438	246.6115	275.7621	(62)
WWHRS	-32.5004	-28.7436	-30.0987	-24.9229	-23.2272	-19.8757	-18.6303	-19.8115	-20.5642	-24.2429	-27.4643	-31.8986	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	246.4611	217.8680	231.5180	204.0382	198.0382	178.7476	176.7738	183.7229	185.6292	206.6009	219.1472	243.8636	(64)
										Total per year (kWh/year) = Sum(64)m =		2492.4086	(64)
12Total per year (kWh/year)												2492	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.7757	102.7915	110.0085	98.4079	96.5917	88.3206	87.9928	90.6961	90.8376	99.7765	104.2766	114.7119	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	135.6045	150.1335	135.6045	140.1246	135.6045	140.1246	135.6045	135.6045	140.1246	135.6045	140.1246	135.6045	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.1732	269.9457	262.9593	248.0860	229.3112	211.6655	199.8771	197.1047	204.0911	218.9644	237.7392	255.3849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	(71)
Water heating gains (Table 5)													
	155.6125	152.9635	147.8609	136.6776	129.8276	122.6675	118.2699	121.9034	126.1634	134.1082	144.8287	154.1826	(72)
Total internal gains													
	626.3237	640.9762	614.3582	592.8218	562.6768	539.3912	518.6851	519.5461	535.3127	556.6106	590.6260	613.1055	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.6200	10.6334	0.6300	0.7000	0.7700	15.0136	(74)
East	9.2400	19.6403	0.6300	0.7000	0.7700	55.4614	(76)
South	6.1600	46.7521	0.6300	0.7000	0.7700	88.0143	(78)
West	1.5400	19.6403	0.6300	0.7000	0.7700	9.2436	(80)

Solar gains	167.7330	299.4133	440.8231	589.8542	694.3319	702.4554	671.8938	593.0341	492.8664	339.8215	203.5278	141.7788	(83)
Total gains	794.0567	940.3895	1055.1813	1182.6760	1257.0087	1241.8466	1190.5789	1112.5802	1028.1791	896.4320	794.1538	754.8843	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3560	57.5005	57.6428	58.3207	58.4494	59.0556	59.0556	59.1693	58.8206	58.4494	58.1898	57.9208	
alpha	4.8237	4.8334	4.8429	4.8880	4.8966	4.9370	4.9370	4.9446	4.9214	4.8966	4.8793	4.8614	
util living area													
	0.9950	0.9881	0.9717	0.9193	0.8040	0.6194	0.4593	0.5092	0.7560	0.9466	0.9890	0.9960	(86)
MIT	19.6391	19.8585	20.1629	20.5481	20.8292	20.9640	20.9932	20.9889	20.9060	20.5288	20.0164	19.6065	(87)
Th 2	19.9114	19.9138	19.9162	19.9274	19.9295	19.9393	19.9393	19.9411	19.9355	19.9295	19.9253	19.9208	(88)
util rest of house													
	0.9933	0.9842	0.9623	0.8930	0.7464	0.5287	0.3516	0.3971	0.6711	0.9233	0.9847	0.9947	(89)
MIT 2	18.3427	18.6230	19.0073	19.4823	19.7916	19.9198	19.9373	19.9374	19.8753	19.4720	18.8338	18.3078	(90)

Living area fraction										fLA = Living area / (4) =		0.2500 (91)
MIT	18.6668	18.9319	19.2962	19.7488	20.0510	20.1809	20.2013	20.2003	20.1329	19.7362	19.1295	18.6325 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6668	18.9319	19.2962	19.7488	20.0510	20.1809	20.2013	20.2003	20.1329	19.7362	19.1295	18.6325 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9905	0.9794	0.9553	0.8878	0.7536	0.5502	0.3786	0.4252	0.6883	0.9180	0.9803	0.9924	(94)
Useful gains	786.5266	921.0227	1008.0295	1050.0285	947.2337	683.2749	450.7313	473.0738	707.6982	822.9300	778.4889	749.1504	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1861.2402	1813.2876	1649.5203	1382.2227	1061.6503	702.1993	453.1207	477.2490	762.1160	1161.4654	1536.1076	1851.5197	(97)
Space heating kWh	799.5869	599.6020	477.2692	239.1798	85.1259	0.0000	0.0000	0.0000	0.0000	251.8703	545.4855	820.1627	(98a)
Space heating requirement - total per year (kWh/year)												3818.2824	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	799.5869	599.6020	477.2692	239.1798	85.1259	0.0000	0.0000	0.0000	0.0000	251.8703	545.4855	820.1627	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3818.2824	
Space heating per m2											(98c) / (4) =	35.6849	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	799.5869	599.6020	477.2692	239.1798	85.1259	0.0000	0.0000	0.0000	0.0000	251.8703	545.4855	820.1627	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000		(210)
Space heating fuel (main heating system)	866.2914	649.6230	517.0847	259.1330	92.2274	0.0000	0.0000	0.0000	0.0000	272.8823	590.9918	888.5837	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	246.4611	217.8680	231.5180	204.0382	198.0382	178.7476	176.7738	183.7229	185.6292	206.6009	219.1472	243.8636	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.5014	86.2087	85.6449	84.4171	82.3078	79.8000	79.8000	79.8000	79.8000	84.5052	86.0195	86.5625	(217)
Fuel for water heating, kWh/month	284.9215	252.7215	270.3231	241.7025	240.6068	223.9945	221.5210	230.2292	232.6180	244.4830	254.7645	281.7197	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	28.1759	22.6038	20.3522	14.9109	11.5176	9.4100	10.5067	13.6571	17.7392	23.2748	26.2888	28.9590	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.5865	-67.7612	-96.3559	-107.1173	-114.4499	-106.3967	-105.0116	-99.6021	-89.9693	-76.8322	-53.1243	-42.0869	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-29.7481	-62.2997	-123.3360	-184.5663	-243.4301	-244.4206	-241.6089	-204.9081	-150.5980	-88.9470	-39.6638	-23.5511	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4136.8173	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2979.6053	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												227.3959	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2644.3715	(233)
Wind generation												0.0000	(234)

Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4785.4470 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4136.8173	0.2100	868.7316	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2979.6053	0.2100	625.7171	(264)
Space and water heating			1494.4487	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	227.3959	0.1443	32.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1007.2939	0.1348	-135.8157	
PV Unit electricity exported	-1637.0776	0.1260	-206.2688	
Total			-342.0845	(269)
Total CO2, kg/year			1197.1138	(272)
Target Carbon Dioxide Emission Rate (TER)			11.1900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4136.8173	1.1300	4674.6036	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2979.6053	1.1300	3366.9540	(278)
Space and water heating			8041.5576	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	227.3959	1.5338	348.7875	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1007.2939	1.4983	-1509.2597	
PV Unit electricity exported	-1637.0776	0.4625	-757.1550	
Total			-2266.4147	(283)
Total Primary energy kWh/year			6254.0311	(286)
Target Primary Energy Rate (TPER)			58.4500	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3BSP2_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3BSP2
Property	1 Bedroom Flat, 3BSP2, Saffron Walden, CB11		

SAP Rating	85 B	DER	13.23	TER	11.12
Environmental	88 B	% DER<TER	-18.97		
CO_2 Emissions (t/year)	1.43	DFEE	40.62	TFEE	43.52
Compliance Check	See BREL	% DFEE < TFEE	6.66		
% DPER < TPER	-26.81	DPER	73.77	TPER	58.17

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		58.0000	(1b)	x 2.5000	(2b) =	145.0000	(1b) -
First floor		58.0000	(1c)	x 2.7500	(2c) =	159.5000	(1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		304.5000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			58.0000	0.1100	6.3800			(28a)
External Wall 1	170.0000	45.1000	124.9000	0.1400	17.4860			(29a)
External Roof 1	58.0000		58.0000	0.1100	6.3800			(30)
Total net area of external elements Aum(A, m2)			286.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.1330			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 14.3000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 95.4330 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.5702	51.5187	51.4681	51.2308	51.1864	50.9796	50.9796	50.9413	51.0593	51.1864	51.2762	51.3701	(38)
Heat transfer coeff													
	147.0033	146.9517	146.9012	146.6638	146.6194	146.4126	146.4126	146.3744	146.4923	146.6194	146.7092	146.8032	(39)

Average = Sum(39)m / 12 = 146.6636

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2673	1.2668	1.2664	1.2643	1.2640	1.2622	1.2622	1.2618	1.2629	1.2640	1.2647	1.2655	(40)
HLP (average)												1.2643	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8464 (42)
Hot water usage for mixer showers

71.9452	70.8640	69.2885	66.2741	64.0495	61.5686	60.1585	61.7221	63.4361	66.0998	69.1790	71.6696	(42a)

Hot water usage for baths

31.0620	30.6007	29.9511	28.7533	27.8564	26.8619	26.3247	26.9698	27.6722	28.7363	29.9588	30.9570	(42b)

Hot water usage for other uses

43.7804	42.1884	40.5964	39.0043	37.4123	35.8203	35.8203	37.4123	39.0043	40.5964	42.1884	43.7804	(42c)

Average daily hot water use (litres/day) 134.9308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	146.7877	143.6531	139.8360	134.0317	129.3182	124.2508	122.3035	126.1042	130.1126	135.4324	141.3261	146.4070	(44)
Energy conte	232.4758	204.5601	214.9227	183.4827	174.0871	152.7809	147.9155	156.1433	160.4418	183.7805	201.3450	229.2380	(45)

Energy content (annual) Total = Sum(45)m = 2241.1733

Distribution loss (46)m = 0.15 x (45)m

34.8714	30.6840	32.2384	27.5224	26.1131	22.9171	22.1873	23.4215	24.0663	27.5671	30.2017	34.3857	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

282.8202	250.0325	265.2671	232.2031	224.4316	201.5013	198.2599	206.4878	209.1622	234.1250	250.0654	279.5824	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

282.8202	250.0325	265.2671	232.2031	224.4316	201.5013	198.2599	206.4878	209.1622	234.1250	250.0654	279.5824	(64)

Total per year (kWh/year) = Sum(64)m = 2833.9384 (64)
12Total per year (kWh/year) 2834 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

117.5737	104.3942	111.7373	99.9843	98.1595	89.7760	89.4574	92.1932	92.3232	101.3826	105.9235	116.4972	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	141.1826	156.3093	141.1826	145.8887	141.1826	145.8887	141.1826	141.1826	145.8887	141.1826	145.8887	141.1826	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9103	282.8149	275.4954	259.9131	240.2432	221.7563	209.4059	206.5014	213.8208	229.4031	249.0730	267.5599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	(71)
Water heating gains (Table 5)													
	158.0292	155.3485	150.1846	138.8671	131.9348	124.6888	120.2385	123.9156	128.2267	136.2669	147.1160	156.5822	(72)
Total internal gains													
	647.8187	663.1692	635.5592	613.3655	582.0572	558.0304	536.5236	537.2961	553.6328	575.5492	610.7743	634.0213	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.3000	11.2829	0.7600	0.7000	0.7700	26.2064	(75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190	(77)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460	(79)
Northwest	12.6000	11.2829	0.7600	0.7000	0.7700	52.4128	(81)

Solar gains	363.4843	645.2624	952.2401	1296.1360	1557.9011	1593.3141	1516.6992	1314.2743	1070.2083	731.8547	440.1261	307.9896 (83)
Total gains	1011.3030	1308.4316	1587.7992	1909.5015	2139.9583	2151.3446	2053.2228	1851.5704	1623.8411	1307.4039	1050.9004	942.0109 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7985	54.8177	54.8366	54.9253	54.9420	55.0195	55.0195	55.0339	54.9896	54.9420	54.9083	54.8732	
alpha	4.6532	4.6545	4.6558	4.6617	4.6628	4.6680	4.6680	4.6689	4.6660	4.6628	4.6606	4.6582	
util living area	0.9904	0.9706	0.9200	0.7919	0.6065	0.4304	0.3128	0.3616	0.5949	0.8803	0.9774	0.9930	(86)
MIT	19.6851	20.0083	20.3943	20.7624	20.9406	20.9900	20.9982	20.9965	20.9594	20.6615	20.0839	19.6144	(87)
Th 2	19.8666	19.8669	19.8673	19.8689	19.8692	19.8706	19.8706	19.8708	19.8700	19.8692	19.8686	19.8679	(88)
util rest of house	0.9874	0.9619	0.8982	0.7464	0.5426	0.3568	0.2330	0.2739	0.5084	0.8390	0.9691	0.9907	(89)
MIT 2	18.3691	18.7744	19.2431	19.6557	19.8267	19.8658	19.8701	19.8698	19.8471	19.5646	18.8757	18.2805	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.6981	19.0829	19.5309	19.9324	20.1051	20.1468	20.1521	20.1515	20.1252	19.8388	19.1777	18.6140	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5481	18.9329	19.3809	19.7824	19.9551	19.9968	20.0021	20.0015	19.9752	19.6888	19.0277	18.4640	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9822	0.9524	0.8870	0.7426	0.5477	0.3651	0.2424	0.2841	0.5168	0.8312	0.9607	0.9865	(94)
Useful gains	993.3437	1246.1243	1408.3818	1417.9448	1171.9586	785.4878	497.6071	526.0968	839.1618	1086.6813	1009.6093	929.3270	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2094.5165	2062.1605	1892.2230	1596.0518	1210.3641	790.1639	498.1147	527.1669	860.6665	1332.5998	1749.9088	2094.0003	(97)
Space heating kWh	819.2726	548.3763	359.9779	128.2370	28.5737	0.0000	0.0000	0.0000	0.0000	182.9633	533.0156	866.5169	(98a)
Space heating requirement - total per year (kWh/year)												3466.9334	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	819.2726	548.3763	359.9779	128.2370	28.5737	0.0000	0.0000	0.0000	0.0000	182.9633	533.0156	866.5169	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3466.9334	
Space heating per m2											(98c) / (4) =	29.8874	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	89.5000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	819.2726	548.3763	359.9779	128.2370	28.5737	0.0000	0.0000	0.0000	0.0000	182.9633	533.0156	866.5169	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	915.3883	612.7110	402.2100	143.2815	31.9259	0.0000	0.0000	0.0000	0.0000	204.4283	595.5482	968.1753	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	282.8202	250.0325	265.2671	232.2031	224.4316	201.5013	198.2599	206.4878	209.1622	234.1250	250.0654	279.5824	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	316.0002	279.3660	296.3878	259.4448	250.7615	225.1411	221.5195	230.7126	233.7008	261.5921	279.4027	312.3826	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	38.0958	30.5619	27.5176	20.1606	15.5726	12.7229	14.2058	18.4653	23.9846	31.4691	35.5443	39.1546 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	3873.6686 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3166.4116 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	307.4551 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	7433.5353 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3873.6686	0.2100	813.4704	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3166.4116	0.2100	664.9464	(264)
Space and water heating			1478.4168	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	307.4551	0.1443	44.3753	(268)
Total CO2, kg/year			1534.7214	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3873.6686	1.1300	4377.2455	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3166.4116	1.1300	3578.0451	(278)
Space and water heating			7955.2906	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	307.4551	1.5338	471.5849	(282)
Total Primary energy kWh/year			8556.9763	(286)
Dwelling Primary energy Rate (DPER)			73.7700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.0000 (1b)	x	2.5000 (2b)	=	145.0000 (1b)	-
First floor	58.0000 (1c)	x	2.7500 (2c)	=	159.5000 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 116.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 304.5000 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1314	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3814	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3242	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4133	0.4052	0.3971	0.3566	0.3485	0.3080	0.3080	0.2998	0.3242	0.3485	0.3647	0.3809	(22b)
Effective ac	0.5854	0.5821	0.5788	0.5636	0.5607	0.5474	0.5474	0.5450	0.5525	0.5607	0.5665	0.5725	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			23.7500	1.1450	27.1947			(27)
Heatloss Floor 1			58.0000	0.1300	7.5400			(28a)
External Wall 1	170.0000	28.9500	141.0500	0.1800	25.3890			(29a)
External Roof 1	58.0000		58.0000	0.1100	6.3800			(30)
Total net area of external elements Aum(A, m2)			286.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.7037			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	38.0000	0.1600	6.0800
E6 Intermediate floor within a dwelling	38.0000	0.0000	0.0000
E14 Flat roof	38.0000	0.0800	3.0400
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0100 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 82.7137 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.8249	58.4916	58.1649	56.6306	56.3435	55.0072	55.0072	54.7597	55.5219	56.3435	56.9243	57.5314	(38)
Heat transfer coeff	141.5385	141.2052	140.8786	139.3443	139.0572	137.7208	137.7208	137.4734	138.2356	139.0572	139.6379	140.2451	(39)

Average = Sum(39)m / 12 = 139.3429

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2202	1.2173	1.2145	1.2012	1.1988	1.1872	1.1872	1.1851	1.1917	1.1988	1.2038	1.2090	(40)
HLP (average)												1.2012	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8464 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.9452	70.8640	69.2885	66.2741	64.0495	61.5686	60.1585	61.7221	63.4361	66.0998	69.1790	71.6696	(42a)

Hot water usage for baths

31.0620	30.6007	29.9511	28.7533	27.8564	26.8619	26.3247	26.9698	27.6722	28.7363	29.9588	30.9570	(42b)

Hot water usage for other uses

43.7804	42.1884	40.5964	39.0043	37.4123	35.8203	35.8203	37.4123	39.0043	40.5964	42.1884	43.7804	(42c)

Average daily hot water use (litres/day) 134.9308 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	146.7877	143.6531	139.8360	134.0317	129.3182	124.2508	122.3035	126.1042	130.1126	135.4324	141.3261	146.4070 (44)
Energy conte	232.4758	204.5601	214.9227	183.4827	174.0871	152.7809	147.9155	156.1433	160.4418	183.7805	201.3450	229.2380 (45)
Energy content (annual)										Total = Sum(45)m =		2241.1733

Distribution loss (46)m = 0.15 x (45)m

	34.8714	30.6840	32.2384	27.5224	26.1131	22.9171	22.1873	23.4215	24.0663	27.5671	30.2017	34.3857 (46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	281.7184	249.0374	264.1653	231.1369	223.3298	200.4350	197.1581	205.3860	208.0960	233.0232	248.9992	278.4806 (62)
WWHRS	-32.8904	-29.0885	-30.4598	-25.2219	-23.5059	-20.1142	-18.8538	-20.0492	-20.8109	-24.5338	-27.7938	-32.2813 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	248.8281	219.9489	233.7055	205.9150	199.8239	180.3209	178.3043	185.3368	187.2851	208.4894	221.2054	246.1994 (64)
										Total per year (kWh/year) = Sum(64)m =		2515.3625 (64)
12Total per year (kWh/year)												2515 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

	116.6923	103.5980	110.8559	99.1314	97.2781	88.9230	88.5760	91.3118	91.4703	100.5012	105.0706	115.6158 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	141.8557	157.0545	141.8557	146.5842	141.8557	146.5842	141.8557	141.8557	146.5842	141.8557	146.5842	141.8557 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	279.9103	282.8149	275.4954	259.9131	240.2432	221.7563	209.4059	206.5014	213.8208	229.4031	249.0730	267.5599 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576 (71)

Water heating gains (Table 5)

	156.8445	154.1638	148.9999	137.6824	130.7501	123.5042	119.0538	122.7309	127.0420	135.0822	145.9313	155.3975 (72)

Total internal gains

	647.3071	662.7297	635.0476	612.8763	581.5456	557.5413	536.0120	536.7845	553.1436	575.0376	610.2851	633.5097 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.7500	11.2829	0.6300	0.7000	0.7700	12.9308	(75)
Southeast	7.5000	36.7938	0.6300	0.7000	0.7700	84.3351	(77)
Southwest	5.0000	36.7938	0.6300	0.7000	0.7700	56.2234	(79)
Northwest	7.5000	11.2829	0.6300	0.7000	0.7700	25.8616	(81)

Solar gains	179.3508	318.3861	469.8553	639.5408	768.7012	786.1747	748.3713	648.4906	528.0633	361.1125	217.1675	151.9685 (83)
Total gains	826.6579	981.1158	1104.9029	1252.4171	1350.2468	1343.7160	1284.3833	1185.2751	1081.2070	936.1501	827.4526	785.4782 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9142	57.0486	57.1808	57.8105	57.9298	58.4919	58.4919	58.5972	58.2741	57.9298	57.6889	57.4391	
alpha	4.7943	4.8032	4.8121	4.8540	4.8620	4.8995	4.8995	4.9065	4.8849	4.8620	4.8459	4.8293	
util living area													
	0.9958	0.9899	0.9755	0.9263	0.8110	0.6248	0.4654	0.5218	0.7742	0.9538	0.9907	0.9967	(86)
MIT	19.5943	19.8112	20.1186	20.5185	20.8185	20.9615	20.9925	20.9873	20.8929	20.4932	19.9739	19.5616	(87)
Th 2	19.9039	19.9062	19.9084	19.9190	19.9210	19.9302	19.9302	19.9319	19.9267	19.9210	19.9170	19.9128	(88)
util rest of house													
	0.9944	0.9865	0.9671	0.9016	0.7539	0.5331	0.3556	0.4066	0.6902	0.9329	0.9871	0.9956	(89)
MIT 2	18.2805	18.5578	18.9469	19.4417	19.7738	19.9093	19.9280	19.9277	19.8570	19.4241	18.7744	18.2449	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6089	18.8712	19.2398	19.7109	20.0350	20.1724	20.1941	20.1926	20.1159	19.6914	19.0743	18.5741	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.6089	18.8712	19.2398	19.7109	20.0350	20.1724	20.1941	20.1926	20.1159	19.6914	19.0743	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9821	0.9604	0.8959	0.7606	0.5548	0.3832	0.4355	0.7065	0.9273	0.9830	0.9935	(94)
Useful gains	819.9557	963.5975	1061.1549	1122.0059	1026.9509	745.4687	492.1265	516.1429	763.9038	868.0729	813.3974	780.3999	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2025.2639	1972.8004	1794.7685	1506.4348	1159.0373	767.4341	494.9832	521.3773	831.6180	1264.2192	1672.0642	2015.8964	(97)
Space heating kWh	896.7493	678.1843	545.8086	276.7888	98.2723	0.0000	0.0000	0.0000	0.0000	294.7328	618.2401	919.2094	(98a)
Space heating requirement - total per year (kWh/year)												4327.9856	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	896.7493	678.1843	545.8086	276.7888	98.2723	0.0000	0.0000	0.0000	0.0000	294.7328	618.2401	919.2094	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4327.9856	
Space heating per m2											(98c) / (4) =	37.3102	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	896.7493	678.1843	545.8086	276.7888	98.2723	0.0000	0.0000	0.0000	0.0000	294.7328	618.2401	919.2094	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	971.5594	734.7609	591.3419	299.8795	106.4705	0.0000	0.0000	0.0000	0.0000	319.3205	669.8159	995.8931	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.8281	219.9489	233.7055	205.9150	199.8239	180.3209	178.3043	185.3368	187.2851	208.4894	221.2054	246.1994	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6767	86.4133	85.8956	84.7238	82.5585	79.8000	79.8000	79.8000	79.8000	84.8359	86.2371	86.7335	(217)
Fuel for water heating, kWh/month	287.0762	254.5313	272.0809	243.0426	242.0393	225.9660	223.4390	232.2516	234.6931	245.7561	256.5085	283.8573	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.4748	23.6458	21.2904	15.5983	12.0485	9.8438	10.9911	14.2866	18.5569	24.3477	27.5007	30.2940	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-52.1910	-72.5447	-102.8125	-113.8926	-121.3435	-112.6688	-111.1864	-105.6177	-95.6645	-82.0508	-56.9722	-45.2370	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.7324	-68.4559	-135.3581	-202.3251	-266.6385	-267.6565	-264.5891	-224.5055	-165.1374	-97.6724	-43.6205	-25.9220	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4689.0418	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3001.2417	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												237.8786	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2866.7953	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5147.3668 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4689.0418	0.2100	984.6988	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3001.2417	0.2100	630.2608	(264)
Space and water heating			1614.9595	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	237.8786	0.1443	34.3332	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1072.1818	0.1349	-144.6461	
PV Unit electricity exported	-1794.6135	0.1260	-226.1772	
Total			-370.8233	(269)
Total CO2, kg/year			1290.3987	(272)
Target Carbon Dioxide Emission Rate (TER)			11.1200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4689.0418	1.1300	5298.6172	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3001.2417	1.1300	3391.4032	(278)
Space and water heating			8690.0204	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	237.8786	1.5338	364.8661	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1072.1818	1.4986	-1606.7887	
PV Unit electricity exported	-1794.6135	0.4626	-830.2358	
Total			-2437.0245	(283)
Total Primary energy kWh/year			6747.9628	(286)
Target Primary Energy Rate (TPER)			58.1700	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B1_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B1
Property	1 Bedroom Flat, 4B1, Saffron Walden, CB11		

SAP Rating	85 B	DER	13.32	TER	11.15
Environmental	87 B	% DER<TER	-19.46		
CO_2 Emissions (t/year)	1.48	DFEE	41.39	TFEE	44.15
Compliance Check	See BREL	% DFEE < TFEE	6.26		
% DPER < TPER	-27.27	DPER	74.23	TPER	58.32

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		59.5000 (1b)	x	2.5000 (2b)	=	148.7500 (1b)	-
First floor		59.5000 (1c)	x	2.7500 (2c)	=	163.6250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.3750	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		0 * 10	=	0.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5)	=	0.0000 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.1500 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			59.5000	0.1100	6.5450			(28a)
External Wall 1	172.0000	45.1000	126.9000	0.1400	17.7660			(29a)
External Roof 1	59.5000		59.5000	0.1100	6.5450			(30)
Total net area of external elements Aum(A, m2)			291.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.7430			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 14.5500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 96.2930 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9039	52.8511	52.7992	52.5557	52.5101	52.2981	52.2981	52.2588	52.3798	52.5101	52.6023	52.6987	(38)
Heat transfer coeff	149.1970	149.1441	149.0922	148.8487	148.8032	148.5911	148.5911	148.5518	148.6728	148.8032	148.8953	148.9917	(39)

Average = Sum(39)m / 12 = 148.8485

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2538	1.2533	1.2529	1.2508	1.2504	1.2487	1.2487	1.2483	1.2494	1.2504	1.2512	1.2520	(40)
HLP (average)												1.2508	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8594 (42)
Hot water usage for mixer showers

72.1620	71.0775	69.4973	66.4737	64.2424	61.7541	60.3397	61.9080	63.6272	66.2989	69.3874	71.8855	(42a)

Hot water usage for baths

31.1552	30.6925	30.0410	28.8396	27.9400	26.9425	26.4037	27.0507	27.7552	28.8226	30.0487	31.0499	(42b)

Hot water usage for other uses

43.9128	42.3159	40.7191	39.1223	37.5255	35.9286	35.9286	37.5255	39.1223	40.7191	42.3159	43.9128	(42c)

Average daily hot water use (litres/day) 135.3375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.2300	144.0860	140.2574	134.4356	129.7079	124.6252	122.6721	126.4842	130.5047	135.8406	141.7520	146.8482	(44)
Energy conte	233.1764	205.1766	215.5703	184.0356	174.6117	153.2413	148.3612	156.6139	160.9253	184.3344	201.9517	229.9288	(45)

Energy content (annual) Total = Sum(45)m = 2247.9272

Distribution loss (46)m = 0.15 x (45)m

34.9765	30.7765	32.3356	27.6053	26.1918	22.9862	22.2542	23.4921	24.1388	27.6502	30.2928	34.4893	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

283.5208	250.6490	265.9148	232.7560	224.9562	201.9617	198.7057	206.9583	209.6457	234.6788	250.6722	280.2732	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

283.5208	250.6490	265.9148	232.7560	224.9562	201.9617	198.7057	206.9583	209.6457	234.6788	250.6722	280.2732	(64)

Total per year (kWh/year) = Sum(64)m = 2840.6924 (64)
12Total per year (kWh/year) 2841 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

117.8067	104.5991	111.9527	100.1682	98.3340	89.9291	89.6057	92.3497	92.4840	101.5667	106.1253	116.7269	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

143.1978	158.5404	143.1978	147.9710	143.1978	147.9710	143.1978	143.1978	147.9710	143.1978	147.9710	143.1978	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

283.9056	286.8516	279.4277	263.6229	243.6723	224.9216	212.3949	209.4488	216.8728	232.6775	252.6281	271.3789	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	(71)

Water heating gains (Table 5)

158.3423	155.6535	150.4740	139.1225	132.1693	124.9015	120.4377	124.1259	128.4500	136.5144	147.3962	156.8910	(72)
Total internal gains 654.3361	669.9360	641.9900	619.6069	587.9299	563.6845	541.9209	542.6630	559.1843	581.2802	616.8859	640.3581	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	10.6334	0.7600	0.7000	0.7700	32.9303 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	6.3000	46.7521	0.7600	0.7000	0.7700	108.5891 (78)
West	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.9899	597.7235	921.3214	1285.1443	1548.8949	1580.0514	1506.1366	1306.7117	1048.9083	690.2824	396.8582	271.3382	(83)
Total gains	978.3261	1267.6595	1563.3114	1904.7512	2136.8248	2143.7359	2048.0575	1849.3746	1608.0926	1271.5626	1013.7441	911.6963	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3891	55.4088	55.4280	55.5187	55.5357	55.6150	55.6150	55.6297	55.5844	55.5357	55.5013	55.4654	
alpha	4.6926	4.6939	4.6952	4.7012	4.7024	4.7077	4.7077	4.7086	4.7056	4.7024	4.7001	4.6977	
util living area	0.9924	0.9758	0.9282	0.8008	0.6153	0.4382	0.3182	0.3673	0.6077	0.8949	0.9819	0.9945	(86)
MIT	19.6555	19.9706	20.3716	20.7560	20.9389	20.9897	20.9982	20.9965	20.9571	20.6376	20.0498	19.5882	(87)
Th 2	19.8772	19.8776	19.8779	19.8796	19.8799	19.8813	19.8813	19.8815	19.8807	19.8799	19.8792	19.8786	(88)
util rest of house	0.9899	0.9685	0.9082	0.7562	0.5515	0.3640	0.2379	0.2792	0.5210	0.8568	0.9751	0.9926	(89)
MIT 2	18.3394	18.7361	19.2258	19.6594	19.8359	19.8763	19.8808	19.8805	19.8562	19.5491	18.8415	18.2547	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.6684	19.0447	19.5122	19.9335	20.1117	20.1546	20.1601	20.1595	20.1314	19.8212	19.1436	18.5880	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5184	18.8947	19.3622	19.7835	19.9617	20.0046	20.0101	20.0095	19.9814	19.6712	18.9936	18.4380	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9856	0.9599	0.8970	0.7520	0.5564	0.3723	0.2472	0.2893	0.5292	0.8483	0.9676	0.9891	(94)
Useful gains	964.2025	1216.7696	1402.3311	1432.3273	1188.8379	798.1236	506.1821	535.0746	850.9950	1078.6965	980.8817	901.7764	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2121.3423	2087.2288	1917.6569	1620.0007	1229.3631	803.0792	506.7141	536.1944	874.4083	1349.8297	1770.9024	2121.3487	(97)
Space heating kWh	860.9120	584.9485	383.4024	135.1249	30.1507	0.0000	0.0000	0.0000	0.0000	201.7231	568.8149	907.3619	(98a)
Space heating requirement - total per year (kWh/year)												3672.4385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	860.9120	584.9485	383.4024	135.1249	30.1507	0.0000	0.0000	0.0000	0.0000	201.7231	568.8149	907.3619	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3672.4385	
Space heating per m2										(98c) / (4) =		30.8608	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	860.9120	584.9485	383.4024	135.1249	30.1507	0.0000	0.0000	0.0000	0.0000	201.7231	568.8149	907.3619	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	961.9129	653.5738	428.3826	150.9775	33.6880	0.0000	0.0000	0.0000	0.0000	225.3890	635.5474	1013.8121	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	283.5208	250.6490	265.9148	232.7560	224.9562	201.9617	198.7057	206.9583	209.6457	234.6788	250.6722	280.2732	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	316.7830	280.0547	297.1115	260.0626	251.3477	225.6555	222.0175	231.2383	234.2410	262.2110	280.0806	313.1545	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	38.7419	31.0802	27.9842	20.5025	15.8367	12.9387	14.4468	18.7784	24.3913	32.0028	36.1470	39.8186 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4103.2833 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3173.9579 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	312.6691 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	7675.9103 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4103.2833	0.2100	861.6895	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3173.9579	0.2100	666.5312	(264)
Space and water heating			1528.2207	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.6691	0.1443	45.1278	(268)
Total CO2, kg/year			1585.2777	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4103.2833	1.1300	4636.7101	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3173.9579	1.1300	3586.5725	(278)
Space and water heating			8223.2826	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.6691	1.5338	479.5823	(282)
Total Primary energy kWh/year			8832.9656	(286)
Dwelling Primary energy Rate (DPER)			74.2300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5000 (1b)	x	2.5000 (2b)	=	148.7500 (1b)	-
First floor	59.5000 (1c)	x	2.7500 (2c)	=	163.6250 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 119.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 312.3750 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1281	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3781	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3213	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4097	0.4017	0.3936	0.3535	0.3454	0.3053	0.3053	0.2972	0.3213	0.3454	0.3615	0.3776	(22b)
Effective ac	0.5839	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5653	0.5713	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			24.5100	1.1450	28.0649			(27)
Heatloss Floor 1			59.5000	0.1300	7.7350			(28a)
External Wall 1	172.0000	29.7100	142.2900	0.1800	25.6122			(29a)
External Roof 1	59.5000		59.5000	0.1100	6.5450			(30)
Total net area of external elements Aum(A, m2)			291.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.1571			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	40.0000	0.1600	6.4000
E6 Intermediate floor within a dwelling	40.0000	0.0000	0.0000
E14 Flat roof	40.0000	0.0800	3.2000
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4900 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 84.6471 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.1939	59.8580	59.5287	57.9819	57.6925	56.3453	56.3453	56.0958	56.8642	57.6925	58.2779	58.8900	(38)
Heat transfer coeff	144.8410	144.5051	144.1757	142.6289	142.3395	140.9923	140.9923	140.7429	141.5113	142.3395	142.9250	143.5371	(39)

Average = Sum(39)m / 12 = 142.6276

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2172	1.2143	1.2116	1.1986	1.1961	1.1848	1.1848	1.1827	1.1892	1.1961	1.2011	1.2062	(40)
HLP (average)												1.1986	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8594 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
72.1620	71.0775	69.4973	66.4737	64.2424	61.7541	60.3397	61.9080	63.6272	66.2989	69.3874	71.8855	(42a)

Hot water usage for baths

31.1552	30.6925	30.0410	28.8396	27.9400	26.9425	26.4037	27.0507	27.7552	28.8226	30.0487	31.0499	(42b)

Hot water usage for other uses

43.9128	42.3159	40.7191	39.1223	37.5255	35.9286	35.9286	37.5255	39.1223	40.7191	42.3159	43.9128	(42c)

Average daily hot water use (litres/day) 135.3375 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	147.2300	144.0860	140.2574	134.4356	129.7079	124.6252	122.6721	126.4842	130.5047	135.8406	141.7520	146.8482 (44)
Energy conte	233.1764	205.1766	215.5703	184.0356	174.6117	153.2413	148.3612	156.6139	160.9253	184.3344	201.9517	229.9288 (45)
Energy content (annual)											Total = Sum(45)m =	2247.9272

Distribution loss (46)m = 0.15 x (45)m

	34.9765	30.7765	32.3356	27.6053	26.1918	22.9862	22.2542	23.4921	24.1388	27.6502	30.2928	34.4893 (46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	282.4190	249.6538	264.8130	231.6898	223.8544	200.8954	197.6039	205.8565	208.5795	233.5770	249.6059	279.1715 (62)
WWHRS	-32.9895	-29.1761	-30.5516	-25.2979	-23.5767	-20.1748	-18.9106	-20.1096	-20.8736	-24.6077	-27.8775	-32.3785 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	249.4296	220.4777	234.2614	206.3919	200.2777	180.7207	178.6932	185.7470	187.7059	208.9694	221.7284	246.7929 (64)
											Total per year (kWh/year) = Sum(64)m =	2521.1957 (64)
12Total per year (kWh/year)												2521 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

	116.9253	103.8030	111.0713	99.3152	97.4525	89.0761	88.7242	91.4682	91.6310	100.6853	105.2723	115.8455 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	143.8062	159.2140	143.8062	148.5997	143.8062	148.5997	143.8062	143.8062	148.5997	143.8062	148.5997	143.8062 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	283.9056	286.8516	279.4277	263.6229	243.6723	224.9216	212.3949	209.4488	216.8728	232.6775	252.6281	271.3789 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747 (71)

Water heating gains (Table 5)

	157.1576	154.4688	149.2893	137.9378	130.9846	123.7168	119.2530	122.9412	127.2653	135.3297	146.2115	155.7063 (72)

Total internal gains

	653.7599	669.4249	641.4137	619.0509	587.3536	563.1285	541.3446	542.0867	558.6283	580.7039	616.3299	639.7818 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.1600	10.6334	0.6300	0.7000	0.7700	16.7685	(74)
East	7.7400	19.6403	0.6300	0.7000	0.7700	46.4580	(76)
South	3.8700	46.7521	0.6300	0.7000	0.7700	55.2947	(78)
West	7.7400	19.6403	0.6300	0.7000	0.7700	46.4580	(80)

Solar gains	164.9791	304.3671	469.1466	654.4090	788.7136	804.5788	766.9406	665.3913	534.1152	351.4991	202.0844	138.1683 (83)
Total gains	818.7390	973.7920	1110.5603	1273.4599	1376.0672	1367.7073	1308.2852	1207.4780	1092.7435	932.2030	818.4143	777.9501 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0549	57.1875	57.3182	57.9398	58.0576	58.6123	58.6123	58.7162	58.3974	58.0576	57.8198	57.5732	
alpha	4.8037	4.8125	4.8212	4.8627	4.8705	4.9075	4.9075	4.9144	4.8932	4.8705	4.8547	4.8382	
util living area													
	0.9964	0.9911	0.9772	0.9281	0.8132	0.6279	0.4677	0.5243	0.7804	0.9583	0.9920	0.9972	(86)
MIT	19.5734	19.7879	20.1045	20.5144	20.8171	20.9610	20.9924	20.9871	20.8895	20.4756	19.9515	19.5415	(87)
Th 2	19.9063	19.9086	19.9108	19.9212	19.9231	19.9322	19.9322	19.9339	19.9287	19.9231	19.9192	19.9150	(88)
util rest of house													
	0.9951	0.9882	0.9694	0.9038	0.7564	0.5362	0.3576	0.4088	0.6971	0.9391	0.9888	0.9962	(89)
MIT 2	18.2554	18.5301	18.9312	19.4388	19.7745	19.9109	19.9299	19.9295	19.8563	19.4054	18.7477	18.2208	(90)
Living area fraction											fLA = Living area / (4) =	0.2500	(91)
MIT	18.5849	18.8445	19.2245	19.7077	20.0351	20.1734	20.1955	20.1939	20.1146	19.6729	19.0486	18.5510	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.5849	18.8445	19.2245	19.7077	20.0351	20.1734	20.1955	20.1939	20.1146	19.6729	19.0486	18.5510	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9929	0.9842	0.9629	0.8980	0.7629	0.5578	0.3852	0.4377	0.7131	0.9333	0.9852	0.9944	(94)
Useful gains	812.9536	958.3665	1069.3697	1143.6227	1049.8034	762.9121	503.9693	528.5232	779.2315	870.0209	806.2614	773.5809	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2069.0398	2015.0555	1834.5683	1541.4905	1186.4179	785.8115	506.9413	533.9680	851.1283	1291.4383	1707.7572	2059.8986	(97)
Space heating kWh	934.5282	710.0950	569.3078	286.4648	101.6413	0.0000	0.0000	0.0000	0.0000	313.5346	649.0770	957.0204	(98a)
Space heating requirement - total per year (kWh/year)												4521.6689	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	934.5282	710.0950	569.3078	286.4648	101.6413	0.0000	0.0000	0.0000	0.0000	313.5346	649.0770	957.0204	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4521.6689	
Space heating per m2											(98c) / (4) =	37.9972	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	934.5282	710.0950	569.3078	286.4648	101.6413	0.0000	0.0000	0.0000	0.0000	313.5346	649.0770	957.0204	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	1012.4899	769.3337	616.8015	310.3628	110.1205	0.0000	0.0000	0.0000	0.0000	339.6907	703.2253	1036.8585	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	249.4296	220.4777	234.2614	206.3919	200.2777	180.7207	178.6932	185.7470	187.7059	208.9694	221.7284	246.7929	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.7391	86.4889	85.9733	84.7952	82.6190	79.8000	79.8000	79.8000	79.8000	84.9675	86.3211	86.7932	(217)
Fuel for water heating, kWh/month	287.5632	254.9202	272.4816	243.4005	242.4113	226.4670	223.9264	232.7656	235.2204	245.9404	256.8646	284.3459	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8801	23.9709	21.5831	15.8127	12.2142	9.9791	11.1422	14.4831	18.8121	24.6825	27.8788	30.7105	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-53.3766	-74.1095	-104.9127	-116.0826	-123.5599	-114.6809	-113.1669	-107.5531	-97.5062	-83.7512	-58.2346	-46.2741	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-33.7432	-70.5377	-139.4175	-208.3132	-274.4561	-275.4804	-272.3269	-231.1079	-170.0406	-100.6201	-44.9596	-26.7253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4898.8829	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3006.3070	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.1494	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2940.9366	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5291.4027 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4898.8829	0.2100	1028.7654	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3006.3070	0.2100	631.3245	(264)
Space and water heating			1660.0899	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.1494	0.1443	34.8053	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1093.2080	0.1349	-147.5104	
PV Unit electricity exported	-1847.7285	0.1260	-232.8918	
Total			-380.4022	(269)
Total CO2, kg/year			1326.4222	(272)
Target Carbon Dioxide Emission Rate (TER)			11.1500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4898.8829	1.1300	5535.7377	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3006.3070	1.1300	3397.1270	(278)
Space and water heating			8932.8646	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.1494	1.5338	369.8830	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1093.2080	1.4987	-1638.4029	
PV Unit electricity exported	-1847.7285	0.4627	-854.8842	
Total			-2493.2871	(283)
Total Primary energy kWh/year			6939.5613	(286)
Target Primary Energy Rate (TPER)			58.3200	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B2_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B2
Property	1 Bedroom Flat, 4B2, Saffron Walden, CB11		

SAP Rating	86 B	DER	12.66	TER	10.49
Environmental	88 B	% DER<TER	-20.69		
CO_2 Emissions (t/year)	1.57	DFEE	39.98	TFEE	43.39
Compliance Check	See BREL	% DFEE < TFEE	7.85		
% DPER < TPER	-28.45	DPER	70.55	TPER	54.92

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		66.5000 (1b)	x	2.5000 (2b)	=	166.2500 (1b)	-
First floor		66.5000 (1c)	x	2.7500 (2c)	=	182.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	349.1250	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			66.5000	0.1100	7.3150			(28a)
External Wall 1	175.0000	45.1000	129.9000	0.1400	18.1860			(29a)
External Roof 1	66.5000		66.5000	0.1100	7.3150			(30)
Total net area of external elements Aum(A, m2)			308.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.7030			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 15.4000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 99.1030 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.1279	59.0688	59.0109	58.7387	58.6878	58.4508	58.4508	58.4069	58.5421	58.6878	58.7908	58.8985	(38)
Heat transfer coeff													
	158.2310	158.1719	158.1139	157.8418	157.7908	157.5538	157.5538	157.5099	157.6451	157.7908	157.8938	158.0015	(39)

Average = Sum(39)m / 12 = 157.8415

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1897	1.1893	1.1888	1.1868	1.1864	1.1846	1.1846	1.1843	1.1853	1.1864	1.1872	1.1880	(40)
HLP (average)												1.1868	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9024 (42)

Hot water usage for mixer showers

	72.8830	71.7877	70.1917	67.1379	64.8843	62.3711	60.9426	62.5266	64.2629	66.9613	70.0807	72.6038 (42a)

Hot water usage for baths

	31.4653	30.9980	30.3399	29.1266	28.2181	27.2106	26.6665	27.3199	28.0314	29.1094	30.3477	31.3589 (42b)

Hot water usage for other uses

	44.3532	42.7403	41.1275	39.5146	37.9018	36.2890	36.2890	37.9018	39.5146	41.1275	42.7403	44.3532 (42c)

Average daily hot water use (litres/day) 136.6901 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	148.7015	145.5261	141.6591	135.7792	131.0042	125.8707	123.8981	127.7483	131.8090	137.1982	143.1688	148.3159	(44)
Energy conte	235.5068	207.2272	217.7248	185.8749	176.3568	154.7727	149.8440	158.1791	162.5337	186.1767	203.9701	232.2268	(45)

Energy content (annual) Total = Sum(45)m = 2270.3936

Distribution loss (46)m = 0.15 x (45)m

	35.3260	31.0841	32.6587	27.8812	26.4535	23.2159	22.4766	23.7269	24.3801	27.9265	30.5955	34.8340 (46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)

If cylinder contains dedicated solar storage

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	285.8513	252.6996	268.0692	234.5953	226.7012	203.4932	200.1884	208.5236	211.2541	236.5211	252.6906	282.5713 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	285.8513	252.6996	268.0692	234.5953	226.7012	203.4932	200.1884	208.5236	211.2541	236.5211	252.6906	282.5713 (64)

Total per year (kWh/year) = Sum(64)m = 2863.1588 (64)

12Total per year (kWh/year) 2863 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	118.5816	105.2810	112.6690	100.7797	98.9142	90.4383	90.0987	92.8701	93.0188	102.1793	106.7964	117.4910 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	151.9718	168.2545	151.9718	157.0375	151.9718	157.0375	151.9718	151.9718	157.0375	151.9718	157.0375	151.9718 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	301.3011	304.4277	296.5488	279.7757	258.6027	238.7030	225.4088	222.2823	230.1611	246.9342	268.1072	288.0069 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948 (71)

Water heating gains (Table 5)

	159.3838	156.6681	151.4369	139.9719	132.9492	125.6087	121.1004	124.8254	129.1928	137.3378	148.3283	157.9180 (72)

Total internal gains

	682.1923	698.8858	669.4931	646.3207	613.0592	587.8848	565.0165	565.6150	582.9269	605.7793	643.0087	667.4322 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	10.6334	0.7600	0.7000	0.7700	32.9303 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	6.3000	46.7521	0.7600	0.7000	0.7700	108.5891 (78)
West	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.9899	597.7235	921.3214	1285.1443	1548.8949	1580.0514	1506.1366	1306.7117	1048.9083	690.2824	396.8582	271.3382	(83)
Total gains	1006.1823	1296.6094	1590.8145	1931.4649	2161.9541	2167.9362	2071.1532	1872.3267	1631.8353	1296.0618	1039.8669	938.7704	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.3711	58.3929	58.4143	58.5150	58.5339	58.6220	58.6220	58.6383	58.5880	58.5339	58.4957	58.4558	
alpha	4.8914	4.8929	4.8943	4.9010	4.9023	4.9081	4.9081	4.9092	4.9059	4.9023	4.8997	4.8971	
util living area	0.9945	0.9816	0.9421	0.8258	0.6424	0.4592	0.3337	0.3847	0.6331	0.9121	0.9863	0.9960	(86)
MIT	19.6862	19.9806	20.3646	20.7480	20.9371	20.9898	20.9983	20.9966	20.9563	20.6325	20.0640	19.6237	(87)
Th 2	19.9282	19.9286	19.9289	19.9306	19.9309	19.9323	19.9323	19.9326	19.9318	19.9309	19.9303	19.9296	(88)
util rest of house	0.9927	0.9759	0.9254	0.7848	0.5800	0.3853	0.2533	0.2966	0.5481	0.8788	0.9811	0.9947	(89)
MIT 2	18.4147	18.7870	19.2601	19.6991	19.8848	19.9273	19.9318	19.9316	19.9062	19.5885	18.8972	18.3360	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.7325	19.0854	19.5363	19.9613	20.1479	20.1929	20.1985	20.1978	20.1687	19.8495	19.1889	18.6579	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5825	18.9354	19.3863	19.8113	19.9979	20.0429	20.0485	20.0478	20.0187	19.6995	19.0389	18.5079	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9687	0.9149	0.7797	0.5841	0.3930	0.2621	0.3062	0.5554	0.8701	0.9749	0.9921	(94)
Useful gains	995.4284	1256.0771	1455.4698	1505.9088	1262.7326	852.0605	542.7543	573.3600	906.3355	1127.7175	1013.8084	931.3083	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2259.9401	2220.0010	2037.4956	1722.2559	1309.3312	857.5496	543.3175	574.5677	933.0585	1435.8149	1885.0825	2260.6756	(97)
Space heating kWh	940.7967	647.7568	433.0272	155.7699	34.6693	0.0000	0.0000	0.0000	0.0000	229.2245	627.3173	989.0492	(98a)
Space heating requirement - total per year (kWh/year)												4057.6110	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	940.7967	647.7568	433.0272	155.7699	34.6693	0.0000	0.0000	0.0000	0.0000	229.2245	627.3173	989.0492	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4057.6110	
Space heating per m2										(98c) / (4) =		30.5084	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	940.7967	647.7568	433.0272	155.7699	34.6693	0.0000	0.0000	0.0000	0.0000	229.2245	627.3173	989.0492	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	1051.1695	723.7506	483.8293	174.0446	38.7367	0.0000	0.0000	0.0000	0.0000	256.1167	700.9132	1105.0830	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	285.8513	252.6996	268.0692	234.5953	226.7012	203.4932	200.1884	208.5236	211.2541	236.5211	252.6906	282.5713	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	319.3869	282.3459	299.5187	262.1177	253.2975	227.3667	223.6742	232.9872	236.0381	264.2694	282.3358	315.7221	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	41.5575	33.3390	30.0181	21.9925	16.9877	13.8791	15.4967	20.1432	26.1640	34.3286	38.7741	42.7125 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4533.6436 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3199.0601 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	335.3930 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	8154.0967 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4533.6436	0.2100	952.0652	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3199.0601	0.2100	671.8026	(264)
Space and water heating			1623.8678	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	335.3930	0.1443	48.4076	(268)
Total CO2, kg/year			1684.2046	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4533.6436	1.1300	5123.0173	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3199.0601	1.1300	3614.9379	(278)
Space and water heating			8737.9551	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	335.3930	1.5338	514.4370	(282)
Total Primary energy kWh/year			9382.4929	(286)
Dwelling Primary energy Rate (DPER)			70.5500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.5000 (2b)	=	166.2500 (1b)	-
First floor	66.5000 (1c)	x	2.7500 (2c)	=	182.8750 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 133.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 349.1250 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1146	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3646	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3099	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3951	0.3874	0.3796	0.3409	0.3331	0.2944	0.2944	0.2866	0.3099	0.3331	0.3486	0.3641	(22b)
Effective ac	0.5781	0.5750	0.5721	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5608	0.5663	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			28.1200	1.1450	32.1985			(27)
Heatloss Floor 1			66.5000	0.1300	8.6450			(28a)
External Wall 1	175.0000	33.3200	141.6800	0.1800	25.5024			(29a)
External Roof 1	66.5000		66.5000	0.1100	7.3150			(30)
Total net area of external elements Aum(A, m2)			308.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.8609			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
E5 Ground floor (normal)	44.0000	0.1600	7.0400	
E6 Intermediate floor within a dwelling	44.0000	0.0000	0.0000	
E14 Flat roof	44.0000	0.0800	3.5200	
E16 Corner (normal)	21.0000	0.0900	1.8900	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.4500	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	91.3109	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	66.5983	66.2491	65.9068	64.2992	63.9984	62.5981	62.5981	62.3388	63.1375	63.9984	64.6069	65.2430	(38)
Heat transfer coeff	157.9092	157.5600	157.2177	155.6100	155.3092	153.9090	153.9090	153.6497	154.4483	155.3092	155.9177	156.5539	(39)
Average = Sum(39)m / 12 =												155.6086	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1873	1.1847	1.1821	1.1700	1.1677	1.1572	1.1572	1.1553	1.1613	1.1677	1.1723	1.1771	(40)
HLP (average)												1.1700	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9024 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.8830	71.7877	70.1917	67.1379	64.8843	62.3711	60.9426	62.5266	64.2629	66.9613	70.0807	72.6038	(42a)
Hot water usage for baths	31.4653	30.9980	30.3399	29.1266	28.2181	27.2106	26.6665	27.3199	28.0314	29.1094	30.3477	31.3589	(42b)
Hot water usage for other uses	44.3532	42.7403	41.1275	39.5146	37.9018	36.2890	36.2890	37.9018	39.5146	41.1275	42.7403	44.3532	(42c)
Average daily hot water use (litres/day)												136.6901	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	148.7015	145.5261	141.6591	135.7792	131.0042	125.8707	123.8981	127.7483	131.8090	137.1982	143.1688	148.3159 (44)
Energy conte	235.5068	207.2272	217.7248	185.8749	176.3568	154.7727	149.8440	158.1791	162.5337	186.1767	203.9701	232.2268 (45)
Energy content (annual)										Total = Sum(45)m =		2270.3936

Distribution loss (46)m = 0.15 x (45)m

	35.3260	31.0841	32.6587	27.8812	26.4535	23.2159	22.4766	23.7269	24.3801	27.9265	30.5955	34.8340 (46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	284.7495	251.7044	266.9674	233.5291	225.5995	202.4269	199.0866	207.4218	210.1879	235.4194	251.6243	281.4695 (62)
WWHRS	-33.3191	-29.4677	-30.8568	-25.5507	-23.8123	-20.3764	-19.0996	-20.3105	-21.0822	-24.8536	-28.1561	-32.7021 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	251.4304	222.2368	236.1106	207.9784	201.7872	182.0506	179.9870	187.1113	189.1057	210.5658	223.4683	248.7674 (64)
										Total per year (kWh/year) = Sum(64)m =		2540.5994 (64)
12Total per year (kWh/year)												2541 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

	117.7002	104.4848	111.7876	99.9268	98.0328	89.5853	89.2173	91.9887	92.1658	101.2979	105.9434	116.6096 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	152.3189	168.6387	152.3189	157.3962	152.3189	157.3962	152.3189	152.3189	157.3962	152.3189	157.3962	152.3189 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	301.3011	304.4277	296.5488	279.7757	258.6027	238.7030	225.4088	222.2823	230.1611	246.9342	268.1072	288.0069 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948 (71)

Water heating gains (Table 5)

	158.1991	155.4834	150.2522	138.7872	131.7645	124.4240	119.9157	123.6407	128.0081	136.1531	147.1437	156.7333 (72)

Total internal gains

	681.3547	698.0854	668.6554	645.4946	612.2216	587.0587	564.1789	564.7774	582.1009	604.9417	642.1826	666.5946 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9200	10.6334	0.6300	0.7000	0.7700	19.2382	(74)
East	8.8800	19.6403	0.6300	0.7000	0.7700	53.3006	(76)
South	4.4400	46.7521	0.6300	0.7000	0.7700	63.4389	(78)
West	8.8800	19.6403	0.6300	0.7000	0.7700	53.3006	(80)

Solar gains	189.2783	349.1964	538.2457	750.7948	904.8807	923.0827	879.9009	763.3947	612.7833	403.2703	231.8487	158.5186	(83)
Total gains	870.6330	1047.2817	1206.9011	1396.2894	1517.1023	1510.1414	1444.0798	1328.1721	1194.8841	1008.2119	874.0313	825.1132	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.4900	58.6196	58.7473	59.3542	59.4692	60.0102	60.0102	60.1115	59.8007	59.4692	59.2371	58.9964	
alpha	4.8993	4.9080	4.9165	4.9569	4.9646	5.0007	5.0007	5.0074	4.9867	4.9646	4.9491	4.9331	
util living area													
	0.9971	0.9923	0.9789	0.9294	0.8113	0.6233	0.4632	0.5213	0.7820	0.9615	0.9933	0.9977	(86)
MIT	19.5838	19.8006	20.1200	20.5301	20.8284	20.9647	20.9934	20.9884	20.8944	20.4811	19.9572	19.5508	(87)
Th 2	19.9302	19.9323	19.9344	19.9441	19.9459	19.9544	19.9544	19.9560	19.9511	19.9459	19.9422	19.9384	(88)
util rest of house													
	0.9961	0.9898	0.9716	0.9056	0.7549	0.5334	0.3562	0.4085	0.6999	0.9436	0.9906	0.9970	(89)
MIT 2	18.2856	18.5634	18.9683	19.4762	19.8064	19.9352	19.9524	19.9521	19.8816	19.4302	18.7716	18.2492	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6101	18.8727	19.2562	19.7396	20.0619	20.1926	20.2126	20.2111	20.1348	19.6930	19.0680	18.5746	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.6101	18.8727	19.2562	19.7396	20.0619	20.1926	20.2126	20.2111	20.1348	19.6930	19.0680	18.5746	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9862	0.9655	0.9001	0.7618	0.5547	0.3830	0.4368	0.7158	0.9380	0.9874	0.9955	(94)
Useful gains	865.6132	1032.7793	1165.2612	1256.8216	1155.6830	837.6979	553.1148	580.1200	855.3131	945.7029	863.0231	821.4004	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2259.7042	2201.5382	2005.5085	1686.7579	1298.6774	860.7459	556.0158	585.5812	932.0641	1412.2210	1866.0185	2250.4045	(97)
Space heating kWh	1037.2037	785.4060	625.1440	309.5541	106.3878	0.0000	0.0000	0.0000	0.0000	347.0894	722.1567	1063.1790	(98a)
Space heating requirement - total per year (kWh/year)												4996.1207	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1037.2037	785.4060	625.1440	309.5541	106.3878	0.0000	0.0000	0.0000	0.0000	347.0894	722.1567	1063.1790	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4996.1207	
Space heating per m2											(98c) / (4) =	37.5648	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1037.2037	785.4060	625.1440	309.5541	106.3878	0.0000	0.0000	0.0000	0.0000	347.0894	722.1567	1063.1790	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	1123.7310	850.9274	677.2957	335.3782	115.2631	0.0000	0.0000	0.0000	0.0000	376.0449	782.4016	1151.8733	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	251.4304	222.2368	236.1106	207.9784	201.7872	182.0506	179.9870	187.1113	189.1057	210.5658	223.4683	248.7674	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.8880	86.6448	86.1367	84.9498	82.6933	79.8000	79.8000	79.8000	79.8000	85.1729	86.4947	86.9407	(217)
Fuel for water heating, kWh/month	289.3730	256.4918	274.1113	244.8250	244.0187	228.1335	225.5477	234.4753	236.9746	247.2217	258.3606	286.1345	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	31.6489	25.3899	22.8608	16.7488	12.9372	10.5698	11.8018	15.3404	19.9257	26.1436	29.5291	32.5285	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-58.8186	-81.2454	-114.4239	-125.9243	-133.4558	-123.6398	-121.9839	-116.2007	-105.7870	-91.4677	-64.0118	-51.0402	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.5505	-80.4191	-158.6511	-236.6357	-311.3856	-312.4228	-308.8622	-262.3028	-193.2359	-114.5943	-51.3229	-30.5473	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5412.9152	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3025.6678	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												255.4244	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3286.9291	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5493.0782 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5412.9152	0.2100	1136.7122	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3025.6678	0.2100	635.3902	(264)
Space and water heating			1772.1024	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	255.4244	0.1443	36.8656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1187.9990	0.1351	-160.4393	
PV Unit electricity exported	-2098.9302	0.1261	-264.6611	
Total			-425.1004	(269)
Total CO2, kg/year			1395.7969	(272)
Target Carbon Dioxide Emission Rate (TER)			10.4900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5412.9152	1.1300	6116.5942	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3025.6678	1.1300	3419.0046	(278)
Space and water heating			9535.5988	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	255.4244	1.5338	391.7784	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1187.9990	1.4991	-1780.9862	
PV Unit electricity exported	-2098.9302	0.4629	-971.5057	
Total			-2752.4919	(283)
Total Primary energy kWh/year			7304.9860	(286)
Target Primary Energy Rate (TPER)			54.9200	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B4_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B4
Property	1 Bedroom Flat, 4B4, Saffron Walden, CB11		

SAP Rating	86 B	DER	12.05	TER	9.96
Environmental	88 B	% DER<TER	-20.98		
CO_2 Emissions (t/year)	1.61	DFEE	38.04	TFEE	42.29
Compliance Check	See BREL	% DFEE < TFEE	10.05		
% DPER < TPER	-28.79	DPER	67.17	TPER	52.15

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.0000	(1b)	x 2.5000	(2b) =	180.0000	(1b) -
First floor		72.0000	(1c)	x 2.7500	(2c) =	198.0000	(1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		378.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			72.0000	0.1100	7.9200			(28a)
External Wall 1	180.0000	45.1000	134.9000	0.1400	18.8860			(29a)
External Roof 1	72.0000		72.0000	0.1100	7.9200			(30)
Total net area of external elements Aum(A, m2)			324.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.6130			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 16.2000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 101.8130 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.0182	63.9542	63.8915	63.5968	63.5417	63.2850	63.2850	63.2375	63.3839	63.5417	63.6532	63.7698	(38)
Heat transfer coeff													
	165.8312	165.7672	165.7045	165.4098	165.3547	165.0981	165.0981	165.0505	165.1969	165.3547	165.4662	165.5828	(39)

Average = Sum(39)m / 12 = 165.4096

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1516	1.1512	1.1507	1.1487	1.1483	1.1465	1.1465	1.1462	1.1472	1.1483	1.1491	1.1499	(40)
HLP (average)												1.1487	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9243 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	73.2515	72.1506	70.5465	67.4773	65.2123	62.6864	61.2507	62.8427	64.5878	67.2998	70.4350	72.9708	(42a)
Hot water usage for baths													
	31.6237	31.1541	30.4927	29.2733	28.3601	27.3476	26.8007	27.4575	28.1726	29.2560	30.5005	31.5168	(42b)
Hot water usage for other uses													
	44.5782	42.9572	41.3361	39.7151	38.0941	36.4731	36.4731	38.0941	39.7151	41.3361	42.9572	44.5782	(42c)

Average daily hot water use (litres/day) 137.3812 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.4534	146.2619	142.3754	136.4657	131.6666	126.5071	124.5245	128.3943	132.4755	137.8920	143.8927	149.0658	(44)
Energy conte	236.6977	208.2750	218.8256	186.8147	177.2485	155.5553	150.6016	158.9789	163.3555	187.1181	205.0015	233.4011	(45)
Energy content (annual)										Total = Sum(45)m =		2281.8735	
Distribution loss (46)m = 0.15 x (45)m													
	35.5046	31.2412	32.8238	28.0222	26.5873	23.3333	22.5902	23.8468	24.5033	28.0677	30.7502	35.0102	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	287.0421	253.7474	269.1701	235.5351	227.5929	204.2757	200.9461	209.3234	212.0759	237.4625	253.7219	283.7455	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	287.0421	253.7474	269.1701	235.5351	227.5929	204.2757	200.9461	209.3234	212.0759	237.4625	253.7219	283.7455	(64)
										Total per year (kWh/year) = Sum(64)m =		2874.6387	(64)
12Total per year (kWh/year)												2875	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	118.9775	105.6293	113.0351	101.0922	99.2107	90.6985	90.3506	93.1360	93.2920	102.4923	107.1393	117.8814	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	158.3345	175.2989	158.3345	163.6123	158.3345	163.6123	158.3345	158.3345	163.6123	158.3345	163.6123	158.3345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	313.9159	317.1734	308.9646	291.4893	269.4298	248.6970	234.8462	231.5887	239.7974	257.2728	279.3323	300.0651	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	(71)
Water heating gains (Table 5)													
	159.9160	157.1865	151.9289	140.4059	133.3477	125.9701	121.4390	125.1829	129.5723	137.7585	148.8046	158.4428	(72)
Total internal gains													
	702.0316	719.5240	689.0932	665.3726	630.9771	605.1445	581.4848	581.9712	599.8472	623.2309	661.6144	686.7075	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	12.6000	10.6334	0.7600	0.7000	0.7700	49.3955	(74)
East	8.4000	19.6403	0.7600	0.7000	0.7700	60.8235	(76)
South	12.6000	46.7521	0.7600	0.7000	0.7700	217.1782	(78)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	373.0148	658.3007	956.3908	1269.8393	1493.6010	1512.5097	1445.9780	1275.5857	1064.9685	743.0763	451.0855	316.3725	(83)
Total gains	1075.0464	1377.8246	1645.4840	1935.2119	2124.5781	2117.6542	2027.4628	1857.5570	1664.8156	1366.3072	1112.6999	1003.0800	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.3023	60.3255	60.3484	60.4559	60.4761	60.5701	60.5701	60.5875	60.5338	60.4761	60.4353	60.3927	
alpha	5.0202	5.0217	5.0232	5.0304	5.0317	5.0380	5.0380	5.0392	5.0356	5.0317	5.0290	5.0262	
util living area	0.9947	0.9822	0.9476	0.8479	0.6780	0.4913	0.3570	0.4061	0.6490	0.9139	0.9864	0.9962	(86)
MIT	19.7348	20.0209	20.3722	20.7315	20.9275	20.9879	20.9980	20.9963	20.9558	20.6493	20.1048	19.6730	(87)
Th 2	19.9589	19.9593	19.9596	19.9613	19.9616	19.9630	19.9630	19.9633	19.9625	19.9616	19.9610	19.9603	(88)
util rest of house	0.9930	0.9767	0.9322	0.8099	0.6163	0.4151	0.2736	0.3160	0.5652	0.8816	0.9813	0.9949	(89)
MIT 2	18.4985	18.8604	19.2945	19.7107	19.9073	19.9569	19.9625	19.9621	19.9362	19.6335	18.9710	18.4208	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.8076	19.1505	19.5639	19.9659	20.1623	20.2147	20.2214	20.2207	20.1911	19.8874	19.2545	18.7338	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6576	19.0005	19.4139	19.8159	20.0123	20.0647	20.0714	20.0707	20.0411	19.7374	19.1045	18.5838	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9898	0.9699	0.9223	0.8040	0.6194	0.4227	0.2823	0.3254	0.5719	0.8732	0.9754	0.9925	(94)
Useful gains	1064.0650	1336.3046	1517.6240	1555.8627	1316.0177	895.1283	572.4060	604.4021	952.0864	1193.0368	1085.3232	995.5175	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2380.9404	2337.4020	2139.8986	1805.5960	1374.4851	902.2058	573.1135	605.8458	981.4468	1510.9143	1986.3352	2381.7183	(97)
Space heating kWh	979.7553	672.7375	462.9724	179.8080	43.4998	0.0000	0.0000	0.0000	0.0000	236.5008	648.7286	1031.3334	(98a)
Space heating requirement - total per year (kWh/year)												4255.3358	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	979.7553	672.7375	462.9724	179.8080	43.4998	0.0000	0.0000	0.0000	0.0000	236.5008	648.7286	1031.3334	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4255.3358	
Space heating per m2											(98c) / (4) =	29.5509	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 89.5000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	979.7553	672.7375	462.9724	179.8080	43.4998	0.0000	0.0000	0.0000	0.0000	236.5008	648.7286	1031.3334	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	1094.6987	751.6620	517.2876	200.9028	48.6031	0.0000	0.0000	0.0000	0.0000	264.2467	724.8365	1152.3278	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	287.0421	253.7474	269.1701	235.5351	227.5929	204.2757	200.9461	209.3234	212.0759	237.4625	253.7219	283.7455	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	320.7174	283.5166	300.7487	263.1677	254.2938	228.2410	224.5207	233.8809	236.9564	265.3213	283.4882	317.0341	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	43.5963	34.9746	31.4908	23.0715	17.8211	14.5600	16.2570	21.1314	27.4476	36.0128	40.6764	44.8080 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4754.5651 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3211.8868 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	351.8475 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	8404.2994 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4754.5651	0.2100	998.4587	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3211.8868	0.2100	674.4962	(264)
Space and water heating			1672.9549	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	351.8475	0.1443	50.7825	(268)
Total CO2, kg/year			1735.6666	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.0500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4754.5651	1.1300	5372.6586	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3211.8868	1.1300	3629.4321	(278)
Space and water heating			9002.0907	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	351.8475	1.5338	539.6754	(282)
Total Primary energy kWh/year			9671.8668	(286)
Dwelling Primary energy Rate (DPER)			67.1700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0000 (1b)	x	2.5000 (2b)	=	180.0000 (1b)	-
First floor	72.0000 (1c)	x	2.7500 (2c)	=	198.0000 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 144.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 378.0000 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1058	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3558	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3024	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3856	0.3781	0.3705	0.3327	0.3251	0.2873	0.2873	0.2798	0.3024	0.3251	0.3403	0.3554	(22b)
Effective ac	0.5744	0.5715	0.5686	0.5553	0.5529	0.5413	0.5413	0.5391	0.5457	0.5529	0.5579	0.5631	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			30.7800	1.1450	35.2443			(27)
Heatloss Floor 1			72.0000	0.1300	9.3600			(28a)
External Wall 1	180.0000	35.9800	144.0200	0.1800	25.9236			(29a)
External Roof 1	72.0000		72.0000	0.1100	7.9200			(30)
Total net area of external elements Aum(A, m2)			324.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.6479			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	47.0000	0.1600	7.5200
E6 Intermediate floor within a dwelling	47.0000	0.0000	0.0000
E14 Flat roof	47.0000	0.0800	3.7600
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.1700 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 96.8179 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.6446	71.2845	70.9314	69.2734	68.9631	67.5190	67.5190	67.2516	68.0752	68.9631	69.5907	70.2468	(38)
Heat transfer coeff	168.4625	168.1023	167.7493	166.0912	165.7810	164.3369	164.3369	164.0694	164.8931	165.7810	166.4086	167.0647	(39)

Average = Sum(39)m / 12 = 166.0897

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1699	1.1674	1.1649	1.1534	1.1513	1.1412	1.1412	1.1394	1.1451	1.1513	1.1556	1.1602	(40)
HLP (average)												1.1534	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9243 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2515	72.1506	70.5465	67.4773	65.2123	62.6864	61.2507	62.8427	64.5878	67.2998	70.4350	72.9708	(42a)

Hot water usage for baths

31.6237	31.1541	30.4927	29.2733	28.3601	27.3476	26.8007	27.4575	28.1726	29.2560	30.5005	31.5168	(42b)

Hot water usage for other uses

44.5782	42.9572	41.3361	39.7151	38.0941	36.4731	36.4731	38.0941	39.7151	41.3361	42.9572	44.5782	(42c)

Average daily hot water use (litres/day) 137.3812 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	149.4534	146.2619	142.3754	136.4657	131.6666	126.5071	124.5245	128.3943	132.4755	137.8920	143.8927	149.0658 (44)
Energy conte	236.6977	208.2750	218.8256	186.8147	177.2485	155.5553	150.6016	158.9789	163.3555	187.1181	205.0015	233.4011 (45)
Energy content (annual)											Total = Sum(45)m =	2281.8735
Distribution loss (46)m = 0.15 x (45)m												
	35.5046	31.2412	32.8238	28.0222	26.5873	23.3333	22.5902	23.8468	24.5033	28.0677	30.7502	35.0102 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	285.9403	252.7522	268.0683	234.4689	226.4912	203.2095	199.8443	208.2216	211.0097	236.3608	252.6557	282.6437 (62)
WWHRS	-33.4875	-29.6166	-31.0128	-25.6798	-23.9327	-20.4794	-19.1961	-20.4132	-21.1888	-24.9792	-28.2984	-32.8674 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	252.4528	223.1356	237.0555	208.7891	202.5585	182.7301	180.6481	187.8084	189.8210	211.3816	224.3573	249.7764 (64)
										Total per year (kWh/year) = Sum(64)m =		2550.5143 (64)
12Total per year (kWh/year)												2551 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	118.0961	104.8332	112.1537	100.2392	98.3293	89.8455	89.4692	92.2546	92.4391	101.6109	106.2864	117.0000 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	158.5911	175.5830	158.5911	163.8774	158.5911	163.8774	158.5911	158.5911	163.8774	158.5911	163.8774	158.5911	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	313.9159	317.1734	308.9646	291.4893	269.4298	248.6970	234.8462	231.5887	239.7974	257.2728	279.3323	300.0651	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	(71)
Water heating gains (Table 5)													
	158.7313	156.0018	150.7442	139.2212	132.1630	124.7854	120.2543	123.9982	128.3876	136.5738	147.6199	157.2581	(72)
Total internal gains													
	701.1034	718.6233	688.1650	664.4531	630.0490	604.2250	580.5566	581.0431	598.9276	622.3028	660.6948	685.7794	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.7200	10.6334	0.6300	0.7000	0.7700	31.5871	(74)
East	6.4800	19.6403	0.6300	0.7000	0.7700	38.8950	(76)
South	9.7200	46.7521	0.6300	0.7000	0.7700	138.8797	(78)
West	4.8600	19.6403	0.6300	0.7000	0.7700	29.1713	(80)

Solar gains	238.5332	420.9659	611.5868	812.0288	955.1185	967.2102	924.6649	815.7035	681.0193	475.1777	288.4573	202.3119 (83)
Total gains	939.6366	1139.5893	1299.7518	1476.4819	1585.1675	1571.4351	1505.2215	1396.7466	1279.9469	1097.4805	949.1521	888.0912 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.3604	59.4876	59.6128	60.2079	60.3205	60.8506	60.8506	60.9498	60.6453	60.3205	60.0931	59.8571	
alpha	4.9574	4.9658	4.9742	5.0139	5.0214	5.0567	5.0567	5.0633	5.0430	5.0214	5.0062	4.9905	
util living area													
	0.9971	0.9921	0.9789	0.9330	0.8221	0.6374	0.4742	0.5291	0.7818	0.9597	0.9931	0.9978	(86)
MIT	19.6082	19.8306	20.1388	20.5297	20.8225	20.9627	20.9930	20.9883	20.8979	20.5007	19.9809	19.5729	(87)
Th 2	19.9442	19.9462	19.9482	19.9575	19.9592	19.9673	19.9673	19.9688	19.9642	19.9592	19.9557	19.9520	(88)
util rest of house													
	0.9961	0.9894	0.9717	0.9102	0.7675	0.5476	0.3662	0.4162	0.7004	0.9413	0.9904	0.9971	(89)
MIT 2	18.3266	18.6114	19.0022	19.4871	19.8135	19.9467	19.9652	19.9648	19.8968	19.4640	18.8113	18.2871	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6470	18.9162	19.2863	19.7478	20.0657	20.2007	20.2221	20.2207	20.1471	19.7231	19.1037	18.6086	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.6470	18.9162	19.2863	19.7478	20.0657	20.2007	20.2221	20.2207	20.1471	19.7231	19.1037	18.6086	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9858	0.9657	0.9047	0.7737	0.5688	0.3933	0.4445	0.7163	0.9359	0.9872	0.9956	(94)
Useful gains	934.3070	1123.4116	1255.1225	1335.7434	1226.4429	893.8648	591.9375	620.8276	916.8210	1027.1142	937.0018	884.2140	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2416.9357	2356.1544	2144.8968	1801.7162	1386.8781	920.4028	595.2516	626.8542	997.1252	1512.4449	1997.5149	2407.1653	(97)
Space heating kWh	1103.0757	828.4032	661.9921	335.5004	119.3638	0.0000	0.0000	0.0000	0.0000	361.0861	763.5694	1133.0757	(98a)
Space heating requirement - total per year (kWh/year)												5306.0665	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1103.0757	828.4032	661.9921	335.5004	119.3638	0.0000	0.0000	0.0000	0.0000	361.0861	763.5694	1133.0757	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5306.0665	
Space heating per m2											(98c) / (4) =	36.8477	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1103.0757	828.4032	661.9921	335.5004	119.3638	0.0000	0.0000	0.0000	0.0000	361.0861	763.5694	1133.0757	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	1195.0983	897.5116	717.2179	363.4890	129.3216	0.0000	0.0000	0.0000	0.0000	391.2092	827.2692	1227.6010	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.4528	223.1356	237.0555	208.7891	202.5585	182.7301	180.6481	187.8084	189.8210	211.3816	224.3573	249.7764	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.9732	86.7245	86.2356	85.1176	82.9159	79.8000	79.8000	79.8000	79.8000	85.2498	86.5824	87.0272	(217)
Fuel for water heating, kWh/month	290.2651	257.2925	274.8930	245.2950	244.2938	228.9851	226.3761	235.3489	237.8709	247.9554	259.1258	287.0097	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	32.9521	26.4354	23.8021	17.4385	13.4700	11.0051	12.2878	15.9721	20.7462	27.2201	30.7450	33.8679	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-63.0067	-86.6919	-121.6205	-133.2993	-140.8107	-130.2752	-128.5126	-122.6342	-111.9965	-97.3218	-68.4409	-54.7138	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-42.4155	-88.3434	-174.0397	-259.2469	-340.8221	-341.8527	-337.9673	-287.1741	-211.7576	-125.7829	-56.4328	-33.6216	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5748.7178	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3034.7112	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												265.9423	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3558.7804	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5576.5909 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5748.7178	0.2100	1207.2307	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3034.7112	0.2100	637.2894	(264)
Space and water heating			1844.5201	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	265.9423	0.1443	38.3837	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1259.3239	0.1351	-170.1827	
PV Unit electricity exported	-2299.4565	0.1261	-290.0350	
Total			-460.2177	(269)
Total CO2, kg/year			1434.6153	(272)
Target Carbon Dioxide Emission Rate (TER)			9.9600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5748.7178	1.1300	6496.0511	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3034.7112	1.1300	3429.2237	(278)
Space and water heating			9925.2748	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	265.9423	1.5338	407.9111	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1259.3239	1.4995	-1888.3292	
PV Unit electricity exported	-2299.4565	0.4630	-1064.6507	
Total			-2952.9799	(283)
Total Primary energy kWh/year			7510.3068	(286)
Target Primary Energy Rate (TPER)			52.1500	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B5_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B5
Property	1 Bedroom Flat, 4B5, Saffron Walden, CB11		

SAP Rating	86 B	DER	12.41	TER	10.20
Environmental	88 B	% DER<TER	-21.67		
CO_2 Emissions (t/year)	1.6	DFEE	39.43	TFEE	42.89
Compliance Check	See BREL	% DFEE < TFEE	8.08		
% DPER < TPER	-29.42	DPER	69.12	TPER	53.41

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		69.5000 (1b)	x	2.5000 (2b)	=	173.7500 (1b)	-
First floor		69.5000 (1c)	x	2.7500 (2c)	=	191.1250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	364.8750	(5)

2. Ventilation rate

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			69.5000	0.1100	7.6450			(28a)
External Wall 1	175.0000	45.1000	129.9000	0.1400	18.1860			(29a)
External Roof 1	69.5000		69.5000	0.1100	7.6450			(30)
Total net area of external elements Aum(A, m2)			314.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.3630			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 15.7000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 100.0630 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.7954	61.7336	61.6730	61.3886	61.3354	61.0876	61.0876	61.0418	61.1831	61.3354	61.4430	61.5556	(38)
Heat transfer coeff	161.8584	161.7966	161.7361	161.4516	161.3984	161.1507	161.1507	161.1048	161.2461	161.3984	161.5061	161.6186	(39)

Average = Sum(39)m / 12 = 161.4514

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1644	1.1640	1.1636	1.1615	1.1611	1.1594	1.1594	1.1590	1.1600	1.1611	1.1619	1.1627	(40)
HLP (average)												1.1615	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9152 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0974	71.9989	70.3982	67.3354	65.0752	62.5546	61.1219	62.7106	64.4520	67.1583	70.2869	72.8174	(42a)
Hot water usage for baths	31.5575	31.0888	30.4289	29.2119	28.3007	27.2904	26.7446	27.4000	28.1136	29.1947	30.4367	31.4508	(42b)
Hot water usage for other uses	44.4841	42.8665	41.2489	39.6313	38.0137	36.3961	36.3961	38.0137	39.6313	41.2489	42.8665	44.4841	(42c)

Average daily hot water use (litres/day) 137.0923 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.1391	145.9543	142.0760	136.1787	131.3897	126.2411	124.2626	128.1243	132.1969	137.6020	143.5901	148.7523	(44)
Energy conte	236.1999	207.8370	218.3655	186.4218	176.8758	155.2282	150.2849	158.6446	163.0120	186.7246	204.5704	232.9102	(45)

Energy content (annual) Total = Sum(45)m = 2277.0747

Distribution loss (46)m = 0.15 x (45)m	35.4300	31.1755	32.7548	27.9633	26.5314	23.2842	22.5427	23.7967	24.4518	28.0087	30.6856	34.9365	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	286.5443	253.3094	268.7099	235.1423	227.2202	203.9486	200.6293	208.9890	211.7324	237.0690	253.2908	283.2547	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	286.5443	253.3094	268.7099	235.1423	227.2202	203.9486	200.6293	208.9890	211.7324	237.0690	253.2908	283.2547	(64)

Total per year (kWh/year) = Sum(64)m = 2869.8398 (64)
12Total per year (kWh/year) 2870 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	118.8120	105.4837	112.8821	100.9616	99.0867	90.5897	90.2453	93.0249	93.1778	102.3615	106.9960	117.7182	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	155.4879	172.1473	155.4879	160.6708	155.4879	160.6708	155.4879	155.4879	160.6708	155.4879	160.6708	155.4879	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	308.2722	311.4711	303.4100	286.2488	264.5859	244.2258	230.6240	227.4251	235.4862	252.6474	274.3103	294.6704	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	(71)
Water heating gains (Table 5)	159.6936	156.9698	151.7232	140.2244	133.1811	125.8190	121.2974	125.0334	129.4136	137.5826	148.6055	158.2234	(72)
Total internal gains	693.1810	710.3156	680.3484	656.8714	622.9822	597.4430	574.1367	574.6738	592.2981	615.4453	653.3141	678.1091	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	10.6334	0.7600	0.7000	0.7700	32.9303 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	6.3000	46.7521	0.7600	0.7000	0.7700	108.5891 (78)
West	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.9899	597.7235	921.3214	1285.1443	1548.8949	1580.0514	1506.1366	1306.7117	1048.9083	690.2824	396.8582	271.3382	(83)
Total gains	1017.1710	1308.0391	1601.6699	1942.0157	2171.8771	2177.4944	2080.2733	1881.3855	1641.2064	1305.7277	1050.1723	949.4473	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6372	59.6599	59.6823	59.7874	59.8071	59.8991	59.8991	59.9161	59.8636	59.8071	59.7673	59.7257	
alpha	4.9758	4.9773	4.9788	4.9858	4.9871	4.9933	4.9933	4.9944	4.9909	4.9871	4.9845	4.9817	
util living area	0.9952	0.9836	0.9471	0.8354	0.6531	0.4676	0.3398	0.3916	0.6432	0.9184	0.9878	0.9965	(86)
MIT	19.6995	19.9859	20.3628	20.7451	20.9365	20.9899	20.9983	20.9967	20.9561	20.6311	20.0707	19.6389	(87)
Th 2	19.9485	19.9489	19.9493	19.9509	19.9512	19.9527	19.9527	19.9529	19.9521	19.9512	19.9506	19.9499	(88)
util rest of house	0.9936	0.9785	0.9316	0.7958	0.5913	0.3938	0.2595	0.3037	0.5589	0.8871	0.9832	0.9954	(89)
MIT 2	18.4461	18.8089	19.2749	19.7151	19.9043	19.9476	19.9522	19.9519	19.9261	19.6046	18.9207	18.3698	(90)
Living area fraction									fLA = Living area / (4) =			0.2518	(91)
MIT	18.7617	19.1052	19.5488	19.9744	20.1642	20.2100	20.2156	20.2150	20.1855	19.8631	19.2103	18.6894	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6117	18.9552	19.3988	19.8244	20.0142	20.0600	20.0656	20.0650	20.0355	19.7131	19.0603	18.5394	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906	0.9719	0.9215	0.7905	0.5952	0.4015	0.2682	0.3132	0.5660	0.8784	0.9775	0.9930	(94)
Useful gains	1007.6003	1271.2643	1476.0105	1535.0720	1292.6903	874.1788	557.9086	589.2009	928.9228	1146.9504	1026.5798	942.8406	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2316.4730	2274.0874	2086.2065	1763.7695	1341.9042	879.8872	558.4837	590.4435	957.0724	1470.8321	1931.6585	2317.5089	(97)
Space heating kWh	973.8013	673.8972	453.9858	164.6622	36.6151	0.0000	0.0000	0.0000	0.0000	240.9679	651.6567	1022.7532	(98a)
Space heating requirement - total per year (kWh/year)												4218.3394	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	973.8013	673.8972	453.9858	164.6622	36.6151	0.0000	0.0000	0.0000	0.0000	240.9679	651.6567	1022.7532	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4218.3394	
Space heating per m2										(98c) / (4) =		30.3478	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	973.8013	673.8972	453.9858	164.6622	36.6151	0.0000	0.0000	0.0000	0.0000	240.9679	651.6567	1022.7532	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	1088.0462	752.9577	507.2467	183.9801	40.9107	0.0000	0.0000	0.0000	0.0000	269.2379	728.1081	1142.7410	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	286.5443	253.3094	268.7099	235.1423	227.2202	203.9486	200.6293	208.9890	211.7324	237.0690	253.2908	283.2547	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	320.1612	283.0272	300.2345	262.7288	253.8773	227.8755	224.1669	233.5073	236.5725	264.8816	283.0065	316.4856	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	42.6849	34.2434	30.8324	22.5891	17.4485	14.2556	15.9171	20.6896	26.8738	35.2599	39.8260	43.8712 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4713.2284 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3206.5249 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	344.4915 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	8350.2448 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4713.2284	0.2100	989.7780	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3206.5249	0.2100	673.3702	(264)
Space and water heating			1663.1482	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4915	0.1443	49.7208	(268)
Total CO2, kg/year			1724.7982	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.4100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4713.2284	1.1300	5325.9481	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3206.5249	1.1300	3623.3732	(278)
Space and water heating			8949.3213	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4915	1.5338	528.3925	(282)
Total Primary energy kWh/year			9607.8146	(286)
Dwelling Primary energy Rate (DPER)			69.1200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.5000 (1b)	x	2.5000 (2b)	=	173.7500 (1b)	-
First floor	69.5000 (1c)	x	2.7500 (2c)	=	191.1250 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 139.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 364.8750 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1096	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3596	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3057	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3897	0.3821	0.3745	0.3363	0.3286	0.2904	0.2904	0.2828	0.3057	0.3286	0.3439	0.3592	(22b)
Effective ac	0.5760	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			29.6400	1.1450	33.9389			(27)
Heatloss Floor 1			69.5000	0.1300	9.0350			(28a)
External Wall 1	175.0000	34.8400	140.1600	0.1800	25.2288			(29a)
External Roof 1	69.5000		69.5000	0.1100	7.6450			(30)
Total net area of external elements Aum(A, m2)			314.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.0477			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	44.0000	0.1600	7.0400	
E6 Intermediate floor within a dwelling	44.0000	0.0000	0.0000	
E14 Flat roof	44.0000	0.0800	3.5200	
E16 Corner (normal)	21.0000	0.0900	1.8900	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.4500	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	93.4977	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.3495	68.9944	68.6463	67.0114	66.7055	65.2815	65.2815	65.0178	65.8300	66.7055	67.3243	67.9712	(38)
Heat transfer coeff	162.8472	162.4921	162.1440	160.5091	160.2032	158.7792	158.7792	158.5155	159.3277	160.2032	160.8220	161.4690	(39)
Average = Sum(39)m / 12 =												160.5076	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1716	1.1690	1.1665	1.1547	1.1525	1.1423	1.1423	1.1404	1.1462	1.1525	1.1570	1.1616	(40)
HLP (average)												1.1547	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9152 (42)
Hot water usage for mixer showers

73.0974	71.9989	70.3982	67.3354	65.0752	62.5546	61.1219	62.7106	64.4520	67.1583	70.2869	72.8174	(42a)

Hot water usage for baths

31.5575	31.0888	30.4289	29.2119	28.3007	27.2904	26.7446	27.4000	28.1136	29.1947	30.4367	31.4508	(42b)

Hot water usage for other uses

44.4841	42.8665	41.2489	39.6313	38.0137	36.3961	36.3961	38.0137	39.6313	41.2489	42.8665	44.4841	(42c)

Average daily hot water use (litres/day) 137.0923 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	149.1391	145.9543	142.0760	136.1787	131.3897	126.2411	124.2626	128.1243	132.1969	137.6020	143.5901	148.7523 (44)
Energy conte	236.1999	207.8370	218.3655	186.4218	176.8758	155.2282	150.2849	158.6446	163.0120	186.7246	204.5704	232.9102 (45)
Energy content (annual)											Total = Sum(45)m =	2277.0747
Distribution loss (46)m = 0.15 x (45)m												
	35.4300	31.1755	32.7548	27.9633	26.5314	23.2842	22.5427	23.7967	24.4518	28.0087	30.6856	34.9365 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	285.4425	252.3142	267.6081	234.0760	226.1184	202.8824	199.5276	207.8873	210.6662	235.9672	252.2246	282.1529 (62)
WWHRS	-33.4171	-29.5544	-30.9476	-25.6259	-23.8824	-20.4363	-19.1558	-20.3703	-21.1442	-24.9267	-28.2389	-32.7983 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	252.0254	222.7599	236.6605	208.4502	202.2360	182.4460	180.3718	187.5170	189.5220	211.0406	223.9857	249.3546 (64)
										Total per year (kWh/year) = Sum(64)m =		2546.3697 (64)
12Total per year (kWh/year)												2546 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	117.9306	104.6876	112.0006	100.1086	98.2053	89.7367	89.3639	92.1435	92.3248	101.4801	106.1430	116.8368 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	155.7613	172.4500	155.7613	160.9533	155.7613	160.9533	155.7613	155.7613	160.9533	155.7613	160.9533	155.7613	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.2722	311.4711	303.4100	286.2488	264.5859	244.2258	230.6240	227.4251	235.4862	252.6474	274.3103	294.6704	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	(71)
Water heating gains (Table 5)													
	158.5089	155.7851	150.5385	139.0398	131.9964	124.6343	120.1127	123.8487	128.2289	136.3979	147.4208	157.0387	(72)
Total internal gains													
	692.2697	709.4335	679.4371	655.9692	622.0709	596.5408	573.2253	573.7625	591.3958	614.5340	652.4118	677.1977	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2400	10.6334	0.6300	0.7000	0.7700	20.2781	(74)
East	9.3600	19.6403	0.6300	0.7000	0.7700	56.1817	(76)
South	4.6800	46.7521	0.6300	0.7000	0.7700	66.8680	(78)
West	9.3600	19.6403	0.6300	0.7000	0.7700	56.1817	(80)

Solar gains	199.5096	368.0719	567.3400	791.3783	953.7932	972.9790	927.4631	804.6593	645.9067	425.0687	244.3811	167.0872	(83)
Total gains	891.7793	1077.5054	1246.7771	1447.3475	1575.8641	1569.5198	1500.6884	1378.4217	1237.3025	1039.6026	896.7929	844.2849	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2750	59.4046	59.5321	60.1385	60.2533	60.7937	60.7937	60.8948	60.5844	60.2533	60.0215	59.7810	
alpha	4.9517	4.9603	4.9688	5.0092	5.0169	5.0529	5.0529	5.0597	5.0390	5.0169	5.0014	4.9854	
util living area													
	0.9973	0.9927	0.9794	0.9296	0.8096	0.6201	0.4603	0.5188	0.7815	0.9625	0.9938	0.9980	(86)
MIT	19.5941	19.8115	20.1312	20.5402	20.8349	20.9669	20.9939	20.9892	20.8978	20.4870	19.9646	19.5608	(87)
Th 2	19.9428	19.9449	19.9469	19.9564	19.9582	19.9664	19.9664	19.9680	19.9632	19.9582	19.9546	19.9508	(88)
util rest of house													
	0.9964	0.9903	0.9724	0.9060	0.7535	0.5313	0.3549	0.4076	0.7001	0.9451	0.9913	0.9973	(89)
MIT 2	18.3077	18.5863	18.9918	19.4982	19.8240	19.9484	19.9646	19.9643	19.8959	19.4471	18.7900	18.2708	(90)
Living area fraction										fLA = Living area / (4) =		0.2518	(91)
MIT	18.6316	18.8948	19.2787	19.7605	20.0786	20.2048	20.2238	20.2224	20.1482	19.7089	19.0857	18.5956	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.6316	18.8948	19.2787	19.7605	20.0786	20.2048	20.2238	20.2224	20.1482	19.7089	19.0857	18.5956	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9869	0.9665	0.9007	0.7606	0.5526	0.3815	0.4357	0.7161	0.9397	0.9882	0.9959	(94)
Useful gains	887.0619	1063.3925	1204.9636	1303.5722	1198.5857	867.2839	572.5755	600.5635	886.0030	976.9018	886.2442	840.8274	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2333.8604	2274.0463	2071.9945	1743.2170	1342.2723	889.9291	575.3780	605.9060	963.6444	1459.2796	1927.5712	2324.4433	(97)
Space heating kWh	1076.4180	813.5594	645.0710	316.5442	106.9029	0.0000	0.0000	0.0000	0.0000	358.8891	749.7555	1103.8102	(98a)
Space heating requirement - total per year (kWh/year)												5170.9502	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1076.4180	813.5594	645.0710	316.5442	106.9029	0.0000	0.0000	0.0000	0.0000	358.8891	749.7555	1103.8102	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5170.9502	
Space heating per m2											(98c) / (4) =	37.2011	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1076.4180	813.5594	645.0710	316.5442	106.9029	0.0000	0.0000	0.0000	0.0000	358.8891	749.7555	1103.8102	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	1166.2167	881.4295	698.8851	342.9515	115.8211	0.0000	0.0000	0.0000	0.0000	388.8289	812.3028	1195.8940	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	252.0254	222.7599	236.6605	208.4502	202.2360	182.4460	180.3718	187.5170	189.5220	211.0406	223.9857	249.3546	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.9398	86.6982	86.1909	84.9939	82.6984	79.8000	79.8000	79.8000	79.8000	85.2402	86.5545	86.9921	(217)
Fuel for water heating, kWh/month	289.8850	256.9372	274.5771	245.2530	244.5464	228.6291	226.0298	234.9837	237.4962	247.5834	258.7798	286.6407	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	32.3641	25.9637	23.3774	17.1273	13.2296	10.8087	12.0685	15.6871	20.3760	26.7344	30.1964	33.2636	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.1113	-84.2314	-118.3754	-129.9805	-137.5068	-127.2968	-125.5821	-119.7435	-109.2017	-94.6805	-66.4381	-53.0508	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-40.6503	-84.7263	-167.0188	-248.9355	-327.4027	-328.4378	-324.7006	-275.8353	-203.3109	-120.6775	-54.0996	-32.2174	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5602.3296	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3031.3415	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												261.1969	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3435.2116	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5545.6564 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5602.3296	0.2100	1176.4892	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3031.3415	0.2100	636.5817	(264)
Space and water heating			1813.0709	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	261.1969	0.1443	37.6988	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1227.1989	0.1351	-165.7928	
PV Unit electricity exported	-2208.0127	0.1261	-278.4627	
Total			-444.2555	(269)
Total CO2, kg/year			1418.4434	(272)
Target Carbon Dioxide Emission Rate (TER)			10.2000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5602.3296	1.1300	6330.6324	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3031.3415	1.1300	3425.4159	(278)
Space and water heating			9756.0483	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	261.1969	1.5338	400.6326	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1227.1989	1.4993	-1839.9761	
PV Unit electricity exported	-2208.0127	0.4629	-1022.1700	
Total			-2862.1461	(283)
Total Primary energy kWh/year			7424.6355	(286)
Target Primary Energy Rate (TPER)			53.4100	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B7_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B7
Property	1 Bedroom Flat, 4B7, Saffron Walden, CB11		

SAP Rating	86 B	DER	11.84	TER	9.59
Environmental	88 B	% DER<TER	-23.46		
CO_2 Emissions (t/year)	1.73	DFEE	38.39	TFEE	42.19
Compliance Check	See BREL	% DFEE < TFEE	9.00		
% DPER < TPER	-31.20	DPER	65.91	TPER	50.24

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		78.5000 (1b)	x	2.5000 (2b)	=	196.2500 (1b)	-
First floor		78.5000 (1c)	x	2.7500 (2c)	=	215.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	157.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	412.1250	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			78.5000	0.1100	8.6350			(28a)
External Wall 1	180.0000	45.1000	134.9000	0.1400	18.8860			(29a)
External Roof 1	78.5000		78.5000	0.1100	8.6350			(30)
Total net area of external elements Aum(A, m2)			337.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.0430			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 16.8500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 103.8930 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.7976	69.7279	69.6595	69.3382	69.2781	68.9983	68.9983	68.9465	69.1061	69.2781	69.3997	69.5268	(38)
Heat transfer coeff													
	173.6907	173.6209	173.5525	173.2312	173.1711	172.8913	172.8913	172.8395	172.9991	173.1711	173.2927	173.4198	(39)

Average = Sum(39)m / 12 = 173.2309

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1063	1.1059	1.1054	1.1034	1.1030	1.1012	1.1012	1.1009	1.1019	1.1030	1.1038	1.1046	(40)
HLP (average)												1.1034	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9446 (42)

Hot water usage for mixer showers

	73.5918	72.4859	70.8743	67.7909	65.5154	62.9777	61.5353	63.1347	64.8879	67.6126	70.7623	73.3099 (42a)

Hot water usage for baths

	31.7701	31.2983	30.6339	29.4088	28.4914	27.4742	26.9248	27.5846	28.3030	29.3914	30.6417	31.6627 (42b)

Hot water usage for other uses

	44.7861	43.1575	41.5289	39.9003	38.2718	36.6432	36.6432	38.2718	39.9003	41.5289	43.1575	44.7861 (42c)

Average daily hot water use (litres/day) 138.0198 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	150.1481	146.9417	143.0371	137.1000	132.2785	127.0951	125.1033	128.9910	133.0912	138.5329	144.5615	149.7587	(44)
Energy conte	237.7978	209.2430	219.8427	187.6830	178.0723	156.2783	151.3016	159.7179	164.1148	187.9878	205.9544	234.4859	(45)

Energy content (annual) Total = Sum(45)m = 2292.4796

Distribution loss (46)m = 0.15 x (45)m

	35.6697	31.3865	32.9764	28.1525	26.7108	23.4417	22.6952	23.9577	24.6172	28.1982	30.8932	35.1729 (46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)

If cylinder contains dedicated solar storage

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	288.1423	254.7154	270.1872	236.4034	228.4168	204.9987	201.6460	210.0623	212.8352	238.3323	254.6748	284.8304 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	288.1423	254.7154	270.1872	236.4034	228.4168	204.9987	201.6460	210.0623	212.8352	238.3323	254.6748	284.8304 (64)

Total per year (kWh/year) = Sum(64)m = 2885.2447 (64)

12Total per year (kWh/year) 2885 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	119.3433	105.9512	113.3733	101.3809	99.4846	90.9389	90.5833	93.3817	93.5445	102.7815	107.4562	118.2421 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	165.4577	183.1853	165.4577	170.9729	165.4577	170.9729	165.4577	165.4577	170.9729	165.4577	170.9729	165.4577	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	328.0384	331.4424	322.8644	304.6028	281.5509	259.8853	245.4114	242.0074	250.5854	268.8470	291.8989	313.5644	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	(71)

Water heating gains (Table 5)

	160.4077	157.6655	152.3834	140.8069	133.7159	126.3040	121.7518	125.5131	129.9229	138.1472	149.2447	158.9276	(72)
Total internal gains													
	724.0734	742.4628	710.8751	686.5523	650.8941	624.3319	599.7906	600.1478	618.6509	642.6215	682.2862	708.1194	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	10.6334	0.7600	0.7000	0.7700	32.9303 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	6.3000	46.7521	0.7600	0.7000	0.7700	108.5891 (78)
West	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.9899	597.7235	921.3214	1285.1443	1548.8949	1580.0514	1506.1366	1306.7117	1048.9083	690.2824	396.8582	271.3382	(83)
Total gains	1048.0633	1340.1864	1632.1966	1971.6965	2199.7890	2204.3833	2105.9272	1906.8595	1667.5593	1332.9039	1079.1443	979.4576	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7712	62.7965	62.8212	62.9377	62.9596	63.0615	63.0615	63.0804	63.0222	62.9596	62.9154	62.8693	
alpha	5.1847	5.1864	5.1881	5.1958	5.1973	5.2041	5.2041	5.2054	5.2015	5.1973	5.1944	5.1913	
util living area	0.9967	0.9884	0.9601	0.8631	0.6868	0.4949	0.3601	0.4144	0.6749	0.9357	0.9914	0.9977	(86)
MIT	19.7226	19.9877	20.3464	20.7285	20.9313	20.9893	20.9983	20.9966	20.9530	20.6186	20.0781	19.6669	(87)
Th 2	19.9957	19.9960	19.9964	19.9981	19.9984	19.9998	19.9998	20.0001	19.9993	19.9984	19.9978	19.9971	(88)
util rest of house	0.9957	0.9847	0.9479	0.8278	0.6266	0.4207	0.2789	0.3257	0.5926	0.9097	0.9881	0.9969	(89)
MIT 2	18.5096	18.8467	19.2940	19.7415	19.9465	19.9944	19.9993	19.9990	19.9707	19.6316	18.9650	18.4395	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.8128	19.1319	19.5571	19.9883	20.1927	20.2431	20.2491	20.2484	20.2163	19.8784	19.2433	18.7463	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6628	18.9819	19.4071	19.8383	20.0427	20.0931	20.0991	20.0984	20.0663	19.7284	19.0933	18.5963	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9935	0.9795	0.9389	0.8215	0.6294	0.4277	0.2870	0.3345	0.5985	0.9010	0.9837	0.9953	(94)
Useful gains	1041.2551	1312.7297	1532.4194	1619.7122	1384.5027	942.9187	604.3085	637.7938	997.9770	1200.8933	1061.6033	974.8185	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2494.6919	2444.9160	2240.0597	1894.8518	1444.7158	949.7117	604.9627	639.2328	1032.1613	1580.7707	2078.3498	2496.6124	(97)
Space heating kWh	1081.3570	760.8292	526.4843	198.1005	44.7985	0.0000	0.0000	0.0000	0.0000	282.6288	732.0575	1132.2146	(98a)
Space heating requirement - total per year (kWh/year)												4758.4707	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1081.3570	760.8292	526.4843	198.1005	44.7985	0.0000	0.0000	0.0000	0.0000	282.6288	732.0575	1132.2146	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4758.4707	
Space heating per m2										(98c) / (4) =		30.3087	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1081.3570	760.8292	526.4843	198.1005	44.7985	0.0000	0.0000	0.0000	0.0000	282.6288	732.0575	1132.2146	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	1208.2202	850.0885	588.2507	221.3414	50.0542	0.0000	0.0000	0.0000	0.0000	315.7864	817.9413	1265.0443	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	288.1423	254.7154	270.1872	236.4034	228.4168	204.9987	201.6460	210.0623	212.8352	238.3323	254.6748	284.8304	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	321.9467	284.5982	301.8851	264.1379	255.2143	229.0488	225.3028	234.7065	237.8047	266.2930	284.5528	318.2462	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	45.8704	36.7989	33.1333	24.2749	18.7506	15.3194	17.1050	22.2337	28.8793	37.8913	42.7981	47.1453 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	5316.7270 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3223.7371 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	370.2002 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	8996.6643 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5316.7270	0.2100	1116.5127	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3223.7371	0.2100	676.9848	(264)
Space and water heating			1793.4975	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	370.2002	0.1443	53.4313	(268)
Total CO2, kg/year			1858.8581	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.8400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5316.7270	1.1300	6007.9015	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3223.7371	1.1300	3642.8230	(278)
Space and water heating			9650.7245	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	370.2002	1.5338	567.8254	(282)
Total Primary energy kWh/year			10348.6507	(286)
Dwelling Primary energy Rate (DPER)			65.9100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.5000 (1b)	x	2.5000 (2b)	=	196.2500 (1b)	-
First floor	78.5000 (1c)	x	2.7500 (2c)	=	215.8750 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 157.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 412.1250 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0971	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3761	0.3687	0.3614	0.3245	0.3171	0.2802	0.2802	0.2729	0.2950	0.3171	0.3319	0.3466	(22b)
Effective ac	0.5707	0.5680	0.5653	0.5526	0.5503	0.5393	0.5393	0.5372	0.5435	0.5503	0.5551	0.5601	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			34.0100	1.1450	38.9427			(27)
Heatloss Floor 1			78.5000	0.1300	10.2050			(28a)
External Wall 1	180.0000	39.2100	140.7900	0.1800	25.3422			(29a)
External Roof 1	78.5000		78.5000	0.1100	8.6350			(30)
Total net area of external elements Aum(A, m2)			337.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3249			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	47.0000	0.1600	7.5200
E6 Intermediate floor within a dwelling	47.0000	0.0000	0.0000
E14 Flat roof	47.0000	0.0800	3.7600
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.1700 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 101.4949 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.6206	77.2471	76.8809	75.1611	74.8393	73.3414	73.3414	73.0640	73.9183	74.8393	75.4902	76.1708	(38)
Heat transfer coeff	179.1156	178.7420	178.3759	176.6560	176.3342	174.8363	174.8363	174.5589	175.4133	176.3342	176.9852	177.6657	(39)

Average = Sum(39)m / 12 = 176.6545

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1409	1.1385	1.1362	1.1252	1.1231	1.1136	1.1136	1.1118	1.1173	1.1231	1.1273	1.1316	(40)
HLP (average)												1.1252	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9446 (42)
Hot water usage for mixer showers

73.5918	72.4859	70.8743	67.7909	65.5154	62.9777	61.5353	63.1347	64.8879	67.6126	70.7623	73.3099	(42a)

Hot water usage for baths

31.7701	31.2983	30.6339	29.4088	28.4914	27.4742	26.9248	27.5846	28.3030	29.3914	30.6417	31.6627	(42b)

Hot water usage for other uses

44.7861	43.1575	41.5289	39.9003	38.2718	36.6432	36.6432	38.2718	39.9003	41.5289	43.1575	44.7861	(42c)

Average daily hot water use (litres/day) 138.0198 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	150.1481	146.9417	143.0371	137.1000	132.2785	127.0951	125.1033	128.9910	133.0912	138.5329	144.5615	149.7587 (44)
Energy conte	237.7978	209.2430	219.8427	187.6830	178.0723	156.2783	151.3016	159.7179	164.1148	187.9878	205.9544	234.4859 (45)
Energy content (annual)										Total = Sum(45)m =		2292.4796

Distribution loss (46)m = 0.15 x (45)m

	35.6697	31.3865	32.9764	28.1525	26.7108	23.4417	22.6952	23.9577	24.6172	28.1982	30.8932	35.1729 (46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	287.0405	253.7203	269.0854	235.3372	227.3150	203.9325	200.5443	208.9605	211.7690	237.2305	253.6086	283.7286 (62)
WWHRS	-33.6431	-29.7543	-31.1569	-25.7992	-24.0439	-20.5745	-19.2854	-20.5080	-21.2872	-25.0953	-28.4299	-33.0201 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	253.3974	223.9660	237.9284	209.5380	203.2711	183.3579	181.2589	188.4525	190.4818	212.1352	225.1787	250.7085 (64)
										Total per year (kWh/year) = Sum(64)m =		2559.6745 (64)
12Total per year (kWh/year)												2560 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

	118.4619	105.1551	112.4918	100.5280	98.6032	90.0859	89.7019	92.5003	92.6915	101.9001	106.6032	117.3607 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	165.6134	183.3577	165.6134	171.1339	165.6134	171.1339	165.6134	165.6134	171.1339	165.6134	171.1339	165.6134 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	328.0384	331.4424	322.8644	304.6028	281.5509	259.8853	245.4114	242.0074	250.5854	268.8470	291.8989	313.5644 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858 (71)

Water heating gains (Table 5)

	159.2230	156.4808	151.1987	139.6222	132.5312	125.1193	120.5671	124.3284	128.7382	136.9625	148.0600	157.7429 (72)

Total internal gains

	723.0445	741.4506	709.8462	685.5285	649.8651	623.3082	598.7616	599.1189	617.6272	641.5925	681.2624	707.0904 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1600	10.6334	0.6300	0.7000	0.7700	23.2679	(74)
East	10.7400	19.6403	0.6300	0.7000	0.7700	64.4649	(76)
South	5.3700	46.7521	0.6300	0.7000	0.7700	76.7268	(78)
West	10.7400	19.6403	0.6300	0.7000	0.7700	64.4649	(80)

Solar gains	228.9245	422.3389	650.9863	908.0559	1094.4165	1116.4311	1064.2044	923.2949	741.1365	487.7390	280.4116	191.7219 (83)
Total gains	951.9689	1163.7894	1360.8325	1593.5844	1744.2817	1739.7392	1662.9660	1522.4138	1358.7637	1129.3316	961.6740	898.8123 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8701	60.9973	61.1225	61.7176	61.8302	62.3599	62.3599	62.4590	62.1548	61.8302	61.6028	61.3668	
alpha	5.0580	5.0665	5.0748	5.1145	5.1220	5.1573	5.1573	5.1639	5.1437	5.1220	5.1069	5.0911	
util living area	0.9979	0.9939	0.9814	0.9320	0.8098	0.6179	0.4579	0.5181	0.7853	0.9662	0.9950	0.9984	(86)
MIT	19.6039	19.8224	20.1437	20.5526	20.8440	20.9698	20.9946	20.9902	20.9015	20.4904	19.9693	19.5700	(87)
Th 2	19.9676	19.9695	19.9714	19.9803	19.9820	19.9897	19.9897	19.9912	19.9867	19.9820	19.9786	19.9751	(88)
util rest of house	0.9972	0.9919	0.9750	0.9093	0.7545	0.5309	0.3553	0.4093	0.7054	0.9503	0.9929	0.9979	(89)
MIT 2	18.3379	18.6181	19.0262	19.5328	19.8549	19.9732	19.9881	19.9878	19.9214	19.4703	18.8134	18.2998	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6544	18.9192	19.3056	19.7878	20.1022	20.2224	20.2397	20.2384	20.1664	19.7253	19.1024	18.6173	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.6544	18.9192	19.3056	19.7878	20.1022	20.2224	20.2397	20.2384	20.1664	19.7253	19.1024	18.6173	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9889	0.9695	0.9041	0.7617	0.5517	0.3810	0.4365	0.7210	0.9451	0.9904	0.9969	(94)
Useful gains	948.0213	1150.8675	1319.3316	1440.8054	1328.5340	959.7977	633.5769	664.5827	979.6845	1067.3175	952.4050	895.9862	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2571.0986	2505.8178	2284.2027	1923.3941	1481.5889	982.9963	636.3556	670.0321	1064.1335	1609.1055	2124.2405	2561.4662	(97)
Space heating kWh													
	1207.5695	910.5266	717.8641	347.4639	113.8728	0.0000	0.0000	0.0000	0.0000	403.0903	843.7216	1239.1171	(98a)
Space heating requirement - total per year (kWh/year)												5783.2258	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1207.5695	910.5266	717.8641	347.4639	113.8728	0.0000	0.0000	0.0000	0.0000	403.0903	843.7216	1239.1171	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5783.2258	
Space heating per m2											(98c) / (4) =	36.8358	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1207.5695	910.5266	717.8641	347.4639	113.8728	0.0000	0.0000	0.0000	0.0000	403.0903	843.7216	1239.1171	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	1308.3093	986.4860	777.7509	376.4506	123.3725	0.0000	0.0000	0.0000	0.0000	436.7175	914.1079	1342.4887	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	253.3974	223.9660	237.9284	209.5380	203.2711	183.3579	181.2589	188.4525	190.4818	212.1352	225.1787	250.7085	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.0963	86.8659	86.3750	85.1858	82.8137	79.8000	79.8000	79.8000	79.8000	85.4760	86.7392	87.1461	(217)
Fuel for water heating, kWh/month													
	290.9394	257.8295	275.4598	245.9777	245.4560	229.7719	227.1415	236.1560	238.6990	248.1811	259.6044	287.6877	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	34.4112	27.6059	24.8561	18.2106	14.0664	11.4924	12.8319	16.6793	21.6648	28.4254	32.1064	35.3676	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.8750	-92.9822	-129.8761	-141.6969	-149.1333	-137.7636	-135.8791	-129.9186	-119.0697	-104.0504	-73.5737	-58.9890	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-47.0644	-97.8549	-192.4755	-286.2874	-375.9802	-376.9869	-372.7136	-316.8862	-233.9122	-139.1957	-62.5732	-37.3211	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	6265.6834	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3042.9040	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	277.7181	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3880.0592	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5792.2463 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6265.6834	0.2100	1315.7935	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3042.9040	0.2100	639.0098	(264)
Space and water heating			1954.8033	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	277.7181	0.1443	40.0833	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1340.8077	0.1352	-181.3274	
PV Unit electricity exported	-2539.2515	0.1262	-320.3909	
Total			-501.7182	(269)
Total CO2, kg/year			1505.0977	(272)
Target Carbon Dioxide Emission Rate (TER)			9.5900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	6265.6834	1.1300	7080.2222	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3042.9040	1.1300	3438.4815	(278)
Space and water heating			10518.7037	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	277.7181	1.5338	425.9733	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1340.8077	1.4999	-2011.0115	
PV Unit electricity exported	-2539.2515	0.4632	-1176.0849	
Total			-3187.0964	(283)
Total Primary energy kWh/year			7887.6814	(286)
Target Primary Energy Rate (TPER)			50.2400	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4BH-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4BH-BUN
Property	1 Bedroom Flat, 4BH-BUN, Saffron Walden, CB11		

SAP Rating	85 B	DER	13.74	TER	11.42
Environmental	87 B	% DER<TER	-20.32		
CO_2 Emissions (t/year)	1.36	DFEE	41.61	TFEE	42.98
Compliance Check	See BREL	% DFEE < TFEE	3.17		
% DPER < TPER	-28.36	DPER	76.63	TPER	59.70

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)
Ground floor		53.0000 (1b)	x	2.5000 (2b)	=	132.5000 (1b) -
First floor		53.0000 (1c)	x	2.7500 (2c)	=	145.7500 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.2500 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			53.0000	0.1100	5.8300			(28a)
External Wall 1	155.0000	45.1000	109.9000	0.1400	15.3860			(29a)
External Roof 1	53.0000		53.0000	0.1100	5.8300			(30)
Total net area of external elements Aum(A, m2)			261.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.9330			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 13.0500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 90.9830 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1245	47.0774	47.0312	46.8143	46.7737	46.5848	46.5848	46.5498	46.6576	46.7737	46.8558	46.9417	(38)
Heat transfer coeff	138.1075	138.0604	138.0143	137.7974	137.7568	137.5678	137.5678	137.5329	137.6406	137.7568	137.8389	137.9247	(39)

Average = Sum(39)m / 12 = 137.7972

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3029	1.3025	1.3020	1.3000	1.2996	1.2978	1.2978	1.2975	1.2985	1.2996	1.3004	1.3012	(40)
HLP (average)												1.3000	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7886 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.9748	69.9082	68.3539	65.3801	63.1855	60.7381	59.3470	60.8895	62.5804	65.2082	68.2459	70.7029	(42a)
Hot water usage for baths	30.6447	30.1896	29.5487	28.3670	27.4821	26.5010	25.9710	26.6074	27.3004	28.3502	29.5563	30.5411	(42b)
Hot water usage for other uses	43.1877	41.6172	40.0467	38.4763	36.9058	35.3354	35.3354	36.9058	38.4763	40.0467	41.6172	43.1877	(42c)

Average daily hot water use (litres/day) 133.1104 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8072	141.7150	137.9494	132.2234	127.5735	122.5745	120.6534	124.4028	128.3571	133.6052	139.4193	144.4317	(44)
Energy conte	229.3392	201.8003	212.0230	181.0072	171.7384	150.7196	145.9199	154.0367	158.2771	181.3009	198.6284	226.1451	(45)

Energy content (annual) Total = Sum(45)m = 2210.9358

Distribution loss (46)m = 0.15 x (45)m	34.4009	30.2700	31.8035	27.1511	25.7608	22.6079	21.8880	23.1055	23.7416	27.1951	29.7943	33.9218	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	279.6836	247.2727	262.3675	229.7276	222.0829	199.4401	196.2643	204.3811	206.9975	231.6454	247.3488	276.4895	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	279.6836	247.2727	262.3675	229.7276	222.0829	199.4401	196.2643	204.3811	206.9975	231.6454	247.3488	276.4895	(64)

Total per year (kWh/year) = Sum(64)m = 2803.7010 (64)
12Total per year (kWh/year) 2804 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	116.5308	103.4765	110.7732	99.1612	97.3786	89.0906	88.7939	91.4927	91.6035	100.5581	105.0203	115.4688	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.0044	148.3621	134.0044	138.4713	134.0044	138.4713	134.0044	134.0044	138.4713	134.0044	138.4713	134.0044	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	(71)
Water heating gains (Table 5)	156.6275	153.9829	148.8887	137.7239	130.8852	123.7370	119.3466	122.9741	127.2271	135.1588	145.8615	155.2000	(72)
Total internal gains	624.1391	638.6091	612.2100	590.7220	560.7466	537.5182	516.9386	517.8092	533.4763	554.7312	588.5706	610.9892	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190 (77)
Southwest	6.3000	36.7938	0.7600	0.7000	0.7700	85.4595 (79)
Northwest	12.6000	11.2829	0.7600	0.7000	0.7700	52.4128 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	343.7333	614.5206	917.8850	1266.4866	1536.4825	1577.2370	1499.0407	1289.6823	1037.3572	699.9566	416.9973	290.7449	(83)
Total gains	967.8724	1253.1297	1530.0949	1857.2086	2097.2291	2114.7552	2015.9793	1807.4915	1570.8335	1254.6878	1005.5679	901.7341	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.2998	53.3180	53.3359	53.4198	53.4356	53.5089	53.5089	53.5226	53.4807	53.4356	53.4037	53.3705	
alpha	4.5533	4.5545	4.5557	4.5613	4.5624	4.5673	4.5673	4.5682	4.5654	4.5624	4.5602	4.5580	
util living area	0.9888	0.9665	0.9106	0.7733	0.5841	0.4119	0.2994	0.3481	0.5790	0.8700	0.9742	0.9917	(86)
MIT	19.6724	20.0046	20.4017	20.7725	20.9446	20.9907	20.9983	20.9966	20.9604	20.6642	20.0783	19.5996	(87)
Th 2	19.8386	19.8389	19.8393	19.8409	19.8412	19.8425	19.8425	19.8428	19.8420	19.8412	19.8405	19.8399	(88)
util rest of house	0.9852	0.9567	0.8868	0.7258	0.5200	0.3394	0.2211	0.2615	0.4920	0.8261	0.9648	0.9890	(89)
MIT 2	18.3331	18.7485	19.2279	19.6391	19.8020	19.8381	19.8421	19.8418	19.8200	19.5424	18.8478	18.2419	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.6679	19.0626	19.5214	19.9225	20.0877	20.1263	20.1311	20.1305	20.1051	19.8228	19.1554	18.5813	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5179	18.9126	19.3714	19.7725	19.9377	19.9763	19.9811	19.9805	19.9551	19.6728	19.0054	18.4313	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9794	0.9465	0.8754	0.7227	0.5255	0.3479	0.2305	0.2719	0.5009	0.8186	0.9556	0.9842	(94)
Useful gains	947.8925	1186.0357	1339.4036	1342.2673	1102.1214	735.6249	464.6958	491.4980	786.7891	1027.1268	960.9106	887.4779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1963.5992	1934.5802	1776.4317	1498.1999	1134.7977	739.6011	465.1372	492.4416	805.8969	1249.8464	1641.0294	1962.8541	(97)
Space heating kWh	755.6858	503.0219	325.1489	112.2714	24.3112	0.0000	0.0000	0.0000	0.0000	165.7034	489.6855	800.0799	(98a)
Space heating requirement - total per year (kWh/year)												3175.9080	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	755.6858	503.0219	325.1489	112.2714	24.3112	0.0000	0.0000	0.0000	0.0000	165.7034	489.6855	800.0799	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3175.9080	
Space heating per m2											(98c) / (4) =	29.9614	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	755.6858	503.0219	325.1489	112.2714	24.3112	0.0000	0.0000	0.0000	0.0000	165.7034	489.6855	800.0799	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	844.3417	562.0356	363.2948	125.4430	27.1633	0.0000	0.0000	0.0000	0.0000	185.1434	547.1347	893.9440	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	279.6836	247.2727	262.3675	229.7276	222.0829	199.4401	196.2643	204.3811	206.9975	231.6454	247.3488	276.4895	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	312.4957	276.2823	293.1480	256.6789	248.1373	222.8381	219.2897	228.3588	231.2822	258.8216	276.3674	308.9268	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	35.8007	28.7207	25.8598	18.9460	14.6344	11.9564	13.3500	17.3528	22.5396	29.5732	33.4029	36.7957 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	3548.5006 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3132.6268 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	288.9322 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	7056.0596 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3548.5006	0.2100	745.1851	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3132.6268	0.2100	657.8516	(264)
Space and water heating			1403.0368	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	288.9322	0.1443	41.7018	(268)
Total CO2, kg/year			1456.6679	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3548.5006	1.1300	4009.8057	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3132.6268	1.1300	3539.8683	(278)
Space and water heating			7549.6740	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	288.9322	1.5338	443.1739	(282)
Total Primary energy kWh/year			8122.9486	(286)
Dwelling Primary energy Rate (DPER)			76.6300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.0000 (1b)	x	2.5000 (2b)	=	132.5000 (1b)	-
First floor	53.0000 (1c)	x	2.7500 (2c)	=	145.7500 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 106.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 278.2500 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1438 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3938 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3347 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4267	0.4184	0.4100	0.3682	0.3598	0.3180	0.3180	0.3096	0.3347	0.3598	0.3765	0.3933	(22b)
Effective ac	0.5911	0.5875	0.5840	0.5678	0.5647	0.5505	0.5505	0.5479	0.5560	0.5647	0.5709	0.5773	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			21.2800	1.1450	24.3664			(27)
Heatloss Floor 1			53.0000	0.1300	6.8900			(28a)
External Wall 1	155.0000	26.4800	128.5200	0.1800	23.1336			(29a)
External Roof 1	53.0000		53.0000	0.1100	5.8300			(30)
Total net area of external elements Aum(A, m2)			261.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4200			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	30.0000	0.1600	4.8000
E6 Intermediate floor within a dwelling	30.0000	0.0000	0.0000
E14 Flat roof	30.0000	0.0800	2.4000
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0900 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 74.5100 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2717	53.9471	53.6289	52.1342	51.8545	50.5527	50.5527	50.3117	51.0542	51.8545	52.4203	53.0117	(38)
Heat transfer coeff	128.7817	128.4571	128.1389	126.6442	126.3646	125.0628	125.0628	124.8217	125.5642	126.3646	126.9303	127.5217	(39)

Average = Sum(39)m / 12 = 126.6429

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2149	1.2119	1.2089	1.1948	1.1921	1.1798	1.1798	1.1776	1.1846	1.1921	1.1975	1.2030	(40)
HLP (average)												1.1947	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7886 (42)
Hot water usage for mixer showers

70.9748	69.9082	68.3539	65.3801	63.1855	60.7381	59.3470	60.8895	62.5804	65.2082	68.2459	70.7029	(42a)

Hot water usage for baths

30.6447	30.1896	29.5487	28.3670	27.4821	26.5010	25.9710	26.6074	27.3004	28.3502	29.5563	30.5411	(42b)

Hot water usage for other uses

43.1877	41.6172	40.0467	38.4763	36.9058	35.3354	35.3354	36.9058	38.4763	40.0467	41.6172	43.1877	(42c)

Average daily hot water use (litres/day) 133.1104 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	144.8072	141.7150	137.9494	132.2234	127.5735	122.5745	120.6534	124.4028	128.3571	133.6052	139.4193	144.4317 (44)
Energy conte	229.3392	201.8003	212.0230	181.0072	171.7384	150.7196	145.9199	154.0367	158.2771	181.3009	198.6284	226.1451 (45)
Energy content (annual)										Total = Sum(45)m =		2210.9358

Distribution loss (46)m = 0.15 x (45)m

	34.4009	30.2700	31.8035	27.1511	25.7608	22.6079	21.8880	23.1055	23.7416	27.1951	29.7943	33.9218 (46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	278.5819	246.2775	261.2657	228.6614	220.9811	198.3738	195.1625	203.2793	205.9313	230.5436	246.2826	275.3877 (62)
WWHRS	-32.4467	-28.6961	-30.0489	-24.8817	-23.1889	-19.8429	-18.5995	-19.7787	-20.5302	-24.2029	-27.4189	-31.8459 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	246.1351	217.5814	231.2168	203.7797	197.7923	178.5310	176.5630	183.5006	185.4011	206.3408	218.8637	243.5419 (64)
										Total per year (kWh/year) = Sum(64)m =		2489.2472 (64)
12Total per year (kWh/year)												2489 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)

Heat gains from water heating, kWh/month

	115.6494	102.6804	109.8918	98.3083	96.4972	88.2376	87.9125	90.6113	90.7505	99.6767	104.1673	114.5874 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	134.8960	149.3491	134.8960	139.3925	134.8960	139.3925	134.8960	134.8960	139.3925	134.8960	139.3925	134.8960 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425 (71)

Water heating gains (Table 5)

	155.4428	152.7982	147.7040	136.5392	129.7005	122.5523	118.1619	121.7894	126.0424	133.9741	144.6768	154.0153 (72)

Total internal gains

	623.8460	638.4115	611.9168	590.4585	560.4534	537.2548	516.6455	517.5160	533.2128	554.4381	588.3071	610.6960 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.4800	11.2829	0.6300	0.7000	0.7700	15.4480	(75)
Southeast	6.7200	36.7938	0.6300	0.7000	0.7700	75.5642	(77)
Southwest	3.3600	36.7938	0.6300	0.7000	0.7700	37.7821	(79)
Northwest	6.7200	11.2829	0.6300	0.7000	0.7700	23.1720	(81)

Solar gains	151.9663	271.6828	405.8018	559.9204	679.2870	697.3048	662.7338	570.1754	458.6211	309.4545	184.3567	128.5399 (83)
Total gains	775.8123	910.0943	1017.7186	1150.3789	1239.7404	1234.5596	1179.3793	1087.6914	991.8339	863.8925	772.6638	739.2359 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1596	57.3040	57.4464	58.1243	58.2530	58.8593	58.8593	58.9730	58.6243	58.2530	57.9933	57.7244	
alpha	4.8106	4.8203	4.8298	4.8750	4.8835	4.9240	4.9240	4.9315	4.9083	4.8835	4.8662	4.8483	
util living area													
	0.9953	0.9892	0.9745	0.9244	0.8071	0.6191	0.4607	0.5170	0.7701	0.9517	0.9898	0.9962	(86)
MIT	19.6222	19.8321	20.1333	20.5295	20.8248	20.9637	20.9930	20.9880	20.8969	20.5062	19.9978	19.5918	(87)
Th 2	19.9081	19.9105	19.9129	19.9242	19.9263	19.9362	19.9362	19.9380	19.9324	19.9263	19.9220	19.9176	(88)
util rest of house													
	0.9937	0.9857	0.9659	0.8992	0.7497	0.5282	0.3524	0.4032	0.6861	0.9302	0.9858	0.9950	(89)
MIT 2	18.3189	18.5873	18.9684	19.4586	19.7846	19.9165	19.9341	19.9340	19.8655	19.4435	18.8081	18.2868	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6447	18.8985	19.2596	19.7263	20.0446	20.1783	20.1988	20.1975	20.1233	19.7092	19.1056	18.6131	(92)
Temperature adjustment												0.0000	

adjusted MIT	18.6447	18.8985	19.2596	19.7263	20.0446	20.1783	20.1988	20.1975	20.1233	19.7092	19.1056	18.6131	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9910	0.9811	0.9592	0.8937	0.7567	0.5498	0.3796	0.4317	0.7026	0.9247	0.9816	0.9927	(94)
Useful gains	768.8391	892.8981	976.1776	1028.0508	938.0713	678.7370	447.6446	469.5293	696.8639	798.7993	758.4198	733.8696	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1847.3369	1798.2076	1635.0024	1371.0877	1054.4631	697.6385	450.0766	474.0116	756.3146	1151.0755	1523.8699	1837.9789	(97)
Space heating kWh	802.4024	608.3680	490.1657	246.9865	86.5954	0.0000	0.0000	0.0000	0.0000	262.0935	551.1241	821.4573	(98a)
Space heating requirement - total per year (kWh/year)												3869.1929	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	802.4024	608.3680	490.1657	246.9865	86.5954	0.0000	0.0000	0.0000	0.0000	262.0935	551.1241	821.4573	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3869.1929	
Space heating per m2											(98c) / (4) =	36.5018	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	802.4024	608.3680	490.1657	246.9865	86.5954	0.0000	0.0000	0.0000	0.0000	262.0935	551.1241	821.4573	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	869.3417	659.1202	531.0571	267.5911	93.8196	0.0000	0.0000	0.0000	0.0000	283.9582	597.1008	889.9863	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	246.1351	217.5814	231.2168	203.7797	197.7923	178.5310	176.5630	183.5006	185.4011	206.3408	218.8637	243.5419	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.5097	86.2378	85.7020	84.4921	82.3412	79.8000	79.8000	79.8000	79.8000	84.5973	86.0417	86.5674	(217)
Fuel for water heating, kWh/month	284.5174	252.3038	269.7916	241.1820	240.2107	223.7230	221.2569	229.9506	232.3322	243.9095	254.3693	281.3322	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	28.0287	22.4857	20.2459	14.8330	11.4574	9.3608	10.4518	13.5857	17.6465	23.1531	26.1514	28.8077	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.1814	-67.2212	-95.6234	-106.3444	-113.6598	-105.6765	-104.3026	-98.9133	-89.3200	-76.2412	-52.6910	-41.7333	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-29.4210	-61.6242	-122.0153	-182.6131	-240.8754	-241.8621	-239.0785	-202.7511	-148.9990	-87.9887	-39.2299	-23.2914	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4191.9750	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2974.8792	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												226.2078	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2619.6578	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4859.4042 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4191.9750	0.2100	880.3147	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2974.8792	0.2100	624.7246	(264)
Space and water heating			1505.0394	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	226.2078	0.1443	32.6488	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-999.9081	0.1348	-134.8115	
PV Unit electricity exported	-1619.7497	0.1260	-204.0796	
Total			-338.8910	(269)
Total CO2, kg/year			1210.7264	(272)
Target Carbon Dioxide Emission Rate (TER)			11.4200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4191.9750	1.1300	4736.9317	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2974.8792	1.1300	3361.6135	(278)
Space and water heating			8098.5452	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	226.2078	1.5338	346.9651	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-999.9081	1.4983	-1498.1617	
PV Unit electricity exported	-1619.7497	0.4625	-749.1189	
Total			-2247.2807	(283)
Total Primary energy kWh/year			6328.3305	(286)
Target Primary Energy Rate (TPER)			59.7000	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3B2_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3B2
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	86 B	DER	12.75	TER	10.62
Environmental	89 B	% DER<TER	-20.06		
CO_2 Emissions (t/year)	1.11	DFEE	32.73	TFEE	36.52
Compliance Check	See BREL	% DFEE < TFEE	10.38		
% DPER < TPER	-29.12	DPER	71.44	TPER	55.33

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor		46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			46.5000	0.1100	5.1150			(28a)
External Wall 1	102.0000	30.4000	71.6000	0.1400	10.0240			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			195.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.3090			(33)

Party Wall 1						49.0000	0.0000	0.0000				(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K											250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)											9.7500	(36)
Point Thermal bridges										(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =	64.0590	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.3451	41.3038	41.2633	41.0729	41.0373	40.8716	40.8716	40.8409	40.9354	41.0373	41.1094	41.1847	(38)
Heat transfer coeff	105.4041	105.3627	105.3222	105.1319	105.0963	104.9306	104.9306	104.8999	104.9944	105.0963	105.1683	105.2436	(39)
Average = Sum(39)m / 12 =												105.1317	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1334	1.1329	1.1325	1.1305	1.1301	1.1283	1.1283	1.1280	1.1290	1.1301	1.1308	1.1317	(40)
HLP (average)												1.1304	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.6646	(42)
Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)
Average daily hot water use (litres/day)												129.2112	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
										Total per year (kWh/year) = Sum(64)m =		2738.9369	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	114.2971	101.5110	108.7082	97.3983	95.7059	87.6227	87.3727	89.9924	90.0619	98.7922	103.0856	113.2661	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.0287	32.8885	26.7467	20.2490	15.1364	12.7788	13.8079	17.9480	24.0898	30.5875	35.7002	38.0578	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	153.6251	151.0581	146.1132	135.2754	128.6370	121.6982	117.4364	120.9576	125.0859	132.7853	143.1745	152.2394	(72)
Total internal gains	665.5083	662.5877	641.9589	604.3092	566.9152	530.5180	511.1845	515.0592	534.8715	572.3827	613.5276	649.0509	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	6.3000	11.2829	0.7600	0.7000	0.7700	26.2064 (75)
Southeast	10.5000	36.7938	0.7600	0.7000	0.7700	142.4325 (77)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	282.5850	490.0515	693.6311	898.1973	1041.4295	1049.4581	1005.3143	896.0780	764.1003	547.8454	340.0569	240.8081	(83)
Total gains	948.0933	1152.6392	1335.5900	1502.5066	1608.3447	1579.9760	1516.4988	1411.1371	1298.9718	1120.2281	953.5845	889.8590	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2721	61.2962	61.3198	61.4308	61.4516	61.5486	61.5486	61.5667	61.5112	61.4516	61.4095	61.3655	
alpha	5.0848	5.0864	5.0880	5.0954	5.0968	5.1032	5.1032	5.1044	5.1007	5.0968	5.0940	5.0910	
util living area	0.9797	0.9504	0.8863	0.7594	0.5879	0.4219	0.3040	0.3410	0.5448	0.8255	0.9574	0.9847	(86)
MIT	20.0388	20.3052	20.6029	20.8484	20.9632	20.9943	20.9991	20.9985	20.9806	20.8054	20.3651	19.9686	(87)
Th 2	19.9737	19.9740	19.9744	19.9760	19.9764	19.9778	19.9778	19.9781	19.9772	19.9764	19.9757	19.9751	(88)
util rest of house	0.9738	0.9374	0.8600	0.7147	0.5297	0.3560	0.2336	0.2658	0.4694	0.7781	0.9438	0.9802	(89)
MIT 2	18.8924	19.2207	19.5730	19.8415	19.9499	19.9750	19.9776	19.9776	19.9663	19.8075	19.3017	18.8056	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.1790	19.4918	19.8305	20.0932	20.2032	20.2298	20.2330	20.2328	20.2199	20.0570	19.5675	19.0964	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0290	19.3418	19.6805	19.9432	20.0532	20.0798	20.0830	20.0828	20.0699	19.9070	19.4175	18.9464	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9666	0.9276	0.8515	0.7131	0.5342	0.3626	0.2409	0.2735	0.4764	0.7745	0.9344	0.9740	(94)
Useful gains	916.4527	1069.1845	1137.1883	1071.4762	859.2070	572.8915	365.2735	385.9493	618.8271	867.6713	891.0751	866.7117	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1552.4975	1521.6282	1388.1943	1160.9933	877.8918	574.9994	365.4682	386.3263	626.8055	978.1293	1295.4159	1551.9601	(97)
Space heating kWh	473.2173	304.0422	186.7485	64.4523	13.9015	0.0000	0.0000	0.0000	0.0000	82.1807	291.1253	509.8248	(98a)
Space heating requirement - total per year (kWh/year)												1925.4926	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	473.2173	304.0422	186.7485	64.4523	13.9015	0.0000	0.0000	0.0000	0.0000	82.1807	291.1253	509.8248	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1925.4926	
Space heating per m2										(98c) / (4) =		20.7042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	473.2173	304.0422	186.7485	64.4523	13.9015	0.0000	0.0000	0.0000	0.0000	82.1807	291.1253	509.8248	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	528.7344	339.7119	208.6575	72.0138	15.5324	0.0000	0.0000	0.0000	0.0000	91.8220	325.2797	569.6367	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	304.9894	269.6776	286.2088	250.7548	242.5166	217.9053	214.5140	223.3173	226.1018	252.8877	269.8663	301.5251	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	32.4110	26.0013	23.4113	17.1521	13.2488	10.8244	12.0860	15.7098	20.4055	26.7731	30.2402	33.3118 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2151.3884 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3060.2647 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	261.5750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5559.2282 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2151.3884	3.6400	78.3105	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3060.2647	3.6400	111.3936	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	261.5750	16.4900	43.1337	(250)
Additional standing charges			92.0000	(251)
Total energy cost			339.0193	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8844 (257)
SAP value		85.6639
SAP rating (Section 12)		86 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2151.3884	0.2100	451.7916	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3060.2647	0.2100	642.6556	(264)
Space and water heating			1094.4472	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	261.5750	0.1443	37.7534	(268)
Total CO2, kg/year			1144.1298	(272)
CO2 emissions per m2			12.3000	(273)
EI value			88.8903	
EI rating			89	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor	46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.8000	3.7000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9250	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000	(22a)
Adj infilt rate	0.1403	0.1371	0.1371	0.1211	0.1179	0.1052	0.1052	0.1084	0.1084	0.1179	0.1211	0.1275	(22b)
Effective ac	0.5098	0.5094	0.5094	0.5073	0.5070	0.5055	0.5055	0.5059	0.5059	0.5070	0.5073	0.5081	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			46.5000	0.1100	5.1150			(28a)
External Wall 1	102.0000	30.4000	71.6000	0.1400	10.0240			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			195.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.3090			(33)
Party Wall 1			49.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		9.7500 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.0590 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.0729	41.0373	41.0373	40.8716	40.8409	40.7263	40.7263	40.7537	40.7537	40.8409	40.8716	40.9354	(38)
Heat transfer coeff	105.1319	105.0963	105.0963	104.9306	104.8999	104.7853	104.7853	104.8127	104.8127	104.8999	104.9306	104.9944	(39)
Average = Sum(39)m / 12 =												104.9313	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1305	1.1301	1.1301	1.1283	1.1280	1.1267	1.1267	1.1270	1.1270	1.1280	1.1283	1.1290	(40)
HLP (average)												1.1283	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6646 (42)

Hot water usage for mixer showers
68.8963 67.8609 66.3522 63.4655 61.3351 58.9594 57.6091 59.1064 60.7477 63.2985 66.2473 68.6323 (42a)
Hot water usage for baths
29.7509 29.3090 28.6868 27.5396 26.6806 25.7280 25.2135 25.8314 26.5041 27.5233 28.6942 29.6503 (42b)
Hot water usage for other uses
41.9181 40.3938 38.8695 37.3453 35.8210 34.2967 34.2967 35.8210 37.3453 38.8695 40.3938 41.9181 (42c)
Average daily hot water use (litres/day) 129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)

Energy content (annual) Total = Sum(45)m = 2146.1718
Distribution loss (46)m = 0.15 x (45)m
33.3932 29.3834 30.8719 26.3558 25.0062 21.9457 21.2468 22.4287 23.0461 26.3985 28.9215 32.9281 (46)
Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss
27.0820 24.4612 27.0820 26.2084 27.0820 26.2084 27.0820 27.0820 26.2084 27.0820 26.2084 27.0820 (56)
If cylinder contains dedicated solar storage
27.0820 24.4612 27.0820 26.2084 27.0820 26.2084 27.0820 27.0820 26.2084 27.0820 26.2084 27.0820 (57)

Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h
272.9656 241.3614 256.1569 224.4256 217.0524 195.0253 191.9900 199.8689 202.3611 226.3345 241.5304 269.8650 (64)
Total per year (kWh/year) = Sum(64)m = 2738.9369 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month
114.2971 101.5110 108.7082 97.3983 95.7059 87.6227 87.3727 89.9924 90.0619 98.7922 103.0856 113.2661 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
37.0287 32.8885 26.7467 20.2490 15.1364 12.7788 13.8079 17.9480 24.0898 30.5875 35.7002 38.0578 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
364.9104 368.6970 359.1549 338.8407 313.1977 289.0969 272.9961 269.2094 278.7516 299.0658 324.7088 348.8096 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
53.6522 53.6522 53.6522 53.6522 53.6522 53.6522 53.6522 53.6522 53.6522 53.6522 53.6522 53.6522 (69)

Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)
-106.5839 -106.5839 -106.5839 -106.5839 -106.5839 -106.5839 -106.5839 -106.5839 -106.5839 -106.5839 -106.5839 -106.5839 (71)
Water heating gains (Table 5)
153.6251 151.0581 146.1132 135.2754 128.6370 121.6982 117.4364 120.9576 125.0859 132.7853 143.1745 152.2394 (72)
Total internal gains
665.5083 662.5877 641.9589 604.3092 566.9152 530.5180 511.1845 515.0592 534.8715 572.3827 613.5276 649.0509 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.3000	12.9418	0.7600	0.7000	0.7700	30.0594	(75)
Southeast	10.5000	40.8799	0.7600	0.7000	0.7700	158.2500	(77)
Southwest	8.4000	40.8799	0.7600	0.7000	0.7700	126.6000	(79)

Solar gains	314.9095	509.2167	702.7220	945.5521	1060.5974	1127.7543	1068.1113	960.1580	816.8237	595.1941	388.2660	265.7491	(83)
Total gains	980.4177	1171.8045	1344.6809	1549.8613	1627.5125	1658.2723	1579.2958	1475.2172	1351.6952	1167.5769	1001.7936	914.8000	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4308	61.4516	61.4516	61.5486	61.5667	61.6340	61.6340	61.6179	61.6179	61.5667	61.5486	61.5112	
alpha	5.0954	5.0968	5.0968	5.1032	5.1044	5.1089	5.1089	5.1079	5.1079	5.1044	5.1032	5.1007	
util living area													
	0.9761	0.9471	0.8763	0.7261	0.5532	0.3589	0.2387	0.2627	0.4820	0.7836	0.9461	0.9824	(86)

MIT	20.0882	20.3264	20.6367	20.8815	20.9736	20.9976	20.9998	20.9996	20.9898	20.8570	20.4332	20.0110 (87)
Th 2	19.9760	19.9764	19.9764	19.9778	19.9781	19.9791	19.9791	19.9788	19.9788	19.9781	19.9778	19.9772 (88)
util rest of house												
	0.9693	0.9335	0.8480	0.6785	0.4939	0.2953	0.1711	0.1903	0.4068	0.7296	0.9294	0.9772 (89)
MIT 2	18.9559	19.2480	19.6134	19.8757	19.9600	19.9781	19.9790	19.9788	19.9737	19.8602	19.3850	18.8605 (90)
Living area fraction										fLA = Living area / (4) =		0.2500 (91)
MIT	19.2390	19.5176	19.8692	20.1271	20.2134	20.2329	20.2342	20.2340	20.2278	20.1094	19.6470	19.1481 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0890	19.3676	19.7192	19.9771	20.0634	20.0829	20.0842	20.0840	20.0778	19.9594	19.4970	18.9981 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9615	0.9236	0.8400	0.6785	0.4989	0.3018	0.1781	0.1978	0.4142	0.7286	0.9198	0.9705	(94)
Useful gains	942.6965	1082.2751	1129.5308	1051.6059	811.9934	500.4069	281.2320	291.7368	559.8686	850.6482	921.4132	887.8219	(95)
Ext temp.	4.4000	4.9000	6.8000	9.3000	12.2000	15.3000	17.4000	17.3000	14.7000	11.1000	7.3000	4.3000	(96)
Heat loss rate W													
	1544.2797	1520.4948	1357.7645	1120.3578	824.8691	501.1815	281.2663	291.7963	563.6572	929.3458	1279.8432	1543.2232	(97)
Space heating kWh													
	447.5779	294.4836	169.8058	49.5014	9.5796	0.0000	0.0000	0.0000	0.0000	58.5510	258.0696	487.6185	(98a)
Space heating requirement - total per year (kWh/year)												1775.1875	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	447.5779	294.4836	169.8058	49.5014	9.5796	0.0000	0.0000	0.0000	0.0000	58.5510	258.0696	487.6185	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1775.1875	
Space heating per m2											(98c) / (4) =	19.0880	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	89.5000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	447.5779	294.4836	169.8058	49.5014	9.5796	0.0000	0.0000	0.0000	0.0000	58.5510	258.0696	487.6185	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	500.0871	329.0320	189.7272	55.3088	10.7034	0.0000	0.0000	0.0000	0.0000	65.4201	288.3460	544.8252	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month													
	304.9894	269.6776	286.2088	250.7548	242.5166	217.9053	214.5140	223.3173	226.1018	252.8877	269.8663	301.5251	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	32.4110	26.0013	23.4113	17.1521	13.2488	10.8244	12.0860	15.7098	20.4055	26.7731	30.2402	33.3118	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1983.4497	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	89.5000	
Water heating fuel used	3060.2647	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	261.5750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5391.2894 (238)

10a. Fuel costs - using BEDF prices (508)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1983.4497	3.5400	70.2141	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3060.2647	3.5400	108.3334	(247)
Energy for instantaneous electric shower(s)	0.0000	17.6200	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	17.6200	15.1532	(249)
Energy for lighting	261.5750	17.6200	46.0895	(250)
Additional standing charges			94.0000	(251)
Total energy cost			333.7902	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1983.4497	0.2100	416.5244	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3060.2647	0.2100	642.6556	(264)
Space and water heating			1059.1800	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	261.5750	0.1443	37.7534	(268)
Total CO2, kg/year			1108.8626	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1983.4497	1.1300	2241.2981	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3060.2647	1.1300	3458.0991	(278)
Space and water heating			5699.3973	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	261.5750	1.5338	401.2125	(282)
Total Primary energy kWh/year			6230.7106	(286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 89

N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 5.4	-£ 141	-108 kg (9.7%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.7	-£ 18	-177 kg (16.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£141	1.16 kg/m²	B 91	B 90
Total Savings	£141	1.16 kg/m²		

Potential energy efficiency rating:	B 91
Potential environmental impact rating:	B 90

Fuel prices for cost data on this page from database revision number 508 TEST (28 Oct 2022)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, East Anglia):

	Current	Potential	Saving
Electricity	£61	£61	£0
Mains gas	£273	£273	£0
Space heating	£179	£179	£0
Water heating	£108	£108	£0
Lighting	£46	£46	£0
Generated (PV)	-£0	-£141	£141
Total cost of fuels	£334	£193	£141
Total cost of uses	£333	£192	£141
Delivered energy	58 kWh/m²	49 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.0 tonnes	0.1 tonnes
CO2 emissions per m²	12 kg/m²	11 kg/m²	1 kg/m²
Primary energy	67 kWh/m²	54 kWh/m²	13 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor	46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80	=	0.0000 (6a)
Number of open flues	0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20	=	0.0000 (6d)
Number of flues attached to other heater	0 * 35	=	0.0000 (6e)
Number of blocked chimneys	0 * 20	=	0.0000 (6f)
Number of intermittent extract fans	0 * 10	=	0.0000 (7a)
Number of passive vents	0 * 10	=	0.0000 (7b)
Number of flueless gas fires	0 * 40	=	0.0000 (7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5)	=	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			46.5000	0.1100	5.1150			(28a)
External Wall 1	102.0000	30.4000	71.6000	0.1400	10.0240			(29a)

External Roof 1	46.5000	46.5000	0.1100	5.1150		(30)
Total net area of external elements Aum(A, m2)		195.0000				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		54.3090		(33)
Party Wall 1		49.0000	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)	9.7500 (36)
Point Thermal bridges (36a) =	0.0000
Total fabric heat loss (33) + (36) + (36a) =	64.0590 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.3451	41.3038	41.2633	41.0729	41.0373	40.8716	40.8716	40.8409	40.9354	41.0373	41.1094	41.1847	(38)
Heat transfer coeff	105.4041	105.3627	105.3222	105.1319	105.0963	104.9306	104.9306	104.8999	104.9944	105.0963	105.1683	105.2436	(39)

Average = Sum(39)m / 12 = 105.1317

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1334	1.1329	1.1325	1.1305	1.1301	1.1283	1.1283	1.1280	1.1290	1.1301	1.1308	1.1317	(40)
HLP (average)												1.1304	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6646 (42)

Hot water usage for mixer showers

68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)

Hot water usage for baths

29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)

Hot water usage for other uses

41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)

Average daily hot water use (litres/day) 129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)

Energy content (annual) Total = Sum(45)m = 2146.1718

Distribution loss (46)m = 0.15 x (45)m

33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)

Volume factor from Table 2a 0.8736 (52)

Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)

Total per year (kWh/year) = Sum(64)m = 2738.9369 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

114.2971	101.5110	108.7082	97.3983	95.7059	87.6227	87.3727	89.9924	90.0619	98.7922	103.0856	113.2661	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.0287	32.8885	26.7467	20.2490	15.1364	12.7788	13.8079	17.9480	24.0898	30.5875	35.7002	38.0578	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	153.6251	151.0581	146.1132	135.2754	128.6370	121.6982	117.4364	120.9576	125.0859	132.7853	143.1745	152.2394	(72)
Total internal gains	665.5083	662.5877	641.9589	604.3092	566.9152	530.5180	511.1845	515.0592	534.8715	572.3827	613.5276	649.0509	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.3000	11.2829	0.7600	0.7000	0.7700	26.2064	(75)
Southeast	10.5000	36.7938	0.7600	0.7000	0.7700	142.4325	(77)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	282.5850	490.0515	693.6311	898.1973	1041.4295	1049.4581	1005.3143	896.0780	764.1003	547.8454	340.0569	240.8081	(83)
Total gains	948.0933	1152.6392	1335.5900	1502.5066	1608.3447	1579.9760	1516.4988	1411.1371	1298.9718	1120.2281	953.5845	889.8590	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2721	61.2962	61.3198	61.4308	61.4516	61.5486	61.5486	61.5667	61.5112	61.4516	61.4095	61.3655	
alpha	5.0848	5.0864	5.0880	5.0954	5.0968	5.1032	5.1032	5.1044	5.1007	5.0968	5.0940	5.0910	
util living area	0.9797	0.9504	0.8863	0.7594	0.5879	0.4219	0.3040	0.3410	0.5448	0.8255	0.9574	0.9847	(86)
MIT	20.0388	20.3052	20.6029	20.8484	20.9632	20.9943	20.9991	20.9985	20.9806	20.8054	20.3651	19.9686	(87)
Th 2	19.9737	19.9740	19.9744	19.9760	19.9764	19.9778	19.9778	19.9781	19.9772	19.9764	19.9757	19.9751	(88)
util rest of house	0.9738	0.9374	0.8600	0.7147	0.5297	0.3560	0.2336	0.2658	0.4694	0.7781	0.9438	0.9802	(89)
MIT 2	18.8924	19.2207	19.5730	19.8415	19.9499	19.9750	19.9776	19.9776	19.9663	19.8075	19.3017	18.8056	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	19.1790	19.4918	19.8305	20.0932	20.2032	20.2298	20.2330	20.2328	20.2199	20.0570	19.5675	19.0964	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0290	19.3418	19.6805	19.9432	20.0532	20.0798	20.0830	20.0828	20.0699	19.9070	19.4175	18.9464	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9666	0.9276	0.8515	0.7131	0.5342	0.3626	0.2409	0.2735	0.4764	0.7745	0.9344	0.9740	(94)
Useful gains	916.4527	1069.1845	1137.1883	1071.4762	859.2070	572.8915	365.2735	385.9493	618.8271	867.6713	891.0751	866.7117	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1552.4975	1521.6282	1388.1943	1160.9933	877.8918	574.9994	365.4682	386.3263	626.8055	978.1293	1295.4159	1551.9601	(97)
Space heating kWh	473.2173	304.0422	186.7485	64.4523	13.9015	0.0000	0.0000	0.0000	0.0000	82.1807	291.1253	509.8248	(98a)
Space heating requirement - total per year (kWh/year)												1925.4926	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	473.2173	304.0422	186.7485	64.4523	13.9015	0.0000	0.0000	0.0000	0.0000	82.1807	291.1253	509.8248	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1925.4926	
Space heating per m2										(98c) / (4) =		20.7042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	89.5000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	473.2173	304.0422	186.7485	64.4523	13.9015	0.0000	0.0000	0.0000	0.0000	82.1807	291.1253	509.8248	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	528.7344	339.7119	208.6575	72.0138	15.5324	0.0000	0.0000	0.0000	0.0000	91.8220	325.2797	569.6367	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	304.9894	269.6776	286.2088	250.7548	242.5166	217.9053	214.5140	223.3173	226.1018	252.8877	269.8663	301.5251	(219)

Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	32.4110	26.0013	23.4113	17.1521	13.2488	10.8244	12.0860	15.7098	20.4055	26.7731	30.2402	33.3118 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-33.8298	-48.8201	-71.8697	-82.7129	-90.6651	-85.1206	-84.0417	-78.6196	-69.2069	-56.6742	-37.5782	-29.1084 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2151.3884 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3060.2647 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	261.5750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-768.2474 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4790.9808 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2151.3884	3.6400	78.3105	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3060.2647	3.6400	111.3936	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	261.5750	16.4900	43.1337	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-768.2474	16.4900	-126.6840	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-126.6840	(252)
Total energy cost			212.3353	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5539 (257)
SAP value		91.0210
SAP rating (Section 12)		91 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2151.3884	0.2100	451.7916	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3060.2647	0.2100	642.6556	(264)
Space and water heating			1094.4472	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	261.5750	0.1443	37.7534	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-768.2474	0.1341	-103.0357	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-103.0357	(269)

Total CO2, kg/year	1041.0941 (272)
CO2 emissions per m2	11.1900 (273)
EI value	89.8908
EI rating	90 (274)
EI band	B

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor	46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.8000	3.7000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9250	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000	(22a)
Adj infilt rate	0.1403	0.1371	0.1371	0.1211	0.1179	0.1052	0.1052	0.1084	0.1084	0.1179	0.1211	0.1275	(22b)
Effective ac	0.5098	0.5094	0.5094	0.5073	0.5070	0.5055	0.5055	0.5059	0.5059	0.5070	0.5073	0.5081	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			46.5000	0.1100	5.1150			(28a)
External Wall 1	102.0000	30.4000	71.6000	0.1400	10.0240			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			195.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.3090			(33)
Party Wall 1			49.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	9.7500	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 64.0590	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.0729	41.0373	41.0373	40.8716	40.8409	40.7263	40.7263	40.7537	40.7537	40.8409	40.8716	40.9354	(38)
Heat transfer coeff	105.1319	105.0963	105.0963	104.9306	104.8999	104.7853	104.7853	104.8127	104.8127	104.8999	104.9306	104.9944	(39)
Average = Sum(39)m / 12 =												104.9313	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1305	1.1301	1.1301	1.1283	1.1280	1.1267	1.1267	1.1270	1.1270	1.1280	1.1283	1.1290	(40)
HLP (average)												1.1283	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6646 (42)
Hot water usage for mixer showers												
	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323 (42a)
Hot water usage for baths												
	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)
Hot water usage for other uses												
	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)
Average daily hot water use (litres/day)												129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m													
	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
										Total per year (kWh/year) = Sum(64)m =		2738.9369	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	114.2971	101.5110	108.7082	97.3983	95.7059	87.6227	87.3727	89.9924	90.0619	98.7922	103.0856	113.2661	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	37.0287	32.8885	26.7467	20.2490	15.1364	12.7788	13.8079	17.9480	24.0898	30.5875	35.7002	38.0578	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	153.6251	151.0581	146.1132	135.2754	128.6370	121.6982	117.4364	120.9576	125.0859	132.7853	143.1745	152.2394	(72)
Total internal gains													
	665.5083	662.5877	641.9589	604.3092	566.9152	530.5180	511.1845	515.0592	534.8715	572.3827	613.5276	649.0509	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.3000	12.9418	0.7600	0.7000	0.7700	30.0594	(75)
Southeast	10.5000	40.8799	0.7600	0.7000	0.7700	158.2500	(77)
Southwest	8.4000	40.8799	0.7600	0.7000	0.7700	126.6000	(79)

Solar gains	314.9095	509.2167	702.7220	945.5521	1060.5974	1127.7543	1068.1113	960.1580	816.8237	595.1941	388.2660	265.7491	(83)
Total gains	980.4177	1171.8045	1344.6809	1549.8613	1627.5125	1658.2723	1579.2958	1475.2172	1351.6952	1167.5769	1001.7936	914.8000	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4308	61.4516	61.4516	61.5486	61.5667	61.6340	61.6340	61.6179	61.6179	61.5667	61.5486	61.5112	
alpha	5.0954	5.0968	5.0968	5.1032	5.1044	5.1089	5.1089	5.1079	5.1079	5.1044	5.1032	5.1007	
util living area	0.9761	0.9471	0.8763	0.7261	0.5532	0.3589	0.2387	0.2627	0.4820	0.7836	0.9461	0.9824	(86)
MIT	20.0882	20.3264	20.6367	20.8815	20.9736	20.9976	20.9998	20.9996	20.9898	20.8570	20.4332	20.0110	(87)
Th 2	19.9760	19.9764	19.9764	19.9778	19.9781	19.9791	19.9791	19.9788	19.9788	19.9781	19.9778	19.9772	(88)
util rest of house	0.9693	0.9335	0.8480	0.6785	0.4939	0.2953	0.1711	0.1903	0.4068	0.7296	0.9294	0.9772	(89)
MIT 2	18.9559	19.2480	19.6134	19.8757	19.9600	19.9781	19.9790	19.9788	19.9737	19.8602	19.3850	18.8605	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.2390	19.5176	19.8692	20.1271	20.2134	20.2329	20.2342	20.2340	20.2278	20.1094	19.6470	19.1481	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0890	19.3676	19.7192	19.9771	20.0634	20.0829	20.0842	20.0840	20.0778	19.9594	19.4970	18.9981	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9615	0.9236	0.8400	0.6785	0.4989	0.3018	0.1781	0.1978	0.4142	0.7286	0.9198	0.9705	(94)
Useful gains	942.6965	1082.2751	1129.5308	1051.6059	811.9934	500.4069	281.2320	291.7368	559.8686	850.6482	921.4132	887.8219	(95)
Ext temp.	4.4000	4.9000	6.8000	9.3000	12.2000	15.3000	17.4000	17.3000	14.7000	11.1000	7.3000	4.3000	(96)
Heat loss rate W	1544.2797	1520.4948	1357.7645	1120.3578	824.8691	501.1815	281.2663	291.7963	563.6572	929.3458	1279.8432	1543.2232	(97)
Space heating kWh	447.5779	294.4836	169.8058	49.5014	9.5796	0.0000	0.0000	0.0000	0.0000	58.5510	258.0696	487.6185	(98a)
Space heating requirement - total per year (kWh/year)												1775.1875	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	447.5779	294.4836	169.8058	49.5014	9.5796	0.0000	0.0000	0.0000	0.0000	58.5510	258.0696	487.6185	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1775.1875	
Space heating per m2										(98c) / (4) =		19.0880	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 89.5000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	447.5779	294.4836	169.8058	49.5014	9.5796	0.0000	0.0000	0.0000	0.0000	58.5510	258.0696	487.6185	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	500.0871	329.0320	189.7272	55.3088	10.7034	0.0000	0.0000	0.0000	0.0000	65.4201	288.3460	544.8252	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	304.9894	269.6776	286.2088	250.7548	242.5166	217.9053	214.5140	223.3173	226.1018	252.8877	269.8663	301.5251	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	32.4110	26.0013	23.4113	17.1521	13.2488	10.8244	12.0860	15.7098	20.4055	26.7731	30.2402	33.3118	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.2158	-50.6247	-72.9603	-85.4689	-91.6636	-88.1856	-86.6278	-81.6744	-72.2809	-60.3643	-41.9263	-31.8247	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1983.4497 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3060.2647 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	261.5750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-800.8173 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4590.4722 (238)

10a. Fuel costs - using BEDF prices (508)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1983.4497	3.5400	70.2141	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3060.2647	3.5400	108.3334	(247)
Energy for instantaneous electric shower(s)	0.0000	17.6200	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	17.6200	15.1532	(249)
Energy for lighting	261.5750	17.6200	46.0895	(250)
Additional standing charges			94.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-800.8173	17.6200	-141.1040	
PV Unit electricity exported	0.0000	5.6800	0.0000	
Total			-141.1040	(252)
Total energy cost			192.6862	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1983.4497	0.2100	416.5244	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3060.2647	0.2100	642.6556	(264)
Space and water heating			1059.1800	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	261.5750	0.1443	37.7534	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-800.8173	0.1343	-107.5423	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-107.5423	(269)
Total CO2, kg/year			1001.3203	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1983.4497	1.1300	2241.2981	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3060.2647	1.1300	3458.0991	(278)
Space and water heating			5699.3973	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	261.5750	1.5338	401.2125	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-800.8173	1.4963	-1198.2552	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1198.2552	(283)
Total Primary energy kWh/year			5032.4554	(286)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 1B_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	1B
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	82 B	DER	5.47	TER	14.36
Environmental	96 A	% DER<TER	61.91		
CO_2 Emissions (t/year)	0.26	DFEE	34.16	TFEE	39.22
Compliance Check	See BREL	% DFEE < TFEE	12.90		
% DPER < TPER	23.57	DPER	57.71	TPER	75.51

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.5000	(2b) =	125.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		125.0000	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3100	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2635	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3360	0.3294	0.3228	0.2899	0.2833	0.2503	0.2503	0.2437	0.2635	0.2833	0.2964	0.3096	(22b)
Effective ac	0.5564	0.5542	0.5521	0.5420	0.5401	0.5313	0.5313	0.5297	0.5347	0.5401	0.5439	0.5479	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			12.6000	1.1450	14.4275			(27)
Door			2.6000	1.0000	2.6000			(26)
Heatloss Floor 1			50.0000	0.1100	5.5000			(28a)
External Wall 1	75.0000	15.2000	59.8000	0.1400	8.3720			(29a)
Total net area of external elements Aum(A, m2)			125.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8995			(33)
Party Ceiling 1			50.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 6.2500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.1495 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.9530	22.8626	22.7740	22.3578	22.2799	21.9174	21.9174	21.8503	22.0570	22.2799	22.4374	22.6021	(38)
Heat transfer coeff	60.1024	60.0120	59.9234	59.5072	59.4294	59.0669	59.0669	58.9998	59.2065	59.4294	59.5869	59.7516	(39)

Average = Sum(39)m / 12 = 59.5069

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2020	1.2002	1.1985	1.1901	1.1886	1.1813	1.1813	1.1800	1.1841	1.1886	1.1917	1.1950	(40)
HLP (average)												1.1901	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual) Total = Sum(45)m = 1637.0557

Distribution loss (46)m = 0.15 x (45)m

25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(64)

Total per year (kWh/year) = Sum(64)m = 2229.8208 (64)
12Total per year (kWh/year) 2230 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

96.7373	86.0602	92.4749	83.5397	82.5571	76.0832	76.2005	78.1985	77.9431	84.9105	87.8773	95.9508	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	130.0232	128.0657	124.2942	116.0273	110.9639	105.6711	102.4200	105.1055	108.2543	114.1271	122.0518	128.9662	(72)
Total internal gains	402.8713	410.3983	394.8201	380.8322	362.9469	347.4054	335.1825	336.3402	345.8144	360.4082	381.1548	395.3179	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.2000	10.6334	0.7600	0.7000	0.7700	16.4652 (74)
East	4.2000	19.6403	0.7600	0.7000	0.7700	30.4118 (76)
South	4.2000	46.7521	0.7600	0.7000	0.7700	72.3927 (78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	119.2696	209.5182	302.4678	399.4647	468.6808	474.2926	453.5483	400.7620	335.9981	235.9267	144.0419	101.2893	(83)
Total gains	522.1410	619.9166	697.2879	780.2970	831.6277	821.6980	788.7308	737.1022	681.8125	596.3349	525.1966	496.6072	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.7717	57.8588	57.9443	58.3496	58.4260	58.7846	58.7846	58.8515	58.6459	58.4260	58.2716	58.1110	
alpha	4.8514	4.8573	4.8630	4.8900	4.8951	4.9190	4.9190	4.9234	4.9097	4.8951	4.8848	4.8741	
util living area	0.9794	0.9552	0.9065	0.7952	0.6314	0.4545	0.3286	0.3665	0.5788	0.8449	0.9576	0.9834	(86)
MIT	20.1520	20.3402	20.5589	20.7778	20.8927	20.9298	20.9359	20.9351	20.9147	20.7543	20.4174	20.1143	(87)
Th 2	19.9184	19.9198	19.9212	19.9279	19.9291	19.9350	19.9350	19.9360	19.9327	19.9291	19.9266	19.9240	(88)
util rest of house	0.9734	0.9429	0.8828	0.7513	0.5692	0.3814	0.2495	0.2826	0.4975	0.7988	0.9438	0.9784	(89)
MIT 2	18.9566	19.1902	19.4536	19.7033	19.8159	19.8506	19.8538	19.8547	19.8392	19.6879	19.2952	18.9141	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.2555	19.4777	19.7299	19.9719	20.0851	20.1204	20.1243	20.1248	20.1080	19.9545	19.5757	19.2141	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2555	19.4777	19.7299	19.9719	20.0851	20.1204	20.1243	20.1248	20.1080	19.9545	19.5757	19.2141	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9686	0.9369	0.8780	0.7533	0.5786	0.3943	0.2637	0.2976	0.5113	0.8000	0.9382	0.9742	(94)
Useful gains	505.7685	580.8178	612.2019	587.7784	481.2039	323.9777	207.9534	219.3636	348.5891	477.0548	492.7587	483.7953	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	898.8593	874.8393	792.7832	658.8592	498.3202	326.0724	208.1721	219.7625	355.7154	555.9345	743.3905	897.1183	(97)
Space heating kWh	292.4595	197.5825	134.3525	51.1782	12.7345	0.0000	0.0000	0.0000	0.0000	58.6865	180.4549	307.5123	(98a)
Space heating requirement - total per year (kWh/year)												1234.9609	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	292.4595	197.5825	134.3525	51.1782	12.7345	0.0000	0.0000	0.0000	0.0000	58.6865	180.4549	307.5123	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1234.9609	
Space heating per m2											(98c) / (4) =	24.6992	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	292.4595	197.5825	134.3525	51.1782	12.7345	0.0000	0.0000	0.0000	0.0000	58.6865	180.4549	307.5123	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	133.3605	90.0969	61.2643	23.3371	5.8069	0.0000	0.0000	0.0000	0.0000	26.7608	82.2868	140.2245	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	115.6272	102.3596	108.8944	95.9798	93.2285	84.2017	83.1876	86.3437	87.1395	96.9459	102.8314	114.3850	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	17.2610	13.8474	12.4680	9.1346	7.0558	5.7647	6.4366	8.3665	10.8673	14.2584	16.1049	17.7407	(232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	563.1377 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1171.1244 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	139.3060 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1873.5680 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	563.1377	0.1572	88.5518	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1171.1244	0.1408	164.9134	(264)
Space and water heating			253.4651	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	139.3060	0.1443	20.1062	(268)
Total CO2, kg/year			273.5713	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.4700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	563.1377	1.5821	890.9419	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1171.1244	1.5207	1780.9095	(278)
Space and water heating			2671.8513	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	139.3060	1.5338	213.6722	(282)
Total Primary energy kWh/year			2885.5235	(286)
Dwelling Primary energy Rate (DPER)			57.7100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000	(1b)	x 2.5000	(2b) =	125.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		125.0000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4100	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3485	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4443	0.4356	0.4269	0.3834	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			9.9000	1.1450	11.3359			(27)
Heatloss Floor 1			50.0000	0.1300	6.5000			(28a)
External Wall 1	75.0000	12.5000	62.5000	0.1800	11.2500			(29a)
Total net area of external elements Aum(A, m2)			125.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.6859			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	30.0000	0.1600	4.8000
E16 Corner (normal)	5.0000	0.0900	0.4500
E18 Party wall between dwellings	5.0000	0.0600	0.3000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5500 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 37.2359 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.6971	24.5390	24.3840	23.6560	23.5198	22.8857	22.8857	22.7683	23.1300	23.5198	23.7953	24.0834	(38)
Heat transfer coeff	61.9330	61.7749	61.6199	60.8919	60.7557	60.1216	60.1216	60.0042	60.3658	60.7557	61.0312	61.3193	(39)
Average = Sum(39)m / 12 =												60.8912	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2387	1.2355	1.2324	1.2178	1.2151	1.2024	1.2024	1.2001	1.2073	1.2151	1.2206	1.2264	(40)
HLP (average)												1.2178	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:

Store volume 180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8381 (55)
Total storage loss
25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (56)
If cylinder contains dedicated solar storage
25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month
219.0524 193.8975 206.2332 181.6793 176.4053 159.2538 157.2875 163.2967 164.8474 183.4833 194.7248 216.6872 (62)
WWHRS -24.0268 -21.2495 -22.2513 -18.4249 -17.1714 -14.6937 -13.7730 -14.6462 -15.2026 -17.9222 -20.3037 -23.5819 (63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h
195.0256 172.6480 183.9820 163.2544 159.2339 144.5601 143.5145 148.6505 149.6447 165.5610 174.4211 193.1053 (64)
Total per year (kWh/year) = Sum(64)m = 1993.6012 (64)
12Total per year (kWh/year) 1994 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month
95.8559 85.2640 91.5935 82.6867 81.6757 75.2302 75.3190 77.3171 77.0901 84.0291 87.0243 95.0694 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.8666	82.8880	74.8666	77.3621	74.8666	77.3621	74.8666	74.8666	77.3621	74.8666	77.3621	74.8666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	128.8385	126.8810	123.1095	114.8427	109.7792	104.4864	101.2353	103.9208	107.0696	112.9424	120.8671	127.7815	(72)
Total internal gains													
	402.2906	409.8823	394.2393	380.2716	362.3662	346.8448	334.6017	335.7595	345.2538	359.8275	380.5942	394.7372	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3000	10.6334	0.6300	0.7000	0.7700	10.7240	(74)
East	3.3000	19.6403	0.6300	0.7000	0.7700	19.8077	(76)
South	3.3000	46.7521	0.6300	0.7000	0.7700	47.1505	(78)

Solar gains	77.6822	136.4625	197.0021	260.1777	305.2592	308.9143	295.4032	261.0226	218.8408	153.6628	93.8167	65.9713	(83)
Total gains	479.9728	546.3448	591.2414	640.4493	667.6254	655.7591	630.0049	596.7821	564.0947	513.4903	474.4109	460.7085	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0642	56.2077	56.3491	57.0228	57.1506	57.7533	57.7533	57.8663	57.5197	57.1506	56.8926	56.6253	
alpha	4.7376	4.7472	4.7566	4.8015	4.8100	4.8502	4.8502	4.8578	4.8346	4.8100	4.7928	4.7750	
util living area													
	0.9857	0.9729	0.9477	0.8801	0.7524	0.5677	0.4163	0.4566	0.6847	0.9014	0.9718	0.9880	(86)
MIT	19.8160	20.0225	20.2963	20.6333	20.8672	20.9734	20.9951	20.9925	20.9357	20.6419	20.1802	19.7842	(87)
Th 2	19.8892	19.8917	19.8942	19.9058	19.9079	19.9181	19.9181	19.9199	19.9142	19.9079	19.9035	19.8989	(88)
util rest of house													
	0.9813	0.9648	0.9320	0.8458	0.6900	0.4798	0.3158	0.3524	0.5969	0.8653	0.9620	0.9843	(89)
MIT 2	18.5505	18.8109	19.1507	19.5567	19.8047	19.9041	19.9166	19.9175	19.8753	19.5784	19.0206	18.5174	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.8669	19.1138	19.4371	19.8259	20.0703	20.1715	20.1863	20.1863	20.1404	19.8443	19.3105	18.8341	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8669	19.1138	19.4371	19.8259	20.0703	20.1715	20.1863	20.1863	20.1404	19.8443	19.3105	18.8341	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9758	0.9575	0.9241	0.8430	0.7000	0.5010	0.3410	0.3785	0.6163	0.8628	0.9550	0.9794	(94)
Useful gains	468.3642	523.1223	546.3429	539.8950	467.3459	328.5370	214.8288	225.8966	347.6635	443.0237	453.0574	451.2159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	902.1688	878.0557	797.1808	665.2970	508.5417	334.9649	215.6121	227.1919	364.6335	561.6409	745.2240	897.3541	(97)
Space heating kWh													
	322.7507	238.5153	186.6234	90.2895	30.6497	0.0000	0.0000	0.0000	0.0000	88.2512	210.3599	331.9268	(98a)
Space heating requirement - total per year (kWh/year)												1499.3665	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	322.7507	238.5153	186.6234	90.2895	30.6497	0.0000	0.0000	0.0000	0.0000	88.2512	210.3599	331.9268	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1499.3665	
Space heating per m2											(98c) / (4) =	29.9873	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	322.7507	238.5153	186.6234	90.2895	30.6497	0.0000	0.0000	0.0000	0.0000	88.2512	210.3599	331.9268	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	349.6757	258.4131	202.1922	97.8217	33.2066	0.0000	0.0000	0.0000	0.0000	95.6134	227.9089	359.6173	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1815	84.7848	84.0918	82.7880	81.1272	79.8000	79.8000	79.8000	79.8000	82.7149	84.4810	85.2632	(217)
Fuel for water heating, kWh/month													
	228.9531	203.6308	218.7871	197.1957	196.2768	181.1531	179.8428	186.2789	187.5247	200.1587	206.4619	226.4814	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5558	12.4794	11.2363	8.2322	6.3588	5.1952	5.8007	7.5400	9.7937	12.8499	14.5139	15.9881	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.8352	-33.8370	-48.9962	-55.5471	-60.3374	-56.5344	-55.8866	-52.5672	-46.7392	-38.9466	-26.3060	-20.5837	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.7698	-26.9391	-53.6635	-80.7536	-106.8963	-107.3989	-106.0856	-89.7273	-65.6754	-38.5203	-17.0530	-10.0883	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1624.4491 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2412.7449 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	125.5442 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1235.6876 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3013.0505 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1624.4491	0.2100	341.1343	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2412.7449	0.2100	506.6764	(264)
Space and water heating			847.8107	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.5442	0.1443	18.1199	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.1166	0.1344	-69.9046	
PV Unit electricity exported	-715.5710	0.1259	-90.0556	
Total			-159.9602	(269)
Total CO2, kg/year			717.8997	(272)
Target Carbon Dioxide Emission Rate (TER)			14.3600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1624.4491	1.1300	1835.6274	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2412.7449	1.1300	2726.4018	(278)
Space and water heating			4562.0292	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.5442	1.5338	192.5639	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.1166	1.4967	-778.4666	
PV Unit electricity exported	-715.5710	0.4620	-330.5653	
Total			-1109.0318	(283)
Total Primary energy kWh/year			3775.6620	(286)
Target Primary Energy Rate (TPER)			75.5100	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 1BF-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	1BF-AFF
Property	1 Bedroom Flat, 1BF-AFF, Saffron Walden, CB11		

SAP Rating	82 B	DER	5.37	TER	13.44
Environmental	96 A	% DER<TER	60.04		
CO_2 Emissions (t/year)	0.25	DFEE	33.75	TFEE	35.22
Compliance Check	See BREL	% DFEE < TFEE	4.18		
% DPER < TPER	19.77	DPER	56.64	TPER	70.59

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)
Ground floor			50.0000 (1b)	x	2.5000 (2b)	=	125.0000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	125.0000 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80	= 0.0000	(6a)
Number of open flues	0 * 20	= 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10	= 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20	= 0.0000	(6d)
Number of flues attached to other heater	0 * 35	= 0.0000	(6e)
Number of blocked chimneys	0 * 20	= 0.0000	(6f)
Number of intermittent extract fans	2 * 10	= 20.0000	(7a)
Number of passive vents	0 * 10	= 0.0000	(7b)
Number of flueless gas fires	0 * 40	= 0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3100	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2635	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3360	0.3294	0.3228	0.2899	0.2833	0.2503	0.2503	0.2437	0.2635	0.2833	0.2964	0.3096	(22b)
Effective ac	0.5564	0.5542	0.5521	0.5420	0.5401	0.5313	0.5313	0.5297	0.5347	0.5401	0.5439	0.5479	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Door			2.6000	1.0000	2.6000			(26)
External Wall 1	50.0000	17.3000	32.7000	0.1400	4.5780			(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000			(30)
Total net area of external elements Aum(A, m2)			100.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.5101			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)
Party Floor 1			50.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 5.0000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 34.5101 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.9530	22.8626	22.7740	22.3578	22.2799	21.9174	21.9174	21.8503	22.0570	22.2799	22.4374	22.6021	(38)
Heat transfer coeff	57.4630	57.3726	57.2840	56.8678	56.7900	56.4275	56.4275	56.3604	56.5671	56.7900	56.9475	57.1122	(39)

Average = Sum(39)m / 12 = 56.8675

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1493	1.1475	1.1457	1.1374	1.1358	1.1285	1.1285	1.1272	1.1313	1.1358	1.1389	1.1422	(40)
HLP (average)												1.1373	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual) Total = Sum(45)m = 1637.0557

Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(64)

Total per year (kWh/year) = Sum(64)m = 2229.8208 (64)
12Total per year (kWh/year) 2230 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	96.7373	86.0602	92.4749	83.5397	82.5571	76.0832	76.2005	78.1985	77.9431	84.9105	87.8773	95.9508	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	130.0232	128.0657	124.2942	116.0273	110.9639	105.6711	102.4200	105.1055	108.2543	114.1271	122.0518	128.9662	(72)
Total internal gains	402.8713	410.3983	394.8201	380.8322	362.9469	347.4054	335.1825	336.3402	345.8144	360.4082	381.1548	395.3179	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.2000	10.6334	0.7600	0.7000	0.7700	16.4652 (74)
East	4.2000	19.6403	0.7600	0.7000	0.7700	30.4118 (76)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)

Solar gains	92.4945	180.1954	298.4045	443.1086	553.4857	572.0115	542.2978	458.2388	349.1572	213.9361	115.1116	76.2490 (83)
Total gains	495.3659	590.5937	693.2246	823.9408	916.4326	919.4169	877.4803	794.5791	694.9716	574.3443	496.2664	471.5670 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.4253	60.5205	60.6142	61.0578	61.1415	61.5342	61.5342	61.6075	61.3824	61.1415	60.9724	60.7965	
alpha	5.0284	5.0347	5.0409	5.0705	5.0761	5.1023	5.1023	5.1072	5.0922	5.0761	5.0648	5.0531	
util living area	0.9823	0.9593	0.9000	0.7521	0.5609	0.3908	0.2826	0.3256	0.5482	0.8469	0.9627	0.9858	(86)
MIT	20.1776	20.3640	20.6058	20.8286	20.9162	20.9363	20.9388	20.9384	20.9241	20.7709	20.4333	20.1422	(87)
Th 2	19.9608	19.9623	19.9637	19.9704	19.9717	19.9776	19.9776	19.9787	19.9753	19.9717	19.9692	19.9665	(88)
util rest of house	0.9770	0.9482	0.8756	0.7068	0.5040	0.3293	0.2171	0.2537	0.4723	0.8020	0.9505	0.9815	(89)
MIT 2	19.0235	19.2555	19.5456	19.7945	19.8772	19.8982	19.8995	19.9005	19.8888	19.7453	19.3507	18.9836	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.3120	19.5326	19.8107	20.0530	20.1369	20.1577	20.1594	20.1600	20.1476	20.0017	19.6214	19.2733	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3120	19.5326	19.8107	20.0530	20.1369	20.1577	20.1594	20.1600	20.1476	20.0017	19.6214	19.2733	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9729	0.9427	0.8715	0.7107	0.5134	0.3402	0.2288	0.2665	0.4854	0.8035	0.9455	0.9778	(94)
Useful gains	481.9272	556.7307	604.1581	585.5586	470.4630	312.7515	200.7618	211.7334	337.3286	461.4869	469.1973	461.1062	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	862.6349	839.5097	762.4894	634.2489	479.1327	313.6073	200.8455	211.9154	342.0946	533.9240	713.0605	860.8665	(97)
Space heating kWh	283.2465	190.0275	117.7984	35.0570	6.4503	0.0000	0.0000	0.0000	0.0000	53.8932	175.5815	297.4217	(98a)
Space heating requirement - total per year (kWh/year)												1159.4761	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	283.2465	190.0275	117.7984	35.0570	6.4503	0.0000	0.0000	0.0000	0.0000	53.8932	175.5815	297.4217	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1159.4761	
Space heating per m2										(98c) / (4) =		23.1895	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	283.2465	190.0275	117.7984	35.0570	6.4503	0.0000	0.0000	0.0000	0.0000	53.8932	175.5815	297.4217	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	129.1594	86.6518	53.7157	15.9859	2.9413	0.0000	0.0000	0.0000	0.0000	24.5751	80.0645	135.6232	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	115.6272	102.3596	108.8944	95.9798	93.2285	84.2017	83.1876	86.3437	87.1395	96.9459	102.8314	114.3850	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)

Lighting	17.2610	13.8474	12.4680	9.1346	7.0558	5.7647	6.4366	8.3665	10.8673	14.2584	16.1049	17.7407 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	528.7169 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1171.1244 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	139.3060 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1839.1472 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	528.7169	0.1576	83.3485	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1171.1244	0.1408	164.9134	(264)
Space and water heating			248.2619	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	139.3060	0.1443	20.1062	(268)
Total CO2, kg/year			268.3681	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.3700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	528.7169	1.5835	837.2490	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1171.1244	1.5207	1780.9095	(278)
Space and water heating			2618.1585	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	139.3060	1.5338	213.6722	(282)
Total Primary energy kWh/year			2831.8307	(286)
Dwelling Primary energy Rate (DPER)			56.6400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000 (1b)	x	2.5000 (2b)	=	125.0000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	125.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1600 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4100 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3485 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4443	0.4356	0.4269	0.3834	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			9.8700	1.1450	11.3015			(27)
External Wall 1	50.0000	12.4700	37.5300	0.1800	6.7554			(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000			(30)
Total net area of external elements Aum(A, m2)			100.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.1569			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			250.0000 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	30.0000	0.0700	2.1000
E14 Flat roof	30.0000	0.0800	2.4000
E16 Corner (normal)	5.0000	0.0900	0.4500
E18 Party wall between dwellings	5.0000	0.0600	0.3000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.2500 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	31.4069 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.6971	24.5390	24.3840	23.6560	23.5198	22.8857	22.8857	22.7683	23.1300	23.5198	23.7953	24.0834	(38)
Heat transfer coeff	56.1040	55.9459	55.7909	55.0629	54.9267	54.2926	54.2926	54.1752	54.5369	54.9267	55.2023	55.4903	(39)
Average = Sum(39)m / 12 =												55.0623	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1221	1.1189	1.1158	1.1013	1.0985	1.0859	1.0859	1.0835	1.0907	1.0985	1.1040	1.1098	(40)
HLP (average)												1.1012	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy			1.6901 (42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556 (42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	

Distribution loss (46)m = 0.15 x (45)m

	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167 (46)

Water storage loss:

Store volume 180.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	219.0524	193.8975	206.2332	181.6793	176.4053	159.2538	157.2875	163.2967	164.8474	183.4833	194.7248	216.6872 (62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053 (64)

Total per year (kWh/year) = Sum(64)m = 1993.6012 (64)

12Total per year (kWh/year) 1994 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	95.8559	85.2640	91.5935	82.6867	81.6757	75.2302	75.3190	77.3171	77.0901	84.0291	87.0243	95.0694 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	74.8919	82.9161	74.8919	77.3883	74.8919	77.3883	74.8919	74.8919	77.3883	74.8919	77.3883	74.8919 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)

Water heating gains (Table 5)

	128.8385	126.8810	123.1095	114.8427	109.7792	104.4864	101.2353	103.9208	107.0696	112.9424	120.8671	127.7815 (72)

Total internal gains

	402.3159	409.9104	394.2647	380.2978	362.3915	346.8710	334.6271	335.7848	345.2800	359.8528	380.6204	394.7625 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.8200	10.6334	0.6300	0.7000	0.7700	9.1642	(74)
East	2.8200	19.6403	0.6300	0.7000	0.7700	16.9265	(76)
West	4.2300	19.6403	0.6300	0.7000	0.7700	25.3898	(80)

Solar gains	51.4805	100.2930	166.0857	246.6249	308.0585	318.3696	301.8315	255.0461	194.3335	119.0723	64.0687	42.4386 (83)
Total gains	453.7965	510.2033	560.3503	626.9228	670.4500	665.2406	636.4586	590.8309	539.6135	478.9251	444.6891	437.2011 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8890	62.0639	62.2363	63.0592	63.2155	63.9538	63.9538	64.0924	63.6674	63.2155	62.9000	62.5735	
alpha	5.1259	5.1376	5.1491	5.2039	5.2144	5.2636	5.2636	5.2728	5.2445	5.2144	5.1933	5.1716	
util living area	0.9873	0.9759	0.9482	0.8632	0.7080	0.5140	0.3740	0.4192	0.6617	0.9032	0.9744	0.9893	(86)
MIT	19.9465	20.1314	20.4010	20.7294	20.9218	20.9880	20.9981	20.9967	20.9583	20.6998	20.2779	19.9208	(87)
Th 2	19.9828	19.9854	19.9879	19.9998	20.0020	20.0124	20.0124	20.0143	20.0084	20.0020	19.9975	19.9928	(88)
util rest of house	0.9835	0.9688	0.9331	0.8280	0.6481	0.4384	0.2908	0.3308	0.5804	0.8690	0.9656	0.9861	(89)
MIT 2	18.7839	19.0179	19.3523	19.7441	19.9423	20.0062	20.0119	20.0132	19.9832	19.7236	19.2135	18.7589	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0746	19.2963	19.6145	19.9904	20.1872	20.2516	20.2584	20.2591	20.2270	19.9677	19.4796	19.0494	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0746	19.2963	19.6145	19.9904	20.1872	20.2516	20.2584	20.2591	20.2270	19.9677	19.4796	19.0494	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9788	0.9626	0.9265	0.8276	0.6597	0.4570	0.3116	0.3529	0.5991	0.8676	0.9597	0.9819	(94)
Useful gains	444.1957	491.1319	519.1387	518.8399	442.3268	304.0052	198.3276	208.5027	323.3006	415.5137	426.7592	429.3021	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	828.9126	805.4138	731.6679	610.6717	466.1732	306.8420	198.6254	209.0680	334.1481	514.5353	683.3816	823.9965	(97)
Space heating kWh													
	286.2294	211.1975	158.1217	66.1189	17.7417	0.0000	0.0000	0.0000	0.0000	73.6721	184.7681	293.6526	(98a)
Space heating requirement - total per year (kWh/year)												1291.5020	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	286.2294	211.1975	158.1217	66.1189	17.7417	0.0000	0.0000	0.0000	0.0000	73.6721	184.7681	293.6526	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1291.5020	
Space heating per m2											(98c) / (4) =	25.8300	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	286.2294	211.1975	158.1217	66.1189	17.7417	0.0000	0.0000	0.0000	0.0000	73.6721	184.7681	293.6526	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	310.1077	228.8163	171.3128	71.6348	19.2218	0.0000	0.0000	0.0000	0.0000	79.8180	200.1821	318.1502	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.9189	84.5129	83.7220	82.2016	80.6191	79.8000	79.8000	79.8000	79.8000	82.3709	84.1892	84.9970	(217)
Fuel for water heating, kWh/month													
	229.6611	204.2861	219.7535	198.6025	197.5138	181.1531	179.8428	186.2789	187.5247	200.9946	207.1774	227.1907	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5611	12.4837	11.2402	8.2350	6.3610	5.1970	5.8027	7.5426	9.7970	12.8542	14.5188	15.9936	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-23.8353	-33.8373	-48.9966	-55.5475	-60.3378	-56.5348	-55.8870	-52.5677	-46.7396	-38.9469	-26.3061	-20.5838	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.7696	-26.9389	-53.6632	-80.7532	-106.8959	-107.3985	-106.0852	-89.7268	-65.6750	-38.5200	-17.0528	-10.0882	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1399.2438	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2419.9791	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.5867	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1235.6876	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2795.1219	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1399.2438	0.2100	293.8412	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2419.9791	0.2100	508.1956	(264)
Space and water heating			802.0368	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.5867	0.1443	18.1260	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.1204	0.1344	-69.9051	
PV Unit electricity exported	-715.5672	0.1259	-90.0551	
Total			-159.9602	(269)
Total CO2, kg/year			672.1319	(272)
Target Carbon Dioxide Emission Rate (TER)			13.4400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1399.2438	1.1300	1581.1455	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2419.9791	1.1300	2734.5764	(278)
Space and water heating			4315.7218	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.5867	1.5338	192.6291	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-520.1204	1.4967	-778.4723	
PV Unit electricity exported	-715.5672	0.4620	-330.5634	
Total			-1109.0357	(283)
Total Primary energy kWh/year			3529.4161	(286)
Target Primary Energy Rate (TPER)			70.5900	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 1BH-BUN_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	1BH-BUN
Property	1 Bedroom Flat, 4B5, Saffron Walden, CB11		

SAP Rating	78 C	DER	5.47	TER	13.66
Environmental	96 A	% DER<TER	59.96		
CO_2 Emissions (t/year)	0.38	DFEE	47.42	TFEE	45.37
Compliance Check	See BREL	% DFEE < TFEE	-4.53		
% DPER < TPER	20.35	DPER	57.09	TPER	71.67

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			37.0000 (1b)	x	2.5000 (2b)	=	92.5000 (1b)	-
First floor			37.0000 (1c)	x	2.7500 (2c)	=	101.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.0000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.2500	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.1030 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.2530 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.2150 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2741	0.2688	0.2634	0.2365	0.2311	0.2043	0.2043	0.1989	0.2150	0.2311	0.2419	0.2526	(22b)
Effective ac	0.5376	0.5361	0.5347	0.5280	0.5267	0.5209	0.5209	0.5198	0.5231	0.5267	0.5293	0.5319	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			37.0000	0.1100	4.0700			(28a)
External Wall 1	132.0000	45.1000	86.9000	0.1400	12.1660			(29a)
External Roof 1	37.0000		37.0000	0.1100	4.0700			(30)
Total net area of external elements Aum(A, m2)			206.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.1930			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 10.3000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.4930 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.4601	34.3665	34.2749	33.8442	33.7636	33.3886	33.3886	33.3191	33.5330	33.7636	33.9266	34.0970	(38)
Heat transfer coeff	115.9531	115.8596	115.7679	115.3372	115.2567	114.8816	114.8816	114.8121	115.0261	115.2567	115.4197	115.5901	(39)

Average = Sum(39)m / 12 = 115.3369

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5669	1.5657	1.5644	1.5586	1.5575	1.5525	1.5525	1.5515	1.5544	1.5575	1.5597	1.5620	(40)
HLP (average)												1.5586	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3392 (42)

Hot water usage for mixer showers	63.4403	62.4869	61.0976	58.4395	56.4779	54.2903	53.0469	54.4256	55.9370	58.2858	61.0010	63.1972 (42a)
Hot water usage for baths	27.4046	26.9976	26.4245	25.3677	24.5764	23.6990	23.2251	23.7942	24.4139	25.3527	26.4313	27.3120 (42b)
Hot water usage for other uses	38.5857	37.1826	35.7795	34.3763	32.9732	31.5701	31.5701	32.9732	34.3763	35.7795	37.1826	38.5857 (42c)

Average daily hot water use (litres/day) 118.9761 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.4306	126.6671	123.3016	118.1836	114.0275	109.5594	107.8421	111.1931	114.7272	119.4180	124.6149	129.0949	(44)
Energy conte	204.9864	180.3722	189.5099	161.7874	153.5030	134.7161	130.4256	137.6802	141.4701	162.0491	177.5367	202.1314	(45)

Energy content (annual) Total = Sum(45)m = 1976.1681

Distribution loss (46)m = 0.15 x (45)m	30.7480	27.0558	28.4265	24.2681	23.0254	20.2074	19.5638	20.6520	21.2205	24.3074	26.6305	30.3197 (46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)

If cylinder contains dedicated solar storage

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	255.3308	225.8446	239.8543	210.5078	203.8474	183.4365	180.7701	188.0247	190.1906	212.3935	226.2571	252.4758 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	255.3308	225.8446	239.8543	210.5078	203.8474	183.4365	180.7701	188.0247	190.1906	212.3935	226.2571	252.4758 (64)

Total per year (kWh/year) = Sum(64)m = 2568.9333 (64)
12Total per year (kWh/year) 2569 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

	108.4335	96.3517	103.2876	92.7706	91.3153	83.7694	83.6421	86.0542	86.0152	94.1569	98.0073	107.4842 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	104.1289	115.2856	104.1289	107.5999	104.1289	107.5999	104.1289	104.1289	107.5999	104.1289	107.5999	104.1289 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	206.4473	208.5895	203.1911	191.6984	177.1909	163.5559	154.4469	152.3047	157.7031	169.1958	183.7033	197.3383 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678 (71)

Water heating gains (Table 5)

	145.7440	143.3805	138.8274	128.8481	122.7356	116.3464	112.4221	115.6643	119.4655	126.5549	136.1212	144.4680 (72)

Total internal gains

	517.4081	528.3435	507.2353	489.2343	465.1434	445.5902	429.0859	430.1858	442.8564	460.9676	488.5123	507.0232 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190 (77)
Southwest	6.3000	36.7938	0.7600	0.7000	0.7700	85.4595 (79)
Northwest	12.6000	11.2829	0.7600	0.7000	0.7700	52.4128 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	343.7333	614.5206	917.8850	1266.4866	1536.4825	1577.2370	1499.0407	1289.6823	1037.3572	699.9566	416.9973	290.7449	(83)
Total gains	861.1414	1142.8642	1425.1203	1755.7209	2001.6259	2022.8272	1928.1266	1719.8681	1480.2136	1160.9242	905.5096	797.7681	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.3187	44.3545	44.3896	44.5553	44.5865	44.7320	44.7320	44.7591	44.6759	44.5865	44.5235	44.4579	
alpha	3.9546	3.9570	3.9593	3.9704	3.9724	3.9821	3.9821	3.9839	3.9784	3.9724	3.9682	3.9639	
util living area	0.9771	0.9389	0.8580	0.6986	0.5137	0.3593	0.2612	0.3051	0.5144	0.8115	0.9522	0.9825	(86)
MIT	19.8162	20.1217	20.4614	20.7513	20.8782	20.9140	20.9206	20.9191	20.8897	20.6627	20.1719	19.7517	(87)
Th 2	19.6377	19.6386	19.6395	19.6438	19.6446	19.6484	19.6484	19.6491	19.6469	19.6446	19.6430	19.6413	(88)
util rest of house	0.9699	0.9218	0.8235	0.6425	0.4461	0.2853	0.1815	0.2165	0.4223	0.7538	0.9356	0.9769	(89)
MIT 2	18.3153	18.6908	19.0890	19.4000	19.5155	19.5452	19.5485	19.5488	19.5305	19.3277	18.7641	18.2374	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.6905	19.0485	19.4321	19.7378	19.8561	19.8874	19.8915	19.8914	19.8703	19.6615	19.1160	18.6159	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6905	19.0485	19.4321	19.7378	19.8561	19.8874	19.8915	19.8914	19.8703	19.6615	19.1160	18.6159	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9632	0.9127	0.8175	0.6467	0.4570	0.2985	0.1959	0.2325	0.4380	0.7546	0.9273	0.9711	(94)
Useful gains	829.4851	1043.1344	1165.0933	1135.3748	914.6930	603.8842	377.6730	399.9230	648.3960	876.0268	839.7021	774.7378	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1668.6267	1639.2403	1497.1215	1250.0002	940.0496	607.4239	378.1361	400.8523	663.7393	1044.3940	1386.8869	1666.3392	(97)
Space heating kWh	624.3214	400.5832	247.0290	82.5303	18.8653	0.0000	0.0000	0.0000	0.0000	125.2652	393.9730	663.3514	(98a)
Space heating requirement - total per year (kWh/year)												2555.9188	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	624.3214	400.5832	247.0290	82.5303	18.8653	0.0000	0.0000	0.0000	0.0000	125.2652	393.9730	663.3514	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2555.9188	
Space heating per m2										(98c) / (4) =		34.5394	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	624.3214	400.5832	247.0290	82.5303	18.8653	0.0000	0.0000	0.0000	0.0000	125.2652	393.9730	663.3514	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	284.6883	182.6645	112.6443	37.6335	8.6025	0.0000	0.0000	0.0000	0.0000	57.1205	179.6503	302.4858	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.3308	225.8446	239.8543	210.5078	203.8474	183.4365	180.7701	188.0247	190.1906	212.3935	226.2571	252.4758	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	134.1023	118.6159	125.9739	110.5608	107.0627	96.3427	94.9423	98.7525	99.8900	111.5512	118.8325	132.6028	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	26.4229	21.1974	19.0859	13.9832	10.8010	8.8245	9.8530	12.8074	16.6355	21.8267	24.6532	27.1573	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1165.4896	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1349.2297	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	213.2479	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2727.9672	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1165.4896	0.1575	183.5830	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1349.2297	0.1409	190.1292	(264)
Space and water heating			373.7122	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	213.2479	0.1443	30.7783	(268)
Total CO2, kg/year			404.4905	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.4700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1165.4896	1.5831	1845.0442	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1349.2297	1.5211	2052.2597	(278)
Space and water heating			3897.3039	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	213.2479	1.5338	327.0868	(282)
Total Primary energy kWh/year			4224.3907	(286)
Dwelling Primary energy Rate (DPER)			57.0900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	37.0000 (1b)	x	2.5000 (2b)	=	92.5000 (1b)	-
First floor	37.0000 (1c)	x	2.7500 (2c)	=	101.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 74.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.2500	(5)

2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		3 * 10 =	30.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1544 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4044 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3438 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4383	0.4297	0.4211	0.3782	0.3696	0.3266	0.3266	0.3180	0.3438	0.3696	0.3867	0.4039	(22b)
Effective ac	0.5961	0.5923	0.5887	0.5715	0.5683	0.5533	0.5533	0.5506	0.5591	0.5683	0.5748	0.5816	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			13.3000	1.1450	15.2290			(27)
Heatloss Floor 1			37.0000	0.1300	4.8100			(28a)
External Wall 1	132.0000	18.5000	113.5000	0.1800	20.4300			(29a)
External Roof 1	37.0000		37.0000	0.1100	4.0700			(30)
Total net area of external elements Aum(A, m2)			206.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7390			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E5	Ground floor (normal)	25.0000	0.1600	4.0000
E6	Intermediate floor within a dwelling	25.0000	0.0000	0.0000
E14	Flat roof	25.0000	0.0800	2.0000
E16	Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8900 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 57.6290 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.2089	37.9697	37.7354	36.6345	36.4286	35.4698	35.4698	35.2922	35.8391	36.4286	36.8452	37.2808	(38)
Heat transfer coeff	95.8379	95.5988	95.3644	94.2635	94.0576	93.0988	93.0988	92.9212	93.4681	94.0576	94.4742	94.9098	(39)

Average = Sum(39)m / 12 = 94.2626

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2951	1.2919	1.2887	1.2738	1.2710	1.2581	1.2581	1.2557	1.2631	1.2710	1.2767	1.2826	(40)
HLP (average)												1.2738	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3392 (42)

Hot water usage for mixer showers

63.4403	62.4869	61.0976	58.4395	56.4779	54.2903	53.0469	54.4256	55.9370	58.2858	61.0010	63.1972	(42a)

Hot water usage for baths

27.4046	26.9976	26.4245	25.3677	24.5764	23.6990	23.2251	23.7942	24.4139	25.3527	26.4313	27.3120	(42b)

Hot water usage for other uses

38.5857	37.1826	35.7795	34.3763	32.9732	31.5701	31.5701	32.9732	34.3763	35.7795	37.1826	38.5857	(42c)

Average daily hot water use (litres/day) 118.9761 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.4306	126.6671	123.3016	118.1836	114.0275	109.5594	107.8421	111.1931	114.7272	119.4180	124.6149	129.0949	(44)

Energy conte	204.9864	180.3722	189.5099	161.7874	153.5030	134.7161	130.4256	137.6802	141.4701	162.0491	177.5367	202.1314	(45)
Energy content (annual)										Total = Sum(45)m =		1976.1681	
Distribution loss (46)m = 0.15 x (45)m													
	30.7480	27.0558	28.4265	24.2681	23.0254	20.2074	19.5638	20.6520	21.2205	24.3074	26.6305	30.3197	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	254.2291	224.8495	238.7526	209.4416	202.7457	182.3703	179.6683	186.9229	189.1243	211.2918	225.1909	251.3740	(62)
WWHRS	-29.0022	-25.6498	-26.8590	-22.2403	-20.7272	-17.7364	-16.6250	-17.6791	-18.3508	-21.6335	-24.5082	-28.4652	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	225.2268	199.1997	211.8936	187.2013	182.0185	164.6339	163.0433	169.2438	170.7736	189.6583	200.6827	222.9089	(64)
										Total per year (kWh/year) = Sum(64)m =		2286.4842	(64)
12Total per year (kWh/year)												2286	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	107.5521	95.5556	102.4062	91.9177	90.4339	82.9165	82.7607	85.1728	85.1622	93.2755	97.1543	106.6028	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	106.3783	117.7759	106.3783	109.9242	106.3783	109.9242	106.3783	106.3783	109.9242	106.3783	109.9242	106.3783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	206.4473	208.5895	203.1911	191.6984	177.1909	163.5559	154.4469	152.3047	157.7031	169.1958	183.7033	197.3383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	(71)
Water heating gains (Table 5)													
	144.5593	142.1958	137.6427	127.6634	121.5509	115.1617	111.2374	114.4796	118.2808	125.3702	134.9365	143.2833	(72)
Total internal gains													
	518.4727	529.6492	508.3000	490.3739	466.2080	446.7298	430.1506	431.2504	443.9961	462.0323	489.6520	508.0878	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.8000	11.2829	0.6300	0.7000	0.7700	9.6550	(75)
Southeast	4.2000	36.7938	0.6300	0.7000	0.7700	47.2276	(77)
Southwest	2.1000	36.7938	0.6300	0.7000	0.7700	23.6138	(79)
Northwest	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(81)

Solar gains	94.9789	169.8018	253.6261	349.9502	424.5544	435.8155	414.2086	356.3596	286.6382	193.4091	115.2229	80.3374	(83)
Total gains	613.4517	699.4509	761.9261	840.3242	890.7624	882.5453	844.3592	787.6100	730.6342	655.4413	604.8749	588.4252	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6207	53.7548	53.8869	54.5162	54.6356	55.1982	55.1982	55.3037	54.9801	54.6356	54.3946	54.1450	
alpha	4.5747	4.5837	4.5925	4.6344	4.6424	4.6799	4.6799	4.6869	4.6653	4.6424	4.6263	4.6097	
util living area													
	0.9923	0.9851	0.9698	0.9222	0.8152	0.6360	0.4765	0.5281	0.7686	0.9426	0.9849	0.9936	(86)
MIT	19.6003	19.7996	20.0903	20.4820	20.7894	20.9510	20.9897	20.9837	20.8816	20.4892	19.9841	19.5716	(87)
Th 2	19.8447	19.8472	19.8497	19.8614	19.8636	19.8738	19.8738	19.8757	19.8699	19.8636	19.8591	19.8545	(88)
util rest of house													
	0.9898	0.9803	0.9597	0.8959	0.7568	0.5399	0.3590	0.4063	0.6810	0.9173	0.9791	0.9915	(89)
MIT 2	18.2463	18.5004	18.8673	19.3516	19.6931	19.8473	19.8708	19.8703	19.7939	19.3724	18.7450	18.2168	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.5848	18.8252	19.1730	19.6342	19.9672	20.1232	20.1505	20.1487	20.0658	19.6516	19.0548	18.5555	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5848	18.8252	19.1730	19.6342	19.9672	20.1232	20.1505	20.1487	20.0658	19.6516	19.0548	18.5555	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9745	0.9519	0.8895	0.7627	0.5623	0.3885	0.4368	0.6978	0.9114	0.9734	0.9880	(94)
Useful gains	604.7474	681.5834	725.3078	747.4997	679.4019	496.2422	328.0387	344.0461	509.8569	597.3733	588.7638	581.3912	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1369.0264	1331.2334	1208.5575	1011.8415	777.5914	514.2075	330.5479	348.3313	557.6132	851.3741	1129.4191	1362.4764	(97)
Space heating kWh													
	568.6236	436.5648	359.5378	190.3261	73.0530	0.0000	0.0000	0.0000	0.0000	188.9766	389.2718	581.1274	(98a)
Space heating requirement - total per year (kWh/year)												2787.4811	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	568.6236	436.5648	359.5378	190.3261	73.0530	0.0000	0.0000	0.0000	0.0000	188.9766	389.2718	581.1274	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2787.4811	
Space heating per m2											(98c) / (4) =	37.6687	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	568.6236	436.5648	359.5378	190.3261	73.0530	0.0000	0.0000	0.0000	0.0000	188.9766	389.2718	581.1274	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	616.0602	472.9846	389.5317	206.2038	79.1473	0.0000	0.0000	0.0000	0.0000	204.7418	421.7462	629.6071	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	225.2268	199.1997	211.8936	187.2013	182.0185	164.6339	163.0433	169.2438	170.7736	189.6583	200.6827	222.9089	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0467	85.7692	85.2354	84.0969	82.1856	79.8000	79.8000	79.8000	79.8000	84.0517	85.5191	86.1076	(217)
Fuel for water heating, kWh/month													
	261.7495	232.2509	248.5981	222.6017	221.4724	206.3081	204.3149	212.0850	214.0020	225.6447	234.6643	258.8723	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.1033	17.7321	15.9658	11.6972	9.0353	7.3819	8.2423	10.7136	13.9159	18.2585	20.6229	22.7176	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.6454	-48.8588	-70.2591	-79.0406	-85.2786	-79.6250	-78.6446	-74.2200	-66.4184	-55.8887	-38.0952	-29.9515	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-19.5299	-41.0898	-81.6773	-122.6846	-162.2271	-162.9963	-161.0743	-136.3759	-99.9552	-58.7623	-26.0760	-15.4430	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3020.0229	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2742.5640	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	178.3863	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1828.8177	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses 4198.1555 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3020.0229	0.2100	634.2048	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2742.5640	0.2100	575.9384	(264)
Space and water heating			1210.1432	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	178.3863	0.1443	25.7467	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-740.9259	0.1346	-99.7094	
PV Unit electricity exported	-1087.8918	0.1259	-136.9593	
Total			-236.6687	(269)
Total CO2, kg/year			1011.1505	(272)
Target Carbon Dioxide Emission Rate (TER)			13.6600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3020.0229	1.1300	3412.6258	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2742.5640	1.1300	3099.0973	(278)
Space and water heating			6511.7232	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	178.3863	1.5338	273.6149	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-740.9259	1.4974	-1109.4345	
PV Unit electricity exported	-1087.8918	0.4621	-502.7348	
Total			-1612.1693	(283)
Total Primary energy kWh/year			5303.2696	(286)
Target Primary Energy Rate (TPER)			71.6700	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 2B_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2B
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	81 B	DER	4.85	TER	12.03
Environmental	96 A	% DER<TER	59.68		
CO_2 Emissions (t/year)	0.32	DFEE	32.14	TFEE	36.67
Compliance Check	See BREL	% DFEE < TFEE	12.36		
% DPER < TPER	18.85	DPER	51.03	TPER	62.89

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000 (1b)	x	2.5000 (2b)	=	175.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 70.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1143 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2643 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2246 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2864	0.2808	0.2752	0.2471	0.2415	0.2134	0.2134	0.2078	0.2246	0.2415	0.2527	0.2640	(22b)
Effective ac	0.5410	0.5394	0.5379	0.5305	0.5292	0.5228	0.5228	0.5216	0.5252	0.5292	0.5319	0.5348	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			12.6000	1.1450	14.4275			(27)
Door			2.6000	1.0000	2.6000			(26)
Heatloss Floor 1			70.0000	0.1100	7.7000			(28a)
External Wall 1	85.0000	15.2000	69.8000	0.1400	9.7720			(29a)
Total net area of external elements Aum(A, m2)			155.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4995			(33)
Party Ceiling 1			70.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 7.7500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 42.2495 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.2438	31.1518	31.0617	30.6382	30.5589	30.1901	30.1901	30.1218	30.3322	30.5589	30.7192	30.8868	(38)
Heat transfer coeff	73.4933	73.4013	73.3111	72.8876	72.8084	72.4396	72.4396	72.3713	72.5816	72.8084	72.9687	73.1363	(39)

Average = Sum(39)m / 12 = 72.8873

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0499	1.0486	1.0473	1.0413	1.0401	1.0349	1.0349	1.0339	1.0369	1.0401	1.0424	1.0448	(40)
HLP (average)												1.0412	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)
Hot water usage for mixer showers

61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths

26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)

Hot water usage for other uses

37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)

Energy content (annual) Total = Sum(45)m = 1927.5450

Distribution loss (46)m = 0.15 x (45)m

29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(64)

Total per year (kWh/year) = Sum(64)m = 2520.3101 (64)
12Total per year (kWh/year) 2520 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

106.7565	94.8760	101.7372	91.4471	90.0595	82.6674	82.5751	84.9278	84.8578	92.8311	96.5548	105.8305	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.6389	112.5288	101.6389	105.0269	101.6389	105.0269	101.6389	101.6389	105.0269	101.6389	105.0269	101.6389	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	143.4899	141.1846	136.7436	127.0098	121.0477	114.8158	110.9880	114.1503	117.8580	124.7730	134.1039	142.2453	(72)
Total internal gains	502.1177	512.7497	492.2596	474.9305	451.7159	432.8413	416.9203	418.0353	430.2901	447.8005	474.3838	492.1679	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.2000	11.2829	0.7600	0.7000	0.7700	17.4709 (75)
Southeast	4.2000	36.7938	0.7600	0.7000	0.7700	56.9730 (77)
Northwest	4.2000	11.2829	0.7600	0.7000	0.7700	17.4709 (81)

Solar gains	91.9149	168.1714	260.9278	374.9753	467.1683	484.5362	458.5110	386.5591	299.9224	194.1773	112.2065	77.2923 (83)
Total gains	594.0327	680.9210	753.1874	849.9057	918.8842	917.3775	875.4313	804.5944	730.2125	641.9778	586.5903	569.4603 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.1436	66.2265	66.3080	66.6932	66.7658	67.1057	67.1057	67.1691	66.9744	66.7658	66.6191	66.4665	
alpha	5.4096	5.4151	5.4205	5.4462	5.4511	5.4737	5.4737	5.4779	5.4650	5.4511	5.4413	5.4311	
util living area	0.9897	0.9779	0.9494	0.8601	0.6942	0.4993	0.3632	0.4118	0.6558	0.9056	0.9779	0.9917	(86)
MIT	20.1947	20.3391	20.5356	20.7662	20.8972	20.9368	20.9424	20.9416	20.9175	20.7370	20.4268	20.1654	(87)
Th 2	20.0420	20.0430	20.0441	20.0491	20.0500	20.0544	20.0544	20.0552	20.0527	20.0500	20.0481	20.0462	(88)
util rest of house	0.9866	0.9715	0.9350	0.8253	0.6363	0.4283	0.2856	0.3283	0.5775	0.8727	0.9703	0.9892	(89)
MIT 2	19.1115	19.2939	19.5371	19.8089	19.9420	19.9783	19.9814	19.9820	19.9643	19.7849	19.4103	19.0779	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	19.3823	19.5552	19.7867	20.0482	20.1808	20.2179	20.2217	20.2219	20.2026	20.0229	19.6644	19.3498	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3823	19.5552	19.7867	20.0482	20.1808	20.2179	20.2217	20.2219	20.2026	20.0229	19.6644	19.3498	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9674	0.9304	0.8253	0.6446	0.4407	0.2994	0.3431	0.5904	0.8716	0.9664	0.9867	(94)
Useful gains	584.4170	658.7348	700.7579	701.4075	592.3439	404.3009	262.1003	276.0688	431.1278	559.5580	566.8783	561.9060	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1108.4445	1075.7091	974.0640	812.5646	617.4756	406.9616	262.3513	276.5924	442.9364	686.0662	916.8110	1107.9989	(97)
Space heating kWh	389.8764	280.2067	203.3398	80.0331	18.6979	0.0000	0.0000	0.0000	0.0000	94.1221	251.9516	406.2931	(98a)
Space heating requirement - total per year (kWh/year)												1724.5208	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	389.8764	280.2067	203.3398	80.0331	18.6979	0.0000	0.0000	0.0000	0.0000	94.1221	251.9516	406.2931	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1724.5208	
Space heating per m2											(98c) / (4) =	24.6360	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	389.8764	280.2067	203.3398	80.0331	18.6979	0.0000	0.0000	0.0000	0.0000	94.1221	251.9516	406.2931	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	177.7822	127.7732	92.7222	36.4948	8.5262	0.0000	0.0000	0.0000	0.0000	42.9193	114.8890	185.2682	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	131.4533	116.2850	123.5250	108.4701	105.0791	94.6019	93.2568	96.9733	98.0618	109.4571	116.5382	129.9907	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	25.5331	20.4836	18.4432	13.5123	10.4373	8.5273	9.5212	12.3761	16.0753	21.0916	23.8229	26.2427	(232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	786.3752 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1323.6923 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	206.0666 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2316.1341 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	786.3752	0.1568	123.3369	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1323.6923	0.1409	186.5137	(264)
Space and water heating			309.8506	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	206.0666	0.1443	29.7418	(268)
Total CO2, kg/year			339.5924	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.8500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	786.3752	1.5806	1242.9717	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1323.6923	1.5210	2013.3526	(278)
Space and water heating			3256.3243	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	206.0666	1.5338	316.0718	(282)
Total Primary energy kWh/year			3572.3961	(286)
Dwelling Primary energy Rate (DPER)			51.0300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.0000	(1b)	x 2.5000	(2b) =	175.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1143	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3643	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3096	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3096	0.3329	0.3483	0.3638	(22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			12.6000	1.1450	14.4275			(27)
Heatloss Floor 1			70.0000	0.1300	9.1000			(28a)
External Wall 1	85.0000	15.2000	69.8000	0.1800	12.5640			(29a)
Total net area of external elements Aum(A, m2)			155.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.6915			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	34.0000	0.1600	5.4400
E16 Corner (normal)	5.0000	0.0900	0.4500
E18 Party wall between dwellings	5.0000	0.0600	0.3000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1900 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 44.8815 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.3755	33.2008	33.0295	32.2249	32.0743	31.3736	31.3736	31.2438	31.6435	32.0743	32.3789	32.6973	(38)
Heat transfer coeff	78.2570	78.0823	77.9110	77.1064	76.9558	76.2550	76.2550	76.1253	76.5250	76.9558	77.2604	77.5787	(39)
Average = Sum(39)m / 12 =												77.1056	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1180	1.1155	1.1130	1.1015	1.0994	1.0894	1.0894	1.0875	1.0932	1.0994	1.1037	1.1083	(40)
HLP (average)												1.1015	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers

61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths

26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)

Hot water usage for other uses

37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)
Energy content (annual)										Total = Sum(45)m =		1927.5450	
Distribution loss (46)m = 0.15 x (45)m													
	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)

Water storage loss:

Store volume 180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8381 (55)
Total storage loss
25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (56)
If cylinder contains dedicated solar storage
25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month
249.1853 220.4115 234.0898 205.4609 198.9689 179.0558 176.4593 183.5353 185.6434 207.3045 220.8226 246.4005 (62)
WWHRS -28.2888 -25.0189 -26.1983 -21.6933 -20.2173 -17.3001 -16.2161 -17.2442 -17.8994 -21.1014 -23.9053 -27.7650 (63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h
220.8965 195.3926 207.8915 183.7677 178.7515 161.7557 160.2432 166.2911 167.7440 186.2031 196.9172 218.6355 (64)
Total per year (kWh/year) = Sum(64)m = 2244.4896 (64)
12Total per year (kWh/year) 2244 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month
105.8751 94.0799 100.8558 90.5941 89.1781 81.8144 81.6937 84.0464 84.0048 91.9497 95.7018 104.9491 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	101.6389	112.5288	101.6389	105.0269	101.6389	105.0269	101.6389	101.6389	105.0269	101.6389	105.0269	101.6389	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)													
	142.3052	139.9999	135.5589	125.8251	119.8630	113.6311	109.8033	112.9656	116.6733	123.5883	132.9192	141.0606	(72)
Total internal gains													
	500.9331	511.5650	491.0749	473.7458	450.5312	431.6566	415.7356	416.8506	429.1054	446.6158	473.1991	490.9832	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(75)
Southeast	4.2000	36.7938	0.6300	0.7000	0.7700	47.2276	(77)
Northwest	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(81)

Solar gains	76.1926	139.4052	216.2954	310.8347	387.2579	401.6550	380.0815	320.4371	248.6199	160.9628	93.0133	64.0713	(83)
Total gains	577.1257	650.9702	707.3703	784.5805	837.7892	833.3116	795.8171	737.2878	677.7253	607.5786	566.2124	555.0545	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1173	62.2563	62.3932	63.0442	63.1676	63.7481	63.7481	63.8567	63.5232	63.1676	62.9186	62.6604	
alpha	5.1412	5.1504	5.1595	5.2029	5.2112	5.2499	5.2499	5.2571	5.2349	5.2112	5.1946	5.1774	
util living area													
	0.9916	0.9835	0.9646	0.9019	0.7665	0.5705	0.4190	0.4699	0.7201	0.9301	0.9827	0.9931	(86)
MIT	19.8684	20.0493	20.3103	20.6518	20.8863	20.9804	20.9968	20.9943	20.9381	20.6364	20.2007	19.8394	(87)
Th 2	19.9862	19.9882	19.9902	19.9996	20.0013	20.0095	20.0095	20.0111	20.0064	20.0013	19.9978	19.9941	(88)
util rest of house													
	0.9890	0.9784	0.9536	0.8729	0.7084	0.4887	0.3261	0.3715	0.6380	0.9026	0.9764	0.9909	(89)
MIT 2	18.6880	18.9179	19.2453	19.6606	19.9114	19.9991	20.0086	20.0091	19.9674	19.6540	19.1186	18.6569	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.9831	19.2008	19.5116	19.9084	20.1551	20.2444	20.2556	20.2554	20.2101	19.8996	19.3891	18.9525	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9831	19.2008	19.5116	19.9084	20.1551	20.2444	20.2556	20.2554	20.2101	19.8996	19.3891	18.9525	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9854	0.9731	0.9470	0.8699	0.7180	0.5086	0.3494	0.3962	0.6559	0.8992	0.9713	0.9877	(94)
Useful gains	568.6713	633.4825	669.8949	682.5022	601.5126	423.8235	278.0225	292.0966	444.5246	546.3309	549.9627	548.2303	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1149.0535	1116.6357	1013.7436	848.8205	650.6715	430.4157	278.7584	293.4945	467.5730	715.6609	949.4621	1144.4830	(97)
Space heating kWh													
	431.8043	324.6789	255.8234	119.7492	36.5742	0.0000	0.0000	0.0000	0.0000	125.9815	287.6396	443.6120	(98a)
Space heating requirement - total per year (kWh/year)												2025.8632	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	431.8043	324.6789	255.8234	119.7492	36.5742	0.0000	0.0000	0.0000	0.0000	125.9815	287.6396	443.6120	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2025.8632	
Space heating per m2											(98c) / (4) =	28.9409	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	431.8043	324.6789	255.8234	119.7492	36.5742	0.0000	0.0000	0.0000	0.0000	125.9815	287.6396	443.6120	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	467.8270	351.7648	277.1651	129.7391	39.6254	0.0000	0.0000	0.0000	0.0000	136.4914	311.6355	480.6197	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5352	85.1903	84.5262	83.1239	81.1978	79.8000	79.8000	79.8000	79.8000	83.2030	84.9084	85.6123	(217)
Fuel for water heating, kWh/month													
	258.2522	229.3602	245.9492	221.0769	220.1433	202.7013	200.8060	208.3848	210.2056	223.7937	231.9173	255.3786	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	21.1186	16.9421	15.2545	11.1761	8.6327	7.0530	7.8751	10.2363	13.2959	17.4450	19.7041	21.7055	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.8736	-46.4122	-66.8180	-75.2641	-81.2912	-75.9416	-75.0150	-70.7566	-63.2542	-53.1420	-36.1687	-28.4144	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.3733	-38.6743	-76.9056	-115.5570	-152.8359	-153.5650	-151.7461	-128.4557	-94.1262	-55.3116	-24.5337	-14.5264	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2194.8680	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2707.9691	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	170.4389	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1729.9627	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3429.3133	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2194.8680	0.2100	460.9223	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2707.9691	0.2100	568.6735	(264)
Space and water heating			1029.5958	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.4389	0.1443	24.5996	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.3517	0.1345	-94.9025	
PV Unit electricity exported	-1024.6110	0.1259	-128.9835	
Total			-223.8860	(269)
Total CO2, kg/year			842.2386	(272)
Target Carbon Dioxide Emission Rate (TER)			12.0300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2194.8680	1.1300	2480.2009	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2707.9691	1.1300	3060.0050	(278)
Space and water heating			5540.2059	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.4389	1.5338	261.4248	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.3517	1.4973	-1056.0935	
PV Unit electricity exported	-1024.6110	0.4621	-473.4580	
Total			-1529.5516	(283)
Total Primary energy kWh/year			4402.1800	(286)
Target Primary Energy Rate (TPER)			62.8900	(287)

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Full SAP Calculation Printout

Property Reference	Plot 2BF-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2BF-AFF
Property	1 Bedroom Flat, 2BF-AFF, Saffron Walden, CB11		

SAP Rating	82 B	DER	4.57	TER	10.97
Environmental	96 A	% DER<TER	58.34		
CO_2 Emissions (t/year)	0.3	DFEE	28.70	TFEE	32.09
Compliance Check	See BREL	% DFEE < TFEE	10.56		
% DPER < TPER	15.72	DPER	48.16	TPER	57.14

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000 (1b)	x	2.5000 (2b)	=	175.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1143 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2643 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2246 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2864	0.2808	0.2752	0.2471	0.2415	0.2134	0.2134	0.2078	0.2246	0.2415	0.2527	0.2640	(22b)
Effective ac	0.5410	0.5394	0.5379	0.5305	0.5292	0.5228	0.5228	0.5216	0.5252	0.5292	0.5319	0.5348	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Door			2.6000	1.0000	2.6000			(26)
External Wall 1	60.0000	17.3000	42.7000	0.1400	5.9780			(29a)
External Roof 1	70.0000		70.0000	0.1100	7.7000			(30)
Total net area of external elements Aum(A, m2)			130.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.1101			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)
Party Floor 1			70.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												6.5000	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	39.6101	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.2438	31.1518	31.0617	30.6382	30.5589	30.1901	30.1901	30.1218	30.3322	30.5589	30.7192	30.8868	(38)
Heat transfer coeff	70.8539	70.7619	70.6717	70.2482	70.1690	69.8001	69.8001	69.7318	69.9422	70.1690	70.3293	70.4969	(39)
Average = Sum(39)m / 12 =												70.2478	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0122	1.0109	1.0096	1.0035	1.0024	0.9971	0.9971	0.9962	0.9992	1.0024	1.0047	1.0071	(40)
HLP (average)												1.0035	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461	(42)
Hot water usage for mixer showers	61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)
Hot water usage for baths	26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)
Hot water usage for other uses	37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)
Average daily hot water use (litres/day)												116.0487	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)
Energy content (annual)										Total = Sum(45)m =		1927.5450	
Distribution loss (46)m = 0.15 x (45)m	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(64)
										Total per year (kWh/year) = Sum(64)m =		2520.3101	(64)
12Total per year (kWh/year)												2520	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	106.7565	94.8760	101.7372	91.4471	90.0595	82.6674	82.5751	84.9278	84.8578	92.8311	96.5548	105.8305	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.7867	110.4781	99.7867	103.1129	99.7867	103.1129	99.7867	99.7867	103.1129	99.7867	103.1129	99.7867	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	143.4899	141.1846	136.7436	127.0098	121.0477	114.8158	110.9880	114.1503	117.8580	124.7730	134.1039	142.2453	(72)
Total internal gains	500.2655	510.6989	490.4073	473.0165	449.8637	430.9273	415.0680	416.1830	428.3761	445.9482	472.4698	490.3157	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.2000	11.2829	0.7600	0.7000	0.7700	17.4709 (75)
Southwest	6.3000	36.7938	0.7600	0.7000	0.7700	85.4595 (79)
Northwest	4.2000	11.2829	0.7600	0.7000	0.7700	17.4709 (81)

Solar gains	120.4014	216.6944	327.3192	457.2374	559.3087	576.0103	546.7018	467.3802	371.8102	247.8056	146.3268	101.6709 (83)
Total gains	620.6669	727.3934	817.7265	930.2538	1009.1724	1006.9376	961.7698	883.5633	800.1863	693.7538	618.7966	591.9865 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.6076	68.6968	68.7844	69.1991	69.2772	69.6433	69.6433	69.7115	69.5018	69.2772	69.1193	68.9550	
alpha	5.5738	5.5798	5.5856	5.6133	5.6185	5.6429	5.6429	5.6474	5.6335	5.6185	5.6080	5.5970	
util living area	0.9868	0.9688	0.9260	0.8080	0.6257	0.4411	0.3190	0.3623	0.5887	0.8695	0.9703	0.9896	(86)
MIT	20.2719	20.4323	20.6291	20.8287	20.9199	20.9420	20.9446	20.9443	20.9314	20.7955	20.4997	20.2388	(87)
Th 2	20.0732	20.0743	20.0753	20.0804	20.0813	20.0857	20.0857	20.0865	20.0840	20.0813	20.0794	20.0774	(88)
util rest of house	0.9829	0.9602	0.9071	0.7688	0.5707	0.3793	0.2529	0.2908	0.5165	0.8306	0.9606	0.9865	(89)
MIT 2	19.2345	19.4354	19.6749	19.9031	19.9921	20.0136	20.0151	20.0158	20.0054	19.8756	19.5264	19.1963	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.4938	19.6847	19.9134	20.1345	20.2240	20.2457	20.2474	20.2479	20.2369	20.1055	19.7697	19.4569	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4938	19.6847	19.9134	20.1345	20.2240	20.2457	20.2474	20.2479	20.2369	20.1055	19.7697	19.4569	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9559	0.9033	0.7713	0.5795	0.3902	0.2646	0.3034	0.5288	0.8317	0.9566	0.9838	(94)
Useful gains	608.1253	695.2842	738.6284	717.4847	584.8124	392.8655	254.4887	268.0983	423.1743	577.0080	591.9142	582.3872	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1076.5422	1046.1900	947.9501	789.2059	598.1225	394.0726	254.5922	268.3214	429.2275	666.9937	891.0521	1075.5623	(97)
Space heating kWh	348.5021	235.8087	155.7353	51.6392	9.9027	0.0000	0.0000	0.0000	0.0000	66.9494	215.3793	366.9223	(98a)
Space heating requirement - total per year (kWh/year)												1450.8390	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	348.5021	235.8087	155.7353	51.6392	9.9027	0.0000	0.0000	0.0000	0.0000	66.9494	215.3793	366.9223	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1450.8390	
Space heating per m2										(98c) / (4) =		20.7263	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	348.5021	235.8087	155.7353	51.6392	9.9027	0.0000	0.0000	0.0000	0.0000	66.9494	215.3793	366.9223	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	158.9157	107.5279	71.0147	23.5473	4.5156	0.0000	0.0000	0.0000	0.0000	30.5287	98.2122	167.3152	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	131.4533	116.2850	123.5250	108.4701	105.0791	94.6019	93.2568	96.9733	98.0618	109.4571	116.5382	129.9907	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)

Lighting	25.0678	20.1103	18.1071	13.2660	10.2471	8.3719	9.3477	12.1505	15.7823	20.7072	23.3888	25.7645 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	661.5773 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1323.6923 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	202.3112 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2187.5808 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	661.5773	0.1575	104.1906	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1323.6923	0.1409	186.5137	(264)
Space and water heating			290.7043	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	202.3112	0.1443	29.1998	(268)
Total CO2, kg/year			319.9041	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.5700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	661.5773	1.5830	1047.2714	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1323.6923	1.5210	2013.3526	(278)
Space and water heating			3060.6240	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	202.3112	1.5338	310.3117	(282)
Total Primary energy kWh/year			3370.9357	(286)
Dwelling Primary energy Rate (DPER)			48.1600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		70.0000 (1b)	x	2.5000 (2b)	=	175.0000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1143 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3643 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3096 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3096	0.3329	0.3483	0.3638	(22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
External Wall 1	60.0000	17.3000	42.7000	0.1800	7.6860			(29a)
External Roof 1	70.0000		70.0000	0.1100	7.7000			(30)
Total net area of external elements Aum(A, m2)			130.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8181			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			250.0000 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	35.0000	0.0700	2.4500
E14 Flat roof	35.0000	0.0800	2.8000
E16 Corner (normal)	5.0000	0.0900	0.4500
E18 Party wall between dwellings	5.0000	0.0600	0.3000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.0000 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	40.8181 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.3755	33.2008	33.0295	32.2249	32.0743	31.3736	31.3736	31.2438	31.6435	32.0743	32.3789	32.6973	(38)
Heat transfer coeff	74.1936	74.0188	73.8475	73.0429	72.8924	72.1916	72.1916	72.0619	72.4616	72.8924	73.1969	73.5153	(39)
Average = Sum(39)m / 12 =												73.0422	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0599	1.0574	1.0550	1.0435	1.0413	1.0313	1.0313	1.0295	1.0352	1.0413	1.0457	1.0502	(40)
HLP (average)												1.0435	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461	(42)
Hot water usage for mixer showers	61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)
Hot water usage for baths	26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)
Hot water usage for other uses	37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)
Average daily hot water use (litres/day)												116.0487	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)
Energy content (annual)										Total = Sum(45)m =		1927.5450	

Distribution loss (46)m = 0.15 x (45)m

	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737 (46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	249.1853	220.4115	234.0898	205.4609	198.9689	179.0558	176.4593	183.5353	185.6434	207.3045	220.8226	246.4005 (62)
WWHRS	-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355 (64)

Total per year (kWh/year) = Sum(64)m =	2244.4896 (64)
12Total per year (kWh/year)	2244 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)

Heat gains from water heating, kWh/month

	105.8751	94.0799	100.8558	90.5941	89.1781	81.8144	81.6937	84.0464	84.0048	91.9497	95.7018	104.9491 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	99.7867	110.4781	99.7867	103.1129	99.7867	103.1129	99.7867	99.7867	103.1129	99.7867	103.1129	99.7867 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)

Water heating gains (Table 5)

	142.3052	139.9999	135.5589	125.8251	119.8630	113.6311	109.8033	112.9656	116.6733	123.5883	132.9192	141.0606 (72)

Total internal gains

	499.0808	509.5142	489.2226	471.8318	448.6790	429.7426	413.8833	414.9983	427.1914	444.7635	471.2851	489.1310 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(75)
Southwest	6.3000	36.7938	0.6300	0.7000	0.7700	70.8414	(79)
Northwest	4.2000	11.2829	0.6300	0.7000	0.7700	14.4825	(81)

Solar gains	99.8064	179.6283	271.3304	379.0257	463.6375	477.4822	453.1870	387.4336	308.2111	205.4178	121.2972	84.2798	(83)
Total gains	598.8872	689.1425	760.5530	850.8575	912.3165	907.2248	867.0703	802.4320	735.4025	650.1813	592.5823	573.4107	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.5193	65.6740	65.8263	66.5514	66.6889	67.3362	67.3362	67.4575	67.0854	66.6889	66.4114	66.1238	
alpha	5.3680	5.3783	5.3884	5.4368	5.4459	5.4891	5.4891	5.4972	5.4724	5.4459	5.4274	5.4083	
util living area	0.9895	0.9771	0.9483	0.8602	0.6986	0.5030	0.3654	0.4112	0.6512	0.9018	0.9771	0.9915	(86)
MIT	19.9935	20.1926	20.4553	20.7628	20.9367	20.9911	20.9987	20.9976	20.9670	20.7317	20.3156	19.9604	(87)
Th 2	20.0337	20.0358	20.0378	20.0473	20.0490	20.0573	20.0573	20.0589	20.0541	20.0490	20.0454	20.0417	(88)
util rest of house	0.9863	0.9705	0.9336	0.8255	0.6406	0.4317	0.2876	0.3281	0.5732	0.8681	0.9692	0.9889	(89)
MIT 2	18.8816	19.1332	19.4585	19.8231	20.0007	20.0527	20.0569	20.0581	20.0342	19.7998	19.2978	18.8457	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.1596	19.3981	19.7077	20.0580	20.2347	20.2873	20.2924	20.2930	20.2674	20.0328	19.5522	19.1244	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1596	19.3981	19.7077	20.0580	20.2347	20.2873	20.2924	20.2930	20.2674	20.0328	19.5522	19.1244	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9649	0.9276	0.8259	0.6524	0.4494	0.3071	0.3489	0.5914	0.8675	0.9639	0.9855	(94)
Useful gains	588.3335	664.9292	705.4706	702.7264	595.2378	407.6642	266.2746	279.9685	434.9376	564.0183	571.2058	565.0916	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1102.4855	1073.1317	975.3577	815.0142	622.1139	410.5767	266.5594	280.5343	446.8969	687.5791	911.4649	1097.1700	(97)
Space heating kWh													
	382.5291	274.3121	200.7960	80.8472	19.9959	0.0000	0.0000	0.0000	0.0000	91.9293	244.9866	395.8663	(98a)
Space heating requirement - total per year (kWh/year)												1691.2624	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	382.5291	274.3121	200.7960	80.8472	19.9959	0.0000	0.0000	0.0000	0.0000	91.9293	244.9866	395.8663	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1691.2624	
Space heating per m2											(98c) / (4) =	24.1609	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	382.5291	274.3121	200.7960	80.8472	19.9959	0.0000	0.0000	0.0000	0.0000	91.9293	244.9866	395.8663	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	414.4411	297.1962	217.5471	87.5918	21.6640	0.0000	0.0000	0.0000	0.0000	99.5983	265.4243	428.8909	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.2792	84.8205	83.9820	82.3500	80.6221	79.8000	79.8000	79.8000	79.8000	82.5659	84.5507	85.3742	(217)
Fuel for water heating, kWh/month													
	259.0275	230.3600	247.5431	223.1544	221.7153	202.7013	200.8060	208.3848	210.2056	225.5207	232.8983	256.0909	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	20.7337	16.6333	14.9765	10.9724	8.4754	6.9245	7.7315	10.0498	13.0536	17.1271	19.3450	21.3099	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.8628	-46.3936	-66.7895	-75.2326	-81.2599	-75.9138	-74.9840	-70.7210	-63.2183	-53.1142	-36.1539	-28.4051	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.3841	-38.6929	-76.9341	-115.5884	-152.8672	-153.5928	-151.7771	-128.4913	-94.1621	-55.3395	-24.5486	-14.5357	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1832.3537	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2718.4078	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												167.3328	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1729.9627	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3074.1316	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1832.3537	0.2100	384.7943	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2718.4078	0.2100	570.8656	(264)
Space and water heating			955.6599	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	167.3328	0.1443	24.1513	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.0487	0.1345	-94.8620	
PV Unit electricity exported	-1024.9140	0.1259	-129.0243	
Total			-223.8863	(269)
Total CO2, kg/year			767.8541	(272)
Target Carbon Dioxide Emission Rate (TER)			10.9700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1832.3537	1.1300	2070.5597	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2718.4078	1.1300	3071.8008	(278)
Space and water heating			5142.3605	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	167.3328	1.5338	256.6606	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.0487	1.4973	-1055.6411	
PV Unit electricity exported	-1024.9140	0.4621	-473.6077	
Total			-1529.2488	(283)
Total Primary energy kWh/year			3999.8731	(286)
Target Primary Energy Rate (TPER)			57.1400	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 2BH_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2BH
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	80 C	DER	4.84	TER	11.93
Environmental	96 A	% DER<TER	59.43		
CO_2 Emissions (t/year)	0.36	DFEE	37.05	TFEE	39.49
Compliance Check	See BREL	% DFEE < TFEE	6.17		
% DPER < TPER	18.64	DPER	50.71	TPER	62.33

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		40.0000 (1b)	x	2.5000 (2b)	=	100.0000 (1b)	-
First floor		40.0000 (1c)	x	2.7500 (2c)	=	110.0000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	210.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0952	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2452	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2085	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2658	0.2606	0.2554	0.2293	0.2241	0.1980	0.1980	0.1928	0.2085	0.2241	0.2345	0.2449	(22b)
Effective ac	0.5353	0.5339	0.5326	0.5263	0.5251	0.5196	0.5196	0.5186	0.5217	0.5251	0.5275	0.5300	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			2.6000	1.0000	2.6000			(26)
Heatloss Floor 1			40.0000	0.1100	4.4000			(28a)
External Wall 1	95.0000	27.8000	67.2000	0.1400	9.4080			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			175.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.6630			(33)

Party Wall 1						42.0000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												8.7500	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	58.4130	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.0976	37.0025	36.9094	36.4718	36.3899	36.0088	36.0088	35.9383	36.1556	36.3899	36.5556	36.7287	(38)
Heat transfer coeff	95.5105	95.4155	95.3223	94.8848	94.8029	94.4218	94.4218	94.3512	94.5686	94.8029	94.9685	95.1417	(39)
Average = Sum(39)m / 12 =												94.8844	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1939	1.1927	1.1915	1.1861	1.1850	1.1803	1.1803	1.1794	1.1821	1.1850	1.1871	1.1893	(40)
HLP (average)												1.1861	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4629	(42)
Hot water usage for mixer showers	65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)
Hot water usage for baths	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)												122.8659	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156	(44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400	(45)
Energy content (annual)											Total = Sum(45)m =	2040.7768	
Distribution loss (46)m = 0.15 x (45)m	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(64)
										Total per year (kWh/year) = Sum(64)m =		2633.5419	(64)
12Total per year (kWh/year)												2634	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	110.6619	98.3124	105.3476	94.5294	92.9839	85.2338	85.0599	87.5509	87.5531	95.9185	99.9373	109.6816	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.6826	122.5414	110.6826	114.3720	110.6826	114.3720	110.6826	110.6826	114.3720	110.6826	114.3720	110.6826	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)	148.7391	146.2983	141.5963	131.2908	124.9784	118.3803	114.3278	117.6760	121.6015	128.9227	138.8018	147.4215	(72)
Total internal gains	541.8052	553.5003	531.2012	512.3691	486.9467	466.5450	449.1207	450.1918	463.5450	482.3928	511.3818	530.8052	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southeast	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (77)
Northwest	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	183.8298	336.3427	521.8556	749.9505	934.3366	969.0724	917.0220	773.1182	599.8448	388.3546	224.4130	154.5847	(83)
Total gains	725.6350	889.8430	1053.0568	1262.3196	1421.2833	1435.6174	1366.1426	1223.3100	1063.3897	870.7474	735.7948	685.3899	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1669	58.2249	58.2818	58.5506	58.6011	58.8376	58.8376	58.8817	58.7463	58.6011	58.4989	58.3925	
alpha	4.8778	4.8817	4.8855	4.9034	4.9067	4.9225	4.9225	4.9254	4.9164	4.9067	4.8999	4.8928	
util living area	0.9882	0.9695	0.9210	0.7890	0.5963	0.4175	0.3035	0.3534	0.5909	0.8779	0.9739	0.9909	(86)
MIT	20.0612	20.2650	20.5254	20.7849	20.9027	20.9321	20.9363	20.9354	20.9128	20.7156	20.3344	20.0195	(87)
Th 2	19.9249	19.9258	19.9268	19.9312	19.9320	19.9358	19.9358	19.9365	19.9343	19.9320	19.9303	19.9286	(88)
util rest of house	0.9845	0.9607	0.8999	0.7447	0.5356	0.3496	0.2304	0.2724	0.5087	0.8372	0.9647	0.9880	(89)
MIT 2	18.8482	19.1037	19.4203	19.7135	19.8265	19.8527	19.8549	19.8553	19.8397	19.6515	19.1977	18.7984	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.1514	19.3940	19.6965	19.9813	20.0956	20.1225	20.1252	20.1253	20.1080	19.9175	19.4819	19.1036	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1514	19.3940	19.6965	19.9813	20.0956	20.1225	20.1252	20.1253	20.1080	19.9175	19.4819	19.1036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9552	0.8947	0.7469	0.5452	0.3616	0.2435	0.2869	0.5226	0.8366	0.9598	0.9851	(94)
Useful gains	711.8906	849.9968	942.1320	942.8551	774.8789	519.1702	332.6153	350.9523	555.7210	728.4717	706.2501	675.1485	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1418.4692	1382.9552	1257.9242	1051.4496	795.9230	521.4464	332.8565	351.4910	568.1671	883.3308	1175.8911	1417.9572	(97)
Space heating kWh	525.6945	358.1481	234.9495	78.1881	15.6568	0.0000	0.0000	0.0000	0.0000	115.2151	338.1415	552.6497	(98a)
Space heating requirement - total per year (kWh/year)												2218.6432	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	525.6945	358.1481	234.9495	78.1881	15.6568	0.0000	0.0000	0.0000	0.0000	115.2151	338.1415	552.6497	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2218.6432	
Space heating per m2										(98c) / (4) =		27.7330	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	525.6945	358.1481	234.9495	78.1881	15.6568	0.0000	0.0000	0.0000	0.0000	115.2151	338.1415	552.6497	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	239.7148	163.3142	107.1361	35.6535	7.1394	0.0000	0.0000	0.0000	0.0000	52.5377	154.1913	252.0062	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	137.6223	121.7131	129.2279	113.3388	109.6985	98.6558	97.1818	101.1166	102.3193	114.3339	121.8811	136.0737	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	28.4546	22.8273	20.5535	15.0584	11.6315	9.5030	10.6107	13.7921	17.9146	23.5049	26.5488	29.2454	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1011.6932	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1383.1628	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	229.6449	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2624.5009	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1011.6932	0.1573	159.1415	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1383.1628	0.1409	194.9334	(264)
Space and water heating			354.0749	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	229.6449	0.1443	33.1449	(268)
Total CO2, kg/year			387.2197	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.8400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1011.6932	1.5823	1600.8029	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1383.1628	1.5211	2103.9581	(278)
Space and water heating			3704.7610	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	229.6449	1.5338	352.2371	(282)
Total Primary energy kWh/year			4056.9981	(286)
Dwelling Primary energy Rate (DPER)			50.7100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.0000 (1b)	x	2.5000 (2b)	=	100.0000 (1b)	-
First floor	40.0000 (1c)	x	2.7500 (2c)	=	110.0000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 80.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	210.0000	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		3 * 10 =	30.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1429 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3929 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3339 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4258	0.4174	0.4091	0.3673	0.3590	0.3172	0.3172	0.3089	0.3339	0.3590	0.3757	0.3924	(22b)
Effective ac	0.5906	0.5871	0.5837	0.5675	0.5644	0.5503	0.5503	0.5477	0.5558	0.5644	0.5706	0.5770	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.6000	1.0000	2.6000			(26)
TER Opening Type (Uw = 1.20)			17.4000	1.1450	19.9237			(27)
Heatloss Floor 1			40.0000	0.1300	5.2000			(28a)
External Wall 1	95.0000	20.0000	75.0000	0.1800	13.5000			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			175.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.6237			(33)
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	26.0000	0.1600	4.1600
E6 Intermediate floor within a dwelling	26.0000	0.0000	0.0000
E14 Flat roof	26.0000	0.0800	2.0800
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8150 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 53.4387 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.9310	40.6871	40.4481	39.3252	39.1151	38.1370	38.1370	37.9559	38.5138	39.1151	39.5401	39.9844	(38)
Heat transfer coeff	94.3697	94.1258	93.8867	92.7638	92.5537	91.5757	91.5757	91.3946	91.9524	92.5537	92.9787	93.4231	(39)
Average = Sum(39)m / 12 =												92.7628	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1796	1.1766	1.1736	1.1595	1.1569	1.1447	1.1447	1.1424	1.1494	1.1569	1.1622	1.1678	(40)
HLP (average)												1.1595	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4629 (42)

Hot water usage for mixer showers

65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)

Hot water usage for baths

28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)

Hot water usage for other uses

39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)

Average daily hot water use (litres/day) 122.8659 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156 (44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400 (45)
Energy content (annual)										Total = Sum(45)m =		2040.7768
Distribution loss (46)m = 0.15 x (45)m												
	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	260.9310	230.7465	244.9482	214.7309	207.7641	186.7745	183.9324	191.4242	193.7497	216.5899	230.9954	257.9827 (62)
WWHRS	-29.9502	-26.4882	-27.7369	-22.9672	-21.4046	-18.3161	-17.1684	-18.2569	-18.9505	-22.3406	-25.3092	-29.3955 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	230.9808	204.2583	217.2113	191.7637	186.3595	168.4584	166.7639	173.1673	174.7991	194.2493	205.6862	228.5871 (64)
										Total per year (kWh/year) = Sum(64)m =		2342.2850 (64)
12Total per year (kWh/year)												2342 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	109.7805	97.5163	104.4662	93.6764	92.1025	84.3809	84.1785	86.6695	86.7001	95.0371	99.0843	108.8002 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	110.7673	122.6352	110.7673	114.4595	110.7673	114.4595	110.7673	110.7673	114.4595	110.7673	114.4595	110.7673	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)													
	147.5544	145.1136	140.4116	130.1061	123.7937	117.1956	113.1431	116.4913	120.4168	127.7380	137.6171	146.2368	(72)
Total internal gains													
	540.7052	552.4094	530.1012	511.2719	485.8468	465.4478	448.0207	449.0918	462.4478	481.2928	510.2847	529.7053	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.8000	11.2829	0.6300	0.7000	0.7700	19.9996	(75)
Southeast	5.8000	36.7938	0.6300	0.7000	0.7700	65.2191	(77)
Northwest	5.8000	11.2829	0.6300	0.7000	0.7700	19.9996	(81)

Solar gains	105.2184	192.5120	298.6937	429.2480	534.7848	554.6664	524.8744	442.5084	343.3322	222.2819	128.4469	88.4794	(83)
Total gains	645.9236	744.9213	828.7949	940.5199	1020.6315	1020.1143	972.8951	891.6003	805.7800	703.5748	638.7316	618.1846	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.8701	59.0227	59.1730	59.8893	60.0252	60.6663	60.6663	60.7865	60.4177	60.0252	59.7508	59.4666	
alpha	4.9247	4.9348	4.9449	4.9926	5.0017	5.0444	5.0444	5.0524	5.0278	5.0017	4.9834	4.9644	
util living area													
	0.9927	0.9845	0.9645	0.8974	0.7554	0.5591	0.4113	0.4659	0.7215	0.9338	0.9847	0.9940	(86)
MIT	19.7541	19.9571	20.2502	20.6276	20.8798	20.9788	20.9963	20.9932	20.9288	20.5911	20.1130	19.7245	(87)
Th 2	19.9363	19.9388	19.9412	19.9525	19.9546	19.9645	19.9645	19.9663	19.9607	19.9546	19.9503	19.9459	(88)
util rest of house													
	0.9903	0.9796	0.9532	0.8669	0.6949	0.4752	0.3160	0.3641	0.6366	0.9068	0.9790	0.9921	(89)
MIT 2	18.5067	18.7653	19.1332	19.5922	19.8606	19.9534	19.9634	19.9641	19.9161	19.5634	18.9733	18.4758	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.8186	19.0632	19.4125	19.8510	20.1154	20.2097	20.2216	20.2214	20.1693	19.8203	19.2582	18.7880	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8186	19.0632	19.4125	19.8510	20.1154	20.2097	20.2216	20.2214	20.1693	19.8203	19.2582	18.7880	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9742	0.9461	0.8635	0.7049	0.4956	0.3399	0.3896	0.6549	0.9026	0.9739	0.9891	(94)
Useful gains	637.4108	725.7176	784.1569	812.1488	719.4073	505.5756	330.6915	347.3837	527.7036	635.0186	622.0308	611.4535	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1370.1143	1333.1261	1212.3109	1015.8588	778.8760	513.7157	331.6522	349.2555	558.0868	853.3757	1130.4547	1362.8557	(97)
Space heating kWh	545.1314	408.1785	318.5466	146.6712	44.2447	0.0000	0.0000	0.0000	0.0000	162.4577	366.0652	559.0432	(98a)
Space heating requirement - total per year (kWh/year)												2550.3385	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	545.1314	408.1785	318.5466	146.6712	44.2447	0.0000	0.0000	0.0000	0.0000	162.4577	366.0652	559.0432	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2550.3385	
Space heating per m2											(98c) / (4) =	31.8792	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	545.1314	408.1785	318.5466	146.6712	44.2447	0.0000	0.0000	0.0000	0.0000	162.4577	366.0652	559.0432	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	590.6082	442.2302	345.1209	158.9071	47.9358	0.0000	0.0000	0.0000	0.0000	176.0105	396.6036	605.6807	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	230.9808	204.2583	217.2113	191.7637	186.3595	168.4584	166.7639	173.1673	174.7991	194.2493	205.6862	228.5871	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9162	85.5809	84.9172	83.4661	81.3825	79.8000	79.8000	79.8000	79.8000	83.6618	85.3376	85.9855	(217)
Fuel for water heating, kWh/month	268.8444	238.6728	255.7920	229.7503	228.9919	211.1008	208.9773	217.0017	219.0465	232.1841	241.0265	265.8437	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.0153	18.4637	16.6245	12.1798	9.4080	7.6865	8.5823	11.1556	14.4901	19.0118	21.4738	23.6549	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.2584	-52.4461	-75.2785	-84.5221	-91.0460	-84.9455	-83.8821	-79.2210	-71.0005	-59.8942	-40.9264	-32.2205	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.3095	-44.7957	-88.9771	-133.5591	-176.5277	-177.3478	-175.2734	-148.4502	-108.8629	-64.0529	-28.4478	-16.8547	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2763.0970	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2817.2319	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	185.7463	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1977.1002	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)

Energy used	0.0000 (237)
Total delivered energy for all uses	3874.9750 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2763.0970	0.2100	580.2504	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2817.2319	0.2100	591.6187	(264)
Space and water heating			1171.8691	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	185.7463	0.1443	26.8089	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-792.6414	0.1346	-106.7035	
PV Unit electricity exported	-1184.4589	0.1259	-149.1376	
Total			-255.8411	(269)
Total CO2, kg/year			954.7662	(272)
Target Carbon Dioxide Emission Rate (TER)			11.9300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2763.0970	1.1300	3122.2996	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2817.2319	1.1300	3183.4721	(278)
Space and water heating			6305.7717	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	185.7463	1.5338	284.9039	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-792.6414	1.4975	-1187.0007	
PV Unit electricity exported	-1184.4589	0.4622	-547.4384	
Total			-1734.4392	(283)
Total Primary energy kWh/year			4986.3372	(286)
Target Primary Energy Rate (TPER)			62.3300	(287)

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Full SAP Calculation Printout

Property Reference	Plot 2BH-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2BH-AFF
Property	1 Bedroom Flat, 2BH-AFF, Saffron Walden, CB11		

SAP Rating	81 B	DER	4.60	TER	11.35
Environmental	96 A	% DER<TER	59.47		
CO_2 Emissions (t/year)	0.35	DFEE	34.23	TFEE	36.48
Compliance Check	See BREL	% DFEE < TFEE	6.17		
% DPER < TPER	18.53	DPER	48.26	TPER	59.23

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			40.0000	(1b)	x 2.5000	(2b) =	100.0000	(1b) -
First floor			40.0000	(1c)	x 2.7500	(2c) =	110.0000	(1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		80.0000						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.0000	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0952	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2452	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2085	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2658	0.2606	0.2554	0.2293	0.2241	0.1980	0.1980	0.1928	0.2085	0.2241	0.2345	0.2449	(22b)
Effective ac	0.5353	0.5339	0.5326	0.5263	0.5251	0.5196	0.5196	0.5186	0.5217	0.5251	0.5275	0.5300	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.3000	1.1450	31.2595			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			40.0000	0.1100	4.4000			(28a)
External Wall 1	100.0000	32.5000	67.5000	0.1400	9.4500			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			180.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.7095			(33)

Party Wall 1						53.0000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												9.0000	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	63.7095	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.0976	37.0025	36.9094	36.4718	36.3899	36.0088	36.0088	35.9383	36.1556	36.3899	36.5556	36.7287	(38)
Heat transfer coeff													
	100.8071	100.7121	100.6189	100.1813	100.0995	99.7184	99.7184	99.6478	99.8652	100.0995	100.2651	100.4382	(39)
Average = Sum(39)m / 12 =												100.1810	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2601	1.2589	1.2577	1.2523	1.2512	1.2465	1.2465	1.2456	1.2483	1.2512	1.2533	1.2555	(40)
HLP (average)												1.2523	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4629	(42)
Hot water usage for mixer showers													
	65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)
Hot water usage for baths													
	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)
Hot water usage for other uses													
	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)												122.8659	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156	(44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400	(45)
Energy content (annual)											Total = Sum(45)m =	2040.7768	
Distribution loss (46)m = 0.15 x (45)m													
	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(64)
										Total per year (kWh/year) = Sum(64)m =		2633.5419	(64)
12Total per year (kWh/year)												2634	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	110.6619	98.3124	105.3476	94.5294	92.9839	85.2338	85.0599	87.5509	87.5531	95.9185	99.9373	109.6816	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	110.6826	122.5414	110.6826	114.3720	110.6826	114.3720	110.6826	110.6826	114.3720	110.6826	114.3720	110.6826	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)													
	148.7391	146.2983	141.5963	131.2908	124.9784	118.3803	114.3278	117.6760	121.6015	128.9227	138.8018	147.4215	(72)
Total internal gains													
	541.8052	553.5003	531.2012	512.3691	486.9467	466.5450	449.1207	450.1918	463.5450	482.3928	511.3818	530.8052	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	8.4000	19.6403	0.7600	0.7000	0.7700	60.8235 (76)
South	12.6000	46.7521	0.7600	0.7000	0.7700	217.1782 (78)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.6193	563.9034	795.9867	1012.1892	1146.5228	1140.9521	1099.0815	1000.3677	872.1108	630.7086	390.1498	275.1940	(83)
Total gains	865.4245	1117.4036	1327.1879	1524.5583	1633.4695	1607.4971	1548.2022	1450.5594	1335.6557	1113.1014	901.5316	805.9992	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1107	55.1628	55.2138	55.4550	55.5003	55.7125	55.7125	55.7519	55.6306	55.5003	55.4087	55.3131	
alpha	4.6740	4.6775	4.6809	4.6970	4.7000	4.7142	4.7142	4.7168	4.7087	4.7000	4.6939	4.6875	
util living area	0.9778	0.9380	0.8606	0.7190	0.5517	0.3939	0.2829	0.3151	0.5046	0.7959	0.9501	0.9834	(86)
MIT	20.1089	20.3689	20.6216	20.8196	20.9048	20.9294	20.9335	20.9330	20.9193	20.7811	20.4042	20.0517	(87)
Th 2	19.8722	19.8732	19.8741	19.8784	19.8792	19.8830	19.8830	19.8837	19.8815	19.8792	19.8776	19.8759	(88)
util rest of house	0.9713	0.9221	0.8296	0.6701	0.4913	0.3266	0.2113	0.2391	0.4275	0.7428	0.9342	0.9784	(89)
MIT 2	18.8654	19.1843	19.4799	19.6948	19.7742	19.7964	19.7985	19.7991	19.7891	19.6655	19.2374	18.7968	(90)
Living area fraction									fLA = Living area / (4) =			0.2469	(91)
MIT	19.1724	19.4767	19.7617	19.9725	20.0533	20.0761	20.0787	20.0790	20.0681	19.9409	19.5254	19.1066	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1724	19.4767	19.7617	19.9725	20.0533	20.0761	20.0787	20.0790	20.0681	19.9409	19.5254	19.1066	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9661	0.9154	0.8262	0.6744	0.5009	0.3383	0.2239	0.2524	0.4406	0.7460	0.9280	0.9739	(94)
Useful gains	836.0783	1022.8733	1096.5121	1028.1577	818.2329	543.8449	346.6606	366.1908	588.5486	830.3447	836.6646	784.9616	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1499.2408	1468.0515	1334.3822	1109.2545	836.1639	546.0704	346.8937	366.6080	596.0100	935.0187	1245.8373	1497.1933	(97)
Space heating kWh	493.3929	299.1597	176.9754	58.3897	13.3407	0.0000	0.0000	0.0000	0.0000	77.8775	294.6043	529.9004	(98a)
Space heating requirement - total per year (kWh/year)												1943.6405	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	493.3929	299.1597	176.9754	58.3897	13.3407	0.0000	0.0000	0.0000	0.0000	77.8775	294.6043	529.9004	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1943.6405	
Space heating per m2										(98c) / (4) =		24.2955	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	493.3929	299.1597	176.9754	58.3897	13.3407	0.0000	0.0000	0.0000	0.0000	77.8775	294.6043	529.9004	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	224.9854	136.4157	80.7001	26.6255	6.0833	0.0000	0.0000	0.0000	0.0000	35.5118	134.3385	241.6326	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.0328	231.7417	246.0500	215.7972	208.8659	187.8407	185.0341	192.5260	194.8159	217.6917	232.0616	259.0844	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	137.6223	121.7131	129.2279	113.3388	109.6985	98.6558	97.1818	101.1166	102.3193	114.3339	121.8811	136.0737	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.4546	22.8273	20.5535	15.0584	11.6315	9.5030	10.6107	13.7921	17.9146	23.5049	26.5488	29.2454 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	886.2930 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1383.1628 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	229.6449 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2499.1007 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	886.2930	0.1579	139.9575	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1383.1628	0.1409	194.9334	(264)
Space and water heating			334.8909	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	229.6449	0.1443	33.1449	(268)
Total CO2, kg/year			368.0358	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.6000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	886.2930	1.5845	1404.3454	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1383.1628	1.5211	2103.9581	(278)
Space and water heating			3508.3036	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	229.6449	1.5338	352.2371	(282)
Total Primary energy kWh/year			3860.5406	(286)
Dwelling Primary energy Rate (DPER)			48.2600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.0000 (1b)	x	2.5000 (2b)	=	100.0000 (1b)	-
First floor	40.0000 (1c)	x	2.7500 (2c)	=	110.0000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 80.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	210.0000	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		3 * 10 =	30.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1429 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3929 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3339 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4258	0.4174	0.4091	0.3673	0.3590	0.3172	0.3172	0.3089	0.3339	0.3590	0.3757	0.3924	(22b)
Effective ac	0.5906	0.5871	0.5837	0.5675	0.5644	0.5503	0.5503	0.5477	0.5558	0.5644	0.5706	0.5770	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			14.8200	1.1450	16.9695			(27)
Heatloss Floor 1			40.0000	0.1300	5.2000			(28a)
External Wall 1	100.0000	20.0200	79.9800	0.1800	14.3964			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			180.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.1659			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	20.0000	0.1600	3.2000
E6 Intermediate floor within a dwelling	20.0000	0.0000	0.0000
E14 Flat roof	20.0000	0.0800	1.6000
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3750 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 52.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.9310	40.6871	40.4481	39.3252	39.1151	38.1370	38.1370	37.9559	38.5138	39.1151	39.5401	39.9844	(38)
Heat transfer coeff	93.4719	93.2280	92.9889	91.8660	91.6559	90.6779	90.6779	90.4968	91.0546	91.6559	92.0809	92.5253	(39)
Average = Sum(39)m / 12 =												91.8650	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1653	1.1624	1.1483	1.1457	1.1335	1.1335	1.1312	1.1382	1.1457	1.1510	1.1566	(40)
HLP (average)												1.1483	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4629 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)

Hot water usage for baths

28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)

Hot water usage for other uses

39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)

Average daily hot water use (litres/day) 122.8659 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156 (44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400 (45)
Energy content (annual)										Total = Sum(45)m =		2040.7768

Distribution loss (46)m = 0.15 x (45)m

	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110 (46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	260.9310	230.7465	244.9482	214.7309	207.7641	186.7745	183.9324	191.4242	193.7497	216.5899	230.9954	257.9827 (62)
WWHRS	-29.9502	-26.4882	-27.7369	-22.9672	-21.4046	-18.3161	-17.1684	-18.2569	-18.9505	-22.3406	-25.3092	-29.3955 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	230.9808	204.2583	217.2113	191.7637	186.3595	168.4584	166.7639	173.1673	174.7991	194.2493	205.6862	228.5871 (64)
									Total per year (kWh/year) = Sum(64)m =			2342.2850 (64)
12Total per year (kWh/year)												2342 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000 (64a)

Heat gains from water heating, kWh/month

	109.7805	97.5163	104.4662	93.6764	92.1025	84.3809	84.1785	86.6695	86.7001	95.0371	99.0843	108.8002 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	112.5489	124.6077	112.5489	116.3005	112.5489	116.3005	112.5489	112.5489	116.3005	112.5489	116.3005	112.5489 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)

Water heating gains (Table 5)

	147.5544	145.1136	140.4116	130.1061	123.7937	117.1956	113.1431	116.4913	120.4168	127.7380	137.6171	146.2368 (72)

Total internal gains

	542.4868	554.3819	531.8829	513.1129	487.6284	467.2888	449.8024	450.8734	464.2888	483.0744	512.1257	531.4869 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5600	19.6403	0.6300	0.7000	0.7700	27.3706	(76)
South	6.8400	46.7521	0.6300	0.7000	0.7700	97.7302	(78)
West	3.4200	19.6403	0.6300	0.7000	0.7700	20.5279	(80)

Solar gains	145.6287	253.7565	358.1940	455.4851	515.9352	513.4285	494.5867	450.1654	392.4499	283.8189	175.5674	123.8373	(83)
Total gains	688.1155	808.1384	890.0769	968.5981	1003.5636	980.7173	944.3890	901.0389	856.7387	766.8933	687.6931	655.3242	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4356	59.5911	59.7443	60.4745	60.6132	61.2669	61.2669	61.3895	61.0134	60.6132	60.3334	60.0437	
alpha	4.9624	4.9727	4.9830	5.0316	5.0409	5.0845	5.0845	5.0926	5.0676	5.0409	5.0222	5.0029	
util living area	0.9903	0.9782	0.9532	0.8860	0.7598	0.5743	0.4194	0.4571	0.6854	0.9107	0.9791	0.9923	(86)
MIT	19.8254	20.0507	20.3316	20.6603	20.8794	20.9770	20.9961	20.9940	20.9449	20.6583	20.1873	19.7899	(87)
Th 2	19.9454	19.9478	19.9502	19.9616	19.9637	19.9736	19.9736	19.9754	19.9698	19.9637	19.9594	19.9549	(88)
util rest of house	0.9873	0.9716	0.9391	0.8535	0.6999	0.4896	0.3232	0.3578	0.6011	0.8776	0.9716	0.9898	(89)
MIT 2	18.6035	18.8888	19.2385	19.6357	19.8690	19.9613	19.9724	19.9735	19.9361	19.6450	19.0724	18.5654	(90)
Living area fraction									fLA = Living area / (4) =			0.2469	(91)
MIT	18.9052	19.1756	19.5084	19.8887	20.1184	20.2121	20.2252	20.2254	20.1852	19.8952	19.3476	18.8677	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9052	19.1756	19.5084	19.8887	20.1184	20.2121	20.2252	20.2254	20.1852	19.8952	19.3476	18.8677	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9654	0.9318	0.8510	0.7095	0.5098	0.3470	0.3824	0.6197	0.8751	0.9657	0.9863	(94)
Useful gains	676.5268	780.1541	829.4103	824.2408	712.0168	500.0136	327.7179	344.5510	530.9347	671.0835	664.1177	646.3328	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1365.1721	1330.8880	1209.6363	1009.4861	771.6006	508.8913	328.7211	346.1893	554.0835	851.9589	1127.7726	1357.1357	(97)
Space heating kWh	512.3521	370.0932	282.8881	133.3766	44.3303	0.0000	0.0000	0.0000	0.0000	134.5712	333.8315	528.8374	(98a)
Space heating requirement - total per year (kWh/year)												2340.2805	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	512.3521	370.0932	282.8881	133.3766	44.3303	0.0000	0.0000	0.0000	0.0000	134.5712	333.8315	528.8374	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2340.2805	
Space heating per m2											(98c) / (4) =	29.2535	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	512.3521	370.0932	282.8881	133.3766	44.3303	0.0000	0.0000	0.0000	0.0000	134.5712	333.8315	528.8374	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	555.0944	400.9677	306.4877	144.5034	48.0285	0.0000	0.0000	0.0000	0.0000	145.7977	361.6810	572.9549	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	230.9808	204.2583	217.2113	191.7637	186.3595	168.4584	166.7639	173.1673	174.7991	194.2493	205.6862	228.5871	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.7933	85.3757	84.6532	83.2617	81.3851	79.8000	79.8000	79.8000	79.8000	83.2532	85.1393	85.8770	(217)
Fuel for water heating, kWh/month	269.2294	239.2466	256.5895	230.3145	228.9848	211.1008	208.9773	217.0017	219.0465	233.3235	241.5879	266.1797	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.3854	18.7607	16.8919	12.3757	9.5594	7.8101	8.7204	11.3351	14.7231	19.3176	21.8191	24.0354	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.2693	-52.4648	-75.3070	-84.5535	-91.0772	-84.9732	-83.9130	-79.2565	-71.0364	-59.9221	-40.9413	-32.2298	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.2986	-44.7770	-88.9486	-133.5277	-176.4966	-177.3201	-175.2425	-148.4147	-108.8269	-64.0250	-28.4329	-16.8454	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2535.5151	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2821.5822	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												188.7339	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1977.1002	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)

Energy used	0.0000 (237)
Total delivered energy for all uses	3654.7310 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2535.5151	0.2100	532.4582	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2821.5822	0.2100	592.5323	(264)
Space and water heating			1124.9904	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	188.7339	0.1443	27.2401	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-792.9442	0.1346	-106.7439	
PV Unit electricity exported	-1184.1560	0.1259	-149.0969	
Total			-255.8408	(269)
Total CO2, kg/year			908.3191	(272)
Target Carbon Dioxide Emission Rate (TER)			11.3500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2535.5151	1.1300	2865.1321	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2821.5822	1.1300	3188.3879	(278)
Space and water heating			6053.5200	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	188.7339	1.5338	289.4864	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-792.9442	1.4975	-1187.4530	
PV Unit electricity exported	-1184.1560	0.4622	-547.2888	
Total			-1734.7417	(283)
Total Primary energy kWh/year			4738.3654	(286)
Target Primary Energy Rate (TPER)			59.2300	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 2BH-BUN_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	2BH-BUN
Property	1 Bedroom Flat, 2BH-BUN, Saffron Walden, CB11		

SAP Rating	79 C	DER	5.16	TER	12.76
Environmental	96 A	% DER<TER	59.56		
CO_2 Emissions (t/year)	0.41	DFEE	44.80	TFEE	44.01
Compliance Check	See BREL	% DFEE < TFEE	-1.79		
% DPER < TPER	19.33	DPER	53.90	TPER	66.81

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		42.0000 (1b)	x	2.5000 (2b)	=	105.0000 (1b)	-
First floor		42.0000 (1c)	x	2.7500 (2c)	=	115.5000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.5000	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0907 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.2407 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.2046 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2609	0.2557	0.2506	0.2251	0.2199	0.1944	0.1944	0.1893	0.2046	0.2199	0.2302	0.2404	(22b)
Effective ac	0.5340	0.5327	0.5314	0.5253	0.5242	0.5189	0.5189	0.5179	0.5209	0.5242	0.5265	0.5289	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			42.0000	0.1100	4.6200			(28a)
External Wall 1	140.0000	45.1000	94.9000	0.1400	13.2860			(29a)
External Roof 1	42.0000		42.0000	0.1100	4.6200			(30)
Total net area of external elements Aum(A, m2)			224.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.4130			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 11.2000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 84.6130 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.8583	38.7622	38.6679	38.2253	38.1425	37.7570	37.7570	37.6856	37.9055	38.1425	38.3100	38.4852	(38)
Heat transfer coeff													
	123.4713	123.3752	123.2809	122.8383	122.7555	122.3700	122.3700	122.2986	122.5185	122.7555	122.9230	123.0982	(39)

Average = Sum(39)m / 12 = 122.8379

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4699	1.4688	1.4676	1.4624	1.4614	1.4568	1.4568	1.4559	1.4586	1.4614	1.4634	1.4655	(40)
HLP (average)												1.4624	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5344 (42)

Hot water usage for mixer showers

66.7131	65.7106	64.2496	61.4544	59.3916	57.0911	55.7836	57.2334	58.8228	61.2927	64.1480	66.4575	(42a)

Hot water usage for baths

28.8121	28.3842	27.7816	26.6705	25.8386	24.9161	24.4179	25.0162	25.6677	26.6548	27.7887	28.7146	(42b)

Hot water usage for other uses

40.5847	39.1089	37.6331	36.1573	34.6815	33.2057	33.2057	34.6815	36.1573	37.6331	39.1089	40.5847	(42c)

Average daily hot water use (litres/day) 125.1158 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	136.1099	133.2036	129.6643	124.2822	119.9116	115.2129	113.4071	116.9311	120.6478	125.5806	131.0456	135.7569	(44)
Energy conte	215.5648	189.6801	199.2892	170.1361	161.4241	141.6677	137.1560	144.7851	148.7708	170.4117	186.6985	212.5624	(45)
Energy content (annual)										Total = Sum(45)m =		2078.1466	
Distribution loss (46)m = 0.15 x (45)m													
	32.3347	28.4520	29.8934	25.5204	24.2136	21.2502	20.5734	21.7178	22.3156	25.5618	28.0048	31.8844	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

265.9092	235.1525	249.6336	218.8565	211.7685	190.3881	187.5005	195.1296	197.4912	220.7562	235.4189	262.9069	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

265.9092	235.1525	249.6336	218.8565	211.7685	190.3881	187.5005	195.1296	197.4912	220.7562	235.4189	262.9069	(64)

Total per year (kWh/year) = Sum(64)m = 2670.9117 (64)
12Total per year (kWh/year) 2671 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

111.9508	99.4466	106.5392	95.5466	93.9491	86.0809	85.8799	88.4166	88.4426	96.9374	101.0536	110.9526	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

114.7966	127.0962	114.7966	118.6232	114.7966	118.6232	114.7966	114.7966	118.6232	114.7966	118.6232	114.7966	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

227.5971	229.9588	224.0073	211.3372	195.3435	180.3117	170.2695	167.9078	173.8593	186.5294	202.5231	217.5549	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	(71)

Water heating gains (Table 5)

150.4715	147.9860	143.1978	132.7036	126.2756	119.5567	115.4300	118.8395	122.8370	130.2923	140.3522	149.1298	(72)
Total internal gains													
556.8811	569.0569	546.0176	526.6798	500.4316	479.5074	461.5120	462.5597	476.3353	495.6341	525.5143	545.4971	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190 (77)
Southwest	6.3000	36.7938	0.7600	0.7000	0.7700	85.4595 (79)
Northwest	12.6000	11.2829	0.7600	0.7000	0.7700	52.4128 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	343.7333	614.5206	917.8850	1266.4866	1536.4825	1577.2370	1499.0407	1289.6823	1037.3572	699.9566	416.9973	290.7449	(83)
Total gains	900.6144	1183.5775	1463.9026	1793.1664	2036.9141	2056.7444	1960.5527	1752.2421	1513.6924	1195.5907	942.5116	836.2420	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.2444	47.2813	47.3174	47.4879	47.5199	47.6696	47.6696	47.6975	47.6119	47.5199	47.4552	47.3876	
alpha	4.1496	4.1521	4.1545	4.1659	4.1680	4.1780	4.1780	4.1798	4.1741	4.1680	4.1637	4.1592	
util living area	0.9816	0.9494	0.8772	0.7243	0.5372	0.3766	0.2737	0.3192	0.5357	0.8320	0.9605	0.9861	(86)
MIT	19.8602	20.1452	20.4701	20.7560	20.8830	20.9182	20.9244	20.9231	20.8947	20.6705	20.1984	19.8003	(87)
Th 2	19.7102	19.7110	19.7119	19.7158	19.7166	19.7201	19.7201	19.7207	19.7187	19.7166	19.7151	19.7135	(88)
util rest of house	0.9758	0.9350	0.8464	0.6710	0.4708	0.3031	0.1946	0.2314	0.4454	0.7790	0.9466	0.9816	(89)
MIT 2	18.4264	18.7791	19.1640	19.4750	19.5923	19.6216	19.6248	19.6251	19.6072	19.4032	18.8548	18.3536	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.7849	19.1206	19.4906	19.7953	19.9150	19.9458	19.9497	19.9496	19.9291	19.7200	19.1907	18.7153	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7849	19.1206	19.4906	19.7953	19.9150	19.9458	19.9497	19.9496	19.9291	19.7200	19.1907	18.7153	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9703	0.9269	0.8404	0.6746	0.4814	0.3162	0.2088	0.2472	0.4607	0.7791	0.9393	0.9769	(94)
Useful gains	873.8886	1097.0627	1230.2541	1209.6006	980.5147	650.4301	409.4344	433.1484	697.4261	931.5080	885.3040	816.9448	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1788.4656	1754.4688	1601.4883	1338.3604	1008.4343	654.1632	409.9035	434.1063	714.1695	1119.5352	1486.2239	1786.8045	(97)
Space heating kWh	680.4453	441.7769	276.1983	92.7070	20.7722	0.0000	0.0000	0.0000	0.0000	139.8923	432.6624	721.5756	(98a)
Space heating requirement - total per year (kWh/year)												2806.0299	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	680.4453	441.7769	276.1983	92.7070	20.7722	0.0000	0.0000	0.0000	0.0000	139.8923	432.6624	721.5756	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2806.0299	
Space heating per m2										(98c) / (4) =		33.4051	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	680.4453	441.7769	276.1983	92.7070	20.7722	0.0000	0.0000	0.0000	0.0000	139.8923	432.6624	721.5756	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	310.2806	201.4486	125.9454	42.2741	9.4720	0.0000	0.0000	0.0000	0.0000	63.7904	197.2925	329.0359	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	265.9092	235.1525	249.6336	218.8565	211.7685	190.3881	187.5005	195.1296	197.4912	220.7562	235.4189	262.9069	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	139.6582	123.5045	131.1101	114.9457	111.2230	99.9938	98.4771	102.4840	103.7244	115.9434	123.6444	138.0813	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	29.7368	23.8560	21.4797	15.7369	12.1557	9.9313	11.0888	14.4136	18.7219	24.5641	27.7451	30.5633	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1279.5394	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1402.7898	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	239.9934	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2922.3226	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1279.5394	0.1575	201.4722	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1402.7898	0.1409	197.7122	(264)
Space and water heating			399.1843	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	239.9934	0.1443	34.6385	(268)
Total CO2, kg/year			433.8228	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.1600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1279.5394	1.5829	2025.3196	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1402.7898	1.5212	2133.8607	(278)
Space and water heating			4159.1803	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	239.9934	1.5338	368.1099	(282)
Total Primary energy kWh/year			4527.2902	(286)
Dwelling Primary energy Rate (DPER)			53.9000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.0000 (1b)	x	2.5000 (2b)	=	105.0000 (1b)	-
First floor	42.0000 (1c)	x	2.7500 (2c)	=	115.5000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	220.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1361	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3861	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3281	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4184	0.4102	0.4020	0.3610	0.3528	0.3117	0.3117	0.3035	0.3281	0.3528	0.3692	0.3856	(22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			15.7700	1.1450	18.0573			(27)
Heatloss Floor 1			42.0000	0.1300	5.4600			(28a)
External Wall 1	140.0000	20.9700	119.0300	0.1800	21.4254			(29a)
External Roof 1	42.0000		42.0000	0.1100	4.6200			(30)
Total net area of external elements Aum(A, m2)			224.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7627			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	26.5000	0.1600	4.2400
E6 Intermediate floor within a dwelling	26.5000	0.0000	0.0000
E14 Flat roof	26.5000	0.0800	2.1200
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.2500 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.0127 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.7512	42.5039	42.2614	41.1229	40.9099	39.9182	39.9182	39.7346	40.3002	40.9099	41.3408	41.7913	(38)
Heat transfer coeff	105.7638	105.5165	105.2741	104.1355	103.9225	102.9308	102.9308	102.7472	103.3128	103.9225	104.3534	104.8040	(39)

Average = Sum(39)m / 12 = 104.1345

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2591	1.2561	1.2533	1.2397	1.2372	1.2254	1.2254	1.2232	1.2299	1.2372	1.2423	1.2477	(40)
HLP (average)												1.2397	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5344 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
66.7131	65.7106	64.2496	61.4544	59.3916	57.0911	55.7836	57.2334	58.8228	61.2927	64.1480	66.4575	(42a)

Hot water usage for baths

28.8121	28.3842	27.7816	26.6705	25.8386	24.9161	24.4179	25.0162	25.6677	26.6548	27.7887	28.7146	(42b)

Hot water usage for other uses

40.5847	39.1089	37.6331	36.1573	34.6815	33.2057	33.2057	34.6815	36.1573	37.6331	39.1089	40.5847	(42c)

Average daily hot water use (litres/day) 125.1158 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	136.1099	133.2036	129.6643	124.2822	119.9116	115.2129	113.4071	116.9311	120.6478	125.5806	131.0456	135.7569	(44)

Energy conte	215.5648	189.6801	199.2892	170.1361	161.4241	141.6677	137.1560	144.7851	148.7708	170.4117	186.6985	212.5624	(45)
Energy content (annual)										Total = Sum(45)m =		2078.1466	
Distribution loss (46)m = 0.15 x (45)m													
	32.3347	28.4520	29.8934	25.5204	24.2136	21.2502	20.5734	21.7178	22.3156	25.5618	28.0048	31.8844	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	264.8074	234.1574	248.5318	217.7903	210.6668	189.3219	186.3987	194.0278	196.4250	219.6544	234.3527	261.8051	(62)
WWHRS	-30.4985	-26.9731	-28.2447	-23.3877	-21.7965	-18.6514	-17.4827	-18.5911	-19.2975	-22.7496	-25.7725	-29.9337	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	234.3090	207.1843	220.2872	194.4026	188.8703	170.6705	168.9160	175.4367	177.1275	196.9048	208.5802	231.8714	(64)
										Total per year (kWh/year) = Sum(64)m =		2374.5605	(64)
12Total per year (kWh/year)												2375	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	111.0694	98.6504	105.6578	94.6936	93.0677	85.2279	84.9985	87.5352	87.5896	96.0560	100.2006	110.0711	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	126.7195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	116.5089	128.9920	116.5089	120.3925	116.5089	120.3925	116.5089	116.5089	120.3925	116.5089	120.3925	116.5089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	227.5971	229.9588	224.0073	211.3372	195.3435	180.3117	170.2695	167.9078	173.8593	186.5294	202.5231	217.5549	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	35.6720	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	-101.3756	(71)
Water heating gains (Table 5)													
	149.2869	146.8013	142.0131	131.5189	125.0909	118.3720	114.2453	117.6548	121.6523	129.1076	139.1675	147.9451	(72)
Total internal gains													
	557.4087	569.7679	546.5452	527.2645	500.9592	480.0921	462.0395	463.0873	476.9199	496.1617	526.0990	546.0247	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.3200	11.2829	0.6300	0.7000	0.7700	11.4481	(75)
Southeast	4.9800	36.7938	0.6300	0.7000	0.7700	55.9985	(77)
Southwest	2.4900	36.7938	0.6300	0.7000	0.7700	27.9992	(79)
Northwest	4.9800	11.2829	0.6300	0.7000	0.7700	17.1721	(81)

Solar gains	112.6179	201.3364	300.7281	414.9410	503.4002	516.7526	491.1331	422.5407	339.8710	229.3279	136.6215	95.2572	(83)
Total gains	670.0266	771.1043	847.2733	942.2055	1004.3594	996.8447	953.1726	885.6280	816.7909	725.4895	662.7204	641.2819	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1543	55.2836	55.4109	56.0167	56.1316	56.6724	56.6724	56.7736	56.4628	56.1316	55.8998	55.6595	
alpha	4.6770	4.6856	4.6941	4.7344	4.7421	4.7782	4.7782	4.7849	4.7642	4.7421	4.7267	4.7106	
util living area													
	0.9933	0.9864	0.9709	0.9215	0.8096	0.6268	0.4679	0.5210	0.7659	0.9447	0.9865	0.9945	(86)
MIT	19.6227	19.8254	20.1184	20.5080	20.8074	20.9572	20.9913	20.9859	20.8903	20.5033	20.0000	19.5920	(87)
Th 2	19.8730	19.8753	19.8776	19.8884	19.8904	19.8998	19.8998	19.9015	19.8961	19.8904	19.8863	19.8821	(88)
util rest of house													
	0.9911	0.9819	0.9612	0.8952	0.7513	0.5329	0.3547	0.4030	0.6796	0.9205	0.9812	0.9927	(89)
MIT 2	18.2947	18.5533	18.9230	19.4037	19.7347	19.8767	19.8972	19.8968	19.8256	19.4105	18.7847	18.2620	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6267	18.8713	19.2218	19.6798	20.0029	20.1468	20.1707	20.1691	20.0917	19.6837	19.0886	18.5945	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6267	18.8713	19.2218	19.6798	20.0029	20.1468	20.1707	20.1691	20.0917	19.6837	19.0886	18.5945	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9876	0.9765	0.9538	0.8894	0.7579	0.5550	0.3831	0.4325	0.6965	0.9148	0.9760	0.9897	(94)
Useful gains	661.7213	752.9955	808.0998	837.9631	761.1757	553.2172	365.1510	383.0667	568.8732	663.6732	646.8365	634.6776	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1515.2447	1474.2015	1339.2782	1122.5613	862.8567	570.9379	367.5388	387.2642	619.0244	944.0038	1251.0466	1508.6003	(97)
Space heating kWh													
	635.0214	484.6505	395.1967	204.9107	75.6507	0.0000	0.0000	0.0000	0.0000	208.5660	435.0313	650.1985	(98a)
Space heating requirement - total per year (kWh/year)												3089.2258	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	635.0214	484.6505	395.1967	204.9107	75.6507	0.0000	0.0000	0.0000	0.0000	208.5660	435.0313	650.1985	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3089.2258	
Space heating per m2											(98c) / (4) =	36.7765	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	635.0214	484.6505	395.1967	204.9107	75.6507	0.0000	0.0000	0.0000	0.0000	208.5660	435.0313	650.1985	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	687.9972	525.0818	428.1654	222.0051	81.9618	0.0000	0.0000	0.0000	0.0000	225.9653	471.3232	704.4404	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	234.3090	207.1843	220.2872	194.4026	188.8703	170.6705	168.9160	175.4367	177.1275	196.9048	208.5802	231.8714	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1803	85.8988	85.3546	84.1780	82.1821	79.8000	79.8000	79.8000	79.8000	84.1890	85.6688	86.2431	(217)
Fuel for water heating, kWh/month													
	271.8823	241.1959	258.0847	230.9422	229.8193	213.8728	211.6741	219.8455	221.9643	233.8841	243.4728	268.8579	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.2082	19.4208	17.4862	12.8112	9.8957	8.0849	9.0272	11.7339	15.2412	19.9972	22.5868	24.8811	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.9974	-54.8283	-78.5994	-88.1299	-94.8223	-88.4212	-87.3095	-82.5119	-74.0341	-62.5571	-42.8118	-33.7317	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-22.4989	-47.2756	-93.8690	-140.8553	-186.1302	-186.9868	-184.8038	-156.5429	-114.8224	-67.5873	-30.0312	-17.7972	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	3346.9402 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2845.4958 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	195.3744 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2075.9552 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)

Total delivered energy for all uses 4397.8552 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3346.9402	0.2100	702.8574	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2845.4958	0.2100	597.5541	(264)
Space and water heating			1300.4116	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	195.3744	0.1443	28.1986	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-826.7548	0.1346	-111.3200	
PV Unit electricity exported	-1249.2005	0.1259	-157.3007	
Total			-268.6207	(269)
Total CO2, kg/year			1071.9187	(272)
Target Carbon Dioxide Emission Rate (TER)			12.7600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3346.9402	1.1300	3782.0424	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2845.4958	1.1300	3215.4103	(278)
Space and water heating			6997.4527	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	195.3744	1.5338	299.6718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-826.7548	1.4976	-1238.1773	
PV Unit electricity exported	-1249.2005	0.4622	-577.4031	
Total			-1815.5805	(283)
Total Primary energy kWh/year			5611.6448	(286)
Target Primary Energy Rate (TPER)			66.8100	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 3B1_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3B1
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	79 C	DER	5.06	TER	12.61
Environmental	96 A	% DER<TER	59.87		
CO_2 Emissions (t/year)	0.43	DFEE	41.88	TFEE	44.82
Compliance Check	See BREL	% DFEE < TFEE	6.55		
% DPER < TPER	19.92	DPER	52.86	TPER	66.00

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		45.0000 (1b)	x	2.5000 (2b)	=	112.5000 (1b)	-
First floor		45.0000 (1c)	x	2.7500 (2c)	=	123.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.2500	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0847	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2347	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1995	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2543	0.2493	0.2443	0.2194	0.2144	0.1895	0.1895	0.1845	0.1995	0.2144	0.2244	0.2344	(22b)
Effective ac	0.5323	0.5311	0.5298	0.5241	0.5230	0.5180	0.5180	0.5170	0.5199	0.5230	0.5252	0.5275	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			45.0000	0.1100	4.9500			(28a)
External Wall 1	147.0000	30.4000	116.6000	0.1400	16.3240			(29a)
External Roof 1	45.0000		45.0000	0.1100	4.9500			(30)
Total net area of external elements Aum(A, m2)			237.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.2790			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												11.8500	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	72.1290	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.5023	41.4044	41.3084	40.8577	40.7734	40.3809	40.3809	40.3082	40.5321	40.7734	40.9440	41.1223	(38)
Heat transfer coeff													
	113.6312	113.5333	113.4374	112.9867	112.9024	112.5098	112.5098	112.4371	112.6610	112.9024	113.0729	113.2513	(39)
Average = Sum(39)m / 12 =												112.9863	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2626	1.2615	1.2604	1.2554	1.2545	1.2501	1.2501	1.2493	1.2518	1.2545	1.2564	1.2583	(40)
HLP (average)												1.2554	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6257	(42)
Hot water usage for mixer showers													
	68.2445	67.2189	65.7244	62.8650	60.7548	58.4016	57.0640	58.5472	60.1730	62.6997	65.6205	67.9830	(42a)
Hot water usage for baths													
	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)
Hot water usage for other uses													
	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)
Average daily hot water use (litres/day)												127.9884	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	139.2350	136.2620	132.6413	127.1357	122.6647	117.8581	116.0109	119.6159	123.4179	128.4640	134.0545	138.8739	(44)
Energy conte	220.5143	194.0352	203.8648	174.0424	165.1303	144.9203	140.3051	148.1094	152.1866	174.3245	190.9852	217.4430	(45)
Energy content (annual)										Total = Sum(45)m =		2125.8611	
Distribution loss (46)m = 0.15 x (45)m													
	33.0771	29.1053	30.5797	26.1064	24.7695	21.7380	21.0458	22.2164	22.8280	26.1487	28.6478	32.6165	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	270.8587	239.5076	254.2092	222.7628	215.4747	193.6407	190.6495	198.4539	200.9071	224.6689	239.7057	267.7875	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	270.8587	239.5076	254.2092	222.7628	215.4747	193.6407	190.6495	198.4539	200.9071	224.6689	239.7057	267.7875	(64)
										Total per year (kWh/year) = Sum(64)m =		2718.6263	(64)
12Total per year (kWh/year)												2719	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.5965	100.8946	108.0606	96.8454	95.1814	87.1623	86.9270	89.5219	89.5784	98.2384	102.4789	112.5754	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.5873	133.5073	120.5873	124.6068	120.5873	124.6068	120.5873	120.5873	124.6068	120.5873	124.6068	120.5873	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	239.0777	241.5586	235.3069	221.9977	205.1972	189.4071	178.8584	176.3775	182.6292	195.9384	212.7389	228.5290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													
	152.6835	150.1408	145.2427	134.5075	127.9320	121.0588	116.8374	120.3252	124.4144	132.0409	142.3318	151.3110	(72)
Total internal gains													
	577.7343	590.5926	566.5227	546.4979	519.1022	497.4586	478.6688	479.6758	494.0363	513.9524	545.0634	565.8130	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (79)
Northwest	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (81)

Solar gains	183.8298	336.3427	521.8556	749.9505	934.3366	969.0724	917.0220	773.1182	599.8448	388.3546	224.4130	154.5847 (83)
Total gains	761.5642	926.9353	1088.3783	1296.4484	1453.4389	1466.5310	1395.6908	1252.7940	1093.8811	902.3071	769.4764	720.3977 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0025	55.0499	55.0965	55.3163	55.3576	55.5507	55.5507	55.5866	55.4762	55.3576	55.2741	55.1870	
alpha	4.6668	4.6700	4.6731	4.6878	4.6905	4.7034	4.7034	4.7058	4.6984	4.6905	4.6849	4.6791	
util living area	0.9915	0.9789	0.9457	0.8453	0.6706	0.4820	0.3529	0.4090	0.6625	0.9133	0.9817	0.9934	(86)
MIT	19.9335	20.1278	20.3947	20.6963	20.8681	20.9227	20.9321	20.9301	20.8879	20.6271	20.2186	19.8940	(87)
Th 2	19.8703	19.8711	19.8720	19.8759	19.8767	19.8801	19.8801	19.8808	19.8788	19.8767	19.8752	19.8736	(88)
util rest of house	0.9888	0.9723	0.9294	0.8054	0.6053	0.4016	0.2640	0.3115	0.5730	0.8796	0.9749	0.9912	(89)
MIT 2	18.6437	18.8891	19.2191	19.5708	19.7432	19.7900	19.7951	19.7951	19.7669	19.5067	19.0096	18.5961	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.9661	19.1987	19.5130	19.8522	20.0244	20.0731	20.0793	20.0788	20.0472	19.7868	19.3118	18.9206	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9661	19.1987	19.5130	19.8522	20.0244	20.0731	20.0793	20.0788	20.0472	19.7868	19.3118	18.9206	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9673	0.9231	0.8045	0.6144	0.4157	0.2800	0.3290	0.5872	0.8764	0.9703	0.9887	(94)
Useful gains	750.7381	896.6335	1004.7058	1042.9375	892.9541	609.7087	390.7460	412.1286	642.3740	790.7952	746.6435	712.2602	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1666.5307	1623.3845	1476.1627	1237.4489	939.8499	615.7829	391.4593	413.6375	670.0152	1037.2100	1380.8258	1667.1229	(97)
Space heating kWh	681.3497	488.3766	350.7640	140.0482	34.8904	0.0000	0.0000	0.0000	0.0000	183.3326	456.6113	710.4179	(98a)
Space heating requirement - total per year (kWh/year)												3045.7906	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	681.3497	488.3766	350.7640	140.0482	34.8904	0.0000	0.0000	0.0000	0.0000	183.3326	456.6113	710.4179	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3045.7906	
Space heating per m2										(98c) / (4) =		33.8421	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	681.3497	488.3766	350.7640	140.0482	34.8904	0.0000	0.0000	0.0000	0.0000	183.3326	456.6113	710.4179	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	310.6930	222.6980	159.9471	63.8615	15.9099	0.0000	0.0000	0.0000	0.0000	83.5990	208.2131	323.9480	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	270.8587	239.5076	254.2092	222.7628	215.4747	193.6407	190.6495	198.4539	200.9071	224.6689	239.7057	267.7875	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	142.2577	125.7918	133.5132	116.9973	113.1695	101.7021	100.1311	104.2300	105.5184	117.9984	125.8958	140.6447	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)

Lighting	31.5514	25.3117	22.7904	16.6972	12.8974	10.5373	11.7655	15.2932	19.8643	26.0631	29.4382	32.4283	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1388.8694 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1427.8499 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	254.6381 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3071.3574 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1388.8694	0.1567	217.5920	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1427.8499	0.1410	201.2601	(264)
Space and water heating			418.8521	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	254.6381	0.1443	36.7521	(268)
Total CO2, kg/year			455.6043	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.0600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1388.8694	1.5800	2194.3925	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1427.8499	1.5212	2172.0408	(278)
Space and water heating			4366.4332	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	254.6381	1.5338	390.5724	(282)
Total Primary energy kWh/year			4757.0056	(286)
Dwelling Primary energy Rate (DPER)			52.8600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.0000 (1b)	x	2.5000 (2b)	=	112.5000 (1b)	-
First floor	45.0000 (1c)	x	2.7500 (2c)	=	123.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 90.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.2500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1270	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3770	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3204	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4086	0.4005	0.3925	0.3525	0.3445	0.3044	0.3044	0.2964	0.3204	0.3445	0.3605	0.3765	(22b)
Effective ac	0.5835	0.5802	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5650	0.5709	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			17.2800	1.1450	19.7863			(27)
Heatloss Floor 1			45.0000	0.1300	5.8500			(28a)
External Wall 1	147.0000	22.4800	124.5200	0.1800	22.4136			(29a)
External Roof 1	45.0000		45.0000	0.1100	4.9500			(30)
Total net area of external elements Aum(A, m2)			237.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.1999			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	28.0000	0.1600	4.4800
E6 Intermediate floor within a dwelling	28.0000	0.0000	0.0000
E14 Flat roof	28.0000	0.0800	2.2400
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.6100	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	66.8099	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4879	45.2353	44.9876	43.8244	43.6067	42.5936	42.5936	42.4060	42.9838	43.6067	44.0470	44.5073	(38)
Heat transfer coeff	112.2978	112.0451	111.7975	110.6342	110.4166	109.4034	109.4034	109.2158	109.7937	110.4166	110.8569	111.3172	(39)

Average = Sum(39)m / 12 =	110.6332

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2478	1.2449	1.2422	1.2293	1.2269	1.2156	1.2156	1.2135	1.2199	1.2269	1.2317	1.2369	(40)
HLP (average)												1.2293	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6257 (42)

Hot water usage for mixer showers

68.2445	67.2189	65.7244	62.8650	60.7548	58.4016	57.0640	58.5472	60.1730	62.6997	65.6205	67.9830	(42a)

Hot water usage for baths

29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)

Hot water usage for other uses

41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)

Average daily hot water use (litres/day)	127.9884 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	139.2350	136.2620	132.6413	127.1357	122.6647	117.8581	116.0109	119.6159	123.4179	128.4640	134.0545	138.8739	(44)
Energy conte	220.5143	194.0352	203.8648	174.0424	165.1303	144.9203	140.3051	148.1094	152.1866	174.3245	190.9852	217.4430	(45)

Energy content (annual)											Total = Sum(45)m =	2125.8611	
Distribution loss (46)m = 0.15 x (45)m													
	33.0771	29.1053	30.5797	26.1064	24.7695	21.7380	21.0458	22.2164	22.8280	26.1487	28.6478	32.6165	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.7569	238.5125	253.1074	221.6966	214.3730	192.5745	189.5478	197.3521	199.8408	223.5672	238.6394	266.6857	(62)
WWHRS	-31.1985	-27.5922	-28.8930	-23.9245	-22.2968	-19.0795	-17.8840	-19.0179	-19.7404	-23.2718	-26.3641	-30.6208	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.5584	210.9202	224.2145	197.7720	192.0762	173.4950	171.6637	178.3343	180.1004	200.2954	212.2753	236.0649	(64)
											Total per year (kWh/year) = Sum(64)m =	2415.7703	(64)
12Total per year (kWh/year)												2416	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	112.7151	100.0985	107.1792	95.9924	94.3000	86.3094	86.0456	88.6405	88.7254	97.3570	101.6259	111.6939	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	122.0169	135.0901	122.0169	126.0841	122.0169	126.0841	122.0169	122.0169	126.0841	122.0169	126.0841	122.0169	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	239.0777	241.5586	235.3069	221.9977	205.1972	189.4071	178.8584	176.3775	182.6292	195.9384	212.7389	228.5290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													
	151.4988	148.9561	144.0580	133.3228	126.7473	119.8741	115.6527	119.1405	123.2297	130.8562	141.1471	150.1263	(72)
Total internal gains													
	577.9792	590.9906	566.7676	546.7904	519.3471	497.7511	478.9137	479.9207	494.3289	514.1973	545.3560	566.0579	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.7600	11.2829	0.6300	0.7000	0.7700	19.8617	(75)
Southwest	5.7600	36.7938	0.6300	0.7000	0.7700	64.7693	(79)
Northwest	5.7600	11.2829	0.6300	0.7000	0.7700	19.8617	(81)

Solar gains	104.4927	191.1843	296.6337	426.2877	531.0966	550.8412	521.2546	439.4567	340.9644	220.7490	127.5611	87.8692	(83)
Total gains	682.4720	782.1749	863.4013	973.0781	1050.4438	1048.5923	1000.1683	919.3773	835.2933	734.9463	672.9170	653.9271	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6556	55.7811	55.9047	56.4925	56.6038	57.1280	57.1280	57.2261	56.9249	56.6038	56.3790	56.1459	
alpha	4.7104	4.7187	4.7270	4.7662	4.7736	4.8085	4.8085	4.8151	4.7950	4.7736	4.7586	4.7431	
util living area													
	0.9945	0.9889	0.9755	0.9290	0.8173	0.6325	0.4738	0.5325	0.7847	0.9537	0.9890	0.9955	(86)
MIT	19.5997	19.7936	20.0877	20.4896	20.8022	20.9566	20.9911	20.9849	20.8799	20.4745	19.9726	19.5705	(87)
Th 2	19.8820	19.8842	19.8864	19.8967	19.8986	19.9075	19.9075	19.9092	19.9041	19.8986	19.8947	19.8906	(88)
util rest of house													
	0.9927	0.9853	0.9672	0.9047	0.7602	0.5389	0.3601	0.4133	0.7005	0.9326	0.9847	0.9941	(89)
MIT 2	18.2718	18.5197	18.8921	19.3900	19.7377	19.8840	19.9049	19.9042	19.8254	19.3841	18.7565	18.2407	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6037	18.8381	19.1910	19.6649	20.0038	20.1521	20.1765	20.1744	20.0890	19.6567	19.0605	18.5732	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6037	18.8381	19.1910	19.6649	20.0038	20.1521	20.1765	20.1744	20.0890	19.6567	19.0605	18.5732	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9897	0.9805	0.9603	0.8985	0.7662	0.5609	0.3886	0.4431	0.7163	0.9267	0.9801	0.9915	(94)
Useful gains	675.4556	766.9367	829.1047	874.3165	804.9017	588.1046	388.6543	407.3957	598.3249	681.0554	659.5039	648.3450	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1606.2785	1561.7010	1418.8193	1190.9661	916.8819	607.4205	391.2780	412.2206	657.5572	1000.0130	1325.9085	1599.9812	(97)
Space heating kWh	692.5323	534.0817	438.7476	227.9877	83.3133	0.0000	0.0000	0.0000	0.0000	237.3045	479.8113	708.0174	(98a)
Space heating requirement - total per year (kWh/year)												3401.7957	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	692.5323	534.0817	438.7476	227.9877	83.3133	0.0000	0.0000	0.0000	0.0000	237.3045	479.8113	708.0174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3401.7957	
Space heating per m2											(98c) / (4) =	37.7977	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	692.5323	534.0817	438.7476	227.9877	83.3133	0.0000	0.0000	0.0000	0.0000	237.3045	479.8113	708.0174	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	750.3058	578.6367	475.3495	247.0073	90.2636	0.0000	0.0000	0.0000	0.0000	257.1013	519.8389	767.0827	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	238.5584	210.9202	224.2145	197.7720	192.0762	173.4950	171.6637	178.3343	180.1004	200.2954	212.2753	236.0649	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3061	86.0523	85.5374	84.3794	82.3242	79.8000	79.8000	79.8000	79.8000	84.4410	85.8309	86.3645	(217)
Fuel for water heating, kWh/month	276.4098	245.1069	262.1246	234.3841	233.3168	217.4122	215.1175	223.4765	225.6897	237.2016	247.3180	273.3357	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.3527	20.3389	18.3129	13.4168	10.3635	8.4671	9.4540	12.2886	15.9617	20.9426	23.6546	26.0573	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.5553	-58.3087	-83.4217	-93.3380	-100.2505	-93.4092	-92.2224	-87.2329	-78.4013	-66.4229	-45.5738	-35.9569	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-24.3335	-51.0883	-101.3659	-152.0033	-200.7701	-201.6708	-199.3276	-168.8972	-123.9450	-73.0176	-32.4722	-19.2527	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3685.5858	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2890.8935	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	204.6108	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2224.2377	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4642.8523	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3685.5858	0.2100	773.9730	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2890.8935	0.2100	607.0876	(264)
Space and water heating			1381.0606	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	204.6108	0.1443	29.5317	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-876.0937	0.1347	-118.0038	
PV Unit electricity exported	-1348.1441	0.1259	-169.7847	
Total			-287.7885	(269)
Total CO2, kg/year			1134.7331	(272)
Target Carbon Dioxide Emission Rate (TER)			12.6100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3685.5858	1.1300	4164.7119	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2890.8935	1.1300	3266.7096	(278)
Space and water heating			7431.4216	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	204.6108	1.5338	313.8388	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-876.0937	1.4978	-1312.2210	
PV Unit electricity exported	-1348.1441	0.4623	-623.2288	
Total			-1935.4498	(283)
Total Primary energy kWh/year			5939.9114	(286)
Target Primary Energy Rate (TPER)			66.0000	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3B2_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3B2
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	82 B	DER	4.34	TER	10.62
Environmental	96 A	% DER<TER	59.13		
CO_2 Emissions (t/year)	0.38	DFEE	32.73	TFEE	36.52
Compliance Check	See BREL	% DFEE < TFEE	10.38		
% DPER < TPER	17.76	DPER	45.50	TPER	55.33

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor			46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250	(5)

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2. Ventilation rate
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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0819 (8)
Pressure test		Yes		
Pressure Test Method		Blower Door		
Measured/design AP50		3.0000		(17)
Infiltration rate		0.2319		(18)
Number of sides sheltered		2		(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	0.1971		(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2513	0.2464	0.2415	0.2169	0.2119	0.1873	0.1873	0.1824	0.1971	0.2119	0.2218	0.2316	(22b)
Effective ac	0.5316	0.5304	0.5292	0.5235	0.5225	0.5175	0.5175	0.5166	0.5194	0.5225	0.5246	0.5268	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			46.5000	0.1100	5.1150			(28a)
External Wall 1	102.0000	30.4000	71.6000	0.1400	10.0240			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			195.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.3090			(33)

Party Wall 1						49.0000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												9.7500	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	64.0590	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8254	42.7266	42.6297	42.1748	42.0897	41.6934	41.6934	41.6200	41.8460	42.0897	42.2619	42.4419	(38)
Heat transfer coeff	106.8844	106.7856	106.6887	106.2337	106.1486	105.7524	105.7524	105.6790	105.9050	106.1486	106.3208	106.5008	(39)
Average = Sum(39)m / 12 =												106.2333	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1493	1.1482	1.1472	1.1423	1.1414	1.1371	1.1371	1.1363	1.1388	1.1414	1.1432	1.1452	(40)
HLP (average)												1.1423	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6646	(42)
Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)
Average daily hot water use (litres/day)												129.2112	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)											Total = Sum(45)m =	2146.1718	
Distribution loss (46)m = 0.15 x (45)m	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
										Total per year (kWh/year) = Sum(64)m =		2738.9369	(64)
12Total per year (kWh/year)												2739	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	114.2971	101.5110	108.7082	97.3983	95.7059	87.6227	87.3727	89.9924	90.0619	98.7922	103.0856	113.2661	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	123.3171	136.5297	123.3171	127.4277	123.3171	127.4277	123.3171	123.3171	127.4277	123.3171	127.4277	123.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	153.6251	151.0581	146.1132	135.2754	128.6370	121.6982	117.4364	120.9576	125.0859	132.7853	143.1745	152.2394	(72)
Total internal gains	587.4011	600.5837	576.0330	555.6953	527.7655	505.7897	486.6299	487.6140	502.2461	522.4454	554.1260	575.2279	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	6.3000	11.2829	0.7600	0.7000	0.7700	26.2064 (75)
Southeast	10.5000	36.7938	0.7600	0.7000	0.7700	142.4325 (77)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	282.5850	490.0515	693.6311	898.1973	1041.4295	1049.4581	1005.3143	896.0780	764.1003	547.8454	340.0569	240.8081	(83)
Total gains	869.9861	1090.6352	1269.6641	1453.8927	1569.1950	1555.2478	1491.9442	1383.6919	1266.3465	1070.2908	894.1829	816.0360	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.4236	60.4795	60.5344	60.7936	60.8424	61.0703	61.0703	61.1127	60.9823	60.8424	60.7438	60.6411	
alpha	5.0282	5.0320	5.0356	5.0529	5.0562	5.0714	5.0714	5.0742	5.0655	5.0562	5.0496	5.0427	
util living area	0.9860	0.9604	0.9048	0.7795	0.6053	0.4315	0.3113	0.3502	0.5614	0.8475	0.9672	0.9895	(86)
MIT	20.1368	20.3575	20.5941	20.8070	20.9063	20.9340	20.9382	20.9376	20.9217	20.7683	20.4080	20.0891	(87)
Th 2	19.9608	19.9616	19.9625	19.9664	19.9672	19.9706	19.9706	19.9713	19.9693	19.9672	19.9657	19.9641	(88)
util rest of house	0.9818	0.9496	0.8812	0.7355	0.5458	0.3638	0.2388	0.2725	0.4840	0.8027	0.9562	0.9863	(89)
MIT 2	18.9722	19.2471	19.5312	19.7697	19.8651	19.8898	19.8920	19.8925	19.8811	19.7383	19.3173	18.9149	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.2634	19.5247	19.7969	20.0290	20.1254	20.1509	20.1536	20.1538	20.1413	19.9958	19.5900	19.2084	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2634	19.5247	19.7969	20.0290	20.1254	20.1509	20.1536	20.1538	20.1413	19.9958	19.5900	19.2084	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9440	0.8769	0.7383	0.5552	0.3758	0.2517	0.2863	0.4972	0.8041	0.9512	0.9832	(94)
Useful gains	850.9274	1029.6137	1113.4233	1073.4771	871.1652	584.3981	375.5390	396.1953	629.6743	860.5971	850.5474	802.3399	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1599.3499	1561.7079	1418.6333	1182.2766	894.3463	587.0166	375.7974	396.6951	639.8006	997.3540	1327.9457	1598.4104	(97)
Space heating kWh	556.8263	357.5673	227.0762	78.3356	17.2468	0.0000	0.0000	0.0000	0.0000	101.7471	343.7268	592.2764	(98a)
Space heating requirement - total per year (kWh/year)												2274.8027	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	556.8263	357.5673	227.0762	78.3356	17.2468	0.0000	0.0000	0.0000	0.0000	101.7471	343.7268	592.2764	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2274.8027	
Space heating per m2										(98c) / (4) =		24.4602	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.8263	357.5673	227.0762	78.3356	17.2468	0.0000	0.0000	0.0000	0.0000	101.7471	343.7268	592.2764	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	253.9108	163.0494	103.5459	35.7208	7.8645	0.0000	0.0000	0.0000	0.0000	46.3963	156.7382	270.0759	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	143.3643	126.7655	134.5362	117.8706	113.9981	102.4292	100.8351	104.9732	106.2821	118.8732	126.8542	141.7358	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	32.4110	26.0013	23.4113	17.1521	13.2488	10.8244	12.0860	15.7098	20.4055	26.7731	30.2402	33.3118	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1037.3017	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1438.5173	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	261.5750	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2737.3940	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1037.3017	0.1576	163.4638	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1438.5173	0.1410	202.7704	(264)
Space and water heating			366.2342	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	261.5750	0.1443	37.7534	(268)
Total CO2, kg/year			403.9876	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.3400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1037.3017	1.5833	1642.3899	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1438.5173	1.5212	2188.2929	(278)
Space and water heating			3830.6828	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	261.5750	1.5338	401.2125	(282)
Total Primary energy kWh/year			4231.8953	(286)
Dwelling Primary energy Rate (DPER)			45.5000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor		46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		3 * 10 =	30.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1229 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3729 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3170 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4041	0.3962	0.3883	0.3487	0.3407	0.3011	0.3011	0.2932	0.3170	0.3407	0.3566	0.3724	(22b)
Effective ac	0.5817	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			18.0000	1.1450	20.6107			(27)
Heatloss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	102.0000	23.2000	78.8000	0.1800	14.1840			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			195.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.1547			(33)
Party Wall 1			49.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	28.6000	0.1600	4.5760
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E14 Flat roof	28.6000	0.0800	2.2880
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4390 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.5937 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8589	46.6034	46.3531	45.1770	44.9570	43.9327	43.9327	43.7430	44.3272	44.9570	45.4021	45.8675	(38)
Heat transfer coeff	106.4526	106.1971	105.9467	104.7707	104.5507	103.5264	103.5264	103.3367	103.9209	104.5507	104.9958	105.4612	(39)
Average = Sum(39)m / 12 =												104.7696	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1447	1.1419	1.1392	1.1266	1.1242	1.1132	1.1132	1.1111	1.1174	1.1242	1.1290	1.1340	(40)
HLP (average)												1.1266	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6646 (42)

Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323 (42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)
Average daily hot water use (litres/day)												129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008 (44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205 (45)
Energy content (annual)										Total = Sum(45)m =		2146.1718
Distribution loss (46)m = 0.15 x (45)m												
	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	271.8638	240.3663	255.0551	223.3594	215.9506	193.9590	190.8882	198.7672	201.2949	225.2327	240.4642	268.7632 (62)
WWHRS	-31.4965	-27.8558	-29.1690	-24.1531	-22.5098	-19.2618	-18.0548	-19.1995	-19.9290	-23.4941	-26.6159	-30.9132 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	240.3673	212.5105	225.8862	199.2063	193.4408	174.6973	172.8334	179.5677	181.3659	201.7386	213.8482	237.8500 (64)
										Total per year (kWh/year) = Sum(64)m =		2433.3121 (64)
12Total per year (kWh/year)												2433 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	113.4157	100.7149	107.8268	96.5453	94.8245	86.7697	86.4913	89.1110	89.2089	97.9108	102.2327	112.3847 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	124.6525	138.0082	124.6525	128.8076	124.6525	128.8076	124.6525	124.6525	128.8076	124.6525	128.8076	124.6525	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	152.4404	149.8734	144.9285	134.0907	127.4523	120.5135	116.2517	119.7729	123.9012	131.6006	141.9898	151.0547	(72)
Total internal gains													
	587.5519	600.8775	576.1837	555.8906	527.9163	505.9850	486.7806	487.7647	502.4414	522.5961	554.3213	575.3786	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.5000	11.2829	0.6300	0.7000	0.7700	15.5170	(75)
Southeast	7.5000	36.7938	0.6300	0.7000	0.7700	84.3351	(77)
Southwest	6.0000	36.7938	0.6300	0.7000	0.7700	67.4680	(79)

Solar gains	167.3201	290.1621	410.7026	531.8274	616.6359	621.3896	595.2519	530.5725	452.4278	324.3821	201.3495	142.5837	(83)
Total gains	754.8719	891.0395	986.8863	1087.7179	1144.5521	1127.3746	1082.0325	1018.3372	954.8692	846.9783	755.6708	717.9624	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6686	60.8146	60.9583	61.6426	61.7723	62.3835	62.3835	62.4980	62.1466	61.7723	61.5104	61.2390	
alpha	5.0446	5.0543	5.0639	5.1095	5.1182	5.1589	5.1589	5.1665	5.1431	5.1182	5.1007	5.0826	
util living area													
	0.9923	0.9819	0.9592	0.8931	0.7616	0.5715	0.4182	0.4619	0.6992	0.9214	0.9829	0.9939	(86)
MIT	19.8131	20.0363	20.3190	20.6571	20.8835	20.9788	20.9965	20.9942	20.9427	20.6446	20.1707	19.7768	(87)
Th 2	19.9645	19.9668	19.9689	19.9792	19.9811	19.9901	19.9901	19.9917	19.9866	19.9811	19.9772	19.9732	(88)
util rest of house													
	0.9899	0.9763	0.9466	0.8622	0.7025	0.4882	0.3237	0.3632	0.6157	0.8913	0.9766	0.9920	(89)
MIT 2	18.6020	18.8853	19.2387	19.6481	19.8894	19.9788	19.9890	19.9898	19.9512	19.6454	19.0655	18.5621	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.9048	19.1730	19.5088	19.9004	20.1379	20.2288	20.2409	20.2409	20.1991	19.8952	19.3418	18.8658	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9048	19.1730	19.5088	19.9004	20.1379	20.2288	20.2409	20.2409	20.1991	19.8952	19.3418	18.8658	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9864	0.9707	0.9397	0.8595	0.7123	0.5084	0.3474	0.3879	0.6343	0.8883	0.9714	0.9891	(94)
Useful gains	744.5942	864.9461	927.4006	934.9225	815.2293	573.2104	375.8596	395.0401	605.6527	752.3433	734.0931	710.1065	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1554.7172	1515.7549	1378.2355	1152.5148	882.1904	582.7270	376.9268	396.9080	633.8210	971.8202	1285.3411	1546.6699	(97)
Space heating kWh	602.7315	437.3435	335.4211	156.6664	49.8190	0.0000	0.0000	0.0000	0.0000	163.2908	396.8985	622.4032	(98a)
Space heating requirement - total per year (kWh/year)												2764.5741	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	602.7315	437.3435	335.4211	156.6664	49.8190	0.0000	0.0000	0.0000	0.0000	163.2908	396.8985	622.4032	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2764.5741	
Space heating per m2											(98c) / (4) =	29.7266	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.7315	437.3435	335.4211	156.6664	49.8190	0.0000	0.0000	0.0000	0.0000	163.2908	396.8985	622.4032	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	653.0136	473.8283	363.4032	169.7361	53.9751	0.0000	0.0000	0.0000	0.0000	176.9131	430.0092	674.3263	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	240.3673	212.5105	225.8862	199.2063	193.4408	174.6973	172.8334	179.5677	181.3659	201.7386	213.8482	237.8500	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0337	85.6414	84.9446	83.5268	81.4915	79.8000	79.8000	79.8000	79.8000	83.5898	85.4265	86.1147	(217)
Fuel for water heating, kWh/month	279.3875	248.1398	265.9216	238.4939	237.3755	218.9189	216.5832	225.0221	227.2755	241.3436	250.3300	276.2014	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.9003	20.7782	18.7085	13.7066	10.5874	8.6500	9.6582	12.5541	16.3065	21.3950	24.1656	26.6202	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.8192	-60.0204	-85.7816	-95.8731	-102.8808	-95.8218	-94.5986	-89.5222	-80.5282	-68.3177	-46.9357	-37.0573	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-25.2659	-53.0232	-105.1655	-157.6463	-208.1737	-209.0941	-206.6697	-175.1456	-128.5630	-75.7707	-33.7119	-19.9926	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2995.2049	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2924.9930	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	209.0305	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2298.3790	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)

Energy used	0.0000 (237)
Total delivered energy for all uses	3916.8494 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2995.2049	0.2100	628.9930	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2924.9930	0.2100	614.2485	(264)
Space and water heating			1243.2416	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	209.0305	0.1443	30.1696	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.1566	0.1347	-121.2663	
PV Unit electricity exported	-1398.2224	0.1259	-176.1051	
Total			-297.3714	(269)
Total CO2, kg/year			987.9690	(272)
Target Carbon Dioxide Emission Rate (TER)			10.6200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2995.2049	1.1300	3384.5816	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2924.9930	1.1300	3305.2421	(278)
Space and water heating			6689.8236	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	209.0305	1.5338	320.6180	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.1566	1.4979	-1348.3430	
PV Unit electricity exported	-1398.2224	0.4623	-646.4297	
Total			-1994.7728	(283)
Total Primary energy kWh/year			5145.7696	(286)
Target Primary Energy Rate (TPER)			55.3300	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 3B4_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3B4
Property	1 Bedroom Flat, 3B4, Saffron Walden, CB11		

SAP Rating	80 C	DER	4.68	TER	11.56
Environmental	96 A	% DER<TER	59.52		
CO_2 Emissions (t/year)	0.45	DFEE	41.11	TFEE	42.79
Compliance Check	See BREL	% DFEE < TFEE	3.91		
% DPER < TPER	19.20	DPER	48.80	TPER	60.40

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			51.0000 (1b)	x	2.5000 (2b)	=	127.5000 (1b)	-
First floor			51.0000 (1c)	x	2.7500 (2c)	=	140.2500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.0000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	267.7500	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0747 (8)
Pressure test		Yes		
Pressure Test Method		Blower Door		
Measured/design AP50		3.0000		(17)
Infiltration rate		0.2247		(18)
Number of sides sheltered		2		(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	0.1910		(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2435	0.2387	0.2340	0.2101	0.2053	0.1814	0.1814	0.1767	0.1910	0.2053	0.2149	0.2244	(22b)
Effective ac	0.5296	0.5285	0.5274	0.5221	0.5211	0.5165	0.5165	0.5156	0.5182	0.5211	0.5231	0.5252	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			37.8000	1.1450	43.2824			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			51.0000	0.1100	5.6100			(28a)
External Wall 1	153.0000	43.0000	110.0000	0.1400	15.4000			(29a)
External Roof 1	51.0000		51.0000	0.1100	5.6100			(30)
Total net area of external elements Aum(A, m2)			255.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.1024			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												12.7500	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	87.8524	(37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7985	46.6968	46.5971	46.1287	46.0411	45.6332	45.6332	45.5576	45.7903	46.0411	46.2184	46.4037	(38)
Heat transfer coeff													
	134.6510	134.5492	134.4495	133.9812	133.8935	133.4856	133.4856	133.4101	133.6427	133.8935	134.0708	134.2561	(39)
Average = Sum(39)m / 12 =												133.9807	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3201	1.3191	1.3181	1.3135	1.3127	1.3087	1.3087	1.3079	1.3102	1.3127	1.3144	1.3162	(40)
HLP (average)												1.3135	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7573	(42)
Hot water usage for mixer showers													
	70.4504	69.3917	67.8489	64.8970	62.7187	60.2894	58.9085	60.4396	62.1180	64.7264	67.7416	70.1805	(42a)
Hot water usage for baths													
	30.4192	29.9674	29.3312	28.1582	27.2799	26.3060	25.7799	26.4116	27.0995	28.1416	29.3388	30.3164	(42b)
Hot water usage for other uses													
	42.8674	41.3085	39.7497	38.1909	36.6321	35.0733	35.0733	36.6321	38.1909	39.7497	41.3085	42.8674	(42c)
Average daily hot water use (litres/day)												132.1266	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.7369	140.6676	136.9299	131.2462	126.6307	121.6686	119.7617	123.4834	127.4084	132.6177	138.3889	143.3642	(44)
Energy conte	227.6442	200.3088	210.4561	179.6695	170.4692	149.6058	144.8414	152.8982	157.1073	179.9610	197.1604	224.4737	(45)
Energy content (annual)										Total = Sum(45)m =		2194.5956	
Distribution loss (46)m = 0.15 x (45)m													
	34.1466	30.0463	31.5684	26.9504	25.5704	22.4409	21.7262	22.9347	23.5661	26.9941	29.5741	33.6710	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	277.9886	245.7812	260.8005	228.3899	220.8137	198.3262	195.1859	203.2427	205.8277	230.3054	245.8808	274.8181	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	277.9886	245.7812	260.8005	228.3899	220.8137	198.3262	195.1859	203.2427	205.8277	230.3054	245.8808	274.8181	(64)
										Total per year (kWh/year) = Sum(64)m =		2787.3607	(64)
12Total per year (kWh/year)												2787	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.9672	102.9806	110.2522	98.7164	96.9566	88.7203	88.4353	91.1142	91.2145	100.1126	104.5322	114.9130	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	130.8986	144.9234	130.8986	135.2619	130.8986	135.2619	130.8986	130.8986	135.2619	130.8986	135.2619	130.8986	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.5211	262.2141	255.4278	240.9805	222.7434	205.6032	194.1524	191.4594	198.2457	212.6930	230.9300	248.0703	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	(71)
Water heating gains (Table 5)													
	155.8699	153.2449	148.1884	137.1062	130.3180	123.2226	118.8647	122.4653	126.6868	134.5599	145.1836	154.4530	(72)
Total internal gains													
	613.6489	627.7417	601.8741	580.7078	551.3193	528.4469	508.2749	509.1826	524.5537	545.5107	578.7347	600.7812	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.3000	10.6334	0.7600	0.7000	0.7700	24.6977 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	8.4000	46.7521	0.7600	0.7000	0.7700	144.7855 (78)
West	10.5000	19.6403	0.7600	0.7000	0.7700	76.0294 (80)

Solar gains	336.7478	611.5251	921.1127	1256.1032	1492.4254	1514.0816	1446.6124	1268.7535	1038.6730	700.1978	410.6473	283.2475 (83)
Total gains	950.3967	1239.2668	1522.9868	1836.8110	2043.7446	2042.5285	1954.8873	1777.9361	1563.2266	1245.7086	989.3821	884.0287 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.6051	52.6449	52.6840	52.8681	52.9027	53.0644	53.0644	53.0944	53.0020	52.9027	52.8328	52.7598	
alpha	4.5070	4.5097	4.5123	4.5245	4.5268	4.5376	4.5376	4.5396	4.5335	4.5268	4.5222	4.5173	
util living area	0.9880	0.9639	0.9034	0.7644	0.5823	0.4136	0.2995	0.3434	0.5665	0.8615	0.9724	0.9911	(86)
MIT	19.9301	20.1883	20.4928	20.7655	20.8894	20.9245	20.9305	20.9294	20.9038	20.6872	20.2417	19.8763	(87)
Th 2	19.8251	19.8259	19.8267	19.8302	19.8309	19.8340	19.8340	19.8346	19.8328	19.8309	19.8296	19.8281	(88)
util rest of house	0.9842	0.9533	0.8782	0.7161	0.5178	0.3403	0.2206	0.2573	0.4801	0.8158	0.9624	0.9882	(89)
MIT 2	18.6038	18.9266	19.2930	19.5960	19.7134	19.7431	19.7462	19.7465	19.7298	19.5274	19.0009	18.5381	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.9354	19.2420	19.5929	19.8884	20.0074	20.0384	20.0423	20.0422	20.0233	19.8174	19.3111	18.8727	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9354	19.2420	19.5929	19.8884	20.0074	20.0384	20.0423	20.0422	20.0233	19.8174	19.3111	18.8727	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9803	0.9468	0.8725	0.7186	0.5279	0.3533	0.2348	0.2727	0.4947	0.8152	0.9567	0.9850	(94)
Useful gains	931.6685	1173.3373	1328.7354	1320.0100	1078.8701	721.6560	459.0019	484.9268	773.3124	1015.5344	946.5901	870.8118	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1970.6714	1929.7072	1760.3350	1472.2342	1112.3108	725.9516	459.4946	485.9058	791.6094	1234.1491	1637.1522	1969.8960	(97)
Space heating kWh	773.0182	508.2806	321.1101	109.6014	24.8798	0.0000	0.0000	0.0000	0.0000	162.6493	497.2047	817.7187	(98a)
Space heating requirement - total per year (kWh/year)												3214.4628	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	773.0182	508.2806	321.1101	109.6014	24.8798	0.0000	0.0000	0.0000	0.0000	162.6493	497.2047	817.7187	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3214.4628	
Space heating per m2											(98c) / (4) =	31.5143	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	219.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	773.0182	508.2806	321.1101	109.6014	24.8798	0.0000	0.0000	0.0000	0.0000	162.6493	497.2047	817.7187	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	352.4935	231.7741	146.4250	49.9778	11.3451	0.0000	0.0000	0.0000	0.0000	74.1675	226.7235	372.8767	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	277.9886	245.7812	260.8005	228.3899	220.8137	198.3262	195.1859	203.2427	205.8277	230.3054	245.8808	274.8181	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	146.0024	129.0868	136.9751	119.9527	115.9736	104.1629	102.5136	106.7451	108.1028	120.9587	129.1391	144.3372	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.8118	27.9273	25.1454	18.4226	14.2302	11.6262	12.9812	16.8735	21.9170	28.7563	32.4802	35.7793 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1465.7833 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1463.9500 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	280.9509 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3210.6842 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1465.7833	0.1574	230.6886	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1463.9500	0.1410	206.3711	(264)
Space and water heating			437.0598	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	280.9509	0.1443	40.5499	(268)
Total CO2, kg/year			477.6097	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.6800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1465.7833	1.5826	2319.7188	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1463.9500	1.5213	2227.0406	(278)
Space and water heating			4546.7594	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	280.9509	1.5338	430.9319	(282)
Total Primary energy kWh/year			4977.6913	(286)
Dwelling Primary energy Rate (DPER)			48.8000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.0000 (1b)	x	2.5000 (2b)	=	127.5000 (1b)	-
First floor	51.0000 (1c)	x	2.7500 (2c)	=	140.2500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	267.7500	(5)

2. Ventilation rate

			m3 per hour
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1494	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3994	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3395	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4328	0.4244	0.4159	0.3734	0.3649	0.3225	0.3225	0.3140	0.3395	0.3649	0.3819	0.3989	(22b)
Effective ac	0.5937	0.5900	0.5865	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5796	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			20.3400	1.1450	23.2901			(27)
Heatloss Floor 1			51.0000	0.1300	6.6300			(28a)
External Wall 1	153.0000	25.5400	127.4600	0.1800	22.9428			(29a)
External Roof 1	51.0000		51.0000	0.1100	5.6100			(30)
Total net area of external elements Aum(A, m2)			255.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.6729			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	29.0000	0.1600	4.6400
E6 Intermediate floor within a dwelling	29.0000	0.0000	0.0000
E14 Flat roof	29.0000	0.0800	2.3200
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8500 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 72.5229 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.4557	52.1343	51.8193	50.3396	50.0627	48.7739	48.7739	48.5352	49.2703	50.0627	50.6228	51.2083	(38)
Heat transfer coeff	124.9786	124.6572	124.3422	122.8624	122.5856	121.2968	121.2968	121.0581	121.7932	122.5856	123.1457	123.7312	(39)

Average = Sum(39)m / 12 = 122.8611

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2253	1.2221	1.2190	1.2045	1.2018	1.1892	1.1892	1.1868	1.1941	1.2018	1.2073	1.2131	(40)
HLP (average)												1.2045	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7573 (42)

Hot water usage for mixer showers

70.4504	69.3917	67.8489	64.8970	62.7187	60.2894	58.9085	60.4396	62.1180	64.7264	67.7416	70.1805 (42a)

Hot water usage for baths

30.4192	29.9674	29.3312	28.1582	27.2799	26.3060	25.7799	26.4116	27.0995	28.1416	29.3388	30.3164 (42b)

Hot water usage for other uses

42.8674	41.3085	39.7497	38.1909	36.6321	35.0733	35.0733	36.6321	38.1909	39.7497	41.3085	42.8674 (42c)

Average daily hot water use (litres/day) 132.1266 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.7369	140.6676	136.9299	131.2462	126.6307	121.6686	119.7617	123.4834	127.4084	132.6177	138.3889	143.3642	(44)

Energy conte	227.6442	200.3088	210.4561	179.6695	170.4692	149.6058	144.8414	152.8982	157.1073	179.9610	197.1604	224.4737	(45)
Energy content (annual)										Total = Sum(45)m =		2194.5956	
Distribution loss (46)m = 0.15 x (45)m													
	34.1466	30.0463	31.5684	26.9504	25.5704	22.4409	21.7262	22.9347	23.5661	26.9941	29.5741	33.6710	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	276.8869	244.7861	259.6988	227.3237	219.7119	197.2600	194.0841	202.1409	204.7615	229.2036	244.8146	273.7163	(62)
WWHRS	-32.2070	-28.4841	-29.8269	-24.6979	-23.0175	-19.6963	-18.4621	-19.6326	-20.3785	-24.0240	-27.2163	-31.6106	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	244.6799	216.3020	229.8718	202.6258	196.6944	177.5637	175.6220	182.5083	184.3830	205.1796	217.5983	242.1058	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.1345	(64)
12Total per year (kWh/year)												2475	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.0858	102.1845	109.3708	97.8635	96.0752	87.8673	87.5539	90.2328	90.3615	99.2312	103.6792	114.0316	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	131.8615	145.9895	131.8615	136.2569	131.8615	136.2569	131.8615	131.8615	136.2569	131.8615	136.2569	131.8615	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.5211	262.2141	255.4278	240.9805	222.7434	205.6032	194.1524	191.4594	198.2457	212.6930	230.9300	248.0703	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	(71)
Water heating gains (Table 5)													
	154.6853	152.0602	147.0037	135.9215	129.1333	122.0379	117.6800	121.2806	125.5021	133.3752	143.9989	153.2683	(72)
Total internal gains													
	613.4271	627.6232	601.6523	580.5182	551.0975	528.2572	508.0532	508.9608	524.3640	545.2890	578.5451	600.5594	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3900	10.6334	0.6300	0.7000	0.7700	11.0165	(74)
East	6.7800	19.6403	0.6300	0.7000	0.7700	40.6957	(76)
South	4.5200	46.7521	0.6300	0.7000	0.7700	64.5819	(78)
West	5.6500	19.6403	0.6300	0.7000	0.7700	33.9131	(80)

Solar gains	150.2073	272.7724	410.8648	560.2881	665.7003	675.3601	645.2653	565.9308	463.3028	312.3251	183.1703	126.3433	(83)
Total gains	763.6344	900.3955	1012.5171	1140.8063	1216.7978	1203.6173	1153.3185	1074.8917	987.6668	857.6141	761.7154	726.9027	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6764	56.8225	56.9665	57.6526	57.7828	58.3967	58.3967	58.5118	58.1587	57.7828	57.5200	57.2478	
alpha	4.7784	4.7882	4.7978	4.8435	4.8522	4.8931	4.8931	4.9008	4.8772	4.8522	4.8347	4.8165	
util living area													
	0.9948	0.9880	0.9715	0.9180	0.8010	0.6160	0.4570	0.5079	0.7567	0.9470	0.9888	0.9959	(86)
MIT	19.6237	19.8409	20.1496	20.5428	20.8278	20.9636	20.9930	20.9886	20.9030	20.5182	20.0031	19.5924	(87)
Th 2	19.8998	19.9023	19.9048	19.9164	19.9185	19.9287	19.9287	19.9305	19.9248	19.9185	19.9142	19.9096	(88)
util rest of house													
	0.9931	0.9841	0.9620	0.8913	0.7427	0.5248	0.3487	0.3950	0.6713	0.9237	0.9845	0.9945	(89)
MIT 2	18.3150	18.5925	18.9822	19.4668	19.7800	19.9090	19.9266	19.9268	19.8626	19.4508	18.8089	18.2819	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6422	18.9046	19.2740	19.7358	20.0420	20.1727	20.1932	20.1922	20.1227	19.7177	19.1075	18.6095	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6422	18.9046	19.2740	19.7358	20.0420	20.1727	20.1932	20.1922	20.1227	19.7177	19.1075	18.6095	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9792	0.9549	0.8861	0.7501	0.5465	0.3759	0.4233	0.6885	0.9183	0.9800	0.9921	(94)
Useful gains	756.1491	881.6824	966.8362	1010.8168	912.6622	657.7330	433.5174	454.9859	679.9709	787.5448	746.4466	721.1535	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1792.4672	1745.7722	1588.3496	1331.3149	1022.6044	675.9482	435.8437	459.0797	733.5283	1117.6938	1478.6669	1782.9019	(97)
Space heating kWh													
	771.0207	580.6684	462.4060	230.7586	81.7970	0.0000	0.0000	0.0000	0.0000	245.6309	527.1986	789.9408	(98a)
Space heating requirement - total per year (kWh/year)												3689.4208	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	771.0207	580.6684	462.4060	230.7586	81.7970	0.0000	0.0000	0.0000	0.0000	245.6309	527.1986	789.9408	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3689.4208	
Space heating per m2											(98c) / (4) =	36.1708	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	771.0207	580.6684	462.4060	230.7586	81.7970	0.0000	0.0000	0.0000	0.0000	245.6309	527.1986	789.9408	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	835.3420	629.1098	500.9815	250.0093	88.6208	0.0000	0.0000	0.0000	0.0000	266.1223	571.1794	855.8405	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	244.6799	216.3020	229.8718	202.6258	196.6944	177.5637	175.6220	182.5083	184.3830	205.1796	217.5983	242.1058	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.4512	86.1626	85.5945	84.3521	82.2484	79.8000	79.8000	79.8000	79.8000	84.4644	85.9674	86.5111	(217)
Fuel for water heating, kWh/month													
	283.0265	251.0393	268.5590	240.2144	239.1467	222.5109	220.0777	228.7071	231.0564	242.9186	253.1173	279.8550	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	27.3982	21.9799	19.7904	14.4993	11.1997	9.1502	10.2167	13.2801	17.2495	22.6323	25.5632	28.1597	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.5503	-65.0409	-92.6579	-103.2064	-110.4444	-102.7424	-101.4135	-96.1099	-86.6838	-73.8499	-50.9439	-40.3096	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-28.1238	-58.9424	-116.7680	-174.8471	-230.7122	-231.6816	-229.0098	-194.1709	-142.6420	-84.1826	-37.5083	-22.2612	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3997.2057	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2960.2290	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	221.1193	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2520.8028	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses 4743.7512 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3997.2057	0.2100	839.4132	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2960.2290	0.2100	621.6481	(264)
Space and water heating			1461.0613	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	221.1193	0.1443	31.9144	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-969.9529	0.1348	-130.7404	
PV Unit electricity exported	-1550.8499	0.1260	-195.3764	
Total			-326.1168	(269)
Total CO2, kg/year			1178.7881	(272)
Target Carbon Dioxide Emission Rate (TER)			11.5600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3997.2057	1.1300	4516.8424	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2960.2290	1.1300	3345.0587	(278)
Space and water heating			7861.9011	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	221.1193	1.5338	339.1602	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-969.9529	1.4982	-1453.1584	
PV Unit electricity exported	-1550.8499	0.4624	-717.1712	
Total			-2170.3295	(283)
Total Primary energy kWh/year			6160.8326	(286)
Target Primary Energy Rate (TPER)			60.4000	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 3BC_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3BC
Property	1 Bedroom Flat, 1B, Saffron Walden, CB11		

SAP Rating	81 B	DER	4.53	TER	10.97
Environmental	96 A	% DER<TER	58.71		
CO_2 Emissions (t/year)	0.4	DFEE	37.51	TFEE	38.31
Compliance Check	See BREL	% DFEE < TFEE	2.09		
% DPER < TPER	17.11	DPER	47.39	TPER	57.17

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)
Ground floor		47.0000 (1b)	x	2.5000 (2b)	=	117.5000 (1b) -
First floor		47.0000 (1c)	x	2.7500 (2c)	=	129.2500 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.7500 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0811 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.2311 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1964 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2504	0.2455	0.2406	0.2160	0.2111	0.1866	0.1866	0.1817	0.1964	0.2111	0.2209	0.2308	(22b)
Effective ac	0.5314	0.5301	0.5289	0.5233	0.5223	0.5174	0.5174	0.5165	0.5193	0.5223	0.5244	0.5266	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			37.8000	1.1450	43.2824			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			47.0000	0.1100	5.1700			(28a)
External Wall 1	105.0000	43.0000	62.0000	0.1400	8.6800			(29a)
External Roof 1	47.0000		47.0000	0.1100	5.1700			(30)
Total net area of external elements Aum(A, m2)			199.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.5024			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 9.9500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 77.4524 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.2666	43.1675	43.0703	42.6139	42.5285	42.1310	42.1310	42.0574	42.2841	42.5285	42.7013	42.8819	(38)
Heat transfer coeff	120.7190	120.6199	120.5227	120.0664	119.9810	119.5835	119.5835	119.5098	119.7366	119.9810	120.1537	120.3343	(39)

Average = Sum(39)m / 12 = 120.0659

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2842	1.2832	1.2822	1.2773	1.2764	1.2722	1.2722	1.2714	1.2738	1.2764	1.2782	1.2802	(40)
HLP (average)												1.2773	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6766 (42)

Hot water usage for mixer showers

69.0977	68.0593	66.5462	63.6510	61.5145	59.1318	57.7775	59.2792	60.9253	63.4836	66.4409	68.8330	(42a)

Hot water usage for baths

29.8375	29.3944	28.7704	27.6198	26.7582	25.8029	25.2869	25.9066	26.5813	27.6035	28.7778	29.7366	(42b)

Hot water usage for other uses

42.0412	40.5124	38.9836	37.4549	35.9261	34.3973	34.3973	35.9261	37.4549	38.9836	40.5124	42.0412	(42c)

Average daily hot water use (litres/day) 129.5891 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.9764	137.9661	134.3002	128.7257	124.1988	119.3321	117.4617	121.1119	124.9615	130.0707	135.7311	140.6108	(44)
Energy conte	223.2722	196.4619	206.4143	176.2190	167.1954	146.7327	142.0598	149.9618	154.0900	176.5047	193.3738	220.1625	(45)

Energy content (annual) Total = Sum(45)m = 2152.4482

Distribution loss (46)m = 0.15 x (45)m

33.4908	29.4693	30.9622	26.4328	25.0793	22.0099	21.3090	22.4943	23.1135	26.4757	29.0061	33.0244	(46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

273.6166	241.9343	256.7588	224.9394	217.5399	195.4531	192.4042	200.3062	202.8104	226.8492	242.0943	270.5070	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

273.6166	241.9343	256.7588	224.9394	217.5399	195.4531	192.4042	200.3062	202.8104	226.8492	242.0943	270.5070	(64)

Total per year (kWh/year) = Sum(64)m = 2745.2133 (64)

12Total per year (kWh/year) 2745 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

114.5135	101.7015	108.9083	97.5692	95.8680	87.7650	87.5104	90.1378	90.2113	98.9634	103.2731	113.4796	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	124.2035	137.5110	124.2035	128.3436	124.2035	128.3436	124.2035	124.2035	128.3436	124.2035	128.3436	124.2035	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	153.9161	151.3415	146.3821	135.5127	128.8549	121.8958	117.6215	121.1530	125.2934	133.0153	143.4349	152.5263	(72)
Total internal gains	590.5161	603.8044	579.0983	558.6606	530.5584	508.4758	489.1963	490.1725	504.8923	525.1823	557.0464	578.2613	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	6.3000	11.2829	0.7600	0.7000	0.7700	26.2064 (75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190 (77)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (79)
Northwest	10.5000	11.2829	0.7600	0.7000	0.7700	43.6774 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	354.7489	627.4811	920.2038	1243.5232	1487.1792	1517.9171	1446.1668	1258.0451	1031.1716	710.1245	429.1346	300.8558	(83)
Total gains	945.2650	1231.2855	1499.3021	1802.1838	2017.7376	2026.3929	1935.3632	1748.2176	1536.0639	1235.3069	986.1810	879.1171	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0741	54.1186	54.1622	54.3681	54.4068	54.5876	54.5876	54.6213	54.5178	54.4068	54.3286	54.2470	
alpha	4.6049	4.6079	4.6108	4.6245	4.6271	4.6392	4.6392	4.6414	4.6345	4.6271	4.6219	4.6165	
util living area	0.9835	0.9514	0.8785	0.7240	0.5365	0.3751	0.2714	0.3135	0.5234	0.8264	0.9622	0.9878	(86)
MIT	20.0259	20.2894	20.5734	20.8094	20.9052	20.9289	20.9325	20.9319	20.9146	20.7434	20.3302	19.9695	(87)
Th 2	19.8532	19.8540	19.8548	19.8587	19.8594	19.8627	19.8627	19.8633	19.8614	19.8594	19.8579	19.8564	(88)
util rest of house	0.9785	0.9381	0.8496	0.6746	0.4762	0.3096	0.2015	0.2365	0.4430	0.7761	0.9493	0.9840	(89)
MIT 2	18.7464	19.0728	19.4090	19.6656	19.7542	19.7751	19.7769	19.7773	19.7656	19.6102	19.1321	18.6780	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0663	19.3769	19.7001	19.9515	20.0420	20.0635	20.0658	20.0660	20.0529	19.8935	19.4316	19.0008	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0663	19.3769	19.7001	19.9515	20.0420	20.0635	20.0658	20.0660	20.0529	19.8935	19.4316	19.0008	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9740	0.9314	0.8452	0.6789	0.4861	0.3213	0.2140	0.2503	0.4569	0.7778	0.9433	0.9802	(94)
Useful gains	920.6415	1146.7969	1267.2698	1223.4903	980.8136	651.0227	414.1988	437.5867	701.7518	960.7723	930.2657	861.6864	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1782.5696	1746.2062	1590.9064	1326.9185	1000.8756	653.3471	414.4546	438.1201	712.7792	1115.0448	1481.6887	1781.0494	(97)
Space heating kWh	641.2745	402.8031	240.7856	74.4683	14.9262	0.0000	0.0000	0.0000	0.0000	114.7787	397.0245	684.0061	(98a)
Space heating requirement - total per year (kWh/year)												2570.0671	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	641.2745	402.8031	240.7856	74.4683	14.9262	0.0000	0.0000	0.0000	0.0000	114.7787	397.0245	684.0061	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2570.0671	
Space heating per m2										(98c) / (4) =		27.3411	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	641.2745	402.8031	240.7856	74.4683	14.9262	0.0000	0.0000	0.0000	0.0000	114.7787	397.0245	684.0061	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	292.4188	183.6767	109.7974	33.9573	6.8063	0.0000	0.0000	0.0000	0.0000	52.3387	181.0417	311.9043	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.6166	241.9343	256.7588	224.9394	217.5399	195.4531	192.4042	200.3062	202.8104	226.8492	242.0943	270.5070	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	143.7062	127.0663	134.8523	118.1404	114.2541	102.6539	101.0526	105.2028	106.5181	119.1435	127.1503	142.0730	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	32.6906	26.2256	23.6133	17.3001	13.3631	10.9178	12.1903	15.8454	20.5816	27.0041	30.5011	33.5992 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1171.9412 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1441.8137 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	263.8321 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2877.5870 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1171.9412	0.1578	184.9016	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1441.8137	0.1410	203.2371	(264)
Space and water heating			388.1387	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	263.8321	0.1443	38.0791	(268)
Total CO2, kg/year			426.2179	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.5300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1171.9412	1.5840	1856.3647	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1441.8137	1.5212	2193.3151	(278)
Space and water heating			4049.6799	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	263.8321	1.5338	404.6745	(282)
Total Primary energy kWh/year			4454.3544	(286)
Dwelling Primary energy Rate (DPER)			47.3900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.0000 (1b)	x	2.5000 (2b)	=	117.5000 (1b)	-
First floor	47.0000 (1c)	x	2.7500 (2c)	=	129.2500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 94.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.7500	(5)

2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		3 * 10 =	30.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1216 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3716 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3158 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4027	0.3948	0.3869	0.3474	0.3395	0.3001	0.3001	0.2922	0.3158	0.3395	0.3553	0.3711	(22b)
Effective ac	0.5811	0.5779	0.5748	0.5604	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			18.3600	1.1450	21.0229			(27)
Heatloss Floor 1			47.0000	0.1300	6.1100			(28a)
External Wall 1	105.0000	23.5600	81.4400	0.1800	14.6592			(29a)
External Roof 1	47.0000		47.0000	0.1100	5.1700			(30)
Total net area of external elements Aum(A, m2)			199.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.1621			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1	Element	Length	Psi-value	Total
E5	Ground floor (normal)	29.0000	0.1600	4.6400
E6	Intermediate floor within a dwelling	29.0000	0.0000	0.0000
E14	Flat roof	29.0000	0.0800	2.3200
E16	Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8500 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 61.0121 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3162	47.0598	46.8085	45.6281	45.4073	44.3792	44.3792	44.1889	44.7752	45.4073	45.8541	46.3211	(38)
Heat transfer coeff	108.3283	108.0719	107.8206	106.6402	106.4194	105.3913	105.3913	105.2010	105.7873	106.4194	106.8662	107.3332	(39)

Average = Sum(39)m / 12 = 106.6392

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1524	1.1497	1.1470	1.1345	1.1321	1.1212	1.1212	1.1192	1.1254	1.1321	1.1369	1.1418	(40)
HLP (average)												1.1345	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6766 (42)

Hot water usage for mixer showers

69.0977	68.0593	66.5462	63.6510	61.5145	59.1318	57.7775	59.2792	60.9253	63.4836	66.4409	68.8330	(42a)

Hot water usage for baths

29.8375	29.3944	28.7704	27.6198	26.7582	25.8029	25.2869	25.9066	26.5813	27.6035	28.7778	29.7366	(42b)

Hot water usage for other uses

42.0412	40.5124	38.9836	37.4549	35.9261	34.3973	34.3973	35.9261	37.4549	38.9836	40.5124	42.0412	(42c)

Average daily hot water use (litres/day) 129.5891 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.9764	137.9661	134.3002	128.7257	124.1988	119.3321	117.4617	121.1119	124.9615	130.0707	135.7311	140.6108	(44)

Energy conte	223.2722	196.4619	206.4143	176.2190	167.1954	146.7327	142.0598	149.9618	154.0900	176.5047	193.3738	220.1625	(45)
Energy content (annual)										Total = Sum(45)m =		2152.4482	
Distribution loss (46)m = 0.15 x (45)m													
	33.4908	29.4693	30.9622	26.4328	25.0793	22.0099	21.3090	22.4943	23.1135	26.4757	29.0061	33.0244	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	272.5148	240.9391	255.6570	223.8732	216.4381	194.3869	191.3025	199.2045	201.7442	225.7474	241.0280	269.4052	(62)
WWHRS	-31.5886	-27.9372	-29.2542	-24.2237	-22.5756	-19.3181	-18.1076	-19.2556	-19.9872	-23.5628	-26.6937	-31.0036	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	240.9262	213.0019	226.4028	199.6495	193.8625	175.0688	173.1948	179.9488	181.7569	202.1846	214.3343	238.4016	(64)
										Total per year (kWh/year) = Sum(64)m =		2438.7329	(64)
12Total per year (kWh/year)												2439	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.6321	100.9054	108.0269	96.7162	94.9866	86.9120	86.6290	89.2564	89.3583	98.0820	102.4202	112.5982	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	125.4097	138.8465	125.4097	129.5900	125.4097	129.5900	125.4097	125.4097	129.5900	125.4097	129.5900	125.4097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)													
	152.7314	150.1568	145.1975	134.3280	127.6702	120.7111	116.4368	119.9683	124.1087	131.8306	142.2502	151.3416	(72)
Total internal gains													
	590.5376	603.9551	579.1198	558.7223	530.5799	508.5375	489.2178	490.1940	504.9540	525.2038	557.1081	578.2828	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0600	11.2829	0.6300	0.7000	0.7700	10.5515	(75)
Southeast	6.1200	36.7938	0.6300	0.7000	0.7700	68.8174	(77)
Southwest	4.0800	36.7938	0.6300	0.7000	0.7700	45.8783	(79)
Northwest	5.1000	11.2829	0.6300	0.7000	0.7700	17.5859	(81)

Solar gains	142.8331	252.6437	370.5031	500.6817	598.7853	611.1614	582.2724	506.5287	415.1823	285.9186	172.7831	121.1340	(83)
Total gains	733.3707	856.5988	949.6229	1059.4040	1129.3652	1119.6988	1071.4903	996.7227	920.1362	811.1224	729.8912	699.4168	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2592	60.4022	60.5429	61.2131	61.3401	61.9385	61.9385	62.0506	61.7066	61.3401	61.0837	60.8179	
alpha	5.0173	5.0268	5.0362	5.0809	5.0893	5.1292	5.1292	5.1367	5.1138	5.0893	5.0722	5.0545	
util living area													
	0.9936	0.9854	0.9665	0.9059	0.7761	0.5838	0.4294	0.4793	0.7270	0.9353	0.9860	0.9949	(86)
MIT	19.7684	19.9783	20.2633	20.6219	20.8705	20.9761	20.9959	20.9929	20.9302	20.6017	20.1246	19.7353	(87)
Th 2	19.9582	19.9604	19.9626	19.9728	19.9747	19.9836	19.9836	19.9852	19.9801	19.9747	19.9708	19.9668	(88)
util rest of house													
	0.9915	0.9808	0.9558	0.8773	0.7177	0.4990	0.3320	0.3768	0.6435	0.9090	0.9807	0.9932	(89)
MIT 2	18.5408	18.8081	19.1662	19.6039	19.8718	19.9708	19.9823	19.9829	19.9361	19.5925	19.0033	18.5048	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.8477	19.1006	19.4405	19.8584	20.1215	20.2221	20.2357	20.2354	20.1846	19.8448	19.2836	18.8124	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8477	19.1006	19.4405	19.8584	20.1215	20.2221	20.2357	20.2354	20.1846	19.8448	19.2836	18.8124	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9884	0.9757	0.9490	0.8737	0.7267	0.5195	0.3564	0.4025	0.6615	0.9049	0.9760	0.9906	(94)
Useful gains	724.8405	835.7939	901.1923	925.5578	820.7081	581.6384	381.9100	401.1701	608.6249	734.0057	712.3400	692.8274	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1575.9245	1534.6886	1395.2547	1168.6095	896.2095	592.5209	383.1727	403.4862	643.6768	983.8244	1302.0136	1568.3966	(97)
Space heating kWh													
	633.2065	469.6572	367.5824	174.9972	56.1731	0.0000	0.0000	0.0000	0.0000	185.8651	424.5650	651.4235	(98a)
Space heating requirement - total per year (kWh/year)												2963.4700	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	633.2065	469.6572	367.5824	174.9972	56.1731	0.0000	0.0000	0.0000	0.0000	185.8651	424.5650	651.4235	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2963.4700	
Space heating per m2											(98c) / (4) =	31.5263	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	633.2065	469.6572	367.5824	174.9972	56.1731	0.0000	0.0000	0.0000	0.0000	185.8651	424.5650	651.4235	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	686.0309	508.8377	398.2475	189.5961	60.8592	0.0000	0.0000	0.0000	0.0000	201.3706	459.9837	705.7676	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	240.9262	213.0019	226.4028	199.6495	193.8625	175.0688	173.1948	179.9488	181.7569	202.1846	214.3343	238.4016	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1229	85.7814	85.1400	83.7656	81.6594	79.8000	79.8000	79.8000	79.8000	83.8715	85.5627	86.1955	(217)
Fuel for water heating, kWh/month													
	279.7470	248.3080	265.9182	238.3432	237.4040	219.3844	217.0361	225.4998	227.7656	241.0648	250.4997	276.5825	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.0577	20.9044	18.8221	13.7899	10.6517	8.7025	9.7168	12.6303	16.4055	21.5250	24.3124	26.7819	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2376	-60.5855	-86.5590	-96.7061	-103.7434	-96.6124	-95.3770	-90.2727	-81.2266	-68.9420	-47.3858	-37.4218	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-25.5796	-53.6736	-106.4414	-159.5393	-210.6558	-211.5822	-209.1307	-177.2410	-130.1129	-76.6958	-34.1289	-20.2416	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3210.6934	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2927.5532	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	210.3002	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2323.0928	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses 4111.4541 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3210.6934	0.2100	674.2456	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2927.5532	0.2100	614.7862	(264)
Space and water heating			1289.0318	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	210.3002	0.1443	30.3528	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-908.0701	0.1347	-122.3397	
PV Unit electricity exported	-1415.0226	0.1260	-178.2259	
Total			-300.5656	(269)
Total CO2, kg/year			1030.7483	(272)
Target Carbon Dioxide Emission Rate (TER)			10.9700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3210.6934	1.1300	3628.0836	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2927.5532	1.1300	3308.1351	(278)
Space and water heating			6936.2187	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	210.3002	1.5338	322.5655	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-908.0701	1.4979	-1360.2240	
PV Unit electricity exported	-1415.0226	0.4623	-654.2148	
Total			-2014.4389	(283)
Total Primary energy kWh/year			5374.4462	(286)
Target Primary Energy Rate (TPER)			57.1700	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3BH-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3BH-AFF
Property	1 Bedroom Flat, 3BH-AFF, Saffron Walden, CB11		

SAP Rating	82 B	DER	4.39	TER	10.58
Environmental	96 A	% DER<TER	58.51		
CO_2 Emissions (t/year)	0.36	DFEE	32.82	TFEE	35.06
Compliance Check	See BREL	% DFEE < TFEE	6.39		
% DPER < TPER	16.39	DPER	46.03	TPER	55.06

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		44.0000	(1b)	x 2.5000	(2b) =	110.0000	(1b) -
First floor		44.0000	(1c)	x 2.7500	(2c) =	121.0000	(1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.0000	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0866	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2366	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2011	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2564	0.2514	0.2463	0.2212	0.2162	0.1910	0.1910	0.1860	0.2011	0.2162	0.2262	0.2363	(22b)
Effective ac	0.5329	0.5316	0.5303	0.5245	0.5234	0.5182	0.5182	0.5173	0.5202	0.5234	0.5256	0.5279	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.3000	1.1450	31.2595			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			44.0000	0.1100	4.8400			(28a)
External Wall 1	100.0000	32.5000	67.5000	0.1400	9.4500			(29a)
External Roof 1	44.0000		44.0000	0.1100	4.8400			(30)
Total net area of external elements Aum(A, m2)			188.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.5895			(33)

Party Wall 1						53.0000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												9.4000	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	64.9895	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.6206	40.5233	40.4279	39.9800	39.8962	39.5060	39.5060	39.4338	39.6563	39.8962	40.0657	40.2430	(38)
Heat transfer coeff													
	105.6101	105.5128	105.4175	104.9695	104.8857	104.4956	104.4956	104.4233	104.6459	104.8857	105.0553	105.2325	(39)
Average = Sum(39)m / 12 =												104.9691	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2001	1.1990	1.1979	1.1928	1.1919	1.1874	1.1874	1.1866	1.1892	1.1919	1.1938	1.1958	(40)
HLP (average)												1.1928	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5973	(42)
Hot water usage for mixer showers													
	67.7687	66.7502	65.2662	62.4267	60.3312	57.9944	56.6662	58.1390	59.7535	62.2625	65.1630	67.5090	(42a)
Hot water usage for baths													
	29.2660	28.8313	28.2193	27.0907	26.2457	25.3087	24.8025	25.4103	26.0721	27.0747	28.2265	29.1670	(42b)
Hot water usage for other uses													
	41.2294	39.7301	38.2309	36.7316	35.2324	33.7331	33.7331	35.2324	36.7316	38.2309	39.7301	41.2294	(42c)
Average daily hot water use (litres/day)												127.0959	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	138.2640	135.3117	131.7163	126.2491	121.8093	117.0362	115.2018	118.7817	122.5572	127.5681	133.1196	137.9054	(44)
Energy conte	218.9764	192.6820	202.4431	172.8287	163.9788	143.9097	139.3266	147.0766	151.1253	173.1088	189.6533	215.9266	(45)
Energy content (annual)											Total = Sum(45)m =	2111.0357	
Distribution loss (46)m = 0.15 x (45)m													
	32.8465	28.9023	30.3665	25.9243	24.5968	21.5865	20.8990	22.0615	22.6688	25.9663	28.4480	32.3890	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.3208	238.1544	252.7875	221.5491	214.3232	192.6301	189.6711	197.4210	199.8457	223.4532	238.3737	266.2710	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	269.3208	238.1544	252.7875	221.5491	214.3232	192.6301	189.6711	197.4210	199.8457	223.4532	238.3737	266.2710	(64)
											Total per year (kWh/year) = Sum(64)m =	2703.8009	(64)
12Total per year (kWh/year)												2704	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.0852	100.4447	107.5879	96.4419	94.7985	86.8263	86.6017	89.1785	89.2255	97.8342	102.0361	112.0711	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	118.7069	131.4255	118.7069	122.6638	118.7069	122.6638	118.7069	118.7069	122.6638	118.7069	122.6638	118.7069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	235.3498	237.7919	231.6377	218.5360	201.9975	186.4537	176.0694	173.6272	179.7815	192.8831	209.4216	224.9655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	(71)
Water heating gains (Table 5)													
	151.9962	149.4713	144.6074	133.9470	127.4173	120.5921	116.4001	119.8636	123.9243	131.4976	141.7168	150.6332	(72)
Total internal gains													
	571.0131	583.6489	559.9121	540.1070	513.0819	491.6697	473.1366	474.1579	488.3297	508.0478	538.7624	559.2658	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	8.4000	19.6403	0.7600	0.7000	0.7700	60.8235 (76)
South	12.6000	46.7521	0.7600	0.7000	0.7700	217.1782 (78)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.6193	563.9034	795.9867	1012.1892	1146.5228	1140.9521	1099.0815	1000.3677	872.1108	630.7086	390.1498	275.1940	(83)
Total gains	894.6324	1147.5523	1355.8989	1552.2962	1659.6047	1632.6219	1572.2181	1474.5255	1360.4405	1138.7564	928.9122	834.4598	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.8648	57.9182	57.9706	58.2180	58.2645	58.4820	58.4820	58.5225	58.3980	58.2645	58.1704	58.0725	
alpha	4.8577	4.8612	4.8647	4.8812	4.8843	4.8988	4.8988	4.9015	4.8932	4.8843	4.8780	4.8715	
util living area	0.9814	0.9464	0.8751	0.7376	0.5689	0.4066	0.2919	0.3249	0.5193	0.8117	0.9569	0.9862	(86)
MIT	20.1344	20.3815	20.6266	20.8231	20.9082	20.9322	20.9361	20.9356	20.9225	20.7857	20.4186	20.0803	(87)
Th 2	19.9199	19.9208	19.9217	19.9257	19.9265	19.9301	19.9301	19.9307	19.9287	19.9265	19.9250	19.9233	(88)
util rest of house	0.9759	0.9324	0.8467	0.6905	0.5095	0.3400	0.2212	0.2498	0.4434	0.7615	0.9430	0.9820	(89)
MIT 2	18.9360	19.2407	19.5298	19.7449	19.8250	19.8467	19.8487	19.8493	19.8397	19.7159	19.2952	18.8708	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.2356	19.5259	19.8040	20.0145	20.0958	20.1181	20.1206	20.1209	20.1104	19.9834	19.5761	19.1732	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2356	19.5259	19.8040	20.0145	20.0958	20.1181	20.1206	20.1209	20.1104	19.9834	19.5761	19.1732	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9714	0.9263	0.8432	0.6946	0.5191	0.3518	0.2338	0.2632	0.4566	0.7644	0.9374	0.9782	(94)
Useful gains	869.0724	1062.9440	1143.2731	1078.2957	861.4280	574.3357	367.6554	388.1302	621.1228	870.4733	870.7733	816.2801	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1577.3496	1543.2223	1402.4736	1166.6803	880.5959	576.6180	367.8844	388.5449	628.9623	984.1799	1310.6794	1575.6643	(97)
Space heating kWh	526.9582	322.7470	192.8452	63.6369	14.2610	0.0000	0.0000	0.0000	0.0000	84.5977	316.7324	564.9818	(98a)
Space heating requirement - total per year (kWh/year)												2086.7602	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	526.9582	322.7470	192.8452	63.6369	14.2610	0.0000	0.0000	0.0000	0.0000	84.5977	316.7324	564.9818	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2086.7602	
Space heating per m2										(98c) / (4) =		23.7132	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	526.9582	322.7470	192.8452	63.6369	14.2610	0.0000	0.0000	0.0000	0.0000	84.5977	316.7324	564.9818	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	240.2910	147.1715	87.9367	29.0182	6.5029	0.0000	0.0000	0.0000	0.0000	38.5763	144.4288	257.6297	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	269.3208	238.1544	252.7875	221.5491	214.3232	192.6301	189.6711	197.4210	199.8457	223.4532	238.3737	266.2710	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	141.4500	125.0811	132.7666	116.3598	112.5647	101.1713	99.6172	103.6875	104.9610	117.3599	125.1963	139.8482	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.9609	24.8380	22.3639	16.3847	12.6560	10.3401	11.5453	15.0070	19.4926	25.5753	28.8872	31.8214 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	951.5550 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1420.0635 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	249.8723 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2621.4908 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	951.5550	0.1579	150.2259	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1420.0635	0.1409	200.1577	(264)
Space and water heating			350.3837	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	249.8723	0.1443	36.0643	(268)
Total CO2, kg/year			386.4480	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.3900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	951.5550	1.5844	1507.6196	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1420.0635	1.5212	2160.1778	(278)
Space and water heating			3667.7974	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	249.8723	1.5338	383.2624	(282)
Total Primary energy kWh/year			4051.0598	(286)
Dwelling Primary energy Rate (DPER)			46.0300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0000 (1b)	x	2.5000 (2b)	=	110.0000 (1b)	-
First floor	44.0000 (1c)	x	2.7500 (2c)	=	121.0000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 88.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	231.0000	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1299	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3799	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3229	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3633	0.3794	(22b)
Effective ac	0.5847	0.5815	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			16.7700	1.1450	19.2023			(27)
Heatloss Floor 1			44.0000	0.1300	5.7200			(28a)
External Wall 1	100.0000	21.9700	78.0300	0.1800	14.0454			(29a)
External Roof 1	44.0000		44.0000	0.1100	4.8400			(30)
Total net area of external elements Aum(A, m2)			188.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.0077			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	19.0000	0.1600	3.0400
E6 Intermediate floor within a dwelling	19.0000	0.0000	0.0000
E14 Flat roof	19.0000	0.0800	1.5200
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1350 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 55.1427 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.5749	44.3240	44.0782	42.9233	42.7072	41.7013	41.7013	41.5151	42.0888	42.7072	43.1443	43.6013	(38)
Heat transfer coeff	99.7176	99.4667	99.2208	98.0660	97.8499	96.8440	96.8440	96.6578	97.2315	97.8499	98.2870	98.7440	(39)

Average = Sum(39)m / 12 = 98.0649

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1332	1.1303	1.1275	1.1144	1.1119	1.1005	1.1005	1.0984	1.1049	1.1119	1.1169	1.1221	(40)
HLP (average)												1.1144	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5973 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
67.7687	66.7502	65.2662	62.4267	60.3312	57.9944	56.6662	58.1390	59.7535	62.2625	65.1630	67.5090	(42a)

Hot water usage for baths

29.2660	28.8313	28.2193	27.0907	26.2457	25.3087	24.8025	25.4103	26.0721	27.0747	28.2265	29.1670	(42b)

Hot water usage for other uses

41.2294	39.7301	38.2309	36.7316	35.2324	33.7331	33.7331	35.2324	36.7316	38.2309	39.7301	41.2294	(42c)

Average daily hot water use (litres/day) 127.0959 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Daily hot water use

	138.2640	135.3117	131.7163	126.2491	121.8093	117.0362	115.2018	118.7817	122.5572	127.5681	133.1196	137.9054 (44)
Energy conte	218.9764	192.6820	202.4431	172.8287	163.9788	143.9097	139.3266	147.0766	151.1253	173.1088	189.6533	215.9266 (45)
Energy content (annual)										Total = Sum(45)m =		2111.0357
Distribution loss (46)m = 0.15 x (45)m												
	32.8465	28.9023	30.3665	25.9243	24.5968	21.5865	20.8990	22.0615	22.6688	25.9663	28.4480	32.3890 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	268.2191	237.1593	251.6857	220.4829	213.2214	191.5639	188.5693	196.3192	198.7795	222.3514	237.3075	265.1692 (62)
WWHRS	-30.9810	-27.3999	-28.6915	-23.7577	-22.1414	-18.9465	-17.7593	-18.8853	-19.6028	-23.1095	-26.1803	-30.4073 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	237.2381	209.7594	222.9942	196.7251	191.0801	172.6174	170.8100	177.4339	179.1767	199.2419	211.1272	234.7620 (64)
										Total per year (kWh/year) = Sum(64)m =		2402.9660 (64)
12Total per year (kWh/year)												2403 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	112.2038	99.6486	106.7065	95.5889	93.9171	85.9733	85.7202	88.2971	88.3725	96.9528	101.1831	111.1897 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.2317	133.1137	120.2317	124.2394	120.2317	124.2394	120.2317	120.2317	124.2394	120.2317	124.2394	120.2317	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	235.3498	237.7919	231.6377	218.5360	201.9975	186.4537	176.0694	173.6272	179.7815	192.8831	209.4216	224.9655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	(71)
Water heating gains (Table 5)													
	150.8115	148.2866	143.4227	132.7623	126.2326	119.4074	115.2154	118.6789	122.7396	130.3129	140.5321	149.4485	(72)
Total internal gains													
	571.3532	584.1524	560.2522	540.4980	513.4220	492.0606	473.4767	474.4980	488.7207	508.3879	539.1533	559.6059	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.1600	19.6403	0.6300	0.7000	0.7700	30.9720	(76)
South	7.7400	46.7521	0.6300	0.7000	0.7700	110.5894	(78)
West	3.8700	19.6403	0.6300	0.7000	0.7700	23.2290	(80)

Solar gains	164.7904	287.1455	405.3248	515.4174	583.8215	580.9848	559.6639	509.3977	444.0880	321.1635	198.6684	140.1317	(83)
Total gains	736.1435	871.2979	965.5770	1055.9154	1097.2435	1073.0455	1033.1405	983.8957	932.8086	829.5514	737.8217	699.7376	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2842	61.4387	61.5910	62.3163	62.4539	63.1026	63.1026	63.2242	62.8512	62.4539	62.1762	61.8884	
alpha	5.0856	5.0959	5.1061	5.1544	5.1636	5.2068	5.2068	5.2149	5.1901	5.1636	5.1451	5.1259	
util living area													
	0.9912	0.9790	0.9530	0.8822	0.7507	0.5631	0.4100	0.4479	0.6773	0.9102	0.9802	0.9930	(86)
MIT	19.8567	20.0850	20.3657	20.6873	20.8941	20.9809	20.9969	20.9952	20.9519	20.6779	20.2120	19.8197	(87)
Th 2	19.9738	19.9762	19.9784	19.9891	19.9911	20.0004	20.0004	20.0022	19.9968	19.9911	19.9871	19.9828	(88)
util rest of house													
	0.9884	0.9727	0.9390	0.8496	0.6914	0.4814	0.3182	0.3529	0.5947	0.8774	0.9731	0.9908	(89)
MIT 2	18.6641	18.9532	19.3024	19.6896	19.9082	19.9903	19.9995	20.0006	19.9675	19.6904	19.1243	18.6236	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.9622	19.2362	19.5682	19.9390	20.1547	20.2379	20.2489	20.2492	20.2136	19.9372	19.3962	18.9226	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9622	19.2362	19.5682	19.9390	20.1547	20.2379	20.2489	20.2492	20.2136	19.9372	19.3962	18.9226	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9846	0.9667	0.9321	0.8478	0.7016	0.5013	0.3412	0.3767	0.6135	0.8754	0.9677	0.9876	(94)
Useful gains	724.8181	842.3268	900.0239	895.1677	769.8626	537.9242	352.4975	370.6032	572.2747	726.1520	713.9854	691.0879	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1462.0819	1425.9700	1296.6421	1082.5506	827.2897	546.0005	353.3704	372.0582	594.4380	913.6478	1208.5595	1453.7721	(97)
Space heating kWh	548.5243	392.2082	295.0839	134.9157	42.7257	0.0000	0.0000	0.0000	0.0000	139.4969	356.0933	567.4370	(98a)
Space heating requirement - total per year (kWh/year)												2476.4851	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	548.5243	392.2082	295.0839	134.9157	42.7257	0.0000	0.0000	0.0000	0.0000	139.4969	356.0933	567.4370	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2476.4851	
Space heating per m2											(98c) / (4) =	28.1419	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.5243	392.2082	295.0839	134.9157	42.7257	0.0000	0.0000	0.0000	0.0000	139.4969	356.0933	567.4370	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	594.2841	424.9276	319.7009	146.1709	46.2901	0.0000	0.0000	0.0000	0.0000	151.1342	385.7999	614.7746	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	237.2381	209.7594	222.9942	196.7251	191.0801	172.6174	170.8100	177.4339	179.1767	199.2419	211.1272	234.7620	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8758	85.4422	84.6888	83.2317	81.3059	79.8000	79.8000	79.8000	79.8000	83.2757	85.2224	85.9628	(217)
Fuel for water heating, kWh/month	276.2571	245.4988	263.3100	236.3583	235.0139	216.3125	214.0476	222.3483	224.5322	239.2556	247.7366	273.0973	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.9818	20.0413	18.0450	13.2205	10.2119	8.3432	9.3156	12.1088	15.7282	20.6362	23.3086	25.6761	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.7073	-57.1573	-81.8298	-91.6228	-98.4663	-91.7710	-90.6090	-85.6808	-76.9628	-65.1458	-44.6590	-35.2188	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-23.7174	-49.8087	-98.8514	-148.2665	-195.8649	-196.7516	-194.4621	-164.7576	-120.8870	-71.1959	-31.6527	-18.7639	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2683.0824	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2893.7682	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	201.6172	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2174.8102	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)

Energy used	0.0000 (237)
Total delivered energy for all uses	3689.6576 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2683.0824	0.2100	563.4473	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2893.7682	0.2100	607.6913	(264)
Space and water heating			1171.1386	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	201.6172	0.1443	29.0996	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-859.8305	0.1347	-115.7998	
PV Unit electricity exported	-1314.9797	0.1259	-165.5996	
Total			-281.3995	(269)
Total CO2, kg/year			930.7680	(272)
Target Carbon Dioxide Emission Rate (TER)			10.5800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2683.0824	1.1300	3031.8831	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2893.7682	1.1300	3269.9581	(278)
Space and water heating			6301.8412	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	201.6172	1.5338	309.2472	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-859.8305	1.4978	-1287.8115	
PV Unit electricity exported	-1314.9797	0.4623	-607.8666	
Total			-1895.6781	(283)
Total Primary energy kWh/year			4845.5111	(286)
Target Primary Energy Rate (TPER)			55.0600	(287)

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Full SAP Calculation Printout

Property Reference	Plot 3BSP1_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3BSP1
Property	1 Bedroom Flat, 3BSP1, Saffron Walden, CB11		

SAP Rating	80 C	DER	4.53	TER	11.19
Environmental	96 A	% DER<TER	59.52		
CO_2 Emissions (t/year)	0.45	DFEE	38.53	TFEE	42.08
Compliance Check	See BREL	% DFEE < TFEE	8.43		
% DPER < TPER	19.11	DPER	47.28	TPER	58.45

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		53.5000 (1b)	x	2.5000 (2b)	=	133.7500 (1b)	-
First floor		53.5000 (1c)	x	2.7500 (2c)	=	147.1250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8750	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0712 (8)
Pressure test		Yes		
Pressure Test Method		Blower Door		
Measured/design AP50		3.0000		(17)
Infiltration rate		0.2212		(18)
Number of sides sheltered		2		(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	0.8500		(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	0.1880		(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2397	0.2350	0.2303	0.2068	0.2021	0.1786	0.1786	0.1739	0.1880	0.2021	0.2115	0.2209	(22b)
Effective ac	0.5287	0.5276	0.5265	0.5214	0.5204	0.5160	0.5160	0.5151	0.5177	0.5204	0.5224	0.5244	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			29.4000	1.1450	33.6641			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			53.5000	0.1100	5.8850			(28a)
External Wall 1	155.0000	34.6000	120.4000	0.1400	16.8560			(29a)
External Roof 1	53.5000		53.5000	0.1100	5.8850			(30)
Total net area of external elements Aum(A, m2)			262.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.4901			(33)

Party Wall 1						53.0000	0.0000	0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												13.1000	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	80.5901	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.0079	48.9044	48.8030	48.3269	48.2378	47.8231	47.8231	47.7463	47.9828	48.2378	48.4180	48.6064	(38)
Heat transfer coeff	129.5980	129.4945	129.3932	128.9170	128.8279	128.4132	128.4132	128.3364	128.5729	128.8279	129.0081	129.1966	(39)
Average = Sum(39)m / 12 =												128.9166	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2112	1.2102	1.2093	1.2048	1.2040	1.2001	1.2001	1.1994	1.2016	1.2040	1.2057	1.2074	(40)
HLP (average)												1.2048	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7956	(42)
Hot water usage for mixer showers	71.0923	70.0239	68.4671	65.4883	63.2901	60.8387	59.4453	60.9903	62.6840	65.3161	68.3588	70.8199	(42a)
Hot water usage for baths	30.6952	30.2394	29.5974	28.4138	27.5274	26.5447	26.0138	26.6513	27.3454	28.3970	29.6050	30.5915	(42b)
Hot water usage for other uses	43.2594	41.6863	40.1133	38.5402	36.9671	35.3941	35.3941	36.9671	38.5402	40.1133	41.6863	43.2594	(42c)
Average daily hot water use (litres/day)												133.3308	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.0469	141.9496	138.1777	132.4423	127.7847	122.7774	120.8532	124.6088	128.5696	133.8264	139.6502	144.6708	(44)
Energy conte	229.7189	202.1344	212.3741	181.3069	172.0228	150.9692	146.1614	154.2917	158.5392	181.6011	198.9573	226.5195	(45)
Energy content (annual)											Total = Sum(45)m =	2214.5962	
Distribution loss (46)m = 0.15 x (45)m	34.4578	30.3202	31.8561	27.1960	25.8034	22.6454	21.9242	23.1438	23.7809	27.2402	29.8436	33.9779	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	280.0633	247.6068	262.7185	230.0273	222.3672	199.6896	196.5059	204.6361	207.2596	231.9455	247.6777	276.8639	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	280.0633	247.6068	262.7185	230.0273	222.3672	199.6896	196.5059	204.6361	207.2596	231.9455	247.6777	276.8639	(64)
										Total per year (kWh/year) = Sum(64)m =		2807.3613	(64)
12Total per year (kWh/year)												2807	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	116.6571	103.5876	110.8899	99.2609	97.4731	89.1736	88.8742	91.5775	91.6906	100.6579	105.1296	115.5933	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.7582	149.1966	134.7582	139.2502	134.7582	139.2502	134.7582	134.7582	139.2502	134.7582	139.2502	134.7582	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1732	269.9457	262.9593	248.0860	229.3112	211.6655	199.8771	197.1047	204.0911	218.9644	237.7392	255.3849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	(71)
Water heating gains (Table 5)	156.7971	154.1482	149.0456	137.8623	131.0123	123.8522	119.4546	123.0881	127.3481	135.2929	146.0134	155.3673	(72)
Total internal gains	626.6621	641.2240	614.6966	593.1320	563.0152	539.7014	519.0235	519.8845	535.6229	556.9490	590.9362	613.4439	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.3000	10.6334	0.7600	0.7000	0.7700	24.6977	(74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353	(76)
South	8.4000	46.7521	0.7600	0.7000	0.7700	144.7855	(78)
West	2.1000	19.6403	0.7600	0.7000	0.7700	15.2059	(80)

Solar gains	275.9243	492.5414	725.1636	970.3230	1142.1910	1155.5544	1105.2799	975.5539	810.7760	559.0137	334.8076	233.2292 (83)
Total gains	902.5865	1133.7654	1339.8601	1563.4550	1705.2062	1695.2558	1624.3033	1495.4384	1346.3988	1115.9627	925.7438	846.6731 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3354	57.3812	57.4262	57.6383	57.6781	57.8644	57.8644	57.8991	57.7925	57.6781	57.5976	57.5136	
alpha	4.8224	4.8254	4.8284	4.8426	4.8452	4.8576	4.8576	4.8599	4.8528	4.8452	4.8398	4.8342	
util living area	0.9914	0.9752	0.9345	0.8279	0.6593	0.4773	0.3465	0.3921	0.6264	0.8950	0.9799	0.9935	(86)
MIT	19.9924	20.2080	20.4720	20.7385	20.8812	20.9268	20.9346	20.9334	20.9036	20.6824	20.2769	19.9475	(87)
Th 2	19.9111	19.9118	19.9126	19.9161	19.9168	19.9199	19.9199	19.9205	19.9187	19.9168	19.9155	19.9140	(88)
util rest of house	0.9886	0.9677	0.9161	0.7867	0.5959	0.4001	0.2622	0.3015	0.5409	0.8576	0.9725	0.9914	(89)
MIT 2	18.7504	19.0219	19.3456	19.6526	19.7943	19.8334	19.8377	19.8378	19.8179	19.6026	19.1146	18.6957	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0609	19.3184	19.6272	19.9240	20.0660	20.1067	20.1119	20.1117	20.0893	19.8726	19.4052	19.0086	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0609	19.3184	19.6272	19.9240	20.0660	20.1067	20.1119	20.1117	20.0893	19.8726	19.4052	19.0086	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9857	0.9626	0.9103	0.7871	0.6050	0.4136	0.2772	0.3177	0.5550	0.8559	0.9680	0.9891	(94)
Useful gains	889.6855	1091.3346	1219.7040	1230.5173	1031.6729	701.2050	450.3287	475.0963	747.2960	955.0982	896.0999	837.4236	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1912.9792	1867.1079	1698.5730	1421.1871	1077.7732	707.1353	450.9741	476.3473	770.0643	1194.5654	1587.4697	1913.2220	(97)
Space heating kWh	761.3305	521.3196	356.2786	137.2823	34.2986	0.0000	0.0000	0.0000	0.0000	178.1635	497.7862	800.3940	(98a)
Space heating requirement - total per year (kWh/year)												3286.8533	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	761.3305	521.3196	356.2786	137.2823	34.2986	0.0000	0.0000	0.0000	0.0000	178.1635	497.7862	800.3940	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3286.8533	
Space heating per m2											(98c) / (4) =	30.7183	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	219.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	761.3305	521.3196	356.2786	137.2823	34.2986	0.0000	0.0000	0.0000	0.0000	178.1635	497.7862	800.3940	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	347.1639	237.7199	162.4617	62.6002	15.6400	0.0000	0.0000	0.0000	0.0000	81.2419	226.9887	364.9767	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	280.0633	247.6068	262.7185	230.0273	222.3672	199.6896	196.5059	204.6361	207.2596	231.9455	247.6777	276.8639	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	147.0921	130.0456	137.9824	120.8127	116.7895	104.8790	103.2069	107.4769	108.8548	121.8201	130.0828	145.4117	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	36.0411	28.9135	26.0334	19.0732	14.7327	12.0367	13.4397	17.4694	22.6910	29.7718	33.6272	37.0428 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1498.7931 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1474.4545 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	290.8726 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3264.1202 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1498.7931	0.1570	235.3113	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1474.4545	0.1410	207.8583	(264)
Space and water heating			443.1696	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	290.8726	0.1443	41.9819	(268)
Total CO2, kg/year			485.1515	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.5300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1498.7931	1.5812	2369.8783	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1474.4545	1.5213	2243.0446	(278)
Space and water heating			4612.9229	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	290.8726	1.5338	446.1502	(282)
Total Primary energy kWh/year			5059.0731	(286)
Dwelling Primary energy Rate (DPER)			47.2800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			53.5000 (1b)	x	2.5000 (2b)	=	133.7500 (1b)	-
First floor			53.5000 (1c)	x	2.7500 (2c)	=	147.1250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.0000							(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 280.8750 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1424	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3924	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3336	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4253	0.4169	0.4086	0.3669	0.3586	0.3169	0.3169	0.3085	0.3336	0.3586	0.3752	0.3919	(22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			21.5600	1.1450	24.6870			(27)
Heatloss Floor 1			53.5000	0.1300	6.9550			(28a)
External Wall 1	155.0000	26.7600	128.2400	0.1800	23.0832			(29a)
External Roof 1	53.5000		53.5000	0.1100	5.8850			(30)
Total net area of external elements Aum(A, m2)			262.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.8102			(33)
Party Wall 1			53.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	31.0000	0.1600	4.9600
E6 Intermediate floor within a dwelling	31.0000	0.0000	0.0000
E14 Flat roof	31.0000	0.0800	2.4800
E16 Corner (normal)	10.5000	0.0900	0.9450
E18 Party wall between dwellings	10.5000	0.0600	0.6300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0150 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 74.8252 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.7262	54.4008	54.0817	52.5832	52.3029	50.9977	50.9977	50.7560	51.5005	52.3029	52.8700	53.4630	(38)
Heat transfer coeff	129.5515	129.2260	128.9069	127.4085	127.1281	125.8230	125.8230	125.5813	126.3257	127.1281	127.6953	128.2882	(39)
Average = Sum(39)m / 12 =												127.4071	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2108	1.2077	1.2047	1.1907	1.1881	1.1759	1.1759	1.1737	1.1806	1.1881	1.1934	1.1990	(40)
HLP (average)												1.1907	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7956 (42)

Hot water usage for mixer showers

71.0923	70.0239	68.4671	65.4883	63.2901	60.8387	59.4453	60.9903	62.6840	65.3161	68.3588	70.8199 (42a)

Hot water usage for baths

30.6952	30.2394	29.5974	28.4138	27.5274	26.5447	26.0138	26.6513	27.3454	28.3970	29.6050	30.5915 (42b)

Hot water usage for other uses

43.2594	41.6863	40.1133	38.5402	36.9671	35.3941	35.3941	36.9671	38.5402	40.1133	41.6863	43.2594 (42c)

Average daily hot water use (litres/day) 133.3308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	145.0469	141.9496	138.1777	132.4423	127.7847	122.7774	120.8532	124.6088	128.5696	133.8264	139.6502	144.6708	(44)
Energy conte	229.7189	202.1344	212.3741	181.3069	172.0228	150.9692	146.1614	154.2917	158.5392	181.6011	198.9573	226.5195	(45)
Energy content (annual)											Total = Sum(45)m =	2214.5962	
Distribution loss (46)m = 0.15 x (45)m													
	34.4578	30.3202	31.8561	27.1960	25.8034	22.6454	21.9242	23.1438	23.7809	27.2402	29.8436	33.9779	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	278.9615	246.6116	261.6167	228.9611	221.2654	198.6234	195.4041	203.5343	206.1933	230.8438	246.6115	275.7621	(62)
WWHRS	-32.5004	-28.7436	-30.0987	-24.9229	-23.2272	-19.8757	-18.6303	-19.8115	-20.5642	-24.2429	-27.4643	-31.8986	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	246.4611	217.8680	231.5180	204.0382	198.0382	178.7476	176.7738	183.7229	185.6292	206.6009	219.1472	243.8636	(64)
											Total per year (kWh/year) = Sum(64)m =	2492.4086	(64)
12Total per year (kWh/year)												2492	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.7757	102.7915	110.0085	98.4079	96.5917	88.3206	87.9928	90.6961	90.8376	99.7765	104.2766	114.7119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	135.6045	150.1335	135.6045	140.1246	135.6045	140.1246	135.6045	135.6045	140.1246	135.6045	140.1246	135.6045	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.1732	269.9457	262.9593	248.0860	229.3112	211.6655	199.8771	197.1047	204.0911	218.9644	237.7392	255.3849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	(71)
Water heating gains (Table 5)													
	155.6125	152.9635	147.8609	136.6776	129.8276	122.6675	118.2699	121.9034	126.1634	134.1082	144.8287	154.1826	(72)
Total internal gains													
	626.3237	640.9762	614.3582	592.8218	562.6768	539.3912	518.6851	519.5461	535.3127	556.6106	590.6260	613.1055	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.6200	10.6334	0.6300	0.7000	0.7700	15.0136	(74)
East	9.2400	19.6403	0.6300	0.7000	0.7700	55.4614	(76)
South	6.1600	46.7521	0.6300	0.7000	0.7700	88.0143	(78)
West	1.5400	19.6403	0.6300	0.7000	0.7700	9.2436	(80)

Solar gains	167.7330	299.4133	440.8231	589.8542	694.3319	702.4554	671.8938	593.0341	492.8664	339.8215	203.5278	141.7788	(83)
Total gains	794.0567	940.3895	1055.1813	1182.6760	1257.0087	1241.8466	1190.5789	1112.5802	1028.1791	896.4320	794.1538	754.8843	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3560	57.5005	57.6428	58.3207	58.4494	59.0556	59.0556	59.1693	58.8206	58.4494	58.1898	57.9208	
alpha	4.8237	4.8334	4.8429	4.8880	4.8966	4.9370	4.9370	4.9446	4.9214	4.8966	4.8793	4.8614	
util living area													
	0.9950	0.9881	0.9717	0.9193	0.8040	0.6194	0.4593	0.5092	0.7560	0.9466	0.9890	0.9960	(86)
MIT	19.6391	19.8585	20.1629	20.5481	20.8292	20.9640	20.9932	20.9889	20.9060	20.5288	20.0164	19.6065	(87)
Th 2	19.9114	19.9138	19.9162	19.9274	19.9295	19.9393	19.9393	19.9411	19.9355	19.9295	19.9253	19.9208	(88)
util rest of house													
	0.9933	0.9842	0.9623	0.8930	0.7464	0.5287	0.3516	0.3971	0.6711	0.9233	0.9847	0.9947	(89)
MIT 2	18.3427	18.6230	19.0073	19.4823	19.7916	19.9198	19.9373	19.9374	19.8753	19.4720	18.8338	18.3078	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6668	18.9319	19.2962	19.7488	20.0510	20.1809	20.2013	20.2003	20.1329	19.7362	19.1295	18.6325	(92)

Temperature adjustment												0.0000	
adjusted MIT	18.6668	18.9319	19.2962	19.7488	20.0510	20.1809	20.2013	20.2003	20.1329	19.7362	19.1295	18.6325	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9905	0.9794	0.9553	0.8878	0.7536	0.5502	0.3786	0.4252	0.6883	0.9180	0.9803	0.9924	(94)
Useful gains	786.5266	921.0227	1008.0295	1050.0285	947.2337	683.2749	450.7313	473.0738	707.6982	822.9300	778.4889	749.1504	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1861.2402	1813.2876	1649.5203	1382.2227	1061.6503	702.1993	453.1207	477.2490	762.1160	1161.4654	1536.1076	1851.5197	(97)
Space heating kWh	799.5869	599.6020	477.2692	239.1798	85.1259	0.0000	0.0000	0.0000	0.0000	251.8703	545.4855	820.1627	(98a)
Space heating requirement - total per year (kWh/year)												3818.2824	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	799.5869	599.6020	477.2692	239.1798	85.1259	0.0000	0.0000	0.0000	0.0000	251.8703	545.4855	820.1627	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3818.2824	
Space heating per m2											(98c) / (4) =	35.6849	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	799.5869	599.6020	477.2692	239.1798	85.1259	0.0000	0.0000	0.0000	0.0000	251.8703	545.4855	820.1627	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	866.2914	649.6230	517.0847	259.1330	92.2274	0.0000	0.0000	0.0000	0.0000	272.8823	590.9918	888.5837	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	246.4611	217.8680	231.5180	204.0382	198.0382	178.7476	176.7738	183.7229	185.6292	206.6009	219.1472	243.8636	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.5014	86.2087	85.6449	84.4171	82.3078	79.8000	79.8000	79.8000	79.8000	84.5052	86.0195	86.5625	(217)
Fuel for water heating, kWh/month	284.9215	252.7215	270.3231	241.7025	240.6068	223.9945	221.5210	230.2292	232.6180	244.4830	254.7645	281.7197	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	28.1759	22.6038	20.3522	14.9109	11.5176	9.4100	10.5067	13.6571	17.7392	23.2748	26.2888	28.9590	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.5865	-67.7612	-96.3559	-107.1173	-114.4499	-106.3967	-105.0116	-99.6021	-89.9693	-76.8322	-53.1243	-42.0869	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-29.7481	-62.2997	-123.3360	-184.5663	-243.4301	-244.4206	-241.6089	-204.9081	-150.5980	-88.9470	-39.6638	-23.5511	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4136.8173	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2979.6053	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												227.3959	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2644.3715	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)

Appendix Q - special features

Energy saved or generated		-0.0000 (236)
Energy used		0.0000 (237)
Total delivered energy for all uses		4785.4470 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4136.8173	0.2100	868.7316	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2979.6053	0.2100	625.7171	(264)
Space and water heating			1494.4487	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	227.3959	0.1443	32.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1007.2939	0.1348	-135.8157	
PV Unit electricity exported	-1637.0776	0.1260	-206.2688	
Total			-342.0845	(269)
Total CO2, kg/year			1197.1138	(272)
Target Carbon Dioxide Emission Rate (TER)			11.1900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4136.8173	1.1300	4674.6036	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2979.6053	1.1300	3366.9540	(278)
Space and water heating			8041.5576	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	227.3959	1.5338	348.7875	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1007.2939	1.4983	-1509.2597	
PV Unit electricity exported	-1637.0776	0.4625	-757.1550	
Total			-2266.4147	(283)
Total Primary energy kWh/year			6254.0311	(286)
Target Primary Energy Rate (TPER)			58.4500	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 3BSP2_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	3BSP2
Property	1 Bedroom Flat, 3BSP2, Saffron Walden, CB11		

SAP Rating	80 C	DER	4.49	TER	11.12
Environmental	96 A	% DER<TER	59.62		
CO_2 Emissions (t/year)	0.49	DFEE	40.62	TFEE	43.52
Compliance Check	See BREL	% DFEE < TFEE	6.66		
% DPER < TPER	19.71	DPER	46.71	TPER	58.17

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)
Ground floor		58.0000 (1b)	x	2.5000 (2b)	=	145.0000 (1b) -
First floor		58.0000 (1c)	x	2.7500 (2c)	=	159.5000 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	304.5000 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0657 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.2157 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1833 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2337	0.2292	0.2246	0.2017	0.1971	0.1742	0.1742	0.1696	0.1833	0.1971	0.2062	0.2154	(22b)
Effective ac	0.5273	0.5263	0.5252	0.5203	0.5194	0.5152	0.5152	0.5144	0.5168	0.5194	0.5213	0.5232	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			58.0000	0.1100	6.3800			(28a)
External Wall 1	170.0000	45.1000	124.9000	0.1400	17.4860			(29a)
External Roof 1	58.0000		58.0000	0.1100	6.3800			(30)
Total net area of external elements Aum(A, m2)			286.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.1330			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 14.3000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 95.4330 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9876	52.8810	52.7765	52.2857	52.1939	51.7665	51.7665	51.6873	51.9311	52.1939	52.3797	52.5739	(38)
Heat transfer coeff	148.4206	148.3140	148.2095	147.7188	147.6269	147.1995	147.1995	147.1204	147.3642	147.6269	147.8127	148.0069	(39)

Average = Sum(39)m / 12 = 147.7183

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2795	1.2786	1.2777	1.2734	1.2726	1.2690	1.2690	1.2683	1.2704	1.2726	1.2742	1.2759	(40)
HLP (average)												1.2734	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8464 (42)

Hot water usage for mixer showers												
	71.9452	70.8640	69.2885	66.2741	64.0495	61.5686	60.1585	61.7221	63.4361	66.0998	69.1790	71.6696 (42a)
Hot water usage for baths												
	31.0620	30.6007	29.9511	28.7533	27.8564	26.8619	26.3247	26.9698	27.6722	28.7363	29.9588	30.9570 (42b)
Hot water usage for other uses												
	43.7804	42.1884	40.5964	39.0043	37.4123	35.8203	35.8203	37.4123	39.0043	40.5964	42.1884	43.7804 (42c)

Average daily hot water use (litres/day) 134.9308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	146.7877	143.6531	139.8360	134.0317	129.3182	124.2508	122.3035	126.1042	130.1126	135.4324	141.3261	146.4070	(44)
Energy conte	232.4758	204.5601	214.9227	183.4827	174.0871	152.7809	147.9155	156.1433	160.4418	183.7805	201.3450	229.2380	(45)

Energy content (annual) Total = Sum(45)m = 2241.1733

Distribution loss (46)m = 0.15 x (45)m												
	34.8714	30.6840	32.2384	27.5224	26.1131	22.9171	22.1873	23.4215	24.0663	27.5671	30.2017	34.3857 (46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	282.8202	250.0325	265.2671	232.2031	224.4316	201.5013	198.2599	206.4878	209.1622	234.1250	250.0654	279.5824 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	282.8202	250.0325	265.2671	232.2031	224.4316	201.5013	198.2599	206.4878	209.1622	234.1250	250.0654	279.5824 (64)

Total per year (kWh/year) = Sum(64)m = 2833.9384 (64)
12Total per year (kWh/year) 2834 (64)

Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month												
	117.5737	104.3942	111.7373	99.9843	98.1595	89.7760	89.4574	92.1932	92.3232	101.3826	105.9235	116.4972 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	141.1826	156.3093	141.1826	145.8887	141.1826	145.8887	141.1826	141.1826	145.8887	141.1826	145.8887	141.1826	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9103	282.8149	275.4954	259.9131	240.2432	221.7563	209.4059	206.5014	213.8208	229.4031	249.0730	267.5599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	(71)
Water heating gains (Table 5)													
	158.0292	155.3485	150.1846	138.8671	131.9348	124.6888	120.2385	123.9156	128.2267	136.2669	147.1160	156.5822	(72)
Total internal gains													
	647.8187	663.1692	635.5592	613.3655	582.0572	558.0304	536.5236	537.2961	553.6328	575.5492	610.7743	634.0213	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	6.3000	11.2829	0.7600	0.7000	0.7700	26.2064 (75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190 (77)
Southwest	8.4000	36.7938	0.7600	0.7000	0.7700	113.9460 (79)
Northwest	12.6000	11.2829	0.7600	0.7000	0.7700	52.4128 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	363.4843	645.2624	952.2401	1296.1360	1557.9011	1593.3141	1516.6992	1314.2743	1070.2083	731.8547	440.1261	307.9896	(83)
Total gains	1011.3030	1308.4316	1587.7992	1909.5015	2139.9583	2151.3446	2053.2228	1851.5704	1623.8411	1307.4039	1050.9004	942.0109	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2752	54.3142	54.3525	54.5331	54.5670	54.7254	54.7254	54.7549	54.6643	54.5670	54.4984	54.4269	
alpha	4.6183	4.6209	4.6235	4.6355	4.6378	4.6484	4.6484	4.6503	4.6443	4.6378	4.6332	4.6285	
util living area	0.9905	0.9710	0.9212	0.7943	0.6096	0.4326	0.3144	0.3633	0.5975	0.8818	0.9776	0.9930	(86)
MIT	19.9330	20.1763	20.4682	20.7498	20.8869	20.9256	20.9320	20.9307	20.9018	20.6740	20.2370	19.8822	(87)
Th 2	19.8569	19.8577	19.8584	19.8617	19.8623	19.8652	19.8652	19.8658	19.8641	19.8623	19.8611	19.8597	(88)
util rest of house	0.9875	0.9623	0.8996	0.7488	0.5452	0.3582	0.2339	0.2749	0.5105	0.8406	0.9694	0.9907	(89)
MIT 2	18.6325	18.9381	19.2932	19.6113	19.7435	19.7760	19.7794	19.7796	19.7608	19.5432	19.0209	18.5703	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.9576	19.2476	19.5869	19.8959	20.0293	20.0634	20.0676	20.0674	20.0460	19.8259	19.3249	18.8983	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9576	19.2476	19.5869	19.8959	20.0293	20.0634	20.0676	20.0674	20.0460	19.8259	19.3249	18.8983	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9842	0.9565	0.8936	0.7503	0.5550	0.3714	0.2483	0.2907	0.5250	0.8390	0.9644	0.9881	(94)
Useful gains	995.3498	1251.4764	1418.7953	1432.6847	1187.7438	798.9992	509.8310	538.3071	852.5176	1096.9411	1013.4433	930.8129	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2175.4870	2127.9542	1939.6066	1624.3048	1229.6343	804.2151	510.4253	539.5446	876.2309	1361.9901	1807.0020	2175.4452	(97)
Space heating kWh	878.0221	588.9931	387.4836	137.9665	31.1665	0.0000	0.0000	0.0000	0.0000	197.1964	571.3623	926.0064	(98a)
Space heating requirement - total per year (kWh/year)												3718.1969	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	878.0221	588.9931	387.4836	137.9665	31.1665	0.0000	0.0000	0.0000	0.0000	197.1964	571.3623	926.0064	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3718.1969	
Space heating per m2										(98c) / (4) =		32.0534	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	878.0221	588.9931	387.4836	137.9665	31.1665	0.0000	0.0000	0.0000	0.0000	197.1964	571.3623	926.0064	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	400.3749	268.5787	176.6911	62.9122	14.2118	0.0000	0.0000	0.0000	0.0000	89.9208	260.5391	422.2555	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	282.8202	250.0325	265.2671	232.2031	224.4316	201.5013	198.2599	206.4878	209.1622	234.1250	250.0654	279.5824	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	148.5400	131.3196	139.3210	121.9554	117.8737	105.8305	104.1281	108.4495	109.8541	122.9648	131.3369	146.8395	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	38.0958	30.5619	27.5176	20.1606	15.5726	12.7229	14.2058	18.4653	23.9846	31.4691	35.5443	39.1546 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1695.4842 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1488.4130 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	307.4551 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3491.3524 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1695.4842	0.1572	266.5381	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1488.4130	0.1410	209.8346	(264)
Space and water heating			476.3727	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	307.4551	0.1443	44.3753	(268)
Total CO2, kg/year			520.7480	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.4900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1695.4842	1.5819	2682.1456	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1488.4130	1.5213	2264.3110	(278)
Space and water heating			4946.4565	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	307.4551	1.5338	471.5849	(282)
Total Primary energy kWh/year			5418.0414	(286)
Dwelling Primary energy Rate (DPER)			46.7100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.0000 (1b)	x	2.5000 (2b)	=	145.0000 (1b)	-
First floor	58.0000 (1c)	x	2.7500 (2c)	=	159.5000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	304.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1314	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3814	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3242	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4133	0.4052	0.3971	0.3566	0.3485	0.3080	0.3080	0.2998	0.3242	0.3485	0.3647	0.3809	(22b)
Effective ac	0.5854	0.5821	0.5788	0.5636	0.5607	0.5474	0.5474	0.5450	0.5525	0.5607	0.5665	0.5725	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			23.7500	1.1450	27.1947			(27)
Heatloss Floor 1			58.0000	0.1300	7.5400			(28a)
External Wall 1	170.0000	28.9500	141.0500	0.1800	25.3890			(29a)
External Roof 1	58.0000		58.0000	0.1100	6.3800			(30)
Total net area of external elements Aum(A, m2)			286.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.7037			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	38.0000	0.1600	6.0800
E6 Intermediate floor within a dwelling	38.0000	0.0000	0.0000
E14 Flat roof	38.0000	0.0800	3.0400
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0100 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 82.7137 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.8249	58.4916	58.1649	56.6306	56.3435	55.0072	55.0072	54.7597	55.5219	56.3435	56.9243	57.5314	(38)
Heat transfer coeff	141.5385	141.2052	140.8786	139.3443	139.0572	137.7208	137.7208	137.4734	138.2356	139.0572	139.6379	140.2451	(39)

Average = Sum(39)m / 12 = 139.3429

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2202	1.2173	1.2145	1.2012	1.1988	1.1872	1.1872	1.1851	1.1917	1.1988	1.2038	1.2090	(40)
HLP (average)												1.2012	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8464 (42)

Hot water usage for mixer showers

71.9452	70.8640	69.2885	66.2741	64.0495	61.5686	60.1585	61.7221	63.4361	66.0998	69.1790	71.6696	(42a)

Hot water usage for baths

31.0620	30.6007	29.9511	28.7533	27.8564	26.8619	26.3247	26.9698	27.6722	28.7363	29.9588	30.9570	(42b)

Hot water usage for other uses

43.7804	42.1884	40.5964	39.0043	37.4123	35.8203	35.8203	37.4123	39.0043	40.5964	42.1884	43.7804	(42c)

Average daily hot water use (litres/day) 134.9308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.7877	143.6531	139.8360	134.0317	129.3182	124.2508	122.3035	126.1042	130.1126	135.4324	141.3261	146.4070	(44)

Energy conte	232.4758	204.5601	214.9227	183.4827	174.0871	152.7809	147.9155	156.1433	160.4418	183.7805	201.3450	229.2380	(45)
Energy content (annual)										Total = Sum(45)m =		2241.1733	
Distribution loss (46)m = 0.15 x (45)m													
	34.8714	30.6840	32.2384	27.5224	26.1131	22.9171	22.1873	23.4215	24.0663	27.5671	30.2017	34.3857	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	281.7184	249.0374	264.1653	231.1369	223.3298	200.4350	197.1581	205.3860	208.0960	233.0232	248.9992	278.4806	(62)
WWHRS	-32.8904	-29.0885	-30.4598	-25.2219	-23.5059	-20.1142	-18.8538	-20.0492	-20.8109	-24.5338	-27.7938	-32.2813	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	248.8281	219.9489	233.7055	205.9150	199.8239	180.3209	178.3043	185.3368	187.2851	208.4894	221.2054	246.1994	(64)
										Total per year (kWh/year) = Sum(64)m =		2515.3625	(64)
12Total per year (kWh/year)												2515	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	116.6923	103.5980	110.8559	99.1314	97.2781	88.9230	88.5760	91.3118	91.4703	100.5012	105.0706	115.6158	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	142.3219	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	141.8557	157.0545	141.8557	146.5842	141.8557	146.5842	141.8557	141.8557	146.5842	141.8557	146.5842	141.8557	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9103	282.8149	275.4954	259.9131	240.2432	221.7563	209.4059	206.5014	213.8208	229.4031	249.0730	267.5599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	37.2322	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	-113.8576	(71)
Water heating gains (Table 5)													
	156.8445	154.1638	148.9999	137.6824	130.7501	123.5042	119.0538	122.7309	127.0420	135.0822	145.9313	155.3975	(72)
Total internal gains													
	647.3071	662.7297	635.0476	612.8763	581.5456	557.5413	536.0120	536.7845	553.1436	575.0376	610.2851	633.5097	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.7500	11.2829	0.6300	0.7000	0.7700	12.9308	(75)
Southeast	7.5000	36.7938	0.6300	0.7000	0.7700	84.3351	(77)
Southwest	5.0000	36.7938	0.6300	0.7000	0.7700	56.2234	(79)
Northwest	7.5000	11.2829	0.6300	0.7000	0.7700	25.8616	(81)

Solar gains	179.3508	318.3861	469.8553	639.5408	768.7012	786.1747	748.3713	648.4906	528.0633	361.1125	217.1675	151.9685	(83)
Total gains	826.6579	981.1158	1104.9029	1252.4171	1350.2468	1343.7160	1284.3833	1185.2751	1081.2070	936.1501	827.4526	785.4782	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9142	57.0486	57.1808	57.8105	57.9298	58.4919	58.4919	58.5972	58.2741	57.9298	57.6889	57.4391	
alpha	4.7943	4.8032	4.8121	4.8540	4.8620	4.8995	4.8995	4.9065	4.8849	4.8620	4.8459	4.8293	
util living area													
	0.9958	0.9899	0.9755	0.9263	0.8110	0.6248	0.4654	0.5218	0.7742	0.9538	0.9907	0.9967	(86)
MIT	19.5943	19.8112	20.1186	20.5185	20.8185	20.9615	20.9925	20.9873	20.8929	20.4932	19.9739	19.5616	(87)
Th 2	19.9039	19.9062	19.9084	19.9190	19.9210	19.9302	19.9302	19.9319	19.9267	19.9210	19.9170	19.9128	(88)
util rest of house													
	0.9944	0.9865	0.9671	0.9016	0.7539	0.5331	0.3556	0.4066	0.6902	0.9329	0.9871	0.9956	(89)
MIT 2	18.2805	18.5578	18.9469	19.4417	19.7738	19.9093	19.9280	19.9277	19.8570	19.4241	18.7744	18.2449	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6089	18.8712	19.2398	19.7109	20.0350	20.1724	20.1941	20.1926	20.1159	19.6914	19.0743	18.5741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6089	18.8712	19.2398	19.7109	20.0350	20.1724	20.1941	20.1926	20.1159	19.6914	19.0743	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9821	0.9604	0.8959	0.7606	0.5548	0.3832	0.4355	0.7065	0.9273	0.9830	0.9935	(94)
Useful gains	819.9557	963.5975	1061.1549	1122.0059	1026.9509	745.4687	492.1265	516.1429	763.9038	868.0729	813.3974	780.3999	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2025.2639	1972.8004	1794.7685	1506.4348	1159.0373	767.4341	494.9832	521.3773	831.6180	1264.2192	1672.0642	2015.8964	(97)
Space heating kWh													
	896.7493	678.1843	545.8086	276.7888	98.2723	0.0000	0.0000	0.0000	0.0000	294.7328	618.2401	919.2094	(98a)
Space heating requirement - total per year (kWh/year)												4327.9856	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	896.7493	678.1843	545.8086	276.7888	98.2723	0.0000	0.0000	0.0000	0.0000	294.7328	618.2401	919.2094	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4327.9856	
Space heating per m2											(98c) / (4) =	37.3102	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	896.7493	678.1843	545.8086	276.7888	98.2723	0.0000	0.0000	0.0000	0.0000	294.7328	618.2401	919.2094	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	971.5594	734.7609	591.3419	299.8795	106.4705	0.0000	0.0000	0.0000	0.0000	319.3205	669.8159	995.8931	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	248.8281	219.9489	233.7055	205.9150	199.8239	180.3209	178.3043	185.3368	187.2851	208.4894	221.2054	246.1994	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6767	86.4133	85.8956	84.7238	82.5585	79.8000	79.8000	79.8000	79.8000	84.8359	86.2371	86.7335	(217)
Fuel for water heating, kWh/month													
	287.0762	254.5313	272.0809	243.0426	242.0393	225.9660	223.4390	232.2516	234.6931	245.7561	256.5085	283.8573	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.4748	23.6458	21.2904	15.5983	12.0485	9.8438	10.9911	14.2866	18.5569	24.3477	27.5007	30.2940	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-52.1910	-72.5447	-102.8125	-113.8926	-121.3435	-112.6688	-111.1864	-105.6177	-95.6645	-82.0508	-56.9722	-45.2370	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.7324	-68.4559	-135.3581	-202.3251	-266.6385	-267.6565	-264.5891	-224.5055	-165.1374	-97.6724	-43.6205	-25.9220	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4689.0418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3001.2417	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	237.8786	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2866.7953	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses 5147.3668 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4689.0418	0.2100	984.6988	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3001.2417	0.2100	630.2608	(264)
Space and water heating			1614.9595	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	237.8786	0.1443	34.3332	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1072.1818	0.1349	-144.6461	
PV Unit electricity exported	-1794.6135	0.1260	-226.1772	
Total			-370.8233	(269)
Total CO2, kg/year			1290.3987	(272)
Target Carbon Dioxide Emission Rate (TER)			11.1200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4689.0418	1.1300	5298.6172	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3001.2417	1.1300	3391.4032	(278)
Space and water heating			8690.0204	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	237.8786	1.5338	364.8661	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1072.1818	1.4986	-1606.7887	
PV Unit electricity exported	-1794.6135	0.4626	-830.2358	
Total			-2437.0245	(283)
Total Primary energy kWh/year			6747.9628	(286)
Target Primary Energy Rate (TPER)			58.1700	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B1_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B1
Property	1 Bedroom Flat, 4B1, Saffron Walden, CB11		

SAP Rating	80 C	DER	4.52	TER	11.15
Environmental	96 A	% DER<TER	59.46		
CO_2 Emissions (t/year)	0.5	DFEE	41.39	TFEE	44.15
Compliance Check	See BREL	% DFEE < TFEE	6.26		
% DPER < TPER	19.49	DPER	46.96	TPER	58.32

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		59.5000 (1b)	x	2.5000 (2b)	=	148.7500 (1b)	-
First floor		59.5000 (1c)	x	2.7500 (2c)	=	163.6250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.3750	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0640	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2140	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1819	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2320	0.2274	0.2229	0.2001	0.1956	0.1728	0.1728	0.1683	0.1819	0.1956	0.2047	0.2138	(22b)
Effective ac	0.5269	0.5259	0.5248	0.5200	0.5191	0.5149	0.5149	0.5142	0.5165	0.5191	0.5209	0.5228	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			59.5000	0.1100	6.5450			(28a)
External Wall 1	172.0000	45.1000	126.9000	0.1400	17.7660			(29a)
External Roof 1	59.5000		59.5000	0.1100	6.5450			(30)
Total net area of external elements Aum(A, m2)			291.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.7430			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 14.5500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 96.2930 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.3149	54.2072	54.1016	53.6059	53.5131	53.0814	53.0814	53.0014	53.2477	53.5131	53.7008	53.8970	(38)
Heat transfer coeff	150.6079	150.5002	150.3947	149.8989	149.8062	149.3744	149.3744	149.2944	149.5407	149.8062	149.9938	150.1900	(39)

Average = Sum(39)m / 12 = 149.8985

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2656	1.2647	1.2638	1.2597	1.2589	1.2552	1.2552	1.2546	1.2566	1.2589	1.2605	1.2621	(40)
HLP (average)												1.2597	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8594 (42)

Hot water usage for mixer showers												
	72.1620	71.0775	69.4973	66.4737	64.2424	61.7541	60.3397	61.9080	63.6272	66.2989	69.3874	71.8855 (42a)
Hot water usage for baths												
	31.1552	30.6925	30.0410	28.8396	27.9400	26.9425	26.4037	27.0507	27.7552	28.8226	30.0487	31.0499 (42b)
Hot water usage for other uses												
	43.9128	42.3159	40.7191	39.1223	37.5255	35.9286	35.9286	37.5255	39.1223	40.7191	42.3159	43.9128 (42c)

Average daily hot water use (litres/day) 135.3375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	147.2300	144.0860	140.2574	134.4356	129.7079	124.6252	122.6721	126.4842	130.5047	135.8406	141.7520	146.8482	(44)
Energy conte	233.1764	205.1766	215.5703	184.0356	174.6117	153.2413	148.3612	156.6139	160.9253	184.3344	201.9517	229.9288	(45)

Energy content (annual) Total = Sum(45)m = 2247.9272

Distribution loss (46)m = 0.15 x (45)m												
	34.9765	30.7765	32.3356	27.6053	26.1918	22.9862	22.2542	23.4921	24.1388	27.6502	30.2928	34.4893 (46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	283.5208	250.6490	265.9148	232.7560	224.9562	201.9617	198.7057	206.9583	209.6457	234.6788	250.6722	280.2732 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	283.5208	250.6490	265.9148	232.7560	224.9562	201.9617	198.7057	206.9583	209.6457	234.6788	250.6722	280.2732 (64)

Total per year (kWh/year) = Sum(64)m = 2840.6924 (64)
12Total per year (kWh/year) 2841 (64)

Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month												
	117.8067	104.5991	111.9527	100.1682	98.3340	89.9291	89.6057	92.3497	92.4840	101.5667	106.1253	116.7269 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	143.1978	158.5404	143.1978	147.9710	143.1978	147.9710	143.1978	143.1978	147.9710	143.1978	147.9710	143.1978	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	283.9056	286.8516	279.4277	263.6229	243.6723	224.9216	212.3949	209.4488	216.8728	232.6775	252.6281	271.3789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	(71)
Water heating gains (Table 5)													
	158.3423	155.6535	150.4740	139.1225	132.1693	124.9015	120.4377	124.1259	128.4500	136.5144	147.3962	156.8910	(72)
Total internal gains													
	654.3361	669.9360	641.9900	619.6069	587.9299	563.6845	541.9209	542.6630	559.1843	581.2802	616.8859	640.3581	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	10.6334	0.7600	0.7000	0.7700	32.9303 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	6.3000	46.7521	0.7600	0.7000	0.7700	108.5891 (78)
West	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.9899	597.7235	921.3214	1285.1443	1548.8949	1580.0514	1506.1366	1306.7117	1048.9083	690.2824	396.8582	271.3382	(83)
Total gains	978.3261	1267.6595	1563.3114	1904.7512	2136.8248	2143.7359	2048.0575	1849.3746	1608.0926	1271.5626	1013.7441	911.6963	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.8702	54.9095	54.9480	55.1297	55.1639	55.3233	55.3233	55.3530	55.2618	55.1639	55.0949	55.0229	
alpha	4.6580	4.6606	4.6632	4.6753	4.6776	4.6882	4.6882	4.6902	4.6841	4.6776	4.6730	4.6682	
util living area	0.9924	0.9761	0.9293	0.8031	0.6183	0.4403	0.3199	0.3691	0.6104	0.8961	0.9820	0.9945	(86)
MIT	19.9118	20.1489	20.4518	20.7456	20.8862	20.9259	20.9325	20.9313	20.9006	20.6566	20.2123	19.8634	(87)
Th 2	19.8679	19.8686	19.8693	19.8726	19.8732	19.8761	19.8761	19.8766	19.8750	19.8732	19.8719	19.8706	(88)
util rest of house	0.9900	0.9688	0.9094	0.7585	0.5541	0.3655	0.2387	0.2801	0.5231	0.8582	0.9753	0.9926	(89)
MIT 2	18.6142	18.9132	19.2839	19.6176	19.7540	19.7874	19.7910	19.7911	19.7711	19.5351	18.9991	18.5549	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.9386	19.2222	19.5759	19.8996	20.0370	20.0721	20.0764	20.0761	20.0535	19.8155	19.3024	18.8820	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9386	19.2222	19.5759	19.8996	20.0370	20.0721	20.0764	20.0761	20.0535	19.8155	19.3024	18.8820	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9872	0.9635	0.9033	0.7597	0.5638	0.3787	0.2532	0.2961	0.5376	0.8560	0.9708	0.9904	(94)
Useful gains	965.8376	1221.3813	1412.1526	1446.9885	1204.7546	811.8592	518.6558	547.5309	864.4805	1088.3969	984.1078	902.9774	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2204.6911	2155.4898	1966.5414	1648.8318	1248.9400	817.3870	519.2791	548.8265	890.2900	1380.5319	1830.2876	2205.0907	(97)
Space heating kWh	921.7070	627.7209	412.4652	145.3271	32.8740	0.0000	0.0000	0.0000	0.0000	217.3484	609.2494	968.7723	(98a)
Space heating requirement - total per year (kWh/year)												3935.4645	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	921.7070	627.7209	412.4652	145.3271	32.8740	0.0000	0.0000	0.0000	0.0000	217.3484	609.2494	968.7723	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3935.4645	
Space heating per m2											(98c) / (4) =	33.0711	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	921.7070	627.7209	412.4652	145.3271	32.8740	0.0000	0.0000	0.0000	0.0000	217.3484	609.2494	968.7723	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	420.2950	286.2384	188.0826	66.2687	14.9904	0.0000	0.0000	0.0000	0.0000	99.1101	277.8155	441.7566	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	283.5208	250.6490	265.9148	232.7560	224.9562	201.9617	198.7057	206.9583	209.6457	234.6788	250.6722	280.2732	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	148.9080	131.6434	139.6611	122.2458	118.1493	106.0723	104.3622	108.6966	110.1081	123.2557	131.6555	147.2023	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	38.7419	31.0802	27.9842	20.5025	15.8367	12.9387	14.4468	18.7784	24.3913	32.0028	36.1470	39.8186	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1794.5574	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1491.9603	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.6691	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3599.1868	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1794.5574	0.1571	281.9735	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1491.9603	0.1410	210.3368	(264)
Space and water heating			492.3103	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	312.6691	0.1443	45.1278	(268)
Total CO2, kg/year			537.4381	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.5200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1794.5574	1.5816	2838.3617	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1491.9603	1.5213	2269.7153	(278)
Space and water heating			5108.0770	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	312.6691	1.5338	479.5823	(282)
Total Primary energy kWh/year			5587.6593	(286)
Dwelling Primary energy Rate (DPER)			46.9600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5000 (1b)	x	2.5000 (2b)	=	148.7500 (1b)	-
First floor	59.5000 (1c)	x	2.7500 (2c)	=	163.6250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	312.3750	(5)

2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		4 * 10 =	40.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1281 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3781 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3213 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4097	0.4017	0.3936	0.3535	0.3454	0.3053	0.3053	0.2972	0.3213	0.3454	0.3615	0.3776	(22b)
Effective ac	0.5839	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5653	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			24.5100	1.1450	28.0649			(27)
Heatloss Floor 1			59.5000	0.1300	7.7350			(28a)
External Wall 1	172.0000	29.7100	142.2900	0.1800	25.6122			(29a)
External Roof 1	59.5000		59.5000	0.1100	6.5450			(30)
Total net area of external elements Aum(A, m2)			291.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.1571			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	40.0000	0.1600	6.4000
E6 Intermediate floor within a dwelling	40.0000	0.0000	0.0000
E14 Flat roof	40.0000	0.0800	3.2000
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4900 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 84.6471 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.1939	59.8580	59.5287	57.9819	57.6925	56.3453	56.3453	56.0958	56.8642	57.6925	58.2779	58.8900	(38)
Heat transfer coeff	144.8410	144.5051	144.1757	142.6289	142.3395	140.9923	140.9923	140.7429	141.5113	142.3395	142.9250	143.5371	(39)

Average = Sum(39)m / 12 = 142.6276

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2172	1.2143	1.2116	1.1986	1.1961	1.1848	1.1848	1.1827	1.1892	1.1961	1.2011	1.2062	(40)
HLP (average)												1.1986	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8594 (42)

Hot water usage for mixer showers

72.1620	71.0775	69.4973	66.4737	64.2424	61.7541	60.3397	61.9080	63.6272	66.2989	69.3874	71.8855	(42a)

Hot water usage for baths

31.1552	30.6925	30.0410	28.8396	27.9400	26.9425	26.4037	27.0507	27.7552	28.8226	30.0487	31.0499	(42b)

Hot water usage for other uses

43.9128	42.3159	40.7191	39.1223	37.5255	35.9286	35.9286	37.5255	39.1223	40.7191	42.3159	43.9128	(42c)

Average daily hot water use (litres/day) 135.3375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.2300	144.0860	140.2574	134.4356	129.7079	124.6252	122.6721	126.4842	130.5047	135.8406	141.7520	146.8482	(44)

Energy conte	233.1764	205.1766	215.5703	184.0356	174.6117	153.2413	148.3612	156.6139	160.9253	184.3344	201.9517	229.9288	(45)
Energy content (annual)										Total = Sum(45)m =		2247.9272	
Distribution loss (46)m = 0.15 x (45)m													
	34.9765	30.7765	32.3356	27.6053	26.1918	22.9862	22.2542	23.4921	24.1388	27.6502	30.2928	34.4893	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	282.4190	249.6538	264.8130	231.6898	223.8544	200.8954	197.6039	205.8565	208.5795	233.5770	249.6059	279.1715	(62)
WWHRS	-32.9895	-29.1761	-30.5516	-25.2979	-23.5767	-20.1748	-18.9106	-20.1096	-20.8736	-24.6077	-27.8775	-32.3785	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	249.4296	220.4777	234.2614	206.3919	200.2777	180.7207	178.6932	185.7470	187.7059	208.9694	221.7284	246.7929	(64)
										Total per year (kWh/year) = Sum(64)m =		2521.1957	(64)
12Total per year (kWh/year)												2521	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	116.9253	103.8030	111.0713	99.3152	97.4525	89.0761	88.7242	91.4682	91.6310	100.6853	105.2723	115.8455	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	142.9683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	143.8062	159.2140	143.8062	148.5997	143.8062	148.5997	143.8062	143.8062	148.5997	143.8062	148.5997	143.8062	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	283.9056	286.8516	279.4277	263.6229	243.6723	224.9216	212.3949	209.4488	216.8728	232.6775	252.6281	271.3789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	37.2968	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	(71)
Water heating gains (Table 5)													
	157.1576	154.4688	149.2893	137.9378	130.9846	123.7168	119.2530	122.9412	127.2653	135.3297	146.2115	155.7063	(72)
Total internal gains													
	653.7599	669.4249	641.4137	619.0509	587.3536	563.1285	541.3446	542.0867	558.6283	580.7039	616.3299	639.7818	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.1600	10.6334	0.6300	0.7000	0.7700	16.7685	(74)
East	7.7400	19.6403	0.6300	0.7000	0.7700	46.4580	(76)
South	3.8700	46.7521	0.6300	0.7000	0.7700	55.2947	(78)
West	7.7400	19.6403	0.6300	0.7000	0.7700	46.4580	(80)

Solar gains	164.9791	304.3671	469.1466	654.4090	788.7136	804.5788	766.9406	665.3913	534.1152	351.4991	202.0844	138.1683	(83)
Total gains	818.7390	973.7920	1110.5603	1273.4599	1376.0672	1367.7073	1308.2852	1207.4780	1092.7435	932.2030	818.4143	777.9501	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0549	57.1875	57.3182	57.9398	58.0576	58.6123	58.6123	58.7162	58.3974	58.0576	57.8198	57.5732	
alpha	4.8037	4.8125	4.8212	4.8627	4.8705	4.9075	4.9075	4.9144	4.8932	4.8705	4.8547	4.8382	
util living area													
	0.9964	0.9911	0.9772	0.9281	0.8132	0.6279	0.4677	0.5243	0.7804	0.9583	0.9920	0.9972	(86)
MIT	19.5734	19.7879	20.1045	20.5144	20.8171	20.9610	20.9924	20.9871	20.8895	20.4756	19.9515	19.5415	(87)
Th 2	19.9063	19.9086	19.9108	19.9212	19.9231	19.9322	19.9322	19.9339	19.9287	19.9231	19.9192	19.9150	(88)
util rest of house													
	0.9951	0.9882	0.9694	0.9038	0.7564	0.5362	0.3576	0.4088	0.6971	0.9391	0.9888	0.9962	(89)
MIT 2	18.2554	18.5301	18.9312	19.4388	19.7745	19.9109	19.9299	19.9295	19.8563	19.4054	18.7477	18.2208	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.5849	18.8445	19.2245	19.7077	20.0351	20.1734	20.1955	20.1939	20.1146	19.6729	19.0486	18.5510	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5849	18.8445	19.2245	19.7077	20.0351	20.1734	20.1955	20.1939	20.1146	19.6729	19.0486	18.5510	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9929	0.9842	0.9629	0.8980	0.7629	0.5578	0.3852	0.4377	0.7131	0.9333	0.9852	0.9944	(94)
Useful gains	812.9536	958.3665	1069.3697	1143.6227	1049.8034	762.9121	503.9693	528.5232	779.2315	870.0209	806.2614	773.5809	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2069.0398	2015.0555	1834.5683	1541.4905	1186.4179	785.8115	506.9413	533.9680	851.1283	1291.4383	1707.7572	2059.8986	(97)
Space heating kWh													
	934.5282	710.0950	569.3078	286.4648	101.6413	0.0000	0.0000	0.0000	0.0000	313.5346	649.0770	957.0204	(98a)
Space heating requirement - total per year (kWh/year)												4521.6689	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	934.5282	710.0950	569.3078	286.4648	101.6413	0.0000	0.0000	0.0000	0.0000	313.5346	649.0770	957.0204	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4521.6689	
Space heating per m2											(98c) / (4) =	37.9972	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	934.5282	710.0950	569.3078	286.4648	101.6413	0.0000	0.0000	0.0000	0.0000	313.5346	649.0770	957.0204	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	1012.4899	769.3337	616.8015	310.3628	110.1205	0.0000	0.0000	0.0000	0.0000	339.6907	703.2253	1036.8585	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	249.4296	220.4777	234.2614	206.3919	200.2777	180.7207	178.6932	185.7470	187.7059	208.9694	221.7284	246.7929	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.7391	86.4889	85.9733	84.7952	82.6190	79.8000	79.8000	79.8000	79.8000	84.9675	86.3211	86.7932	(217)
Fuel for water heating, kWh/month													
	287.5632	254.9202	272.4816	243.4005	242.4113	226.4670	223.9264	232.7656	235.2204	245.9404	256.8646	284.3459	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8801	23.9709	21.5831	15.8127	12.2142	9.9791	11.1422	14.4831	18.8121	24.6825	27.8788	30.7105	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-53.3766	-74.1095	-104.9127	-116.0826	-123.5599	-114.6809	-113.1669	-107.5531	-97.5062	-83.7512	-58.2346	-46.2741	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-33.7432	-70.5377	-139.4175	-208.3132	-274.4561	-275.4804	-272.3269	-231.1079	-170.0406	-100.6201	-44.9596	-26.7253	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4898.8829	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3006.3070	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.1494	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2940.9366	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses 5291.4027 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4898.8829	0.2100	1028.7654	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3006.3070	0.2100	631.3245	(264)
Space and water heating			1660.0899	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.1494	0.1443	34.8053	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1093.2080	0.1349	-147.5104	
PV Unit electricity exported	-1847.7285	0.1260	-232.8918	
Total			-380.4022	(269)
Total CO2, kg/year			1326.4222	(272)
Target Carbon Dioxide Emission Rate (TER)			11.1500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4898.8829	1.1300	5535.7377	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3006.3070	1.1300	3397.1270	(278)
Space and water heating			8932.8646	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.1494	1.5338	369.8830	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1093.2080	1.4987	-1638.4029	
PV Unit electricity exported	-1847.7285	0.4627	-854.8842	
Total			-2493.2871	(283)
Total Primary energy kWh/year			6939.5613	(286)
Target Primary Energy Rate (TPER)			58.3200	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B2_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B2
Property	1 Bedroom Flat, 4B2, Saffron Walden, CB11		

SAP Rating	80 C	DER	4.29	TER	10.49
Environmental	96 A	% DER<TER	59.10		
CO_2 Emissions (t/year)	0.53	DFEE	39.98	TFEE	43.39
Compliance Check	See BREL	% DFEE < TFEE	7.85		
% DPER < TPER	18.82	DPER	44.59	TPER	54.92

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.5000 (2b)	=	166.2500 (1b)	-
First floor	66.5000 (1c)	x	2.7500 (2c)	=	182.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	349.1250	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0573	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2073	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1762	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2246	0.2202	0.2158	0.1938	0.1894	0.1674	0.1674	0.1630	0.1762	0.1894	0.1982	0.2070	(22b)
Effective ac	0.5252	0.5243	0.5233	0.5188	0.5179	0.5140	0.5140	0.5133	0.5155	0.5179	0.5196	0.5214	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			66.5000	0.1100	7.3150			(28a)
External Wall 1	175.0000	45.1000	129.9000	0.1400	18.1860			(29a)
External Roof 1	66.5000		66.5000	0.1100	7.3150			(30)
Total net area of external elements Aum(A, m2)			308.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.7030			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 15.4000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 99.1030 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.5127	60.3999	60.2892	59.7695	59.6722	59.2196	59.2196	59.1357	59.3939	59.6722	59.8690	60.0746	(38)
Heat transfer coeff													
	159.6158	159.5029	159.3922	158.8725	158.7753	158.3226	158.3226	158.2388	158.4970	158.7753	158.9720	159.1776	(39)

Average = Sum(39)m / 12 = 158.8720

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2001	1.1993	1.1984	1.1945	1.1938	1.1904	1.1904	1.1898	1.1917	1.1938	1.1953	1.1968	(40)
HLP (average)												1.1945	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9024 (42)

Hot water usage for mixer showers

	72.8830	71.7877	70.1917	67.1379	64.8843	62.3711	60.9426	62.5266	64.2629	66.9613	70.0807	72.6038 (42a)

Hot water usage for baths

	31.4653	30.9980	30.3399	29.1266	28.2181	27.2106	26.6665	27.3199	28.0314	29.1094	30.3477	31.3589 (42b)

Hot water usage for other uses

	44.3532	42.7403	41.1275	39.5146	37.9018	36.2890	36.2890	37.9018	39.5146	41.1275	42.7403	44.3532 (42c)

Average daily hot water use (litres/day) 136.6901 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	148.7015	145.5261	141.6591	135.7792	131.0042	125.8707	123.8981	127.7483	131.8090	137.1982	143.1688	148.3159	(44)
Energy conte	235.5068	207.2272	217.7248	185.8749	176.3568	154.7727	149.8440	158.1791	162.5337	186.1767	203.9701	232.2268	(45)

Energy content (annual) Total = Sum(45)m = 2270.3936

Distribution loss (46)m = 0.15 x (45)m

	35.3260	31.0841	32.6587	27.8812	26.4535	23.2159	22.4766	23.7269	24.3801	27.9265	30.5955	34.8340 (46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)

Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)

If cylinder contains dedicated solar storage

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	285.8513	252.6996	268.0692	234.5953	226.7012	203.4932	200.1884	208.5236	211.2541	236.5211	252.6906	282.5713 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	285.8513	252.6996	268.0692	234.5953	226.7012	203.4932	200.1884	208.5236	211.2541	236.5211	252.6906	282.5713 (64)

Total per year (kWh/year) = Sum(64)m = 2863.1588 (64)

12Total per year (kWh/year) 2863 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	118.5816	105.2810	112.6690	100.7797	98.9142	90.4383	90.0987	92.8701	93.0188	102.1793	106.7964	117.4910 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	151.9718	168.2545	151.9718	157.0375	151.9718	157.0375	151.9718	151.9718	157.0375	151.9718	157.0375	151.9718	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	301.3011	304.4277	296.5488	279.7757	258.6027	238.7030	225.4088	222.2823	230.1611	246.9342	268.1072	288.0069	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	(71)

Water heating gains (Table 5)

	159.3838	156.6681	151.4369	139.9719	132.9492	125.6087	121.1004	124.8254	129.1928	137.3378	148.3283	157.9180	(72)
Total internal gains													
	682.1923	698.8858	669.4931	646.3207	613.0592	587.8848	565.0165	565.6150	582.9269	605.7793	643.0087	667.4322	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	10.6334	0.7600	0.7000	0.7700	32.9303 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	6.3000	46.7521	0.7600	0.7000	0.7700	108.5891 (78)
West	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.9899	597.7235	921.3214	1285.1443	1548.8949	1580.0514	1506.1366	1306.7117	1048.9083	690.2824	396.8582	271.3382	(83)
Total gains	1006.1823	1296.6094	1590.8145	1931.4649	2161.9541	2167.9362	2071.1532	1872.3267	1631.8353	1296.0618	1039.8669	938.7704	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.8647	57.9056	57.9458	58.1354	58.1710	58.3373	58.3373	58.3682	58.2731	58.1710	58.0990	58.0239	
alpha	4.8576	4.8604	4.8631	4.8757	4.8781	4.8892	4.8892	4.8912	4.8849	4.8781	4.8733	4.8683	
util living area	0.9945	0.9818	0.9429	0.8278	0.6453	0.4613	0.3353	0.3864	0.6356	0.9131	0.9864	0.9960	(86)
MIT	19.9389	20.1604	20.4503	20.7426	20.8876	20.9287	20.9353	20.9341	20.9028	20.6559	20.2266	19.8940	(87)
Th 2	19.9199	19.9206	19.9212	19.9244	19.9250	19.9277	19.9277	19.9282	19.9266	19.9250	19.9238	19.9225	(88)
util rest of house	0.9927	0.9761	0.9263	0.7868	0.5825	0.3867	0.2541	0.2976	0.5502	0.8800	0.9812	0.9947	(89)
MIT 2	18.6895	18.9700	19.3277	19.6646	19.8076	19.8425	19.8460	19.8461	19.8255	19.5819	19.0588	18.6343	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0018	19.2676	19.6084	19.9341	20.0776	20.1140	20.1184	20.1181	20.0948	19.8504	19.3508	18.9492	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0018	19.2676	19.6084	19.9341	20.0776	20.1140	20.1184	20.1181	20.0948	19.8504	19.3508	18.9492	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906	0.9717	0.9206	0.7872	0.5918	0.3999	0.2686	0.3135	0.5642	0.8773	0.9775	0.9930	(94)
Useful gains	996.7190	1259.9630	1464.4363	1520.5225	1279.3640	866.8602	556.3728	586.9473	920.6631	1137.0396	1016.5077	932.2420	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2346.6434	2291.6746	2089.3714	1753.0112	1330.1593	872.9962	557.0359	588.3509	950.1568	1468.7315	1947.5307	2347.7420	(97)
Space heating kWh	1004.3438	693.3102	464.9517	167.3918	37.7917	0.0000	0.0000	0.0000	0.0000	246.7788	670.3365	1053.1320	(98a)
Space heating requirement - total per year (kWh/year)												4338.0366	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1004.3438	693.3102	464.9517	167.3918	37.7917	0.0000	0.0000	0.0000	0.0000	246.7788	670.3365	1053.1320	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4338.0366	
Space heating per m2										(98c) / (4) =		32.6168	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1004.3438	693.3102	464.9517	167.3918	37.7917	0.0000	0.0000	0.0000	0.0000	246.7788	670.3365	1053.1320	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	457.9771	316.1469	212.0163	76.3301	17.2329	0.0000	0.0000	0.0000	0.0000	112.5302	305.6710	480.2243	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	285.8513	252.6996	268.0692	234.5953	226.7012	203.4932	200.1884	208.5236	211.2541	236.5211	252.6906	282.5713	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	150.1320	132.7204	140.7927	123.2118	119.0658	106.8767	105.1410	109.5187	110.9528	124.2233	132.7156	148.4093	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	41.5575	33.3390	30.0181	21.9925	16.9877	13.8791	15.4967	20.1432	26.1640	34.3286	38.7741	42.7125	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1978.1288	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1503.7599	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	335.3930	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3817.2817	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1978.1288	0.1570	310.5992	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1503.7599	0.1410	212.0073	(264)
Space and water heating			522.6065	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	335.3930	0.1443	48.4076	(268)
Total CO2, kg/year			571.0141	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.2900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1978.1288	1.5812	3127.9139	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1503.7599	1.5213	2287.6925	(278)
Space and water heating			5415.6064	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	335.3930	1.5338	514.4370	(282)
Total Primary energy kWh/year			5930.0434	(286)
Dwelling Primary energy Rate (DPER)			44.5900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	66.5000 (1b)	x	2.5000 (2b)	=	166.2500 (1b)	-
First floor	66.5000 (1c)	x	2.7500 (2c)	=	182.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 133.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	349.1250	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1146	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3646	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3099	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3951	0.3874	0.3796	0.3409	0.3331	0.2944	0.2944	0.2866	0.3099	0.3331	0.3486	0.3641	(22b)
Effective ac	0.5781	0.5750	0.5721	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5608	0.5663	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			28.1200	1.1450	32.1985			(27)
Heatloss Floor 1			66.5000	0.1300	8.6450			(28a)
External Wall 1	175.0000	33.3200	141.6800	0.1800	25.5024			(29a)
External Roof 1	66.5000		66.5000	0.1100	7.3150			(30)
Total net area of external elements Aum(A, m2)			308.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.8609			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E5	Ground floor (normal)	44.0000	0.1600	7.0400
E6	Intermediate floor within a dwelling	44.0000	0.0000	0.0000
E14	Flat roof	44.0000	0.0800	3.5200
E16	Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4500 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 91.3109 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	66.5983	66.2491	65.9068	64.2992	63.9984	62.5981	62.5981	62.3388	63.1375	63.9984	64.6069	65.2430	(38)
Heat transfer coeff	157.9092	157.5600	157.2177	155.6100	155.3092	153.9090	153.9090	153.6497	154.4483	155.3092	155.9177	156.5539	(39)

Average = Sum(39)m / 12 = 155.6086

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1873	1.1847	1.1821	1.1700	1.1677	1.1572	1.1572	1.1553	1.1613	1.1677	1.1723	1.1771	(40)
HLP (average)												1.1700	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9024 (42)

Hot water usage for mixer showers

72.8830	71.7877	70.1917	67.1379	64.8843	62.3711	60.9426	62.5266	64.2629	66.9613	70.0807	72.6038	(42a)

Hot water usage for baths

31.4653	30.9980	30.3399	29.1266	28.2181	27.2106	26.6665	27.3199	28.0314	29.1094	30.3477	31.3589	(42b)

Hot water usage for other uses

44.3532	42.7403	41.1275	39.5146	37.9018	36.2890	36.2890	37.9018	39.5146	41.1275	42.7403	44.3532	(42c)

Average daily hot water use (litres/day) 136.6901 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7015	145.5261	141.6591	135.7792	131.0042	125.8707	123.8981	127.7483	131.8090	137.1982	143.1688	148.3159	(44)

Energy conte	235.5068	207.2272	217.7248	185.8749	176.3568	154.7727	149.8440	158.1791	162.5337	186.1767	203.9701	232.2268	(45)
Energy content (annual)										Total = Sum(45)m =		2270.3936	
Distribution loss (46)m = 0.15 x (45)m													
	35.3260	31.0841	32.6587	27.8812	26.4535	23.2159	22.4766	23.7269	24.3801	27.9265	30.5955	34.8340	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	284.7495	251.7044	266.9674	233.5291	225.5995	202.4269	199.0866	207.4218	210.1879	235.4194	251.6243	281.4695	(62)
WWHRS	-33.3191	-29.4677	-30.8568	-25.5507	-23.8123	-20.3764	-19.0996	-20.3105	-21.0822	-24.8536	-28.1561	-32.7021	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	251.4304	222.2368	236.1106	207.9784	201.7872	182.0506	179.9870	187.1113	189.1057	210.5658	223.4683	248.7674	(64)
										Total per year (kWh/year) = Sum(64)m =		2540.5994	(64)
12Total per year (kWh/year)												2541	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	117.7002	104.4848	111.7876	99.9268	98.0328	89.5853	89.2173	91.9887	92.1658	101.2979	105.9434	116.6096	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	145.1185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	152.3189	168.6387	152.3189	157.3962	152.3189	157.3962	152.3189	152.3189	157.3962	152.3189	157.3962	152.3189	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.3011	304.4277	296.5488	279.7757	258.6027	238.7030	225.4088	222.2823	230.1611	246.9342	268.1072	288.0069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	37.5118	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	-116.0948	(71)
Water heating gains (Table 5)													
	158.1991	155.4834	150.2522	138.7872	131.7645	124.4240	119.9157	123.6407	128.0081	136.1531	147.1437	156.7333	(72)
Total internal gains													
	681.3547	698.0854	668.6554	645.4946	612.2216	587.0587	564.1789	564.7774	582.1009	604.9417	642.1826	666.5946	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9200	10.6334	0.6300	0.7000	0.7700	19.2382	(74)
East	8.8800	19.6403	0.6300	0.7000	0.7700	53.3006	(76)
South	4.4400	46.7521	0.6300	0.7000	0.7700	63.4389	(78)
West	8.8800	19.6403	0.6300	0.7000	0.7700	53.3006	(80)

Solar gains	189.2783	349.1964	538.2457	750.7948	904.8807	923.0827	879.9009	763.3947	612.7833	403.2703	231.8487	158.5186	(83)
Total gains	870.6330	1047.2817	1206.9011	1396.2894	1517.1023	1510.1414	1444.0798	1328.1721	1194.8841	1008.2119	874.0313	825.1132	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.4900	58.6196	58.7473	59.3542	59.4692	60.0102	60.0102	60.1115	59.8007	59.4692	59.2371	58.9964	
alpha	4.8993	4.9080	4.9165	4.9569	4.9646	5.0007	5.0007	5.0074	4.9867	4.9646	4.9491	4.9331	
util living area													
	0.9971	0.9923	0.9789	0.9294	0.8113	0.6233	0.4632	0.5213	0.7820	0.9615	0.9933	0.9977	(86)
MIT	19.5838	19.8006	20.1200	20.5301	20.8284	20.9647	20.9934	20.9884	20.8944	20.4811	19.9572	19.5508	(87)
Th 2	19.9302	19.9323	19.9344	19.9441	19.9459	19.9544	19.9544	19.9560	19.9511	19.9459	19.9422	19.9384	(88)
util rest of house													
	0.9961	0.9898	0.9716	0.9056	0.7549	0.5334	0.3562	0.4085	0.6999	0.9436	0.9906	0.9970	(89)
MIT 2	18.2856	18.5634	18.9683	19.4762	19.8064	19.9352	19.9524	19.9521	19.8816	19.4302	18.7716	18.2492	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6101	18.8727	19.2562	19.7396	20.0619	20.1926	20.2126	20.2111	20.1348	19.6930	19.0680	18.5746	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6101	18.8727	19.2562	19.7396	20.0619	20.1926	20.2126	20.2111	20.1348	19.6930	19.0680	18.5746	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9862	0.9655	0.9001	0.7618	0.5547	0.3830	0.4368	0.7158	0.9380	0.9874	0.9955	(94)
Useful gains	865.6132	1032.7793	1165.2612	1256.8216	1155.6830	837.6979	553.1148	580.1200	855.3131	945.7029	863.0231	821.4004	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2259.7042	2201.5382	2005.5085	1686.7579	1298.6774	860.7459	556.0158	585.5812	932.0641	1412.2210	1866.0185	2250.4045	(97)
Space heating kWh													
	1037.2037	785.4060	625.1440	309.5541	106.3878	0.0000	0.0000	0.0000	0.0000	347.0894	722.1567	1063.1790	(98a)
Space heating requirement - total per year (kWh/year)												4996.1207	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1037.2037	785.4060	625.1440	309.5541	106.3878	0.0000	0.0000	0.0000	0.0000	347.0894	722.1567	1063.1790	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4996.1207	
Space heating per m2											(98c) / (4) =	37.5648	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1037.2037	785.4060	625.1440	309.5541	106.3878	0.0000	0.0000	0.0000	0.0000	347.0894	722.1567	1063.1790	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	1123.7310	850.9274	677.2957	335.3782	115.2631	0.0000	0.0000	0.0000	0.0000	376.0449	782.4016	1151.8733	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	251.4304	222.2368	236.1106	207.9784	201.7872	182.0506	179.9870	187.1113	189.1057	210.5658	223.4683	248.7674	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.8880	86.6448	86.1367	84.9498	82.6933	79.8000	79.8000	79.8000	79.8000	85.1729	86.4947	86.9407	(217)
Fuel for water heating, kWh/month													
	289.3730	256.4918	274.1113	244.8250	244.0187	228.1335	225.5477	234.4753	236.9746	247.2217	258.3606	286.1345	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	31.6489	25.3899	22.8608	16.7488	12.9372	10.5698	11.8018	15.3404	19.9257	26.1436	29.5291	32.5285	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-58.8186	-81.2454	-114.4239	-125.9243	-133.4558	-123.6398	-121.9839	-116.2007	-105.7870	-91.4677	-64.0118	-51.0402	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.5505	-80.4191	-158.6511	-236.6357	-311.3856	-312.4228	-308.8622	-262.3028	-193.2359	-114.5943	-51.3229	-30.5473	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	5412.9152	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3025.6678	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	255.4244	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3286.9291	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses 5493.0782 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5412.9152	0.2100	1136.7122	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3025.6678	0.2100	635.3902	(264)
Space and water heating			1772.1024	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	255.4244	0.1443	36.8656	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1187.9990	0.1351	-160.4393	
PV Unit electricity exported	-2098.9302	0.1261	-264.6611	
Total			-425.1004	(269)
Total CO2, kg/year			1395.7969	(272)
Target Carbon Dioxide Emission Rate (TER)			10.4900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5412.9152	1.1300	6116.5942	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3025.6678	1.1300	3419.0046	(278)
Space and water heating			9535.5988	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	255.4244	1.5338	391.7784	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1187.9990	1.4991	-1780.9862	
PV Unit electricity exported	-2098.9302	0.4629	-971.5057	
Total			-2752.4919	(283)
Total Primary energy kWh/year			7304.9860	(286)
Target Primary Energy Rate (TPER)			54.9200	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B4_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B4
Property	1 Bedroom Flat, 4B4, Saffron Walden, CB11		

SAP Rating	81 B	DER	4.09	TER	9.96
Environmental	96 A	% DER<TER	58.94		
CO_2 Emissions (t/year)	0.55	DFEE	38.04	TFEE	42.29
Compliance Check	See BREL	% DFEE < TFEE	10.05		
% DPER < TPER	18.61	DPER	42.44	TPER	52.15

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		72.0000 (1b)	x	2.5000 (2b)	=	180.0000 (1b)	-
First floor		72.0000 (1c)	x	2.7500 (2c)	=	198.0000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	378.0000	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0529 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.2029 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.1725 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2199	0.2156	0.2113	0.1897	0.1854	0.1638	0.1638	0.1595	0.1725	0.1854	0.1940	0.2027	(22b)
Effective ac	0.5242	0.5232	0.5223	0.5180	0.5172	0.5134	0.5134	0.5127	0.5149	0.5172	0.5188	0.5205	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			72.0000	0.1100	7.9200			(28a)
External Wall 1	180.0000	45.1000	134.9000	0.1400	18.8860			(29a)
External Roof 1	72.0000		72.0000	0.1100	7.9200			(30)
Total net area of external elements Aum(A, m2)			324.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.6130			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												16.2000	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	101.8130	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.3861	65.2690	65.1542	64.6149	64.5141	64.0444	64.0444	63.9575	64.2253	64.5141	64.7181	64.9315	(38)
Heat transfer coeff													
	167.1991	167.0820	166.9672	166.4280	166.3271	165.8575	165.8575	165.7705	166.0384	166.3271	166.5312	166.7445	(39)
Average = Sum(39)m / 12 =												166.4275	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1611	1.1603	1.1595	1.1557	1.1550	1.1518	1.1518	1.1512	1.1530	1.1550	1.1565	1.1579	(40)
HLP (average)												1.1557	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9243	(42)
Hot water usage for mixer showers													
	73.2515	72.1506	70.5465	67.4773	65.2123	62.6864	61.2507	62.8427	64.5878	67.2998	70.4350	72.9708	(42a)
Hot water usage for baths													
	31.6237	31.1541	30.4927	29.2733	28.3601	27.3476	26.8007	27.4575	28.1726	29.2560	30.5005	31.5168	(42b)
Hot water usage for other uses													
	44.5782	42.9572	41.3361	39.7151	38.0941	36.4731	36.4731	38.0941	39.7151	41.3361	42.9572	44.5782	(42c)
Average daily hot water use (litres/day)												137.3812	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.4534	146.2619	142.3754	136.4657	131.6666	126.5071	124.5245	128.3943	132.4755	137.8920	143.8927	149.0658	(44)
Energy conte	236.6977	208.2750	218.8256	186.8147	177.2485	155.5553	150.6016	158.9789	163.3555	187.1181	205.0015	233.4011	(45)
Energy content (annual)										Total = Sum(45)m =		2281.8735	
Distribution loss (46)m = 0.15 x (45)m													
	35.5046	31.2412	32.8238	28.0222	26.5873	23.3333	22.5902	23.8468	24.5033	28.0677	30.7502	35.0102	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	287.0421	253.7474	269.1701	235.5351	227.5929	204.2757	200.9461	209.3234	212.0759	237.4625	253.7219	283.7455	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	287.0421	253.7474	269.1701	235.5351	227.5929	204.2757	200.9461	209.3234	212.0759	237.4625	253.7219	283.7455	(64)
										Total per year (kWh/year) = Sum(64)m =		2874.6387	(64)
12Total per year (kWh/year)												2875	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	118.9775	105.6293	113.0351	101.0922	99.2107	90.6985	90.3506	93.1360	93.2920	102.4923	107.1393	117.8814	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	158.3345	175.2989	158.3345	163.6123	158.3345	163.6123	158.3345	158.3345	163.6123	158.3345	163.6123	158.3345	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	313.9159	317.1734	308.9646	291.4893	269.4298	248.6970	234.8462	231.5887	239.7974	257.2728	279.3323	300.0651	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	(71)
Water heating gains (Table 5)													
	159.9160	157.1865	151.9289	140.4059	133.3477	125.9701	121.4390	125.1829	129.5723	137.7585	148.8046	158.4428	(72)
Total internal gains													
	702.0316	719.5240	689.0932	665.3726	630.9771	605.1445	581.4848	581.9712	599.8472	623.2309	661.6144	686.7075	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	12.6000	10.6334	0.7600	0.7000	0.7700	49.3955 (74)
East	8.4000	19.6403	0.7600	0.7000	0.7700	60.8235 (76)
South	12.6000	46.7521	0.7600	0.7000	0.7700	217.1782 (78)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	373.0148	658.3007	956.3908	1269.8393	1493.6010	1512.5097	1445.9780	1275.5857	1064.9685	743.0763	451.0855	316.3725	(83)
Total gains	1075.0464	1377.8246	1645.4840	1935.2119	2124.5781	2117.6542	2027.4628	1857.5570	1664.8156	1366.3072	1112.6999	1003.0800	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8089	59.8509	59.8920	60.0861	60.1225	60.2927	60.2927	60.3244	60.2270	60.1225	60.0488	59.9720	
alpha	4.9873	4.9901	4.9928	5.0057	5.0082	5.0195	5.0195	5.0216	5.0151	5.0082	5.0033	4.9981	
util living area	0.9947	0.9824	0.9483	0.8496	0.6806	0.4933	0.3586	0.4077	0.6513	0.9149	0.9865	0.9962	(86)
MIT	19.9779	20.1931	20.4583	20.7320	20.8819	20.9289	20.9367	20.9354	20.9040	20.6705	20.2594	19.9334	(87)
Th 2	19.9512	19.9519	19.9525	19.9556	19.9561	19.9588	19.9588	19.9593	19.9577	19.9561	19.9550	19.9538	(88)
util rest of house	0.9930	0.9769	0.9331	0.8118	0.6186	0.4166	0.2745	0.3169	0.5671	0.8828	0.9815	0.9950	(89)
MIT 2	18.7638	19.0364	19.3646	19.6836	19.8346	19.8748	19.8791	19.8792	19.8581	19.6262	19.1251	18.7090	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0673	19.3256	19.6380	19.9457	20.0964	20.1383	20.1435	20.1432	20.1196	19.8873	19.4087	19.0151	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0673	19.3256	19.6380	19.9457	20.0964	20.1383	20.1435	20.1432	20.1196	19.8873	19.4087	19.0151	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9910	0.9727	0.9276	0.8114	0.6274	0.4300	0.2895	0.3331	0.5809	0.8803	0.9779	0.9934	(94)
Useful gains	1065.3809	1340.2777	1526.3637	1570.1866	1332.9112	910.6651	586.8870	618.8385	967.0667	1202.6984	1088.1430	996.4629	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2469.0828	2410.2552	2193.6189	1838.3180	1396.5571	918.5753	587.7213	620.5195	999.4865	1544.7275	2049.7792	2470.3370	(97)
Space heating kWh	1044.3542	719.0249	496.4379	193.0546	47.3525	0.0000	0.0000	0.0000	0.0000	254.4697	692.3780	1096.5624	(98a)
Space heating requirement - total per year (kWh/year)												4543.6342	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1044.3542	719.0249	496.4379	193.0546	47.3525	0.0000	0.0000	0.0000	0.0000	254.4697	692.3780	1096.5624	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4543.6342	
Space heating per m2										(98c) / (4) =		31.5530	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1044.3542	719.0249	496.4379	193.0546	47.3525	0.0000	0.0000	0.0000	0.0000	254.4697	692.3780	1096.5624	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	476.2217	327.8727	226.3739	88.0322	21.5926	0.0000	0.0000	0.0000	0.0000	116.0372	315.7219	500.0284	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	287.0421	253.7474	269.1701	235.5351	227.5929	204.2757	200.9461	209.3234	212.0759	237.4625	253.7219	283.7455	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	150.7574	133.2707	141.3708	123.7054	119.5341	107.2877	105.5389	109.9387	111.3844	124.7177	133.2573	149.0260	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	43.5963	34.9746	31.4908	23.0715	17.8211	14.5600	16.2570	21.1314	27.4476	36.0128	40.6764	44.8080 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2071.8806 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1509.7892 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	351.8475 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3933.5173 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2071.8806	0.1569	325.1175	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1509.7892	0.1410	212.8610	(264)
Space and water heating			537.9785	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	351.8475	0.1443	50.7825	(268)
Total CO2, kg/year			588.7609	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.0900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2071.8806	1.5809	3275.4204	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1509.7892	1.5213	2296.8784	(278)
Space and water heating			5572.2988	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	351.8475	1.5338	539.6754	(282)
Total Primary energy kWh/year			6111.9742	(286)
Dwelling Primary energy Rate (DPER)			42.4400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0000 (1b)	x	2.5000 (2b)	=	180.0000 (1b)	-
First floor	72.0000 (1c)	x	2.7500 (2c)	=	198.0000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 144.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	378.0000	(5)

2. Ventilation rate

			m3 per hour
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1058	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3558	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3024	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3856	0.3781	0.3705	0.3327	0.3251	0.2873	0.2873	0.2798	0.3024	0.3251	0.3403	0.3554	(22b)
Effective ac	0.5744	0.5715	0.5686	0.5553	0.5529	0.5413	0.5413	0.5391	0.5457	0.5529	0.5579	0.5631	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			30.7800	1.1450	35.2443			(27)
Heatloss Floor 1			72.0000	0.1300	9.3600			(28a)
External Wall 1	180.0000	35.9800	144.0200	0.1800	25.9236			(29a)
External Roof 1	72.0000		72.0000	0.1100	7.9200			(30)
Total net area of external elements Aum(A, m2)			324.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.6479			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	47.0000	0.1600	7.5200
E6 Intermediate floor within a dwelling	47.0000	0.0000	0.0000
E14 Flat roof	47.0000	0.0800	3.7600
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.1700 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 96.8179 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.6446	71.2845	70.9314	69.2734	68.9631	67.5190	67.5190	67.2516	68.0752	68.9631	69.5907	70.2468	(38)
Heat transfer coeff	168.4625	168.1023	167.7493	166.0912	165.7810	164.3369	164.3369	164.0694	164.8931	165.7810	166.4086	167.0647	(39)

Average = Sum(39)m / 12 = 166.0897

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1699	1.1674	1.1649	1.1534	1.1513	1.1412	1.1412	1.1394	1.1451	1.1513	1.1556	1.1602	(40)
HLP (average)												1.1534	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9243 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2515	72.1506	70.5465	67.4773	65.2123	62.6864	61.2507	62.8427	64.5878	67.2998	70.4350	72.9708	(42a)
Hot water usage for baths	31.6237	31.1541	30.4927	29.2733	28.3601	27.3476	26.8007	27.4575	28.1726	29.2560	30.5005	31.5168	(42b)
Hot water usage for other uses	44.5782	42.9572	41.3361	39.7151	38.0941	36.4731	36.4731	38.0941	39.7151	41.3361	42.9572	44.5782	(42c)

Average daily hot water use (litres/day) 137.3812 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.4534	146.2619	142.3754	136.4657	131.6666	126.5071	124.5245	128.3943	132.4755	137.8920	143.8927	149.0658	(44)

Energy conte	236.6977	208.2750	218.8256	186.8147	177.2485	155.5553	150.6016	158.9789	163.3555	187.1181	205.0015	233.4011	(45)
Energy content (annual)										Total = Sum(45)m =		2281.8735	
Distribution loss (46)m = 0.15 x (45)m													
	35.5046	31.2412	32.8238	28.0222	26.5873	23.3333	22.5902	23.8468	24.5033	28.0677	30.7502	35.0102	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	285.9403	252.7522	268.0683	234.4689	226.4912	203.2095	199.8443	208.2216	211.0097	236.3608	252.6557	282.6437	(62)
WWHRS	-33.4875	-29.6166	-31.0128	-25.6798	-23.9327	-20.4794	-19.1961	-20.4132	-21.1888	-24.9792	-28.2984	-32.8674	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.4528	223.1356	237.0555	208.7891	202.5585	182.7301	180.6481	187.8084	189.8210	211.3816	224.3573	249.7764	(64)
										Total per year (kWh/year) = Sum(64)m =		2550.5143	(64)
12Total per year (kWh/year)												2551	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	118.0961	104.8332	112.1537	100.2392	98.3293	89.8455	89.4692	92.2546	92.4391	101.6109	106.2864	117.0000	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	146.2172	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	158.5911	175.5830	158.5911	163.8774	158.5911	163.8774	158.5911	158.5911	163.8774	158.5911	163.8774	158.5911	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	313.9159	317.1734	308.9646	291.4893	269.4298	248.6970	234.8462	231.5887	239.7974	257.2728	279.3323	300.0651	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	37.6217	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	-116.9737	(71)
Water heating gains (Table 5)													
	158.7313	156.0018	150.7442	139.2212	132.1630	124.7854	120.2543	123.9982	128.3876	136.5738	147.6199	157.2581	(72)
Total internal gains													
	701.1034	718.6233	688.1650	664.4531	630.0490	604.2250	580.5566	581.0431	598.9276	622.3028	660.6948	685.7794	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.7200	10.6334	0.6300	0.7000	0.7700	31.5871	(74)
East	6.4800	19.6403	0.6300	0.7000	0.7700	38.8950	(76)
South	9.7200	46.7521	0.6300	0.7000	0.7700	138.8797	(78)
West	4.8600	19.6403	0.6300	0.7000	0.7700	29.1713	(80)

Solar gains	238.5332	420.9659	611.5868	812.0288	955.1185	967.2102	924.6649	815.7035	681.0193	475.1777	288.4573	202.3119	(83)
Total gains	939.6366	1139.5893	1299.7518	1476.4819	1585.1675	1571.4351	1505.2215	1396.7466	1279.9469	1097.4805	949.1521	888.0912	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.3604	59.4876	59.6128	60.2079	60.3205	60.8506	60.8506	60.9498	60.6453	60.3205	60.0931	59.8571	
alpha	4.9574	4.9658	4.9742	5.0139	5.0214	5.0567	5.0567	5.0633	5.0430	5.0214	5.0062	4.9905	
util living area													
	0.9971	0.9921	0.9789	0.9330	0.8221	0.6374	0.4742	0.5291	0.7818	0.9597	0.9931	0.9978	(86)
MIT	19.6082	19.8306	20.1388	20.5297	20.8225	20.9627	20.9930	20.9883	20.8979	20.5007	19.9809	19.5729	(87)
Th 2	19.9442	19.9462	19.9482	19.9575	19.9592	19.9673	19.9673	19.9688	19.9642	19.9592	19.9557	19.9520	(88)
util rest of house													
	0.9961	0.9894	0.9717	0.9102	0.7675	0.5476	0.3662	0.4162	0.7004	0.9413	0.9904	0.9971	(89)
MIT 2	18.3266	18.6114	19.0022	19.4871	19.8135	19.9467	19.9652	19.9648	19.8968	19.4640	18.8113	18.2871	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6470	18.9162	19.2863	19.7478	20.0657	20.2007	20.2221	20.2207	20.1471	19.7231	19.1037	18.6086	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6470	18.9162	19.2863	19.7478	20.0657	20.2007	20.2221	20.2207	20.1471	19.7231	19.1037	18.6086	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9858	0.9657	0.9047	0.7737	0.5688	0.3933	0.4445	0.7163	0.9359	0.9872	0.9956	(94)
Useful gains	934.3070	1123.4116	1255.1225	1335.7434	1226.4429	893.8648	591.9375	620.8276	916.8210	1027.1142	937.0018	884.2140	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2416.9357	2356.1544	2144.8968	1801.7162	1386.8781	920.4028	595.2516	626.8542	997.1252	1512.4449	1997.5149	2407.1653	(97)
Space heating kWh													
	1103.0757	828.4032	661.9921	335.5004	119.3638	0.0000	0.0000	0.0000	0.0000	361.0861	763.5694	1133.0757	(98a)
Space heating requirement - total per year (kWh/year)												5306.0665	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1103.0757	828.4032	661.9921	335.5004	119.3638	0.0000	0.0000	0.0000	0.0000	361.0861	763.5694	1133.0757	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5306.0665	
Space heating per m2											(98c) / (4) =	36.8477	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1103.0757	828.4032	661.9921	335.5004	119.3638	0.0000	0.0000	0.0000	0.0000	361.0861	763.5694	1133.0757	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	1195.0983	897.5116	717.2179	363.4890	129.3216	0.0000	0.0000	0.0000	0.0000	391.2092	827.2692	1227.6010	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.4528	223.1356	237.0555	208.7891	202.5585	182.7301	180.6481	187.8084	189.8210	211.3816	224.3573	249.7764	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.9732	86.7245	86.2356	85.1176	82.9159	79.8000	79.8000	79.8000	79.8000	85.2498	86.5824	87.0272	(217)
Fuel for water heating, kWh/month													
	290.2651	257.2925	274.8930	245.2950	244.2938	228.9851	226.3761	235.3489	237.8709	247.9554	259.1258	287.0097	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	32.9521	26.4354	23.8021	17.4385	13.4700	11.0051	12.2878	15.9721	20.7462	27.2201	30.7450	33.8679	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-63.0067	-86.6919	-121.6205	-133.2993	-140.8107	-130.2752	-128.5126	-122.6342	-111.9965	-97.3218	-68.4409	-54.7138	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-42.4155	-88.3434	-174.0397	-259.2469	-340.8221	-341.8527	-337.9673	-287.1741	-211.7576	-125.7829	-56.4328	-33.6216	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	5748.7178	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3034.7112	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	265.9423	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3558.7804	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses 5576.5909 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5748.7178	0.2100	1207.2307	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3034.7112	0.2100	637.2894	(264)
Space and water heating			1844.5201	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	265.9423	0.1443	38.3837	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1259.3239	0.1351	-170.1827	
PV Unit electricity exported	-2299.4565	0.1261	-290.0350	
Total			-460.2177	(269)
Total CO2, kg/year			1434.6153	(272)
Target Carbon Dioxide Emission Rate (TER)			9.9600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5748.7178	1.1300	6496.0511	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3034.7112	1.1300	3429.2237	(278)
Space and water heating			9925.2748	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	265.9423	1.5338	407.9111	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1259.3239	1.4995	-1888.3292	
PV Unit electricity exported	-2299.4565	0.4630	-1064.6507	
Total			-2952.9799	(283)
Total Primary energy kWh/year			7510.3068	(286)
Target Primary Energy Rate (TPER)			52.1500	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B5_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B5
Property	1 Bedroom Flat, 4B5, Saffron Walden, CB11		

SAP Rating	80 C	DER	4.21	TER	10.20
Environmental	96 A	% DER<TER	58.73		
CO_2 Emissions (t/year)	0.55	DFEE	39.43	TFEE	42.89
Compliance Check	See BREL	% DFEE < TFEE	8.08		
% DPER < TPER	18.24	DPER	43.67	TPER	53.41

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		69.5000 (1b)	x	2.5000 (2b)	=	173.7500 (1b)	-
First floor		69.5000 (1c)	x	2.7500 (2c)	=	191.1250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.0000						(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=			364.8750	(5)

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2. Ventilation rate

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				m3 per hour	
Number of open chimneys		0 * 80	=	0.0000	(6a)
Number of open flues		0 * 20	=	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000	(6d)
Number of flues attached to other heater		0 * 35	=	0.0000	(6e)
Number of blocked chimneys		0 * 20	=	0.0000	(6f)
Number of intermittent extract fans		2 * 10	=	20.0000	(7a)
Number of passive vents		0 * 10	=	0.0000	(7b)
Number of flueless gas fires		0 * 40	=	0.0000	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)		20.0000 / (5)	=	0.0548	(8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				3.0000	(17)
Infiltration rate				0.2048	(18)
Number of sides sheltered				2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.1741	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2220	0.2176	0.2133	0.1915	0.1871	0.1654	0.1654	0.1610	0.1741	0.1871	0.1959	0.2046	(22b)
Effective ac	0.5246	0.5237	0.5227	0.5183	0.5175	0.5137	0.5137	0.5130	0.5152	0.5175	0.5192	0.5209	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			69.5000	0.1100	7.6450			(28a)
External Wall 1	175.0000	45.1000	129.9000	0.1400	18.1860			(29a)
External Roof 1	69.5000		69.5000	0.1100	7.6450			(30)
Total net area of external elements Aum(A, m2)			314.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.3630			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 15.7000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 100.0630 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.1706	63.0554	62.9425	62.4122	62.3130	61.8511	61.8511	61.7656	62.0290	62.3130	62.5137	62.7235	(38)
Heat transfer coeff	163.2336	163.1184	163.0055	162.4752	162.3760	161.9142	161.9142	161.8286	162.0921	162.3760	162.5767	162.7866	(39)

Average = Sum(39)m / 12 = 162.4748

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1743	1.1735	1.1727	1.1689	1.1682	1.1649	1.1649	1.1642	1.1661	1.1682	1.1696	1.1711	(40)
HLP (average)												1.1689	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9152 (42)

Hot water usage for mixer showers												
	73.0974	71.9989	70.3982	67.3354	65.0752	62.5546	61.1219	62.7106	64.4520	67.1583	70.2869	72.8174 (42a)
Hot water usage for baths												
	31.5575	31.0888	30.4289	29.2119	28.3007	27.2904	26.7446	27.4000	28.1136	29.1947	30.4367	31.4508 (42b)
Hot water usage for other uses												
	44.4841	42.8665	41.2489	39.6313	38.0137	36.3961	36.3961	38.0137	39.6313	41.2489	42.8665	44.4841 (42c)

Average daily hot water use (litres/day) 137.0923 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.1391	145.9543	142.0760	136.1787	131.3897	126.2411	124.2626	128.1243	132.1969	137.6020	143.5901	148.7523	(44)
Energy conte	236.1999	207.8370	218.3655	186.4218	176.8758	155.2282	150.2849	158.6446	163.0120	186.7246	204.5704	232.9102	(45)

Energy content (annual) Total = Sum(45)m = 2277.0747

Distribution loss (46)m = 0.15 x (45)m												
	35.4300	31.1755	32.7548	27.9633	26.5314	23.2842	22.5427	23.7967	24.4518	28.0087	30.6856	34.9365 (46)
Water storage loss:												

Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	286.5443	253.3094	268.7099	235.1423	227.2202	203.9486	200.6293	208.9890	211.7324	237.0690	253.2908	283.2547 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	286.5443	253.3094	268.7099	235.1423	227.2202	203.9486	200.6293	208.9890	211.7324	237.0690	253.2908	283.2547 (64)

Total per year (kWh/year) = Sum(64)m = 2869.8398 (64)
12Total per year (kWh/year) 2870 (64)

Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month												
	118.8120	105.4837	112.8821	100.9616	99.0867	90.5897	90.2453	93.0249	93.1778	102.3615	106.9960	117.7182 (65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	155.4879	172.1473	155.4879	160.6708	155.4879	160.6708	155.4879	155.4879	160.6708	155.4879	160.6708	155.4879	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.2722	311.4711	303.4100	286.2488	264.5859	244.2258	230.6240	227.4251	235.4862	252.6474	274.3103	294.6704	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	(71)
Water heating gains (Table 5)													
	159.6936	156.9698	151.7232	140.2244	133.1811	125.8190	121.2974	125.0334	129.4136	137.5826	148.6055	158.2234	(72)
Total internal gains													
	693.1810	710.3156	680.3484	656.8714	622.9822	597.4430	574.1367	574.6738	592.2981	615.4453	653.3141	678.1091	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	10.6334	0.7600	0.7000	0.7700	32.9303 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	6.3000	46.7521	0.7600	0.7000	0.7700	108.5891 (78)
West	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.9899	597.7235	921.3214	1285.1443	1548.8949	1580.0514	1506.1366	1306.7117	1048.9083	690.2824	396.8582	271.3382	(83)
Total gains	1017.1710	1308.0391	1601.6699	1942.0157	2171.8771	2177.4944	2080.2733	1881.3855	1641.2064	1305.7277	1050.1723	949.4473	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1347	59.1765	59.2175	59.4108	59.4471	59.6166	59.6166	59.6481	59.5512	59.4471	59.3737	59.2971	
alpha	4.9423	4.9451	4.9478	4.9607	4.9631	4.9744	4.9744	4.9765	4.9701	4.9631	4.9582	4.9531	
util living area	0.9952	0.9838	0.9478	0.8373	0.6559	0.4696	0.3414	0.3933	0.6456	0.9193	0.9879	0.9965	(86)
MIT	19.9505	20.1660	20.4504	20.7416	20.8883	20.9298	20.9364	20.9352	20.9037	20.6561	20.2330	19.9069	(87)
Th 2	19.9406	19.9412	19.9419	19.9450	19.9455	19.9482	19.9482	19.9487	19.9472	19.9455	19.9444	19.9432	(88)
util rest of house	0.9936	0.9787	0.9325	0.7977	0.5938	0.3952	0.2604	0.3047	0.5609	0.8882	0.9833	0.9954	(89)
MIT 2	18.7205	18.9937	19.3459	19.6834	19.8290	19.8644	19.8680	19.8680	19.8471	19.6008	19.0836	18.6669	(90)
Living area fraction									fLA = Living area / (4) =			0.2518	(91)
MIT	19.0302	19.2889	19.6240	19.9499	20.0957	20.1327	20.1370	20.1367	20.1132	19.8665	19.3730	18.9791	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0302	19.2889	19.6240	19.9499	20.0957	20.1327	20.1370	20.1367	20.1132	19.8665	19.3730	18.9791	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9746	0.9269	0.7980	0.6030	0.4085	0.2750	0.3206	0.5749	0.8854	0.9799	0.9939	(94)
Useful gains	1008.7647	1274.8675	1484.6107	1549.6350	1309.6147	889.4280	572.0108	603.2657	943.5978	1156.0876	1029.0748	943.6777	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2404.4600	2347.0945	2139.2912	1795.3316	1363.2639	895.8161	572.6894	604.7131	974.6857	1504.6613	1995.3030	2405.8396	(97)
Space heating kWh	1038.3973	720.5366	487.0823	176.9015	39.9150	0.0000	0.0000	0.0000	0.0000	259.3388	695.6842	1087.8484	(98a)
Space heating requirement - total per year (kWh/year)												4505.7042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1038.3973	720.5366	487.0823	176.9015	39.9150	0.0000	0.0000	0.0000	0.0000	259.3388	695.6842	1087.8484	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4505.7042	
Space heating per m2										(98c) / (4) =		32.4151	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1038.3973	720.5366	487.0823	176.9015	39.9150	0.0000	0.0000	0.0000	0.0000	259.3388	695.6842	1087.8484	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	473.5054	328.5621	222.1077	80.6664	18.2011	0.0000	0.0000	0.0000	0.0000	118.2576	317.2295	496.0549	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	286.5443	253.3094	268.7099	235.1423	227.2202	203.9486	200.6293	208.9890	211.7324	237.0690	253.2908	283.2547	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	150.4960	133.0406	141.1291	123.4991	119.3383	107.1159	105.3726	109.7631	111.2040	124.5110	133.0309	148.7682	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	42.6849	34.2434	30.8324	22.5891	17.4485	14.2556	15.9171	20.6896	26.8738	35.2599	39.8260	43.8712 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2054.5847 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1507.2688 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	344.4915 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3906.3450 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2054.5847	0.1570	322.5133	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1507.2688	0.1410	212.5041	(264)
Space and water heating			535.0174	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	344.4915	0.1443	49.7208	(268)
Total CO2, kg/year			584.7382	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.2100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2054.5847	1.5811	3248.4796	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1507.2688	1.5213	2293.0385	(278)
Space and water heating			5541.5181	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	344.4915	1.5338	528.3925	(282)
Total Primary energy kWh/year			6069.9106	(286)
Dwelling Primary energy Rate (DPER)			43.6700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.5000 (1b)	x	2.5000 (2b)	=	173.7500 (1b)	-
First floor	69.5000 (1c)	x	2.7500 (2c)	=	191.1250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 139.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	364.8750	(5)

2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		4 * 10 =	40.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5) =	0.1096 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3596 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3057 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3897	0.3821	0.3745	0.3363	0.3286	0.2904	0.2904	0.2828	0.3057	0.3286	0.3439	0.3592	(22b)
Effective ac	0.5760	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			29.6400	1.1450	33.9389			(27)
Heatloss Floor 1			69.5000	0.1300	9.0350			(28a)
External Wall 1	175.0000	34.8400	140.1600	0.1800	25.2288			(29a)
External Roof 1	69.5000		69.5000	0.1100	7.6450			(30)
Total net area of external elements Aum(A, m2)			314.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.0477			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E5	Ground floor (normal)	44.0000	0.1600	7.0400
E6	Intermediate floor within a dwelling	44.0000	0.0000	0.0000
E14	Flat roof	44.0000	0.0800	3.5200
E16	Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4500 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 93.4977 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.3495	68.9944	68.6463	67.0114	66.7055	65.2815	65.2815	65.0178	65.8300	66.7055	67.3243	67.9712	(38)
Heat transfer coeff	162.8472	162.4921	162.1440	160.5091	160.2032	158.7792	158.7792	158.5155	159.3277	160.2032	160.8220	161.4690	(39)

Average = Sum(39)m / 12 = 160.5076

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1716	1.1690	1.1665	1.1547	1.1525	1.1423	1.1423	1.1404	1.1462	1.1525	1.1570	1.1616	(40)
HLP (average)												1.1547	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9152 (42)

Hot water usage for mixer showers

73.0974	71.9989	70.3982	67.3354	65.0752	62.5546	61.1219	62.7106	64.4520	67.1583	70.2869	72.8174	(42a)

Hot water usage for baths

31.5575	31.0888	30.4289	29.2119	28.3007	27.2904	26.7446	27.4000	28.1136	29.1947	30.4367	31.4508	(42b)

Hot water usage for other uses

44.4841	42.8665	41.2489	39.6313	38.0137	36.3961	36.3961	38.0137	39.6313	41.2489	42.8665	44.4841	(42c)

Average daily hot water use (litres/day) 137.0923 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.1391	145.9543	142.0760	136.1787	131.3897	126.2411	124.2626	128.1243	132.1969	137.6020	143.5901	148.7523	(44)

Energy conte	236.1999	207.8370	218.3655	186.4218	176.8758	155.2282	150.2849	158.6446	163.0120	186.7246	204.5704	232.9102	(45)
Energy content (annual)										Total = Sum(45)m =		2277.0747	
Distribution loss (46)m = 0.15 x (45)m													
	35.4300	31.1755	32.7548	27.9633	26.5314	23.2842	22.5427	23.7967	24.4518	28.0087	30.6856	34.9365	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	285.4425	252.3142	267.6081	234.0760	226.1184	202.8824	199.5276	207.8873	210.6662	235.9672	252.2246	282.1529	(62)
WWHRS	-33.4171	-29.5544	-30.9476	-25.6259	-23.8824	-20.4363	-19.1558	-20.3703	-21.1442	-24.9267	-28.2389	-32.7983	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	252.0254	222.7599	236.6605	208.4502	202.2360	182.4460	180.3718	187.5170	189.5220	211.0406	223.9857	249.3546	(64)
										Total per year (kWh/year) = Sum(64)m =		2546.3697	(64)
12Total per year (kWh/year)												2546	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	117.9306	104.6876	112.0006	100.1086	98.2053	89.7367	89.3639	92.1435	92.3248	101.4801	106.1430	116.8368	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	155.7613	172.4500	155.7613	160.9533	155.7613	160.9533	155.7613	155.7613	160.9533	155.7613	160.9533	155.7613	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.2722	311.4711	303.4100	286.2488	264.5859	244.2258	230.6240	227.4251	235.4862	252.6474	274.3103	294.6704	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	(71)
Water heating gains (Table 5)													
	158.5089	155.7851	150.5385	139.0398	131.9964	124.6343	120.1127	123.8487	128.2289	136.3979	147.4208	157.0387	(72)
Total internal gains													
	692.2697	709.4335	679.4371	655.9692	622.0709	596.5408	573.2253	573.7625	591.3958	614.5340	652.4118	677.1977	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2400	10.6334	0.6300	0.7000	0.7700	20.2781	(74)
East	9.3600	19.6403	0.6300	0.7000	0.7700	56.1817	(76)
South	4.6800	46.7521	0.6300	0.7000	0.7700	66.8680	(78)
West	9.3600	19.6403	0.6300	0.7000	0.7700	56.1817	(80)

Solar gains	199.5096	368.0719	567.3400	791.3783	953.7932	972.9790	927.4631	804.6593	645.9067	425.0687	244.3811	167.0872	(83)
Total gains	891.7793	1077.5054	1246.7771	1447.3475	1575.8641	1569.5198	1500.6884	1378.4217	1237.3025	1039.6026	896.7929	844.2849	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2750	59.4046	59.5321	60.1385	60.2533	60.7937	60.7937	60.8948	60.5844	60.2533	60.0215	59.7810	
alpha	4.9517	4.9603	4.9688	5.0092	5.0169	5.0529	5.0529	5.0597	5.0390	5.0169	5.0014	4.9854	
util living area													
	0.9973	0.9927	0.9794	0.9296	0.8096	0.6201	0.4603	0.5188	0.7815	0.9625	0.9938	0.9980	(86)
MIT	19.5941	19.8115	20.1312	20.5402	20.8349	20.9669	20.9939	20.9892	20.8978	20.4870	19.9646	19.5608	(87)
Th 2	19.9428	19.9449	19.9469	19.9564	19.9582	19.9664	19.9664	19.9680	19.9632	19.9582	19.9546	19.9508	(88)
util rest of house													
	0.9964	0.9903	0.9724	0.9060	0.7535	0.5313	0.3549	0.4076	0.7001	0.9451	0.9913	0.9973	(89)
MIT 2	18.3077	18.5863	18.9918	19.4982	19.8240	19.9484	19.9646	19.9643	19.8959	19.4471	18.7900	18.2708	(90)
Living area fraction										fLA = Living area / (4) =		0.2518	(91)
MIT	18.6316	18.8948	19.2787	19.7605	20.0786	20.2048	20.2238	20.2224	20.1482	19.7089	19.0857	18.5956	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6316	18.8948	19.2787	19.7605	20.0786	20.2048	20.2238	20.2224	20.1482	19.7089	19.0857	18.5956	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9869	0.9665	0.9007	0.7606	0.5526	0.3815	0.4357	0.7161	0.9397	0.9882	0.9959	(94)
Useful gains	887.0619	1063.3925	1204.9636	1303.5722	1198.5857	867.2839	572.5755	600.5635	886.0030	976.9018	886.2442	840.8274	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2333.8604	2274.0463	2071.9945	1743.2170	1342.2723	889.9291	575.3780	605.9060	963.6444	1459.2796	1927.5712	2324.4433	(97)
Space heating kWh													
	1076.4180	813.5594	645.0710	316.5442	106.9029	0.0000	0.0000	0.0000	0.0000	358.8891	749.7555	1103.8102	(98a)
Space heating requirement - total per year (kWh/year)												5170.9502	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1076.4180	813.5594	645.0710	316.5442	106.9029	0.0000	0.0000	0.0000	0.0000	358.8891	749.7555	1103.8102	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5170.9502	
Space heating per m2											(98c) / (4) =	37.2011	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1076.4180	813.5594	645.0710	316.5442	106.9029	0.0000	0.0000	0.0000	0.0000	358.8891	749.7555	1103.8102	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	1166.2167	881.4295	698.8851	342.9515	115.8211	0.0000	0.0000	0.0000	0.0000	388.8289	812.3028	1195.8940	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	252.0254	222.7599	236.6605	208.4502	202.2360	182.4460	180.3718	187.5170	189.5220	211.0406	223.9857	249.3546	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.9398	86.6982	86.1909	84.9939	82.6984	79.8000	79.8000	79.8000	79.8000	85.2402	86.5545	86.9921	(217)
Fuel for water heating, kWh/month													
	289.8850	256.9372	274.5771	245.2530	244.5464	228.6291	226.0298	234.9837	237.4962	247.5834	258.7798	286.6407	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	32.3641	25.9637	23.3774	17.1273	13.2296	10.8087	12.0685	15.6871	20.3760	26.7344	30.1964	33.2636	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.1113	-84.2314	-118.3754	-129.9805	-137.5068	-127.2968	-125.5821	-119.7435	-109.2017	-94.6805	-66.4381	-53.0508	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-40.6503	-84.7263	-167.0188	-248.9355	-327.4027	-328.4378	-324.7006	-275.8353	-203.3109	-120.6775	-54.0996	-32.2174	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	5602.3296	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3031.3415	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	261.1969	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3435.2116	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses 5545.6564 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5602.3296	0.2100	1176.4892	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3031.3415	0.2100	636.5817	(264)
Space and water heating			1813.0709	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	261.1969	0.1443	37.6988	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1227.1989	0.1351	-165.7928	
PV Unit electricity exported	-2208.0127	0.1261	-278.4627	
Total			-444.2555	(269)
Total CO2, kg/year			1418.4434	(272)
Target Carbon Dioxide Emission Rate (TER)			10.2000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5602.3296	1.1300	6330.6324	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3031.3415	1.1300	3425.4159	(278)
Space and water heating			9756.0483	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	261.1969	1.5338	400.6326	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1227.1989	1.4993	-1839.9761	
PV Unit electricity exported	-2208.0127	0.4629	-1022.1700	
Total			-2862.1461	(283)
Total Primary energy kWh/year			7424.6355	(286)
Target Primary Energy Rate (TPER)			53.4100	(287)

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Full SAP Calculation Printout

Property Reference	Plot 4B7_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4B7
Property	1 Bedroom Flat, 4B7, Saffron Walden, CB11		

SAP Rating	81 B	DER	4.01	TER	9.59
Environmental	96 A	% DER<TER	58.19		
CO_2 Emissions (t/year)	0.59	DFEE	38.39	TFEE	42.19
Compliance Check	See BREL	% DFEE < TFEE	9.00		
% DPER < TPER	17.25	DPER	41.58	TPER	50.24

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			78.5000 (1b)	x	2.5000 (2b)	=	196.2500 (1b)	-
First floor			78.5000 (1c)	x	2.7500 (2c)	=	215.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	157.0000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	412.1250	(5)

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2. Ventilation rate

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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0485 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.1985 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.1687 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2152	0.2109	0.2067	0.1856	0.1814	0.1603	0.1603	0.1561	0.1687	0.1814	0.1898	0.1983	(22b)
Effective ac	0.5231	0.5222	0.5214	0.5172	0.5165	0.5128	0.5128	0.5122	0.5142	0.5165	0.5180	0.5197	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			78.5000	0.1100	8.6350			(28a)
External Wall 1	180.0000	45.1000	134.9000	0.1400	18.8860			(29a)
External Roof 1	78.5000		78.5000	0.1100	8.6350			(30)
Total net area of external elements Aum(A, m2)			337.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.0430			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 16.8500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 103.8930 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.1485	71.0263	70.9065	70.3437	70.2384	69.7482	69.7482	69.6575	69.9370	70.2384	70.4514	70.6741	(38)
Heat transfer coeff													
	175.0415	174.9193	174.7995	174.2367	174.1314	173.6413	173.6413	173.5505	173.8301	174.1314	174.3444	174.5671	(39)

Average = Sum(39)m / 12 = 174.2362

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1149	1.1141	1.1134	1.1098	1.1091	1.1060	1.1060	1.1054	1.1072	1.1091	1.1105	1.1119	(40)
HLP (average)												1.1098	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9446 (42)

Hot water usage for mixer showers

	73.5918	72.4859	70.8743	67.7909	65.5154	62.9777	61.5353	63.1347	64.8879	67.6126	70.7623	73.3099 (42a)

Hot water usage for baths

	31.7701	31.2983	30.6339	29.4088	28.4914	27.4742	26.9248	27.5846	28.3030	29.3914	30.6417	31.6627 (42b)

Hot water usage for other uses

	44.7861	43.1575	41.5289	39.9003	38.2718	36.6432	36.6432	38.2718	39.9003	41.5289	43.1575	44.7861 (42c)

Average daily hot water use (litres/day) 138.0198 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	150.1481	146.9417	143.0371	137.1000	132.2785	127.0951	125.1033	128.9910	133.0912	138.5329	144.5615	149.7587	(44)
Energy conte	237.7978	209.2430	219.8427	187.6830	178.0723	156.2783	151.3016	159.7179	164.1148	187.9878	205.9544	234.4859	(45)
Energy content (annual)										Total = Sum(45)m =		2292.4796	
Distribution loss (46)m = 0.15 x (45)m													
	35.6697	31.3865	32.9764	28.1525	26.7108	23.4417	22.6952	23.9577	24.6172	28.1982	30.8932	35.1729	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)

If cylinder contains dedicated solar storage

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	288.1423	254.7154	270.1872	236.4034	228.4168	204.9987	201.6460	210.0623	212.8352	238.3323	254.6748	284.8304 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	288.1423	254.7154	270.1872	236.4034	228.4168	204.9987	201.6460	210.0623	212.8352	238.3323	254.6748	284.8304 (64)

Total per year (kWh/year) = Sum(64)m = 2885.2447 (64)
12Total per year (kWh/year) 2885 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	119.3433	105.9512	113.3733	101.3809	99.4846	90.9389	90.5833	93.3817	93.5445	102.7815	107.4562	118.2421 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	165.4577	183.1853	165.4577	170.9729	165.4577	170.9729	165.4577	165.4577	170.9729	165.4577	170.9729	165.4577	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.0384	331.4424	322.8644	304.6028	281.5509	259.8853	245.4114	242.0074	250.5854	268.8470	291.8989	313.5644	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	(71)
Water heating gains (Table 5)													
	160.4077	157.6655	152.3834	140.8069	133.7159	126.3040	121.7518	125.5131	129.9229	138.1472	149.2447	158.9276	(72)
Total internal gains													
	724.0734	742.4628	710.8751	686.5523	650.8941	624.3319	599.7906	600.1478	618.6509	642.6215	682.2862	708.1194	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.4000	10.6334	0.7600	0.7000	0.7700	32.9303 (74)
East	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (76)
South	6.3000	46.7521	0.7600	0.7000	0.7700	108.5891 (78)
West	12.6000	19.6403	0.7600	0.7000	0.7700	91.2353 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	323.9899	597.7235	921.3214	1285.1443	1548.8949	1580.0514	1506.1366	1306.7117	1048.9083	690.2824	396.8582	271.3382	(83)
Total gains	1048.0633	1340.1864	1632.1966	1971.6965	2199.7890	2204.3833	2105.9272	1906.8595	1667.5593	1332.9039	1079.1443	979.4576	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2868	62.3303	62.3731	62.5745	62.6124	62.7891	62.7891	62.8219	62.7209	62.6124	62.5359	62.4561	
alpha	5.1525	5.1554	5.1582	5.1716	5.1742	5.1859	5.1859	5.1881	5.1814	5.1742	5.1691	5.1637	
util living area	0.9967	0.9885	0.9606	0.8647	0.6893	0.4969	0.3616	0.4160	0.6772	0.9364	0.9915	0.9977	(86)
MIT	19.9717	20.1711	20.4416	20.7320	20.8869	20.9320	20.9389	20.9376	20.9039	20.6497	20.2419	19.9316	(87)
Th 2	19.9887	19.9893	19.9899	19.9928	19.9934	19.9959	19.9959	19.9964	19.9950	19.9934	19.9923	19.9911	(88)
util rest of house	0.9957	0.9848	0.9485	0.8295	0.6289	0.4221	0.2797	0.3267	0.5945	0.9105	0.9882	0.9969	(89)
MIT 2	18.7855	19.0394	19.3771	19.7192	19.8763	19.9150	19.9189	19.9189	19.8961	19.6371	19.1335	18.7362	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.0820	19.3223	19.6432	19.9724	20.1290	20.1693	20.1739	20.1736	20.1481	19.8903	19.4106	19.0350	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0820	19.3223	19.6432	19.9724	20.1290	20.1693	20.1739	20.1736	20.1481	19.8903	19.4106	19.0350	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9816	0.9435	0.8287	0.6374	0.4352	0.2943	0.3426	0.6078	0.9073	0.9856	0.9959	(94)
Useful gains	1042.1168	1315.5918	1539.9220	1633.9575	1402.1615	959.4385	619.7994	653.2265	1013.5648	1209.3838	1063.5708	975.4281	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2587.4704	2522.7402	2297.4265	1929.2162	1467.7488	967.0521	620.5748	654.9093	1051.3399	1617.7295	2146.2824	2589.7094	(97)
Space heating kWh	1149.7431	811.2037	563.5833	212.5863	48.7970	0.0000	0.0000	0.0000	0.0000	303.8092	779.5523	1201.0253	(98a)
Space heating requirement - total per year (kWh/year)												5070.3002	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1149.7431	811.2037	563.5833	212.5863	48.7970	0.0000	0.0000	0.0000	0.0000	303.8092	779.5523	1201.0253	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5070.3002	
Space heating per m2											(98c) / (4) =	32.2949	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1149.7431	811.2037	563.5833	212.5863	48.7970	0.0000	0.0000	0.0000	0.0000	303.8092	779.5523	1201.0253	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	524.2787	369.9059	256.9919	96.9386	22.2512	0.0000	0.0000	0.0000	0.0000	138.5359	355.4730	547.6631	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	288.1423	254.7154	270.1872	236.4034	228.4168	204.9987	201.6460	210.0623	212.8352	238.3323	254.6748	284.8304	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	151.3352	133.7791	141.9050	124.1615	119.9668	107.6674	105.9065	110.3268	111.7832	125.1745	133.7578	149.5958	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	45.8704	36.7989	33.1333	24.2749	18.7506	15.3194	17.1050	22.2337	28.8793	37.8913	42.7981	47.1453 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2312.0384 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1515.3596 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	370.2002 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4197.5982 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2312.0384	0.1568	362.5479	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1515.3596	0.1410	213.6496	(264)
Space and water heating			576.1975	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	370.2002	0.1443	53.4313	(268)
Total CO2, kg/year			629.6289	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.0100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2312.0384	1.5805	3654.1581	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1515.3596	1.5213	2305.3652	(278)
Space and water heating			5959.5233	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	370.2002	1.5338	567.8254	(282)
Total Primary energy kWh/year			6527.3487	(286)
Dwelling Primary energy Rate (DPER)			41.5800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.5000 (1b)	x	2.5000 (2b)	=	196.2500 (1b)	-
First floor	78.5000 (1c)	x	2.7500 (2c)	=	215.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	157.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	412.1250	(5)

2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		4 * 10 =	40.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5) =	0.0971 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3471 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2950 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3761	0.3687	0.3614	0.3245	0.3171	0.2802	0.2802	0.2729	0.2950	0.3171	0.3319	0.3466	(22b)
Effective ac	0.5707	0.5680	0.5653	0.5526	0.5503	0.5393	0.5393	0.5372	0.5435	0.5503	0.5551	0.5601	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			34.0100	1.1450	38.9427			(27)
Heatloss Floor 1			78.5000	0.1300	10.2050			(28a)
External Wall 1	180.0000	39.2100	140.7900	0.1800	25.3422			(29a)
External Roof 1	78.5000		78.5000	0.1100	8.6350			(30)
Total net area of external elements Aum(A, m2)			337.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3249			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	47.0000	0.1600	7.5200
E6 Intermediate floor within a dwelling	47.0000	0.0000	0.0000
E14 Flat roof	47.0000	0.0800	3.7600
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.1700 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 101.4949 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.6206	77.2471	76.8809	75.1611	74.8393	73.3414	73.3414	73.0640	73.9183	74.8393	75.4902	76.1708	(38)
Heat transfer coeff	179.1156	178.7420	178.3759	176.6560	176.3342	174.8363	174.8363	174.5589	175.4133	176.3342	176.9852	177.6657	(39)

Average = Sum(39)m / 12 = 176.6545

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1409	1.1385	1.1362	1.1252	1.1231	1.1136	1.1136	1.1118	1.1173	1.1231	1.1273	1.1316	(40)
HLP (average)												1.1252	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9446 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.5918	72.4859	70.8743	67.7909	65.5154	62.9777	61.5353	63.1347	64.8879	67.6126	70.7623	73.3099	(42a)
Hot water usage for baths	31.7701	31.2983	30.6339	29.4088	28.4914	27.4742	26.9248	27.5846	28.3030	29.3914	30.6417	31.6627	(42b)
Hot water usage for other uses	44.7861	43.1575	41.5289	39.9003	38.2718	36.6432	36.6432	38.2718	39.9003	41.5289	43.1575	44.7861	(42c)

Average daily hot water use (litres/day) 138.0198 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.1481	146.9417	143.0371	137.1000	132.2785	127.0951	125.1033	128.9910	133.0912	138.5329	144.5615	149.7587	(44)

Energy conte	237.7978	209.2430	219.8427	187.6830	178.0723	156.2783	151.3016	159.7179	164.1148	187.9878	205.9544	234.4859	(45)
Energy content (annual)											Total = Sum(45)m =	2292.4796	
Distribution loss (46)m = 0.15 x (45)m													
	35.6697	31.3865	32.9764	28.1525	26.7108	23.4417	22.6952	23.9577	24.6172	28.1982	30.8932	35.1729	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	287.0405	253.7203	269.0854	235.3372	227.3150	203.9325	200.5443	208.9605	211.7690	237.2305	253.6086	283.7286	(62)
WWHRS	-33.6431	-29.7543	-31.1569	-25.7992	-24.0439	-20.5745	-19.2854	-20.5080	-21.2872	-25.0953	-28.4299	-33.0201	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	253.3974	223.9660	237.9284	209.5380	203.2711	183.3579	181.2589	188.4525	190.4818	212.1352	225.1787	250.7085	(64)
											Total per year (kWh/year) = Sum(64)m =	2559.6745	(64)
12Total per year (kWh/year)												2560	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	118.4619	105.1551	112.4918	100.5280	98.6032	90.0859	89.7019	92.5003	92.6915	101.9001	106.6032	117.3607	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	147.2322	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	165.6134	183.3577	165.6134	171.1339	165.6134	171.1339	165.6134	165.6134	171.1339	165.6134	171.1339	165.6134	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.0384	331.4424	322.8644	304.6028	281.5509	259.8853	245.4114	242.0074	250.5854	268.8470	291.8989	313.5644	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	37.7232	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	-117.7858	(71)
Water heating gains (Table 5)													
	159.2230	156.4808	151.1987	139.6222	132.5312	125.1193	120.5671	124.3284	128.7382	136.9625	148.0600	157.7429	(72)
Total internal gains													
	723.0445	741.4506	709.8462	685.5285	649.8651	623.3082	598.7616	599.1189	617.6272	641.5925	681.2624	707.0904	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1600	10.6334	0.6300	0.7000	0.7700	23.2679	(74)
East	10.7400	19.6403	0.6300	0.7000	0.7700	64.4649	(76)
South	5.3700	46.7521	0.6300	0.7000	0.7700	76.7268	(78)
West	10.7400	19.6403	0.6300	0.7000	0.7700	64.4649	(80)

Solar gains	228.9245	422.3389	650.9863	908.0559	1094.4165	1116.4311	1064.2044	923.2949	741.1365	487.7390	280.4116	191.7219	(83)
Total gains	951.9689	1163.7894	1360.8325	1593.5844	1744.2817	1739.7392	1662.9660	1522.4138	1358.7637	1129.3316	961.6740	898.8123	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8701	60.9973	61.1225	61.7176	61.8302	62.3599	62.3599	62.4590	62.1548	61.8302	61.6028	61.3668	
alpha	5.0580	5.0665	5.0748	5.1145	5.1220	5.1573	5.1573	5.1639	5.1437	5.1220	5.1069	5.0911	
util living area													
	0.9979	0.9939	0.9814	0.9320	0.8098	0.6179	0.4579	0.5181	0.7853	0.9662	0.9950	0.9984	(86)
MIT	19.6039	19.8224	20.1437	20.5526	20.8440	20.9698	20.9946	20.9902	20.9015	20.4904	19.9693	19.5700	(87)
Th 2	19.9676	19.9695	19.9714	19.9803	19.9820	19.9897	19.9897	19.9912	19.9867	19.9820	19.9786	19.9751	(88)
util rest of house													
	0.9972	0.9919	0.9750	0.9093	0.7545	0.5309	0.3553	0.4093	0.7054	0.9503	0.9929	0.9979	(89)
MIT 2	18.3379	18.6181	19.0262	19.5328	19.8549	19.9732	19.9881	19.9878	19.9214	19.4703	18.8134	18.2998	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6544	18.9192	19.3056	19.7878	20.1022	20.2224	20.2397	20.2384	20.1664	19.7253	19.1024	18.6173	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6544	18.9192	19.3056	19.7878	20.1022	20.2224	20.2397	20.2384	20.1664	19.7253	19.1024	18.6173	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9889	0.9695	0.9041	0.7617	0.5517	0.3810	0.4365	0.7210	0.9451	0.9904	0.9969	(94)
Useful gains	948.0213	1150.8675	1319.3316	1440.8054	1328.5340	959.7977	633.5769	664.5827	979.6845	1067.3175	952.4050	895.9862	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2571.0986	2505.8178	2284.2027	1923.3941	1481.5889	982.9963	636.3556	670.0321	1064.1335	1609.1055	2124.2405	2561.4662	(97)
Space heating kWh													
	1207.5695	910.5266	717.8641	347.4639	113.8728	0.0000	0.0000	0.0000	0.0000	403.0903	843.7216	1239.1171	(98a)
Space heating requirement - total per year (kWh/year)												5783.2258	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	1207.5695	910.5266	717.8641	347.4639	113.8728	0.0000	0.0000	0.0000	0.0000	403.0903	843.7216	1239.1171	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5783.2258	
Space heating per m2											(98c) / (4) =	36.8358	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1207.5695	910.5266	717.8641	347.4639	113.8728	0.0000	0.0000	0.0000	0.0000	403.0903	843.7216	1239.1171	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	1308.3093	986.4860	777.7509	376.4506	123.3725	0.0000	0.0000	0.0000	0.0000	436.7175	914.1079	1342.4887	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	253.3974	223.9660	237.9284	209.5380	203.2711	183.3579	181.2589	188.4525	190.4818	212.1352	225.1787	250.7085	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.0963	86.8659	86.3750	85.1858	82.8137	79.8000	79.8000	79.8000	79.8000	85.4760	86.7392	87.1461	(217)
Fuel for water heating, kWh/month													
	290.9394	257.8295	275.4598	245.9777	245.4560	229.7719	227.1415	236.1560	238.6990	248.1811	259.6044	287.6877	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	34.4112	27.6059	24.8561	18.2106	14.0664	11.4924	12.8319	16.6793	21.6648	28.4254	32.1064	35.3676	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.8750	-92.9822	-129.8761	-141.6969	-149.1333	-137.7636	-135.8791	-129.9186	-119.0697	-104.0504	-73.5737	-58.9890	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-47.0644	-97.8549	-192.4755	-286.2874	-375.9802	-376.9869	-372.7136	-316.8862	-233.9122	-139.1957	-62.5732	-37.3211	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	6265.6834	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3042.9040	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	277.7181	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3880.0592	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)

Total delivered energy for all uses	5792.2463 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6265.6834	0.2100	1315.7935	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3042.9040	0.2100	639.0098	(264)
Space and water heating			1954.8033	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	277.7181	0.1443	40.0833	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1340.8077	0.1352	-181.3274	
PV Unit electricity exported	-2539.2515	0.1262	-320.3909	
Total			-501.7182	(269)
Total CO2, kg/year			1505.0977	(272)
Target Carbon Dioxide Emission Rate (TER)			9.5900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	6265.6834	1.1300	7080.2222	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3042.9040	1.1300	3438.4815	(278)
Space and water heating			10518.7037	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	277.7181	1.5338	425.9733	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1340.8077	1.4999	-2011.0115	
PV Unit electricity exported	-2539.2515	0.4632	-1176.0849	
Total			-3187.0964	(283)
Total Primary energy kWh/year			7887.6814	(286)
Target Primary Energy Rate (TPER)			50.2400	(287)

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Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 4BH-AFF_Be Lean_MEV	Issued on Date	21/11/2022
Assessment Reference	00001	Prop Type Ref	4BH-BUN
Property	1 Bedroom Flat, 4BH-BUN, Saffron Walden, CB11		

SAP Rating	79 C	DER	4.66	TER	11.42
Environmental	96 A	% DER<TER	59.19		
CO_2 Emissions (t/year)	0.46	DFEE	41.61	TFEE	42.98
Compliance Check	See BREL	% DFEE < TFEE	3.17		
% DPER < TPER	18.69	DPER	48.54	TPER	59.70

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---
1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		53.0000 (1b)	x	2.5000 (2b)	=	132.5000 (1b)	-
First floor		53.0000 (1c)	x	2.7500 (2c)	=	145.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.2500	(5)

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2. Ventilation rate
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		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0719 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.2219 (18)
Number of sides sheltered				2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20)	=	0.1886 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2405	0.2357	0.2310	0.2075	0.2027	0.1792	0.1792	0.1745	0.1886	0.2027	0.2122	0.2216	(22b)
Effective ac	0.5289	0.5278	0.5267	0.5215	0.5206	0.5161	0.5161	0.5152	0.5178	0.5206	0.5225	0.5246	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			39.9000	1.1450	45.6870			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			53.0000	0.1100	5.8300			(28a)
External Wall 1	155.0000	45.1000	109.9000	0.1400	15.3860			(29a)
External Roof 1	53.0000		53.0000	0.1100	5.8300			(30)
Total net area of external elements Aum(A, m2)			261.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.9330			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												13.0500	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	90.9830	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.5659	48.4628	48.3618	47.8872	47.7984	47.3850	47.3850	47.3085	47.5442	47.7984	47.9780	48.1658	(38)
Heat transfer coeff													
	139.5489	139.4458	139.3448	138.8702	138.7814	138.3681	138.3681	138.2915	138.5273	138.7814	138.9610	139.1488	(39)
Average = Sum(39)m / 12 =												138.8698	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3165	1.3155	1.3146	1.3101	1.3093	1.3054	1.3054	1.3046	1.3069	1.3093	1.3110	1.3127	(40)
HLP (average)												1.3101	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7886	(42)
Hot water usage for mixer showers													
	70.9748	69.9082	68.3539	65.3801	63.1855	60.7381	59.3470	60.8895	62.5804	65.2082	68.2459	70.7029	(42a)
Hot water usage for baths													
	30.6447	30.1896	29.5487	28.3670	27.4821	26.5010	25.9710	26.6074	27.3004	28.3502	29.5563	30.5411	(42b)
Hot water usage for other uses													
	43.1877	41.6172	40.0467	38.4763	36.9058	35.3354	35.3354	36.9058	38.4763	40.0467	41.6172	43.1877	(42c)
Average daily hot water use (litres/day)												133.1104	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	144.8072	141.7150	137.9494	132.2234	127.5735	122.5745	120.6534	124.4028	128.3571	133.6052	139.4193	144.4317	(44)
Energy conte	229.3392	201.8003	212.0230	181.0072	171.7384	150.7196	145.9199	154.0367	158.2771	181.3009	198.6284	226.1451	(45)
Energy content (annual)										Total = Sum(45)m =		2210.9358	
Distribution loss (46)m = 0.15 x (45)m													
	34.4009	30.2700	31.8035	27.1511	25.7608	22.6079	21.8880	23.1055	23.7416	27.1951	29.7943	33.9218	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	279.6836	247.2727	262.3675	229.7276	222.0829	199.4401	196.2643	204.3811	206.9975	231.6454	247.3488	276.4895	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	279.6836	247.2727	262.3675	229.7276	222.0829	199.4401	196.2643	204.3811	206.9975	231.6454	247.3488	276.4895	(64)
										Total per year (kWh/year) = Sum(64)m =		2803.7010	(64)
12Total per year (kWh/year)												2804	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	116.5308	103.4765	110.7732	99.1612	97.3786	89.0906	88.7939	91.4927	91.6035	100.5581	105.0203	115.4688	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	134.0044	148.3621	134.0044	138.4713	134.0044	138.4713	134.0044	134.0044	138.4713	134.0044	138.4713	134.0044	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	(71)
Water heating gains (Table 5)													
	156.6275	153.9829	148.8887	137.7239	130.8852	123.7370	119.3466	122.9741	127.2271	135.1588	145.8615	155.2000	(72)
Total internal gains													
	624.1391	638.6091	612.2100	590.7220	560.7466	537.5182	516.9386	517.8092	533.4763	554.7312	588.5706	610.9892	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.4000	11.2829	0.7600	0.7000	0.7700	34.9419 (75)
Southeast	12.6000	36.7938	0.7600	0.7000	0.7700	170.9190 (77)
Southwest	6.3000	36.7938	0.7600	0.7000	0.7700	85.4595 (79)
Northwest	12.6000	11.2829	0.7600	0.7000	0.7700	52.4128 (81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	343.7333	614.5206	917.8850	1266.4866	1536.4825	1577.2370	1499.0407	1289.6823	1037.3572	699.9566	416.9973	290.7449	(83)
Total gains	967.8724	1253.1297	1530.0949	1857.2086	2097.2291	2114.7552	2015.9793	1807.4915	1570.8335	1254.6878	1005.5679	901.7341	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7493	52.7883	52.8266	53.0071	53.0410	53.1995	53.1995	53.2289	53.1384	53.0410	52.9725	52.9010	
alpha	4.5166	4.5192	4.5218	4.5338	4.5361	4.5466	4.5466	4.5486	4.5426	4.5361	4.5315	4.5267	
util living area	0.9889	0.9670	0.9120	0.7760	0.5873	0.4141	0.3011	0.3500	0.5819	0.8717	0.9744	0.9917	(86)
MIT	19.9205	20.1708	20.4713	20.7556	20.8884	20.9246	20.9306	20.9293	20.9010	20.6741	20.2304	19.8684	(87)
Th 2	19.8279	19.8287	19.8294	19.8329	19.8336	19.8366	19.8366	19.8372	19.8355	19.8336	19.8323	19.8309	(88)
util rest of house	0.9853	0.9572	0.8884	0.7285	0.5228	0.3409	0.2220	0.2625	0.4942	0.8279	0.9651	0.9890	(89)
MIT 2	18.5940	18.9074	19.2710	19.5890	19.7154	19.7459	19.7490	19.7492	19.7309	19.5165	18.9894	18.5303	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	18.9256	19.2232	19.5711	19.8807	20.0087	20.0406	20.0444	20.0442	20.0234	19.8059	19.2996	18.8648	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9256	19.2232	19.5711	19.8807	20.0087	20.0406	20.0444	20.0442	20.0234	19.8059	19.2996	18.8648	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9509	0.8823	0.7306	0.5328	0.3539	0.2362	0.2782	0.5089	0.8267	0.9596	0.9860	(94)
Useful gains	950.0782	1191.6419	1350.0220	1356.8178	1117.3602	748.3585	476.0757	502.8729	799.4627	1037.2550	964.9405	889.1144	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2040.9900	1997.3153	1821.3865	1524.8867	1153.0862	752.7994	476.5926	503.9639	820.5558	1277.6107	1695.2745	2040.5913	(97)
Space heating kWh	811.6384	541.4125	350.6952	121.0096	26.5802	0.0000	0.0000	0.0000	0.0000	178.8246	525.8405	856.6988	(98a)
Space heating requirement - total per year (kWh/year)												3412.6998	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	811.6384	541.4125	350.6952	121.0096	26.5802	0.0000	0.0000	0.0000	0.0000	178.8246	525.8405	856.6988	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3412.6998	
Space heating per m2											(98c) / (4) =	32.1953	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	219.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	811.6384	541.4125	350.6952	121.0096	26.5802	0.0000	0.0000	0.0000	0.0000	178.8246	525.8405	856.6988	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	370.1041	246.8821	159.9157	55.1799	12.1205	0.0000	0.0000	0.0000	0.0000	81.5434	239.7814	390.6515	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	279.6836	247.2727	262.3675	229.7276	222.0829	199.4401	196.2643	204.3811	206.9975	231.6454	247.3488	276.4895	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	146.8927	129.8701	137.7980	120.6553	116.6402	104.7479	103.0800	107.3430	108.7172	121.6625	129.9101	145.2151	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	35.8007	28.7207	25.8598	18.9460	14.6344	11.9564	13.3500	17.3528	22.5396	29.5732	33.4029	36.7957 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1556.1787 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1472.5320 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	288.9322 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3317.6429 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1556.1787	0.1573	244.7589	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1472.5320	0.1410	207.5862	(264)
Space and water heating			452.3451	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	288.9322	0.1443	41.7018	(268)
Total CO2, kg/year			494.0469	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.6600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1556.1787	1.5822	2462.2120	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1472.5320	1.5213	2240.1157	(278)
Space and water heating			4702.3277	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	288.9322	1.5338	443.1739	(282)
Total Primary energy kWh/year			5145.5016	(286)
Dwelling Primary energy Rate (DPER)			48.5400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.0000 (1b)	x	2.5000 (2b)	=	132.5000 (1b)	-
First floor	53.0000 (1c)	x	2.7500 (2c)	=	145.7500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.2500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1438	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3938	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3347	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4267	0.4184	0.4100	0.3682	0.3598	0.3180	0.3180	0.3096	0.3347	0.3598	0.3765	0.3933	(22b)
Effective ac	0.5911	0.5875	0.5840	0.5678	0.5647	0.5505	0.5505	0.5479	0.5560	0.5647	0.5709	0.5773	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			21.2800	1.1450	24.3664			(27)
Heatloss Floor 1			53.0000	0.1300	6.8900			(28a)
External Wall 1	155.0000	26.4800	128.5200	0.1800	23.1336			(29a)
External Roof 1	53.0000		53.0000	0.1100	5.8300			(30)
Total net area of external elements Aum(A, m2)			261.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.4200			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	30.0000	0.1600	4.8000
E6 Intermediate floor within a dwelling	30.0000	0.0000	0.0000
E14 Flat roof	30.0000	0.0800	2.4000
E16 Corner (normal)	21.0000	0.0900	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0900 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 74.5100 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2717	53.9471	53.6289	52.1342	51.8545	50.5527	50.5527	50.3117	51.0542	51.8545	52.4203	53.0117	(38)
Heat transfer coeff	128.7817	128.4571	128.1389	126.6442	126.3646	125.0628	125.0628	124.8217	125.5642	126.3646	126.9303	127.5217	(39)

Average = Sum(39)m / 12 = 126.6429

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2149	1.2119	1.2089	1.1948	1.1921	1.1798	1.1798	1.1776	1.1846	1.1921	1.1975	1.2030	(40)
HLP (average)												1.1947	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7886 (42)

Hot water usage for mixer showers

70.9748	69.9082	68.3539	65.3801	63.1855	60.7381	59.3470	60.8895	62.5804	65.2082	68.2459	70.7029	(42a)

Hot water usage for baths

30.6447	30.1896	29.5487	28.3670	27.4821	26.5010	25.9710	26.6074	27.3004	28.3502	29.5563	30.5411	(42b)

Hot water usage for other uses

43.1877	41.6172	40.0467	38.4763	36.9058	35.3354	35.3354	36.9058	38.4763	40.0467	41.6172	43.1877	(42c)

Average daily hot water use (litres/day) 133.1104 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8072	141.7150	137.9494	132.2234	127.5735	122.5745	120.6534	124.4028	128.3571	133.6052	139.4193	144.4317	(44)

Energy conte	229.3392	201.8003	212.0230	181.0072	171.7384	150.7196	145.9199	154.0367	158.2771	181.3009	198.6284	226.1451	(45)
Energy content (annual)										Total = Sum(45)m =		2210.9358	
Distribution loss (46)m = 0.15 x (45)m													
	34.4009	30.2700	31.8035	27.1511	25.7608	22.6079	21.8880	23.1055	23.7416	27.1951	29.7943	33.9218	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	278.5819	246.2775	261.2657	228.6614	220.9811	198.3738	195.1625	203.2793	205.9313	230.5436	246.2826	275.3877	(62)
WWHRS	-32.4467	-28.6961	-30.0489	-24.8817	-23.1889	-19.8429	-18.5995	-19.7787	-20.5302	-24.2029	-27.4189	-31.8459	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	246.1351	217.5814	231.2168	203.7797	197.7923	178.5310	176.5630	183.5006	185.4011	206.3408	218.8637	243.5419	(64)
										Total per year (kWh/year) = Sum(64)m =		2489.2472	(64)
12Total per year (kWh/year)												2489	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.6494	102.6804	109.8918	98.3083	96.4972	88.2376	87.9125	90.6113	90.7505	99.6767	104.1673	114.5874	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	134.8960	149.3491	134.8960	139.3925	134.8960	139.3925	134.8960	134.8960	139.3925	134.8960	139.3925	134.8960	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	(71)
Water heating gains (Table 5)													
	155.4428	152.7982	147.7040	136.5392	129.7005	122.5523	118.1619	121.7894	126.0424	133.9741	144.6768	154.0153	(72)
Total internal gains													
	623.8460	638.4115	611.9168	590.4585	560.4534	537.2548	516.6455	517.5160	533.2128	554.4381	588.3071	610.6960	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.4800	11.2829	0.6300	0.7000	0.7700	15.4480	(75)
Southeast	6.7200	36.7938	0.6300	0.7000	0.7700	75.5642	(77)
Southwest	3.3600	36.7938	0.6300	0.7000	0.7700	37.7821	(79)
Northwest	6.7200	11.2829	0.6300	0.7000	0.7700	23.1720	(81)

Solar gains	151.9663	271.6828	405.8018	559.9204	679.2870	697.3048	662.7338	570.1754	458.6211	309.4545	184.3567	128.5399	(83)
Total gains	775.8123	910.0943	1017.7186	1150.3789	1239.7404	1234.5596	1179.3793	1087.6914	991.8339	863.8925	772.6638	739.2359	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1596	57.3040	57.4464	58.1243	58.2530	58.8593	58.8593	58.9730	58.6243	58.2530	57.9933	57.7244	
alpha	4.8106	4.8203	4.8298	4.8750	4.8835	4.9240	4.9240	4.9315	4.9083	4.8835	4.8662	4.8483	
util living area													
	0.9953	0.9892	0.9745	0.9244	0.8071	0.6191	0.4607	0.5170	0.7701	0.9517	0.9898	0.9962	(86)
MIT	19.6222	19.8321	20.1333	20.5295	20.8248	20.9637	20.9930	20.9880	20.8969	20.5062	19.9978	19.5918	(87)
Th 2	19.9081	19.9105	19.9129	19.9242	19.9263	19.9362	19.9362	19.9380	19.9324	19.9263	19.9220	19.9176	(88)
util rest of house													
	0.9937	0.9857	0.9659	0.8992	0.7497	0.5282	0.3524	0.4032	0.6861	0.9302	0.9858	0.9950	(89)
MIT 2	18.3189	18.5873	18.9684	19.4586	19.7846	19.9165	19.9341	19.9340	19.8655	19.4435	18.8081	18.2868	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6447	18.8985	19.2596	19.7263	20.0446	20.1783	20.1988	20.1975	20.1233	19.7092	19.1056	18.6131	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6447	18.8985	19.2596	19.7263	20.0446	20.1783	20.1988	20.1975	20.1233	19.7092	19.1056	18.6131	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9910	0.9811	0.9592	0.8937	0.7567	0.5498	0.3796	0.4317	0.7026	0.9247	0.9816	0.9927	(94)
Useful gains	768.8391	892.8981	976.1776	1028.0508	938.0713	678.7370	447.6446	469.5293	696.8639	798.7993	758.4198	733.8696	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1847.3369	1798.2076	1635.0024	1371.0877	1054.4631	697.6385	450.0766	474.0116	756.3146	1151.0755	1523.8699	1837.9789	(97)
Space heating kWh													
	802.4024	608.3680	490.1657	246.9865	86.5954	0.0000	0.0000	0.0000	0.0000	262.0935	551.1241	821.4573	(98a)
Space heating requirement - total per year (kWh/year)												3869.1929	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	802.4024	608.3680	490.1657	246.9865	86.5954	0.0000	0.0000	0.0000	0.0000	262.0935	551.1241	821.4573	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3869.1929	
Space heating per m2											(98c) / (4) =	36.5018	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	802.4024	608.3680	490.1657	246.9865	86.5954	0.0000	0.0000	0.0000	0.0000	262.0935	551.1241	821.4573	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	869.3417	659.1202	531.0571	267.5911	93.8196	0.0000	0.0000	0.0000	0.0000	283.9582	597.1008	889.9863	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	246.1351	217.5814	231.2168	203.7797	197.7923	178.5310	176.5630	183.5006	185.4011	206.3408	218.8637	243.5419	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.5097	86.2378	85.7020	84.4921	82.3412	79.8000	79.8000	79.8000	79.8000	84.5973	86.0417	86.5674	(217)
Fuel for water heating, kWh/month													
	284.5174	252.3038	269.7916	241.1820	240.2107	223.7230	221.2569	229.9506	232.3322	243.9095	254.3693	281.3322	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	28.0287	22.4857	20.2459	14.8330	11.4574	9.3608	10.4518	13.5857	17.6465	23.1531	26.1514	28.8077	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.1814	-67.2212	-95.6234	-106.3444	-113.6598	-105.6765	-104.3026	-98.9133	-89.3200	-76.2412	-52.6910	-41.7333	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-29.4210	-61.6242	-122.0153	-182.6131	-240.8754	-241.8621	-239.0785	-202.7511	-148.9990	-87.9887	-39.2299	-23.2914	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4191.9750	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2974.8792	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												226.2078	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2619.6578	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)

Total delivered energy for all uses 4859.4042 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4191.9750	0.2100	880.3147	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2974.8792	0.2100	624.7246	(264)
Space and water heating			1505.0394	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	226.2078	0.1443	32.6488	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-999.9081	0.1348	-134.8115	
PV Unit electricity exported	-1619.7497	0.1260	-204.0796	
Total			-338.8910	(269)
Total CO2, kg/year			1210.7264	(272)
Target Carbon Dioxide Emission Rate (TER)			11.4200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4191.9750	1.1300	4736.9317	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2974.8792	1.1300	3361.6135	(278)
Space and water heating			8098.5452	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	226.2078	1.5338	346.9651	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-999.9081	1.4983	-1498.1617	
PV Unit electricity exported	-1619.7497	0.4625	-749.1189	
Total			-2247.2807	(283)
Total Primary energy kWh/year			6328.3305	(286)
Target Primary Energy Rate (TPER)			59.7000	(287)

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