TwoEighty
CONSULTING

Colne Spring Eco-Living

Energy and Sustainability Statement
October 2024

Table of Contents

0. Executive Summary **3**

1. Introduction **4**

1.1 Site Overview 4

1.2 Site Context 4

2. Overview of Policies **5**

2.1 National Policy 5

2.2 Local Policy: Local Plan 6

2.3 Local Policy: Regulation 19 Local Plan 6

3. Methodology **7**

3.1 Energy Hierarchy Application 7

3.2 Energy Modelling 7

3.3 LETI Energy Strategy 7

4. Energy: Be Lean **8**

4.1 Passive Measures 8

4.2 Active Measures 8

4.3 Be Lean Results 8

4.4 Passive Overheating Mitigation Measures 9

5. Energy: Be Clean **10**

5.1 Area Wide Energy Networks 10

6. Energy: Be Green **11**

6.1 Renewable and Low Carbon Technologies Appraisal 11

6.2 Site Constraints Review 11

6.3 Included Low Carbon Technologies: Air Source Heat Pump 12

6.4 Included Renewable Technologies: Solar PV 13

6.5 Be Green Results 14

7. Carbon Reduction Summary **15**

8. Sustainability **16**

8.1 Sustainability Summary 16

8.2 Management 16

8.3 Health and Wellbeing 16

8.4 Energy 16

8.5 Transport 16

8.6 Water 17

8.7 Waste 17

8.8 Flood Risk 17

8.9 Materials and Embodied Carbon 17

8.10 Pollution 18

8.11 Land Use and Ecology 18

8.12 Sustainability Conclusion 18

9. Conclusion **19**

10. Appendices **20**

10.1 Appendix A – SAP Worksheets 21

Audit Sheet

Revision	Issued for	Date	Author
0	Draft	08/10/2024	OE
1	Client Review	10/11/2024	OE
2	Revised	17/10/2024	OE
3	Submission	28/10/2024	OE

Executive Summary

This Energy and Sustainability Statement reports how the proposed scheme at Colne Spring, Colney Heath, AL4 0PB has responded to local policy requirements regarding sustainability, energy and climate change.

This assessment is prepared to support the full planning application for:

The construction of 6x single storey and 3x double storey dwellings, a covered social hub, community garden, allotments and associated landscaping.

This assessment has been prepared in line with the requirements of St Alban's existing and draft local policy surrounding Energy and Climate Change. The scheme complies with all relevant policies contained the City and District of St Albans Local Plan (1994), St Albans Draft Local Plan (Regulation 19 Publication).

The energy strategy follows the energy hierarchy; Be Lean, Be Clean, Be Green to maximise the carbon reduction in lieu of the scheme's sustainability vision. The proposed energy strategy is set out in this report and the scheme achieves an on-site **CO2 reduction of 102% demonstrating that Net-Zero regulated carbon can be achieved.**

With regards to sustainability, the scheme aspires to reduce its environmental impact by incorporating sustainable measures across the design. Additional sustainability measures that will be integrated are contained in the body of this report.

Table 1: Site-wide Regulated domestic carbon dioxide savings achieved through the energy hierarchy.

	Regulated domestic carbon dioxide emissions	
	Tonnes CO2 saving per annum	% Reduction
Be Lean – Savings from demand reduction	2.4	25%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	7.4	77%
Total regulated carbon dioxide reduction	**9.8**	**102%**

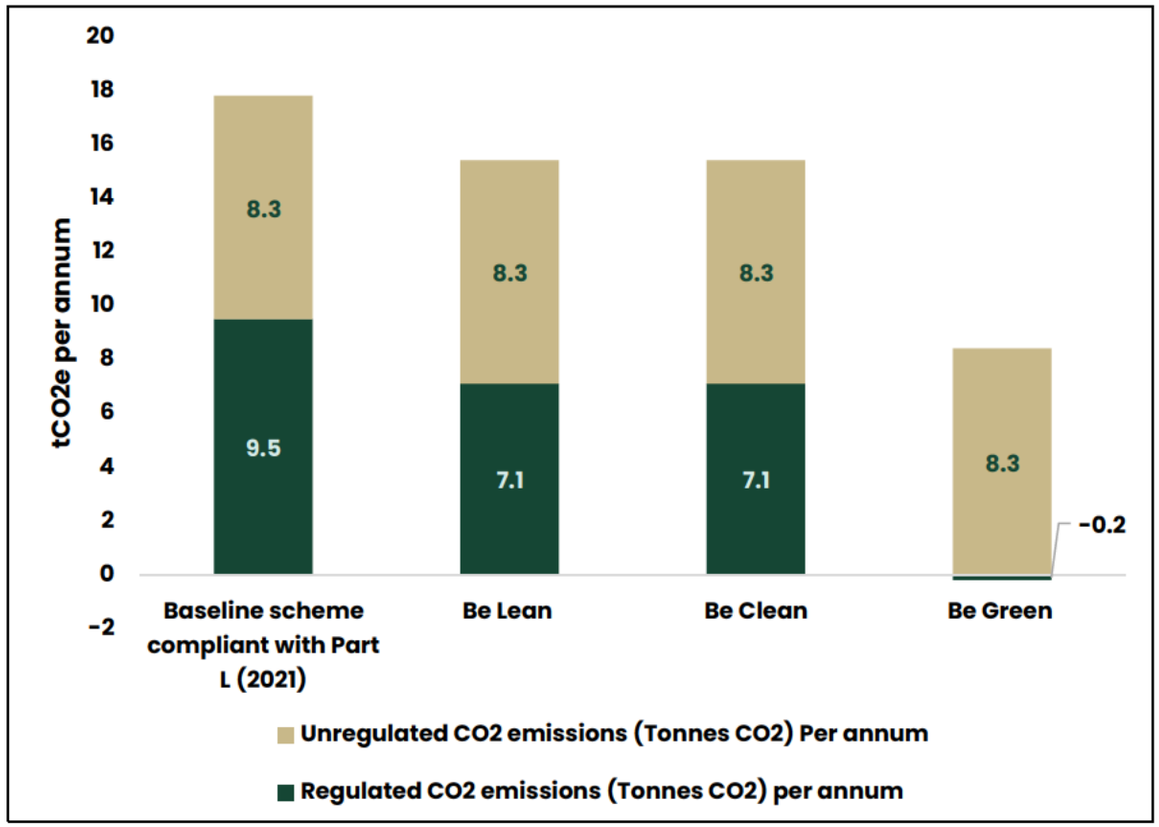

Figure 1: Carbon dioxide emissions per annum at the proposed scheme having utilised the Energy Hierarchy.*

**SAP 10.2 Carbon Factors have been used to assess the scheme, with the following emission rates:*

- *Natural Gas: 0.210kgCO2/kWh*
- *Grid Electricity: 0.136 kgCO2/kWh*

1. Introduction

1.1 Site Overview

TwoEighty are appointed to prepare this Energy and Sustainability Statement for the proposed scheme at Colne Spring, Colney Heath, AL4 0PB. The site plan is shown in Figure 2 to the right.

The proposed development entails the construction of 6x single storey and 3x double storey dwellings, a covered social hub, community garden, allotments and associated landscaping.

The site is situated within the jurisdiction of St Albans City and District Council. This assessment details how the proposed scheme adheres to local policy requirements regarding energy and sustainability.

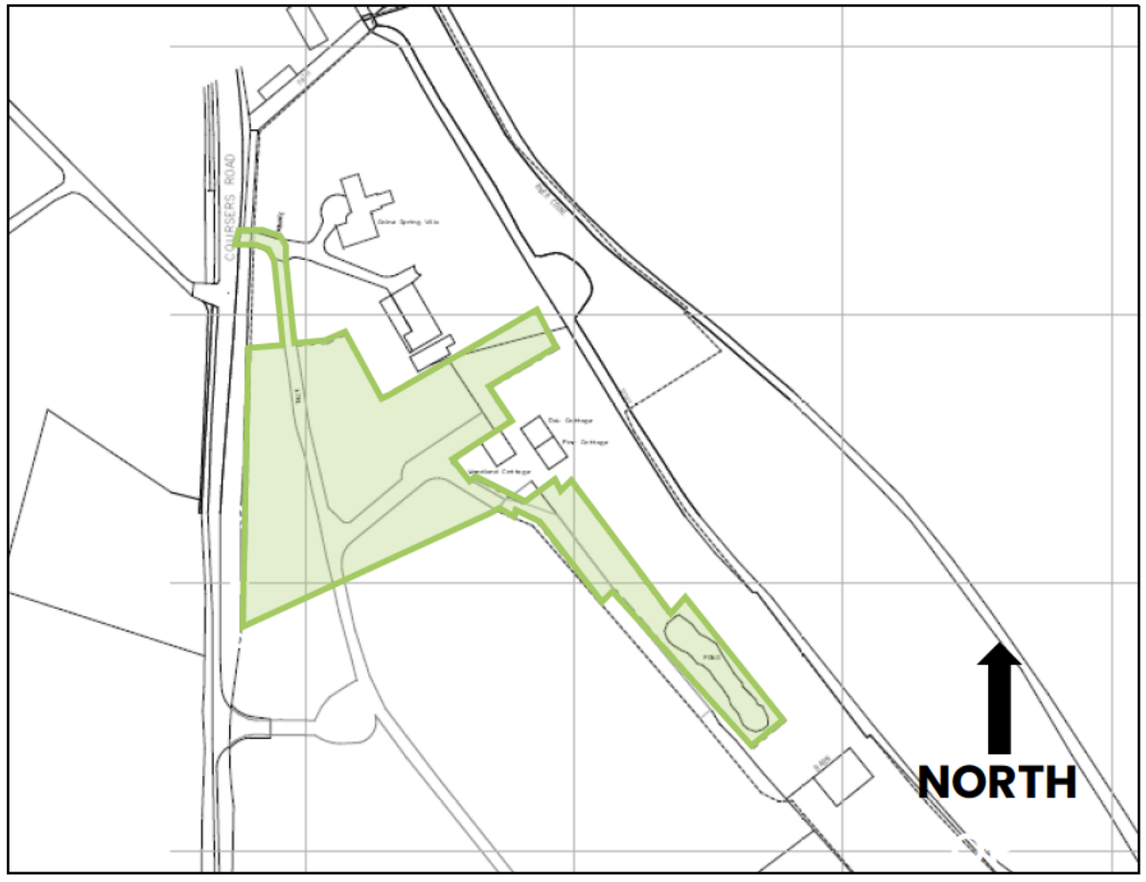

Figure 2: Proposed development location (green).

2. Overview of Policies

2.1 National Policy

The National Planning Policy Framework (NPPF) (December 2023) establishes the Government's planning policies for England and denotes how these are expected to be applied. It provides a clear framework for which local authorities can use to develop their own distinctive local and neighbourhood plans. At the heart of the NPPF is a presumption in favour of sustainable development, which should be a core principle of plan making and decision taking. The core elements of the NPPF relating to sustainability focused decisions are listed below:

Plans and decisions should apply a presumption in favour of sustainable development. For plan-making this means that:

a) all plans should promote a sustainable pattern of development that seeks to: meet the development needs of their area; align growth and infrastructure; improve the environment; mitigate climate change (including by making effective use of land in urban areas) and adapt to its effects;
b) strategic policies should, as a minimum, provide for objectively assessed needs for housing and other uses, as well as any needs that cannot be met within neighbouring areas, unless: i. the application of policies in this Framework that protect areas or assets of particular importance provides a strong reason for restricting the overall scale, type or distribution of development in the plan area; or ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole. For decision-taking this means:
c) approving development proposals that accord with an up-to-date development plan without delay; or
d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:
    i. the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed; or
    ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.

The NPPF also acknowledges that the planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure. To this extent, the policies relevant to procuring a low carbon future include:

New development should be planned for in ways that:

a) 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
b) 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:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts);
b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for colocating potential heat customers and suppliers.

2. Overview of Policies

2.2 St Albans District Local Plan Saved and Deleted Policies Version (July 2020)

The current adopted Local Plan in St Albans is the District Local Plan Review (1994). This is in the process of being replaced by a new Local Plan. The policies listed in the List of Saved Policies (July 2020) are the remaining operational policies that guide development in the district.

The local plan details that energy conservation is an important feature within the district, and the best current energy practices should be achieved without prejudice to the principles of good design and appearance.

2.3 St Albans District Draft Local Plan 2041

St Albans council are in the process of developing a new Local Plan. The intention of the plan is to provide a blueprint for future development in the district, whilst also helping tackle Climate Change and improve biodiversity. The Draft Local Plan is currently undergoing Regulation 19 consultation and is at the pre-submission publication stage. It is envisioned that the local plan will be adopted in March 2026.

Although the document is not currently material in the determination of planning applications, the proposed development has significant sustainability aspirations, and therefore, considering this, has made efforts to comply with draft policies relating to Energy and Sustainability contained within the Draft Local Plan. The policies deemed relevant to this energy and sustainability statement include:

- **Strategic Policy SP2 – Responding to the Climate Emergency**
- **CE1 – Promoting Sustainable Design, Construction and Building Efficiency**
- **CE2 Renewable and Low Carbon Energy**

The policies detailed above encourage and require new development to demonstrate adaptation and mitigation to climate change, minimise carbon and energy use through design and construction, use low embodied carbon materials and maximise the use of renewable and low carbon energy. The proposed development has adhered to all principles through a sustainability focused design.

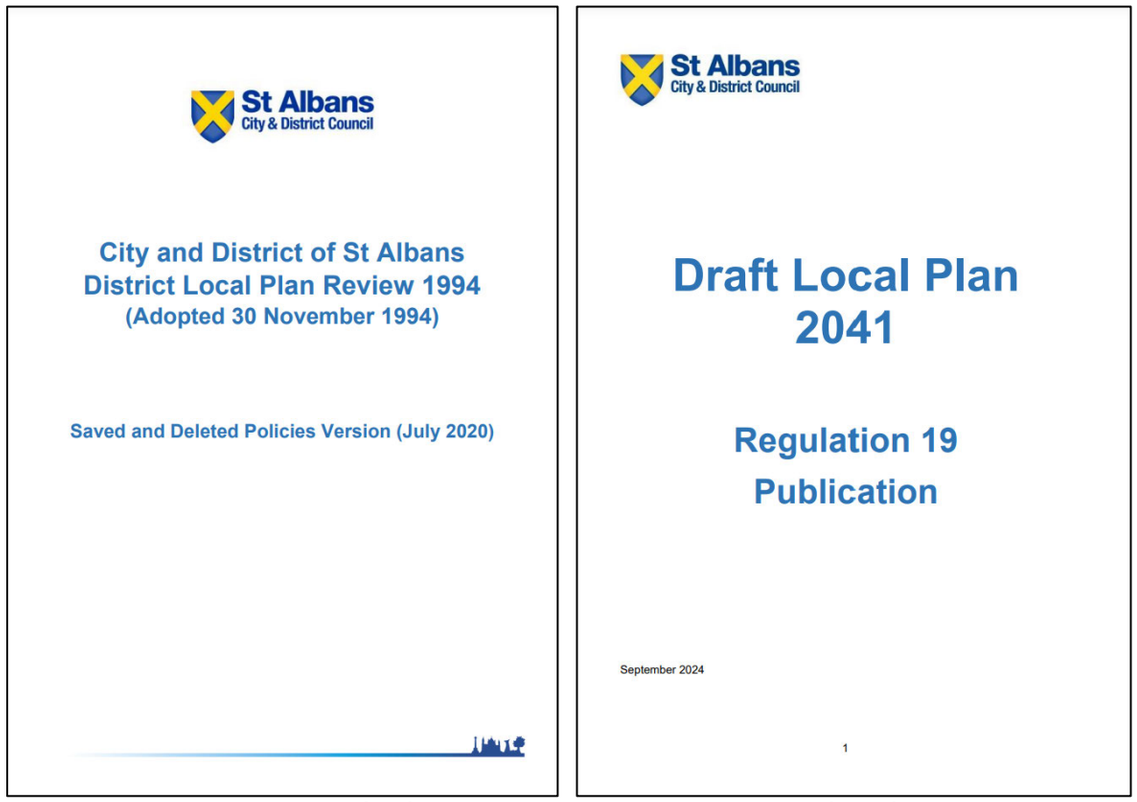

Figure 3: St Albans Local Plan (Left) and Regulation 19 Draft Local Plan (Right).

3. Methodology

3.1 Energy Hierarchy Application

In accordance with best practice, the proposed scheme has adopted the Energy Hierarchy, comprised of:

- Be Lean – use less energy; achieved through implementation of building envelope upgrades and passive design measures.
- Be Clean – supply energy efficiently; connecting to existing or future District Heating networks.
- Be Green – use renewable technology; achieved through the implementation of green measures, such as Air Source Heat Pumps and Solar PV panels.

3.2 Energy Modelling

The latest version (SAP 10.2) of SAP software has been used to model the proposed scheme and accordingly, SAP 10.2 carbon factors have also been used. For the purposes of this report, renewable technology includes the provision of low carbon technologies such as Heat Pump technologies and PV panels.

For the purposes of 'Be Lean' energy modelling, space heating and domestic hot water is provided by gas boilers with 89.5% efficiency, to standardise a target for comparison of energy efficiency. The 'Be Green' stage of the energy modelling then utilises an all-electric energy strategy comprised of Air Source Heat Pumps (ASHPs) and Solar Photovoltaic Panels (PV), which is the proposed energy strategy for this scheme.

The residential portion of the scheme has been assessed using SAP software at each stage of the energy hierarchy. The SAP worksheets are included in the appendices of this report. The scheme has been modelled utilising the latest drawing set received from Create Design on the 26th September 2024.

3.3 LETI Climate Emergency Design Guide

The London Energy Transformation Initiative (LETI) is a network of professionals in the built environment who are working to achieve a net zero carbon future for the UK. LETI has created several resources to help schemes achieve net zero carbon, this scheme has utilised the Emergency Design Guide to inform its design and achieve regulated net-zero carbon on-site.

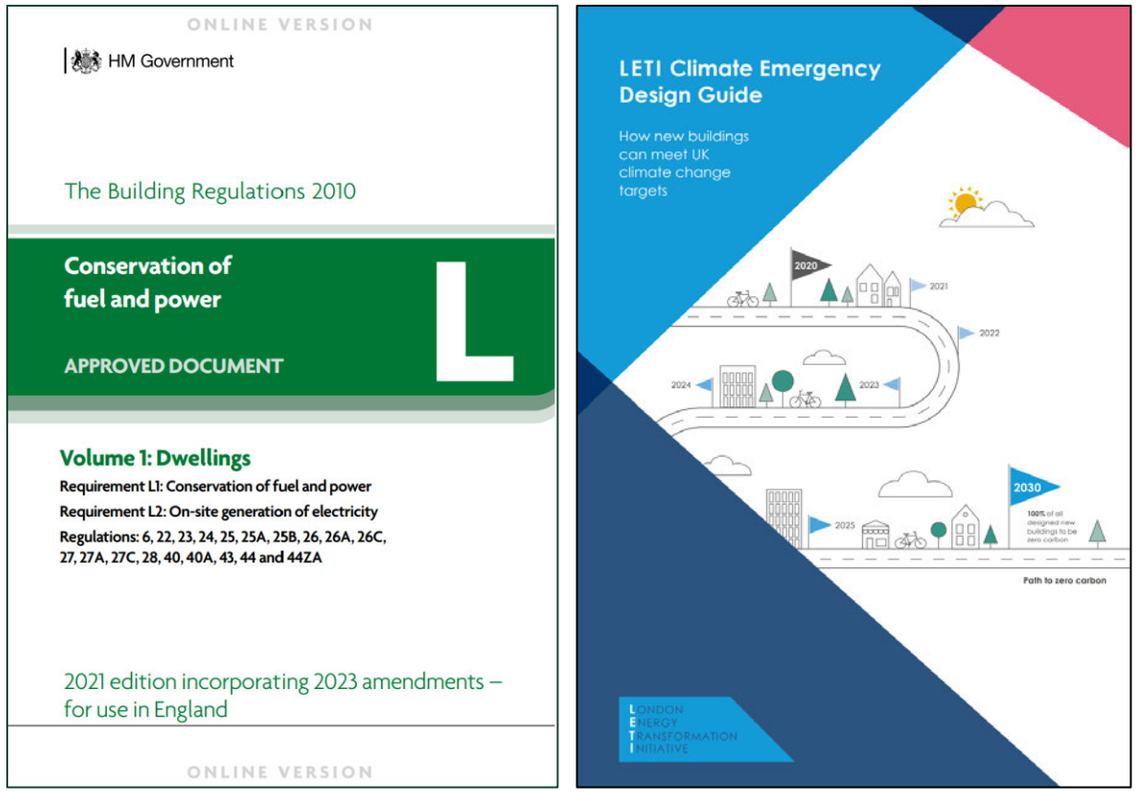

Figure 4: Building Regulations Part L (2021) (Left), LETI Climate Emergency Design Guide (Right).

4. Energy: Be Lean

Be Lean refers to the passive design and energy efficient solutions to minimise energy demand on-site.

4.1 Passive Measures

The following passive design measures will be included in the design to reduce energy demand and subsequent CO2 emissions emanating from the proposed development. The proposed building fabric values represent a significant improvement in comparison to the Part L (2021) backstop values and are extracted from LETI best-practice guidance. The following typical envelope performance characteristics and passive design measures will be included (see Table 2).

Table 2: Building fabric parameters included in the proposed scheme's energy model.

Parameter	Input	Unit
Floor U-Value	0.08	W/m2K
Roof U-Value	0.10	W/m2K
External Walls U-Value	0.13	W/m2K
Glazing U-Value	0.8 (Triple Glazing)	W/m2K
Glazing G-Value	0.68 (Default)	-
Frame Factor	0.7 (Default)	-
Thermal Mass Parameter	250 (Medium)	kJ/m2K
Thermal Bridge Y-Value	<0.1 (Default)	-
Ventilation Method	Natural Ventilation	-
Other Measures	Wastewater Heat Recovery	Horizontal System (55% Efficiency)
Air Permeability	1.0 @ 50Pa (m3/(h.m2))	-

The proposed building fabric will support in maximising energy efficiency, reducing space heating demand, whilst also providing thermal mass to support in passive cooling. The high-performance triple glazing will minimise heat loss through glazed areas and reduce levels of solar transmittance in warmer periods.

A low air permeability for all dwellings on site has been targeted to minimise heat loss. All units will be capable of capitalising on the benefits of cross-ventilation. The site benefits from an orientation that suits sunlight and daylight access. These measures support the scheme in achieving a site wide Be Lean reduction of 25%.

4.2 Active Measures

To support the high performing building envelope, several active Be Lean measures have also been included to further reduce energy consumption and increase occupant wellbeing.

The scheme will benefit from high efficiency LED lighting throughout, with a minimum efficacy of 100 limens/Watt. Wastewater Heat Recovery Systems (WWHRS) are proposed to capture waste heat and reduce domestic hot water demand. Owing to the single-storey design of most of the dwellings, these systems will be horizontal, and similar units indicate efficiencies of around 55%.

4.3 Be Lean Results

The proposed scheme also has a Dwelling Fabric Energy Efficiency (DFEE) score of 38.75 kWh/m2, which exceeds the Target Fabric Energy Efficiency (TFEE) rating of 51.14 kWh/m2, representing a fabric efficiency improvement of 24% against Building Regulations Part L (2021).

The regulated CO2 savings made through the implementation of these Be Lean measures results in a **25% CO2 reduction** by comparison to the Part L compliant Baseline, or a 2.4 tonne CO2 reduction. This reduction demonstrates an excellent energy efficiency with the scheme adopting the fabric first approach, indicating exemplary performance.

4. Energy: Be Lean

4.4 Passive Overheating Mitigation Measures

Whilst the Be Lean stage predominantly relates to Energy Reduction through design, passive measures to mitigate overheating risk have also been considered, and include:

- Minimising internal heat through fully insulated pipework.
- Reducing heat entering through the use of, ~200mm window reveals.
- Openable windows with large free area to maximise passive ventilation to habitable spaces.
- Careful design of internal spaces to facilitate natural and cross-ventilation as much as possible at the scheme.
- External shutters will be provided to south facing elevations.
- Generous overhangs (ranging from 900mm to 12oomm) to shade windows and glazed doors from direct sunlight in summer months.
- Active cooling has been avoided in any residential application due to the increased energy consumption associated with its use.

It is envisioned that through the combination of the above measures, and by adopting principles included within Part O (2021) Building Regulations, the overheating risk of the scheme is reduced and well adapted to future climate risks.

5. Energy: Be Clean

Be Clean refers to measures that serve to reduce the overall emissions of the development using either District Heating Networks or Combined Heat and Power (CHP) engines. This can be achieved through exploiting local energy resources in proximity to the site boundary, such as secondary heat. The Be Clean stage is reviewed after development has made all reasonable efforts to reduce energy demand at the Be Lean Stage.

5.1 Area Wide Energy Networks: Existing and Planned

The first stage in assessing feasibility of the Be Clean stage is to evaluate localised opportunities for connecting to District Heating Networks (DHN) that are either already existing or planned within the vicinity of the proposed development.

An investigation has been carried out to determine the presence of any area wide district heating networks in the area or if any are planned in the future. This investigation has been conducted utilising the Department for Energy Security and Net Zero's (DESNZ) Heat Network Planning Database.

The investigation concluded that there are no District Heat Networks, either in situ or proposed, in vicinity of the site. In addition, as a development of only nine energy-efficient residential units, it is not envisioned that the on-site space heating and domestic hot water demand would be sufficiently large enough to warrant any form of on-site communal systems. Therefore, there are no carbon savings at this stage of the energy hierarchy.

6. Energy: Be Green

Once all Be Lean and Be Clean measures have been incorporated into the design, the scheme should then look to reduce the overall emissions of the development through the inclusion of renewable and low carbon technologies such as Air Source Heat Pumps or Solar Photovoltaic Panels (PV panels).

6.1 Renewable and Low Carbon Technologies Appraisal

The following renewable and low carbon technologies were reviewed for their compatibility with the proposed scheme and discussed with the design team:

- **Solar Photovoltaic Panels (PV):** PV panels generate electricity on site through exposure to solar radiation.
- **Solar Thermal Panels:** Solar Thermal panels capture long-wave radiation and use it to heat fluid contained in vacuum sealed circuits.
- **Biomass Heating:** Biomass relies on the combustion of organic material such as woodchips to provide space heating and domestic hot water.
- **Air Source Ground Heat Pumps (ASHPs):** ASHPs work by capturing energy from the ambient outdoor air and use it to evaporate and compress refrigerant. This compression generates heat. ASHPs can be used for both space heating and/or domestic hot water supply.
- **Ground Source Heat Pumps (GSHPs):** GSHPs capture heat from the earth or sub-terrain aquifers and use this heat to evaporate and compress refrigerant; generating heat.

6.2 Site Constraints Review

A review of the potential low carbon technologies listed above illustrated that Air Source Heat Pumps were best suited to the proposed scheme, partially for their ability to provide both space heating and domestic hot water at very high efficiencies. Solar Photovoltaic (PV) panels have also been deemed suitable for the site, owing to the large south facing roof areas of the scheme.

Biomass was ruled out as a Be Green measure, owing to its requirements for large storage areas for fuel, and equally because of the potential impact on local Air Quality. Any combustion process can emit oxides of nitrogen and particulate matter.

Ground Source Heat Pumps were assessed for their feasibility at the site, however due to complications with both their requirement for borehole or slinky arrangements and subsequent potential for further environmental complications, they were ruled out.

Solar Thermal panels were considered, however priority was given toward Solar Photovoltaic Panels, as these can produce renewable energy to reduce the demand on the grid for both regulated and unregulated appliances and are therefore more versatile for occupants needs.

Further information regarding the chosen technologies for the site can be found overleaf.

6. Energy: Be Green

6.3 Included Low Carbon Technologies: Air Source Heat Pump

The scheme has opted to utilise an individual wet Air Source Heat Pump (ASHP) system to provide space heating and domestic hot water (DHW) for the residential units.

Heat Pumps work by extracting energy from the ambient air temperature outside, and using it to evaporate and compress refrigerant, which in turn, generates hot water or air. They capture the energy from ambient air via an external condenser unit (Figure 6), which connects to an internal heat pump unit. It is currently proposed that the condensers will be discreetly situated at the scheme, away from any local sensitive noise receptors.

All water generated by the Heat Pump system will be stored in a well-insulated hot water cylinder. The space will be heated using an underfloor heating system to maximise efficiency. Further details, including specification of systems, will be mapped out at the detailed design stage. The Heat Pumps will seek to comply with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) criteria and the Microgeneration Certification Scheme (MCS) for Heat Pump Certification.

Table 3: Summary of Space Heating and Domestic Hot Water Strategy at the Be Green Stage.

Space Heating and DHW Strategy	Type	Details
Domestic Space Heating System	ASHP	175% default efficiency. (MCS)
Domestic Heating Emitter	Underfloor Heating	Wet System
Domestic Hot Water System	ASHP	175% default efficiency. (MCS)
DHW Storage	Yes	~200 litres, 150 mm foam insulation

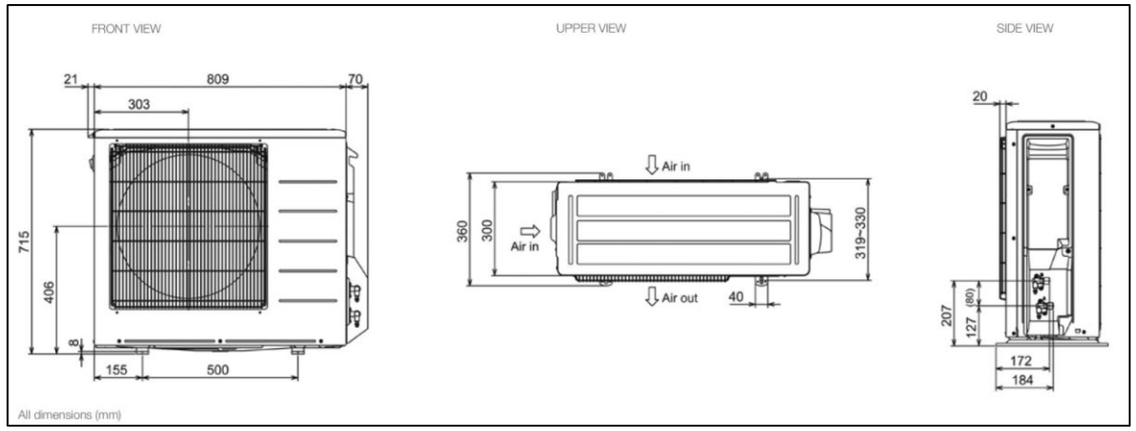

Figure 5: Dimensions of a Mitsubishi external condenser unit.

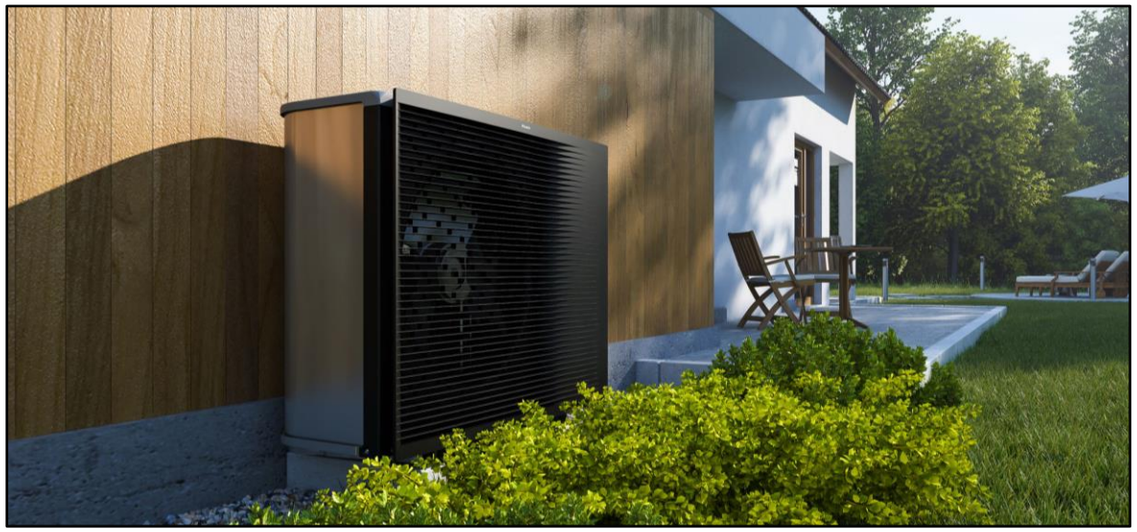

Figure 6: Indicative example of Daikin Altherma External Condenser (Source: Daikin).

6. Energy: Be Green

6.4 Included Renewable Technologies: Solar Photovoltaic (PV) Panels

The proposed scheme intends to maximise its carbon reduction and reduce its environmental impact as much as possible. Therefore, solar PV will be included at the site. This will enable future residents to utilise the energy themselves, reducing the primary energy demand from the grid.

The scheme has space for approximately 156 PV panels to the roof area of the dwellings and the covered social hub, indicated in green in the figure to the right, achieving a total estimated annual carbon saving of approximately 2.6 tonnes CO2e.

Table 4: Summary of proposed Solar PV details.

Solar PV Detail	Quantum	Unit
Approx PV array size	275	M2
Length of individual panel	1.6	M
Width of individual panel	1.1	M
Total panel size	1.76	m2
Assumed panel power	450	Watts/panel
Inclination of panel	30	Degrees
Assumed number of panels	156	#
PV Peak power	70.2	kWp
Total CO2 savings (p/a)	**2.6**	**tCO2**

Figure 7: Space allocated for Solar PV (green).

6. Energy: Be Green

6.5 Be Green Results

In summary, the proposed scheme benefits from the following low-carbon and renewable technologies on-site:

- **Individual Air Source Heat Pumps**
- **Solar Photovoltaic Panels (PV) (70 kWp)**

The proposed development achieves a CO2 reduction of 77% at the be green stage of the energy hierarchy, bringing the total CO2 reduction to 102%, demonstrating Net-Zero from an operational regulated carbon perspective, highlighting the sustainability credentials of the scheme.

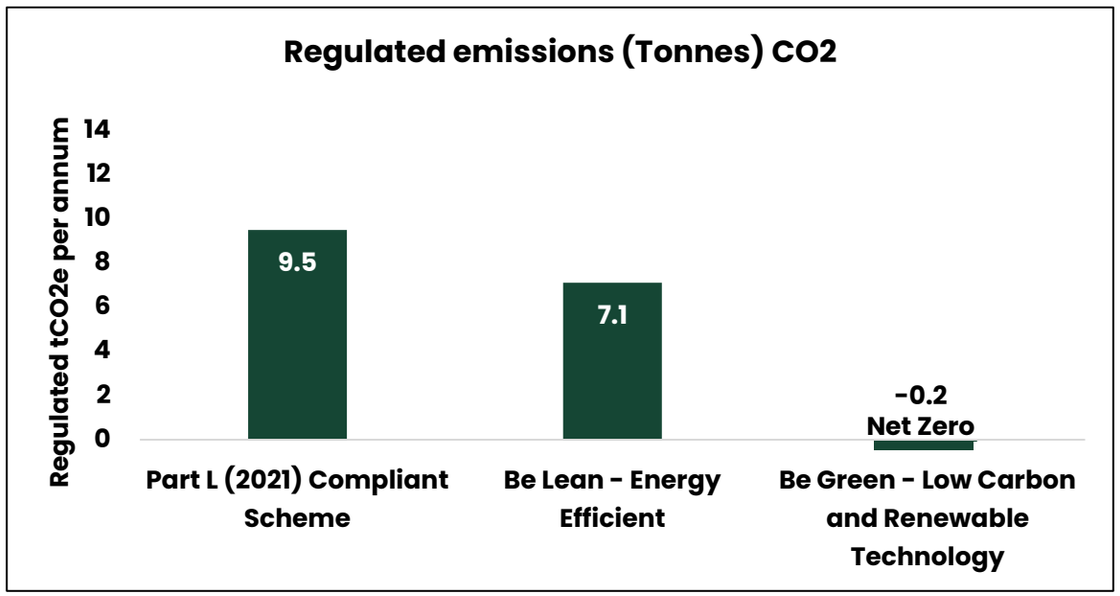

Figure 8: Be Green regulated carbon savings.

Table 15 Site-wide Regulated domestic carbon dioxide savings achieved through the energy hierarchy.

	Regulated domestic carbon dioxide emissions	
	Tonnes CO2 saving per annum	% Reduction
Be Lean – Savings from demand reduction	2.4	25%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	7.4	77%
Total regulated carbon dioxide reduction	**9.8**	**102%**

7. Site Wide Carbon Reduction Summary

The proposed energy strategy follows the energy hierarchy as stipulated in local policy.

The scheme has adopted the Energy Hierarchy, achieving a 25% carbon reduction the Be Lean Stage, and opting for a low-carbon individual Air Source Heat Pump solution with Solar PV at the Be Green Stage, resulting in an additional 77% carbon reduction.

The scheme achieves an overall **on-site regulated CO2 reduction of 102%**, to achieve net-zero from an operational regulated carbon perspective.

Table 6: Summary of carbon dioxide emissions from the baseline scheme.

	Carbon dioxide emissions (tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline Scheme Compliant with Part L (2021) Building Regulations	9.5	8.3
After application of Energy Hierarchy at Colne Spring (Proposed Scheme)	**-0.2**	**8.3**

Table 7: Percentage of carbon dioxide reductions achieved through use of energy hierarchy.

	Regulated domestic carbon dioxide savings	
	Tonnes CO2 per annum	% Reduction
Be Lean – Savings from demand reduction	2.4	25%
Be Clean – Savings from district energy	0.0	0%
Be Green – Savings from renewable energy	7.4	77%
Total regulated carbon dioxide emission savings at Colne Spring	**9.8**	**102%**

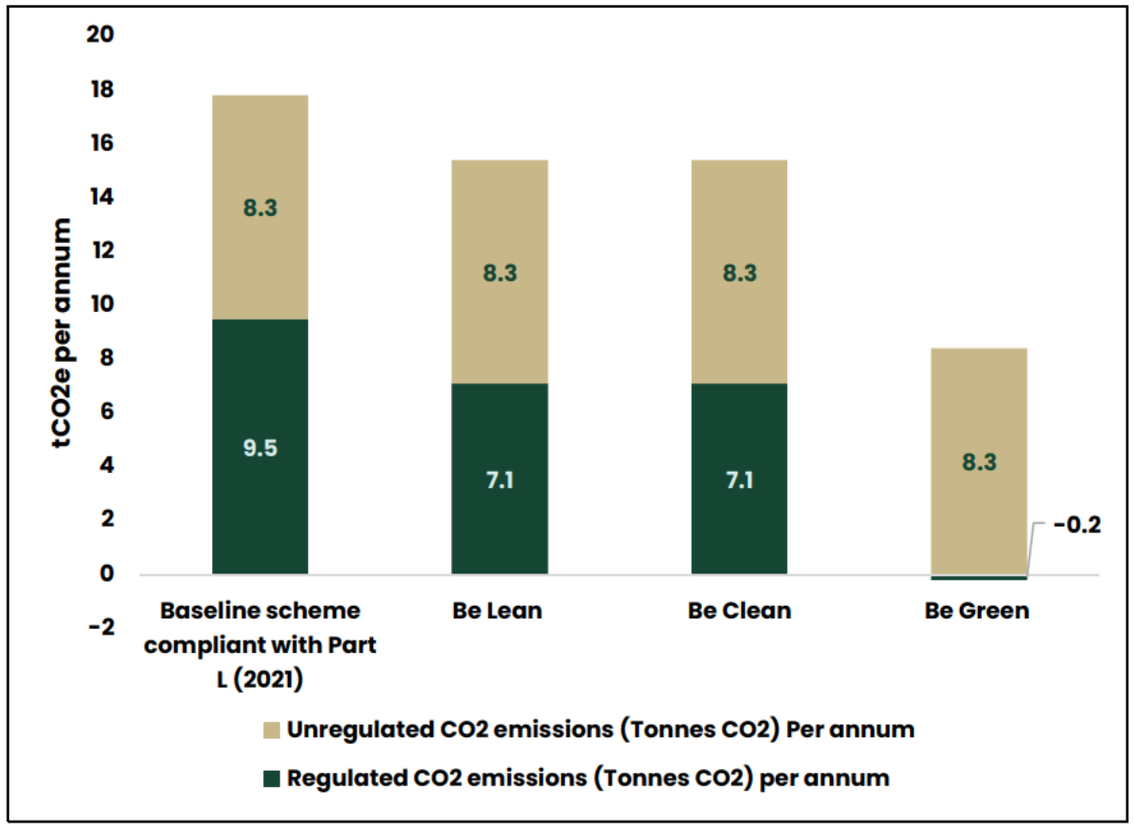

Figure 9: Carbon emissions summary of the proposed scheme across each stage of the energy hierarchy.

8. Sustainability

8.1 Sustainability Summary

Sustainability is a core focal point of the design which constitutes the construction of energy efficient dwellings. The scheme's target is to meet or exceed the required carbon reduction target, and compliance at the design stage has been demonstrated in the body of this report.

Additional sustainability measures that will be incorporated and adhered to are detailed below, to assist with compliance with both local and regional policies regarding Energy and Sustainability.

8.2 Management

To ensure that the construction site is managed in a way that is not detrimental to the environment or neighbours, the contractor will be selected with consideration of their ability to comply with the principles of the Considerate Constructors Scheme. The principal contractors and subcontractors will be encouraged to monitor their energy and water consumption on-site to promote conservation use and all timber used will be legally harvested and FSC certified.

To ensure that the proposed building services and energy strategy are sufficiently installed, the scheme will look to achieve MCS certification for the Air Source Heat Pumps and Solar Photovoltaic Panels proposed.

Post completion, a building user guide will be provided to occupants to ensure that the occupants are familiar with the building systems and to answer any questions that might impact on the use of the space. This will ensure that the proposed scheme is used in an efficient manner.

8.3 Health and Wellbeing

The development is designed to encourage a healthy and safe internal and external environment. All habitable spaces will look to meet daylight targets set by the Building Research Establishment's publication on *Site Layout: Planning for Daylight and Sunlight – A guide to good practice* (2022).

Building materials will be specified to improve both the thermal efficiency of the units, and to improve sound insulation between dwellings and external noise sources.

All buildings will be capable of using passive ventilation methods to ensure a constant and fresh flow of air. Cross ventilation has been maximised in accordance with best practice to reduce overheating risk in hotter periods.

8.4 Energy

The proposed scheme demonstrates a carbon reduction that equates to a 9.8 tonne CO2 reduction beyond Building Regulations Part L (2021) requirements, to achieve net-zero on-site for regulated operational carbon.

To further support with energy conservation, the scheme will benefit from the ability to display energy consumption data and record energy use, which will enable residents to reduce their unregulated energy use.

Where white goods are provided to the units, the scheme will look to procure A-rated energy efficient appliances where feasible. This will reduce both energy consumption and carbon emissions from appliance use within the units.

All external lighting will use energy efficient bulbs and operate on either a timer or passive infrared (PIR) sensor to minimise use when the spaces aren't in use.

8.5 Transport

To promote the use of public transport, occupants will be provided with details of the local public transport connections in the vicinity of the site. Several bus stops are approximately 600m to the north-east of the site along Tollgate Road, providing frequent connections to bus routes 200, 230, 305, 312, 355 and 356. These services offer connections between Birchwood, Potters Bar, Forty Hill, Welwyn Garden City and Bush Hill Park. In addition, a site shuttle bus will be provided free of use to residents to London Colney Fields (or shopping areas), along with zip cars on-site to reduce the need for private vehicle travel.

8. Sustainability

8.5 Transport Continued

St Albans Railway and Hatfield Railway station are equally located approximately 6km to the site, equating to a 30-minute cycle. Hatfield is served by the Great Northen and Thameslink lines, and St Albans is also served by Thameslink services. Therefore, residents have a reasonable public transport accessibility from the site.

To promote active travel, the site will be bike and pedestrian friendly, with pedestrian accesses and dropped kerbs provided with tactile paving for the internal road network. Cycle Storage spaces will also be provided to all dwellings accommodating 4x bicycles per dwelling. In accordance with Part S of Building Regulations electric Vehicle charging infrastructure will also be incorporated as part of the scheme. This will encourage electric vehicle trips and reduce the use of Internal Combustion Engine (ICE) vehicles, benefitting local air quality.

8.6 Water

Reducing the consumption of potable water will be a significant consideration for the scheme. The water consumption criteria for occupants will be in line with the 110 litres per person per day, as required by Building Regulations Part G.

Water use will be reduced as much as possible, primarily through the specification of efficient sanitary ware and water efficient fittings. External water use will be reduced through providing rainwater harvesting butts and used for irrigation purposes.

8.7 Waste

To minimise waste in the construction process, a pre-commencement audit will be conducted to identify materials that can be removed and reused arising from the pre-commencement works for the proposed development. Where possible, closed loop recycling will be practiced on site, and where this isn't possible, open loop recycling will be undertaken to minimise the amount of waste generated. Additionally, a construction site waste management strategy will be implemented to set out targets to minimise waste and procedures for handling any hazardous materials that may arise as a result of the proposed works.

Municipal waste will be minimised through the installation of on-site recycling space and storage. Residents will be requested to separate and recycle their waste in dedicated recycling containers provided to each dwelling accordingly.

8.8 Flood Risk

The scheme is situated within flood Zone 1, meaning the site has a low risk of fluvial flooding. *https://flood-map-for-planning.service.gov.uk/location*

Figure 10 Flood risk map for planning. Site (red).

8.9 Materials and Embodied Carbon

Materials with a low environmental impact and low embodied carbon footprint will be implemented where feasible. Recycled, sustainable and locally sourced materials will be prioritised. Where possible, building materials should achieve a rating of A+ to D in the BRE's Green Guide on Materials.

To minimise the embodied carbon footprint of the scheme, a timber frame wall and roof structure are currently proposed, to benefit from the use of a regenerative material that contains sequestered carbon. All roofs and external cladding to the second stories (where applicable) will be made cladded in zinc, which is an abundant material, light weight has a long life-span. It can also easily be recycled at the end of its life. Circular economy principles will be adopted and any waste arising from the pre-commencement works will be assessed for practicability of reusing the waste in the new scheme. The walls of the single storey dwellings will be cladded in timber, predominantly larch, which will be sourced from the site. On-site sourcing will support in reducing emissions associated with transportation. Where possible, all materials will be locally sourced and be from either recycled or reclaimed sources.

8. Sustainability

8.10 Pollution

To reduce both the carbon dioxide and nitrogen oxide (NOX) emissions associated with the proposed site, there will be no combustion boilers provided as the site benefits from an all-electric energy strategy. All external lighting provided will be designed with the consideration of reducing nighttime pollution.

8.11 Land Use and Ecology

To promote an improvement in ecological value, the site will look to protect existing ecological features during the construction stage. The scheme will also benefit from new planting of shrubs and other native species in the garden areas and green spaces of the development. The scheme will exceed the 10% Biodiversity Net Gain (BNG) Requirement, demonstrating the improvements to local wildlife and fauna.

An allotment is proposed for the development for use by residents. This will also increase biodiversity, as well as providing locally grown food.

8.12 Sustainability Conclusion

The measures identified and detailed in this section promote a holistically sustainable scheme that demonstrates a significant improvement beyond building regulation requirements and draft local policy. The proposed scheme will benefit from:

- Reduced carbon dioxide emissions to provide net-zero carbon regulated dwellings, exceeding all regulatory recommendations.
- No nitrogen oxide emissions from the energy strategy.
- Low flow water appliances.
- Promotion of public transport and active travel, supported by proximity of local transport links and amenities.
- Planting of new shrubs and native species resulting in a diversification of the natural habitat and a BNG improvement.
- Creation of an allotment for residents to grow their own fruit and vegetables.
- Low embodied carbon structures.
- Minimising waste arising from construction and occupation through adoption of circular economy principles.

9. Conclusion

An Energy and Sustainability Statement has been undertaken to demonstrate how the proposed scheme at Colne Spring, Colney Heath, AL4 0PB, has responded to local policy requirements regarding sustainability, energy and climate change.

This assessment is prepared to support the full planning application for:

The construction of 6x single storey and 3x double storey dwellings, a covered social hub, community garden, allotments and associated landscaping.

This assessment has been prepared in line with the requirements of St Alban's existing and draft local policy surrounding Energy and Climate Change. The scheme complies with all relevant policies contained the City and District of St Albans Local Plan (1994), St Albans Draft Local Plan (Regulation 19 Publication).

All buildings at the site will benefit from significant passive design and energy efficiency improvements, including an improved building fabric, beyond requirements of Part L (2021), Wastewater Heat Recovery Systems (WWHRS) and low energy lighting. The energy strategy is comprised of an Air Source Heat Pump solution providing space heating and domestic hot water, combined with Solar Photovoltaic (PV) panels to each dwelling and the covered social hub, to maximise on-site CO2 reduction.

The energy strategy follows the energy hierarchy; Be Lean, Be Clean, Be Green to maximise the carbon reduction in lieu of the scheme's sustainability vision. The proposed energy strategy is set out in this report and the scheme achieves an on-site **CO2 reduction of 102% demonstrating that Net-Zero regulated carbon can be achieved.**

With regards to sustainability, the scheme aspires to reduce its environmental impact by incorporating sustainable measures across the design. Additional sustainability measures that will be integrated are contained in the body of this report.

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Table 8 Percentage of carbon dioxide reductions achieved at each stage of the energy hierarchy.

	Regulated domestic carbon dioxide emissions	
	Tonnes CO2 saving per annum	% Reduction
Be Lean – Savings from demand reduction	2.4	25%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	7.4	77%
Total regulated carbon dioxide reduction	**9.8**	**102%**

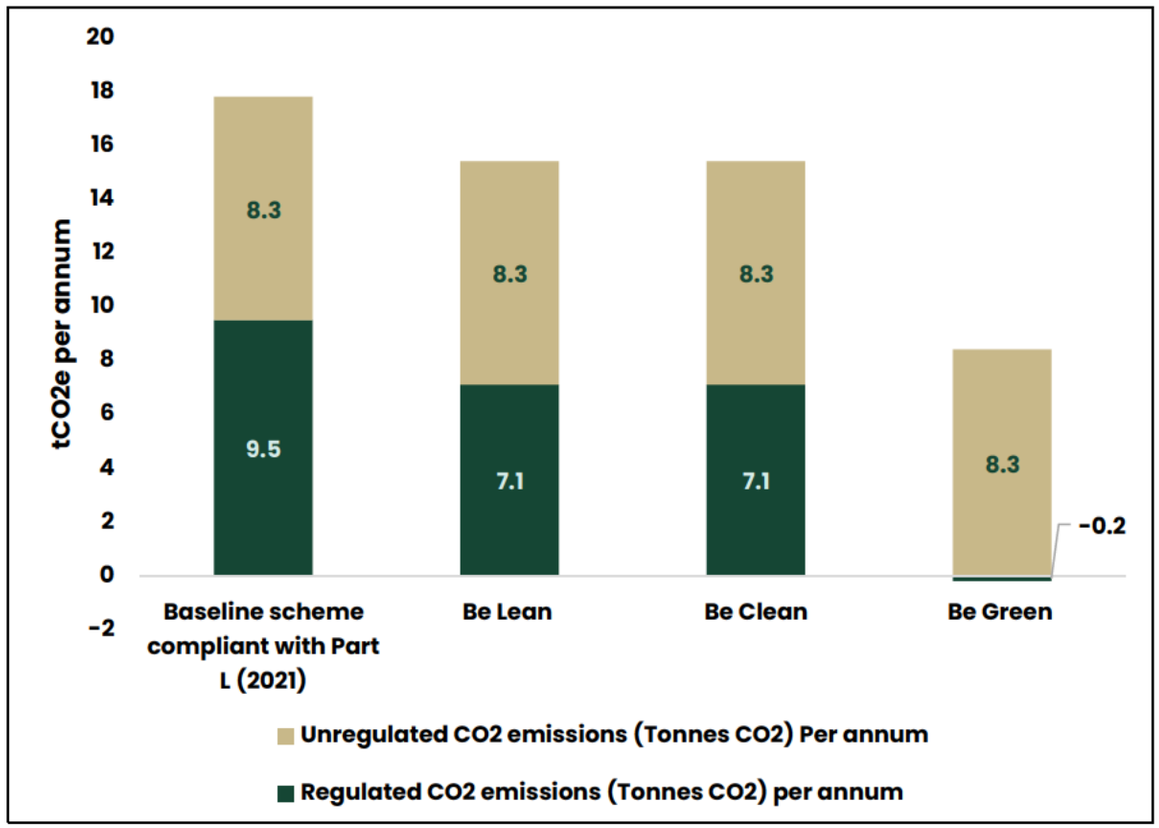

Figure 11 Carbon dioxide emissions per annum at the proposed scheme having utilised the Energy Hierarchy.*

**SAP 10.2 Carbon Factors have been used to assess the scheme, with the following emission rates:*

- *Natural Gas: 0.210kgCO2/kWh*
- *Grid Electricity: 0.136 kgCO2/kWh*

10. Appendices

10.1 Appendix A – SAP Worksheets

Full SAP Calculation Printout

Property Reference	Type A_Lean	Issued on Date	23/10/2024
Assessment Reference	00001	Prop Type Ref	
Property			

SAP Rating	85 B	DER	13.93	TER	9.73
Environmental	88 B	% DER < TER			-43.17
CO_2 Emissions (t/year)	1.13	DFEE	37.04	TFEE	47.06
Compliance Check	See BREL	% DFEE < TFEE			21.28
% DPER < TPER	-47.31	DPER	77.22	TPER	52.42

Assessor Details	Mr. Oliver Eggenton	Assessor ID	AQ01-0001
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	92.9000	(1b)	x 3.0000	(2b) =	278.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		278.7000	(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) =	0.0718 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2218 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2218 (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	0.2827	0.2772	0.2717	0.2439	0.2384	0.2107	0.2107	0.2051	0.2218	0.2384	0.2495	0.2606	(22b)
Effective ac	0.5400	0.5384	0.5369	0.5298	0.5284	0.5222	0.5222	0.5210	0.5246	0.5284	0.5311	0.5339	(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 = 0.80)			21.9000	0.7752	16.9767			(27)
Door			2.5000	1.0000	2.5000			(26)
Heatloss Floor 1			92.9000	0.0800	7.4320	20.0000	1858.0000	(28a)
External Wall 1	127.5000	24.4000	103.1000	0.1300	13.4030	150.0000	15465.0000	(29a)
External Roof 1	92.9000		92.9000	0.1000	9.2900	0.0000	0.0000	(30)
Total net area of external elements Aum(A, m2)			313.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.6017			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17323.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		186.4693 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		15.6650 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	65.2667 (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	49.6618	49.5191	49.3791	48.7219	48.5989	48.0265	48.0265	47.9205	48.2470	48.5989	48.8477	49.1078	(38)
Heat transfer coeff	114.9286	114.7858	114.6459	113.9886	113.8657	113.2932	113.2932	113.1872	113.5137	113.8657	114.1144	114.3745	(39)
Average = Sum(39)m / 12 =												113.9881	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2356	1.2341	1.2270	1.2257	1.2195	1.2195	1.2184	1.2219	1.2257	1.2284	1.2312	(40)
HLP (average)												1.2270	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6634	(42)
Hot water usage for mixer showers													
	68.8757	67.8407	66.3324	63.4465	61.3168	58.9418	57.5919	59.0887	60.7296	63.2796	66.2275	68.6118	(42a)
Hot water usage for baths													
	29.7420	29.3003	28.6783	27.5314	26.6726	25.7204	25.2060	25.8237	26.4962	27.5152	28.6857	29.6415	(42b)
Hot water usage for other uses													
	41.9056	40.3817	38.8579	37.3341	35.8102	34.2864	34.2864	35.8102	37.3341	38.8579	40.3817	41.9056	(42c)
Average daily hot water use (litres/day)												129.1727	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5233	137.5227	133.8686	128.3120	123.7997	118.9486	117.0843	120.7226	124.5599	129.6527	135.2949	140.1589	(44)
Energy conte	222.5546	195.8305	205.7510	175.6527	166.6581	146.2611	141.6033	149.4798	153.5948	175.9375	192.7524	219.4550	(45)
Energy content (annual)										Total = Sum(45)m =		2145.5309	
Distribution loss (46)m = 0.15 x (45)m													
	33.3832	29.3746	30.8627	26.3479	24.9987	21.9392	21.2405	22.4220	23.0392	26.3906	28.9129	32.9182	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(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													
	270.9270	239.5217	254.1234	222.4647	215.0305	193.0731	189.9757	197.8522	200.4068	224.3099	239.5644	267.8274	(62)
WWHRS	-48.9911	-43.3281	-45.3707	-37.5688	-35.0127	-29.9606	-28.0833	-29.8638	-30.9984	-36.5437	-41.3996	-48.0839	(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													
	221.9359	196.1936	208.7527	184.8959	180.0178	163.1125	161.8923	167.9885	169.4083	187.7662	198.1648	219.7435	(64)
										Total per year (kWh/year) = Sum(64)m =		2259.8720	(64)
12Total per year (kWh/year)												2260	(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													
	112.6973	100.0666	107.1101	95.8541	94.1118	86.0814	85.7810	88.4000	88.5199	97.1971	101.5398	111.6667	(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	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	123.7361	136.9935	123.7361	127.8606	123.7361	127.8606	123.7361	123.7361	127.8606	123.7361	127.8606	123.7361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.3130	246.8482	240.4595	226.8589	209.6905	193.5547	182.7749	180.2397	186.6284	200.2290	217.3974	233.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	(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)													
	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	(71)
Water heating gains (Table 5)													
	151.4749	148.9086	143.9652	133.1307	126.4943	119.5575	115.2970	118.8172	122.9443	130.6413	141.0275	150.0896	(72)
Total internal gains													
	585.4745	598.7009	574.1114	553.8008	525.8715	503.9234	484.7586	485.7436	500.3838	520.5570	552.2360	573.3095	(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	7.3000	10.6334	0.6800	0.7000	0.7700	25.6056	(74)
South	13.7000	46.7521	0.6800	0.7000	0.7700	211.2815	(78)
West	0.9000	19.6403	0.6800	0.7000	0.7700	5.8308	(80)

Solar gains	242.7180	406.3647	542.7089	659.1271	732.6177	726.5644	700.6722	644.8133	582.2613	445.0038	289.2988	208.7078	(83)
Total gains	828.1925	1005.0656	1116.8203	1212.9279	1258.4891	1230.4878	1185.4308	1130.5569	1082.6451	965.5607	841.5349	782.0173	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.8690	41.9211	41.9722	42.2142	42.2598	42.4734	42.4734	42.5131	42.3909	42.2598	42.1677	42.0718	
alpha	3.7913	3.7947	3.7981	3.8143	3.8173	3.8316	3.8316	3.8342	3.8261	3.8173	3.8112	3.8048	
util living area													
	0.9761	0.9522	0.9149	0.8399	0.7192	0.5547	0.4116	0.4475	0.6501	0.8647	0.9560	0.9803	(86)
MIT	19.4271	19.7380	20.0925	20.4884	20.7816	20.9395	20.9849	20.9791	20.8872	20.5042	19.8911	19.3627	(87)
Th 2	19.8904	19.8916	19.8928	19.8985	19.8995	19.9044	19.9044	19.9053	19.9025	19.8995	19.8974	19.8952	(88)
util rest of house													
	0.9704	0.9415	0.8961	0.8052	0.6616	0.4718	0.3132	0.3468	0.5692	0.8273	0.9442	0.9756	(89)

MIT 2	18.0952	18.4839	18.9207	19.3939	19.7154	19.8673	19.8988	19.8968	19.8253	19.4258	18.6854	18.0174	(90)
Living area fraction										fLA = Living area / (4) =		0.1625	(91)
MIT	18.3117	18.6878	19.1112	19.5718	19.8887	20.0415	20.0753	20.0727	19.9979	19.6010	18.8814	18.2361	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1617	18.5378	18.9612	19.4218	19.7387	19.8915	19.9253	19.9227	19.8479	19.4510	18.7314	18.0861	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9580	0.9243	0.8764	0.7878	0.6523	0.4708	0.3151	0.3485	0.5649	0.8090	0.9274	0.9646	(94)
Useful gains	793.3849	929.0256	978.7945	955.5533	820.9406	579.3192	373.5411	393.9484	611.5645	781.1780	780.4800	754.3018	(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	1593.1083	1565.4229	1428.6226	1199.3661	915.3314	599.4954	376.7337	398.7257	652.4620	1007.8307	1327.3081	1588.2131	(97)
Space heating kWh	594.9942	427.6590	334.6721	175.5452	70.2268	0.0000	0.0000	0.0000	0.0000	168.6296	393.7162	620.4300	(98a)
Space heating requirement - total per year (kWh/year)												2785.8730	
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	594.9942	427.6590	334.6721	175.5452	70.2268	0.0000	0.0000	0.0000	0.0000	168.6296	393.7162	620.4300	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2785.8730	
Space heating per m2											(98c) / (4) =	29.9879	(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 %)												84.5000	(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	594.9942	427.6590	334.6721	175.5452	70.2268	0.0000	0.0000	0.0000	0.0000	168.6296	393.7162	620.4300	(98)
Space heating efficiency (main heating system 1)	84.5000	84.5000	84.5000	84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210)
Space heating fuel (main heating system)	704.1351	506.1053	396.0617	207.7458	83.1086	0.0000	0.0000	0.0000	0.0000	199.5616	465.9363	734.2367	(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	221.9359	196.1936	208.7527	184.8959	180.0178	163.1125	161.8923	167.9885	169.4083	187.7662	198.1648	219.7435	(64)
Efficiency of water heater												89.5000	(216)
(217)m	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	(217)
Fuel for water heating, kWh/month	262.6461	232.1818	247.0446	218.8118	213.0388	193.0325	191.5886	198.8029	200.4833	222.2085	234.5145	260.0515	(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	23.9232	19.1921	17.2804	12.6603	9.7792	7.9897	8.9209	11.5957	15.0617	19.7618	22.3209	24.5881	(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												3296.8912	(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												2674.4048	(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)												193.0741	(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												6250.3701	(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	3296.8912	0.2100	692.3471	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2674.4048	0.2100	561.6250	(264)
Space and water heating			1253.9722	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	193.0741	0.1443	27.8666	(268)
Total CO2, kg/year			1293.7680	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.9300	(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	3296.8912	1.1300	3725.4870	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2674.4048	1.1300	3022.0774	(278)
Space and water heating			6747.5644	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	193.0741	1.5338	296.1435	(282)
Total Primary energy kWh/year			7173.8088	(286)
Dwelling Primary energy Rate (DPER)			77.2200	(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	92.9000	(1b)	x 3.0000	(2b) =	278.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		278.7000	(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) =	0.1076 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3576 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3576 (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	0.4560	0.4471	0.4381	0.3934	0.3845	0.3398	0.3398	0.3308	0.3576	0.3845	0.4023	0.4202	(22b)
Effective ac	0.6040	0.5999	0.5960	0.5774	0.5739	0.5577	0.5577	0.5547	0.5640	0.5739	0.5809	0.5883	(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			2.5000	1.0000	2.5000			(26)
TER Opening Type (Uw = 1.20)			20.7300	1.1450	23.7366			(27)
Heatloss Floor 1			92.9000	0.1300	12.0770			(28a)
External Wall 1	127.5000	23.2300	104.2700	0.1800	18.7686			(29a)
External Roof 1	92.9000		92.9000	0.1100	10.2190			(30)
Total net area of external elements Aum(A, m2)			313.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3012			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	186.4693	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E5 Ground floor (normal)	42.5000	0.1600	6.8000	
E16 Corner (normal)	12.0000	0.0900	1.0800	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.8800	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		75.1812	(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	55.5473	55.1760	54.8121	53.1026	52.7828	51.2939	51.2939	51.0182	51.8674	52.7828	53.4298	54.1062	(38)
Heat transfer coeff													
	130.7285	130.3572	129.9933	128.2839	127.9640	126.4752	126.4752	126.1995	127.0487	127.9640	128.6111	129.2875	(39)
Average = Sum(39)m / 12 =												128.2823	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4072	1.4032	1.3993	1.3809	1.3774	1.3614	1.3614	1.3584	1.3676	1.3774	1.3844	1.3917	(40)
HLP (average)												1.3809	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6634	(42)
Hot water usage for mixer showers													
	68.8757	67.8407	66.3324	63.4465	61.3168	58.9418	57.5919	59.0887	60.7296	63.2796	66.2275	68.6118	(42a)
Hot water usage for baths													
	29.7420	29.3003	28.6783	27.5314	26.6726	25.7204	25.2060	25.8237	26.4962	27.5152	28.6857	29.6415	(42b)
Hot water usage for other uses													
	41.9056	40.3817	38.8579	37.3341	35.8102	34.2864	34.2864	35.8102	37.3341	38.8579	40.3817	41.9056	(42c)
Average daily hot water use (litres/day)												129.1727	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5233	137.5227	133.8686	128.3120	123.7997	118.9486	117.0843	120.7226	124.5599	129.6527	135.2949	140.1589	(44)
Energy conte	222.5546	195.8305	205.7510	175.6527	166.6581	146.2611	141.6033	149.4798	153.5948	175.9375	192.7524	219.4550	(45)
Energy content (annual)										Total = Sum(45)m =		2145.5309	
Distribution loss (46)m = 0.15 x (45)m													
	33.3832	29.3746	30.8627	26.3479	24.9987	21.9392	21.2405	22.4220	23.0392	26.3906	28.9129	32.9182	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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													
	273.4807	241.8283	256.6771	224.9360	217.5842	195.5444	192.5293	200.4059	202.8781	226.8636	242.0357	270.3810	(62)
WWHRS	-31.4871	-27.8475	-29.1603	-24.1458	-22.5031	-19.2560	-18.0495	-19.1938	-19.9230	-23.4870	-26.6080	-30.9040	(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													
	241.9936	213.9808	227.5168	200.7901	195.0812	176.2884	174.4799	181.2121	182.9551	203.3765	215.4277	239.4770	(64)
										Total per year (kWh/year) = Sum(64)m =		2452.5793	(64)
12Total per year (kWh/year)												2453	(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													
	114.7403	101.9118	109.1531	97.8312	96.1547	88.0585	87.8239	90.4429	90.4969	99.2401	103.5168	113.7096	(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	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	123.2258	136.4286	123.2258	127.3334	123.2258	127.3334	123.2258	123.2258	127.3334	123.2258	127.3334	123.2258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.3130	246.8482	240.4595	226.8589	209.6905	193.5547	182.7749	180.2397	186.6284	200.2290	217.3974	233.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	(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)													
	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	(71)
Water heating gains (Table 5)													
	154.2208	151.6545	146.7111	135.8766	129.2402	122.3034	118.0429	121.5630	125.6901	133.3872	143.7733	152.8355	(72)
Total internal gains													
	587.7101	600.8818	576.3470	556.0194	528.1071	506.1420	486.9943	487.9792	502.6024	522.7926	554.4546	575.5451	(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	6.9100	10.6334	0.6300	0.7000	0.7700	22.4554	(74)
South	12.9700	46.7521	0.6300	0.7000	0.7700	185.3159	(78)
West	0.8500	19.6403	0.6300	0.7000	0.7700	5.1020	(80)

Solar gains	212.8733	356.3937	475.9618	578.0480	642.4879	637.1752	614.4701	565.4906	510.6447	390.2785	253.7257	183.0455	(83)
Total gains	800.5834	957.2755	1052.3088	1134.0674	1170.5949	1143.3172	1101.4644	1053.4698	1013.2471	913.0711	808.1804	758.5907	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.8087	36.9135	37.0169	37.5101	37.6039	38.0466	38.0466	38.1297	37.8748	37.6039	37.4147	37.2190	
alpha	3.4539	3.4609	3.4678	3.5007	3.5069	3.5364	3.5364	3.5420	3.5250	3.5069	3.4943	3.4813	
util living area													
	0.9800	0.9629	0.9368	0.8813	0.7845	0.6309	0.4818	0.5189	0.7195	0.8975	0.9648	0.9831	(86)

MIT	19.0922	19.3932	19.7715	20.2417	20.6269	20.8787	20.9645	20.9534	20.7970	20.2980	19.6184	19.0481	(87)
Th 2	19.7578	19.7609	19.7639	19.7780	19.7807	19.7930	19.7930	19.7953	19.7883	19.7807	19.7753	19.7697	(88)
util rest of house	0.9749	0.9539	0.9210	0.8507	0.7276	0.5370	0.3599	0.3966	0.6339	0.8644	0.9546	0.9789	(89)
MIT 2	17.5870	17.9669	18.4401	19.0198	19.4595	19.7173	19.7799	19.7764	19.6464	19.1015	18.2650	17.5387	(90)
Living area fraction										fLA = Living area / (4) =		0.1625	(91)
MIT	17.8317	18.1987	18.6565	19.2184	19.6493	19.9061	19.9724	19.9677	19.8334	19.2960	18.4849	17.7840	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8317	18.1987	18.6565	19.2184	19.6493	19.9061	19.9724	19.9677	19.8334	19.2960	18.4849	17.7840	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9635	0.9383	0.9026	0.8337	0.7206	0.5465	0.3788	0.4151	0.6375	0.8480	0.9397	0.9687	(94)
Useful gains	771.3819	898.2038	949.8141	945.4676	843.5520	624.8466	417.2813	437.2761	645.9147	774.2621	759.4178	734.8538	(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	1768.9738	1733.5881	1580.2599	1323.6816	1017.2195	671.0910	426.5296	450.2462	728.4181	1112.7756	1464.2303	1756.2447	(97)
Space heating kWh	742.2083	561.3783	469.0517	272.3141	129.2086	0.0000	0.0000	0.0000	0.0000	251.8540	507.4650	759.9148	(98a)
Space heating requirement - total per year (kWh/year)												3693.3949	
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	742.2083	561.3783	469.0517	272.3141	129.2086	0.0000	0.0000	0.0000	0.0000	251.8540	507.4650	759.9148	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3693.3949	
Space heating per m2											(98c) / (4) =	39.7567	(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	742.2083	561.3783	469.0517	272.3141	129.2086	0.0000	0.0000	0.0000	0.0000	251.8540	507.4650	759.9148	(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)	804.1261	608.2105	508.1817	295.0315	139.9876	0.0000	0.0000	0.0000	0.0000	272.8646	549.7996	823.3097	(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	241.9936	213.9808	227.5168	200.7901	195.0812	176.2884	174.4799	181.2121	182.9551	203.3765	215.4277	239.4770	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.4040	86.1195	85.6451	84.7437	83.1581	79.8000	79.8000	79.8000	79.8000	84.5404	85.9125	86.4633	(217)
Fuel for water heating, kWh/month	280.0723	248.4696	265.6509	236.9382	234.5907	220.9128	218.6465	227.0829	229.2670	240.5674	250.7525	276.9695	(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	25.6039	20.5404	18.4943	13.5498	10.4662	8.5510	9.5476	12.4104	16.1199	21.1501	23.8890	26.3155	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-70.2305	-91.6063	-121.9514	-126.6847	-128.4283	-117.0482	-115.5094	-112.8099	-107.2226	-99.3661	-74.4829	-61.6201	(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	-65.7934	-134.2378	-259.5323	-379.8089	-493.0118	-492.1280	-486.3793	-415.9565	-310.5101	-188.5009	-86.6388	-52.3570	(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	4001.5112	(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	2929.9202	(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)	206.6381	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4591.8153	(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	2632.2542	(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	4001.5112	0.2100	840.3174	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2929.9202	0.2100	615.2832	(264)
Space and water heating			1455.6006	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	206.6381	0.1443	29.8243	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1226.9604	0.1363	-167.2196	
PV Unit electricity exported	-3364.8548	0.1267	-426.2501	
Total			-593.4696	(269)
Total CO2, kg/year			903.8845	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.7300	(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	4001.5112	1.1300	4521.7077	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2929.9202	1.1300	3310.8098	(278)
Space and water heating			7832.5175	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	206.6381	1.5338	316.9484	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1226.9604	1.5038	-1845.0887	
PV Unit electricity exported	-3364.8548	0.4650	-1564.7459	
Total			-3409.8345	(283)
Total Primary energy kWh/year			4869.7321	(286)
Target Primary Energy Rate (TPER)			52.4200	(287)

Full SAP Calculation Printout

Property Reference	Type A_Green	Issued on Date	23/10/2024
Assessment Reference	00001	Prop Type Ref	
Property			

SAP Rating	100 A	DER	-0.07	TER	9.80
Environmental	100 A	% DER < TER			100.71
CO_2 Emissions (t/year)	-0.09	DFEE	36.76	TFEE	47.25
Compliance Check	See BREL	% DFEE < TFEE			22.19
% DPER < TPER	91.52	DPER	4.48	TPER	52.78

Assessor Details	Mr. Oliver Eggenton	Assessor ID	AQ01-0001
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		92.9000 (1b)	x	3.0000 (2b)	=	278.7000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9000						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.7000	(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) =	0.0718 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.2218 (18)
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2218 (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	0.2827	0.2772	0.2717	0.2439	0.2384	0.2107	0.2107	0.2051	0.2218	0.2384	0.2495	0.2606	(22b)
Effective ac	0.5400	0.5384	0.5369	0.5298	0.5284	0.5222	0.5222	0.5210	0.5246	0.5284	0.5311	0.5339	(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 = 0.80)			21.9000	0.7752	16.9767			(27)
Door			2.5000	1.0000	2.5000			(26)
Heatloss Floor 1			92.9000	0.0800	7.4320	20.0000	1858.0000	(28a)
External Wall 1	127.5000	24.4000	103.1000	0.1300	13.4030	190.0000	19589.0000	(29a)
External Roof 1	92.9000		92.9000	0.1000	9.2900	0.0000	0.0000	(30)
Total net area of external elements Aum(A, m2)			313.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.6017			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	21447.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		230.8611	(35)
Thermal bridges (User defined value 0.050 * total exposed area)		15.6650	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	65.2667	(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	49.6618	49.5191	49.3791	48.7219	48.5989	48.0265	48.0265	47.9205	48.2470	48.5989	48.8477	49.1078	(38)
Heat transfer coeff	114.9286	114.7858	114.6459	113.9886	113.8657	113.2932	113.2932	113.1872	113.5137	113.8657	114.1144	114.3745	(39)
Average = Sum(39)m / 12 =												113.9881	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2356	1.2341	1.2270	1.2257	1.2195	1.2195	1.2184	1.2219	1.2257	1.2284	1.2312	(40)
HLP (average)												1.2270	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6634	(42)
Hot water usage for mixer showers													
	68.8757	67.8407	66.3324	63.4465	61.3168	58.9418	57.5919	59.0887	60.7296	63.2796	66.2275	68.6118	(42a)
Hot water usage for baths													
	29.7420	29.3003	28.6783	27.5314	26.6726	25.7204	25.2060	25.8237	26.4962	27.5152	28.6857	29.6415	(42b)
Hot water usage for other uses													
	41.9056	40.3817	38.8579	37.3341	35.8102	34.2864	34.2864	35.8102	37.3341	38.8579	40.3817	41.9056	(42c)
Average daily hot water use (litres/day)												129.1727	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5233	137.5227	133.8686	128.3120	123.7997	118.9486	117.0843	120.7226	124.5599	129.6527	135.2949	140.1589	(44)
Energy conte	222.5546	195.8305	205.7510	175.6527	166.6581	146.2611	141.6033	149.4798	153.5948	175.9375	192.7524	219.4550	(45)
Energy content (annual)										Total = Sum(45)m =		2145.5309	
Distribution loss (46)m = 0.15 x (45)m													
	33.3832	29.3746	30.8627	26.3479	24.9987	21.9392	21.2405	22.4220	23.0392	26.3906	28.9129	32.9182	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(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													
	270.9270	239.5217	254.1234	222.4647	215.0305	193.0731	189.9757	197.8522	200.4068	224.3099	239.5644	267.8274	(62)
WWHRS	-48.9911	-43.3281	-45.3707	-37.5688	-35.0127	-29.9606	-28.0833	-29.8638	-30.9984	-36.5437	-41.3996	-48.0839	(63a)
PV diverter	-48.8328	-101.3236	-199.4623	-297.7076	-390.8702	-392.0219	-386.8271	-327.2046	-240.6683	-143.2734	-64.6009	-38.6338	(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													
	173.1032	94.8700	9.2904	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	44.4928	133.5639	181.1097	(64)
										Total per year (kWh/year) = Sum(64)m =		636.4299	(64)
12Total per year (kWh/year)												636	(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													
	112.6973	100.0666	107.1101	95.8541	94.1118	86.0814	85.7810	88.4000	88.5199	97.1971	101.5398	111.6667	(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	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	123.7361	136.9935	123.7361	127.8606	123.7361	127.8606	123.7361	123.7361	127.8606	123.7361	127.8606	123.7361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.3130	246.8482	240.4595	226.8589	209.6905	193.5547	182.7749	180.2397	186.6284	200.2290	217.3974	233.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	(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)													
	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	(71)
Water heating gains (Table 5)													
	151.4749	148.9086	143.9652	133.1307	126.4943	119.5575	115.2970	118.8172	122.9443	130.6413	141.0275	150.0896	(72)
Total internal gains													
	585.4745	598.7009	574.1114	553.8008	525.8715	503.9234	484.7586	485.7436	500.3838	520.5570	552.2360	573.3095	(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	7.3000	10.6334	0.6800	0.7000	0.7700	25.6056	(74)
South	13.7000	46.7521	0.6800	0.7000	0.7700	211.2815	(78)
West	0.9000	19.6403	0.6800	0.7000	0.7700	5.8308	(80)

Solar gains	242.7180	406.3647	542.7089	659.1271	732.6177	726.5644	700.6722	644.8133	582.2613	445.0038	289.2988	208.7078	(83)
Total gains	828.1925	1005.0656	1116.8203	1212.9279	1258.4891	1230.4878	1185.4308	1130.5569	1082.6451	965.5607	841.5349	782.0173	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.8365	51.9010	51.9644	52.2640	52.3204	52.5848	52.5848	52.6340	52.4826	52.3204	52.2064	52.0877	
alpha	4.4558	4.4601	4.4643	4.4843	4.4880	4.5057	4.5057	4.5089	4.4988	4.4880	4.4804	4.4725	
util living area													
	0.9864	0.9687	0.9373	0.8660	0.7410	0.5656	0.4156	0.4529	0.6674	0.8904	0.9717	0.9893	(86)
MIT	19.9320	20.1383	20.3728	20.6325	20.8164	20.9049	20.9260	20.9235	20.8761	20.6365	20.2337	19.8899	(87)
Th 2	19.8904	19.8916	19.8928	19.8985	19.8995	19.9044	19.9044	19.9053	19.9025	19.8995	19.8974	19.8952	(88)
util rest of house													
	0.9825	0.9601	0.9201	0.8309	0.6796	0.4783	0.3146	0.3489	0.5811	0.8534	0.9623	0.9861	(89)

MIT 2	18.6644	18.9238	19.2133	19.5236	19.7198	19.8018	19.8147	19.8146	19.7799	19.5374	19.0513	18.6148	(90)
Living area fraction										fLA = Living area / (4) =		0.1625	(91)
MIT	18.8704	19.1212	19.4018	19.7039	19.8981	19.9811	19.9953	19.9949	19.9581	19.7161	19.2435	18.8221	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8704	19.1212	19.4018	19.7039	19.8981	19.9811	19.9953	19.9949	19.9581	19.7161	19.2435	18.8221	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9776	0.9525	0.9109	0.8238	0.6796	0.4847	0.3231	0.3576	0.5858	0.8461	0.9550	0.9819	(94)
Useful gains	809.6240	957.2769	1017.3595	999.2377	855.2163	596.3748	383.0308	404.2854	634.2357	816.9331	803.7057	767.8980	(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	1674.5595	1632.3902	1479.1373	1231.5169	933.4791	609.6472	384.6648	406.8926	664.9733	1038.0079	1385.7499	1672.3912	(97)
Space heating kWh	643.5120	453.6762	343.5627	167.2410	58.2275	0.0000	0.0000	0.0000	0.0000	164.4797	419.0718	672.9429	(98a)
Space heating requirement - total per year (kWh/year)												2922.7138	
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	643.5120	453.6762	343.5627	167.2410	58.2275	0.0000	0.0000	0.0000	0.0000	164.4797	419.0718	672.9429	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2922.7138	
Space heating per m2											(98c) / (4) =	31.4609	(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	643.5120	453.6762	343.5627	167.2410	58.2275	0.0000	0.0000	0.0000	0.0000	164.4797	419.0718	672.9429	(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)	293.4391	206.8747	156.6633	76.2613	26.5515	0.0000	0.0000	0.0000	0.0000	75.0021	191.0952	306.8595	(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	173.1032	94.8700	9.2904	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	44.4928	133.5639	181.1097	(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	90.9155	49.8267	4.8794	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	23.3680	70.1491	95.1206	(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	23.9232	19.1921	17.2804	12.6603	9.7792	7.9897	8.9209	11.5957	15.0617	19.7618	22.3209	24.5881	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-94.0319	-125.2376	-159.5307	-152.8430	-138.8595	-115.6128	-113.8859	-112.0972	-108.0413	-121.5054	-99.1995	-82.1256	(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	-1.9690	-12.9205	-45.8833	-88.6870	-133.8885	-143.9485	-142.2608	-123.6641	-93.9388	-39.8396	-7.2511	-0.6895	(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												1332.7468	(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												334.2594	(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)												193.0741	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2257.9111	(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												-397.8307	(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	1332.7468	0.1564	208.3840	(261)
Total CO2 associated with community systems			0.0000	(373)

Water heating (other fuel)	334.2594	0.1580	52.8133	(264)
Space and water heating			261.1972	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	193.0741	0.1443	27.8666	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1422.9704	0.1385	-197.1005	
PV Unit electricity exported	-834.9407	0.1183	-98.7508	
Total			-295.8514	(269)
Total CO2, kg/year			-6.7876	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.0700	(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	1332.7468	1.5788	2104.1831	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	334.2594	1.5846	529.6829	(278)
Space and water heating			2633.8660	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	193.0741	1.5338	296.1435	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1422.9704	1.5122	-2151.7694	
PV Unit electricity exported	-834.9407	0.4339	-362.2810	
Total			-2514.0504	(283)
Total Primary energy kWh/year			415.9591	(286)
Dwelling Primary energy Rate (DPER)			4.4800	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	92.9000	(1b)	x 3.0000	(2b) =	278.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		278.7000	(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) =	0.1076 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3576 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3576 (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	0.4560	0.4471	0.4381	0.3934	0.3845	0.3398	0.3398	0.3308	0.3576	0.3845	0.4023	0.4202	(22b)
Effective ac	0.6040	0.5999	0.5960	0.5774	0.5739	0.5577	0.5577	0.5547	0.5640	0.5739	0.5809	0.5883	(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			2.5000	1.0000	2.5000			(26)
TER Opening Type (Uw = 1.20)			20.7300	1.1450	23.7366			(27)
Heatloss Floor 1			92.9000	0.1300	12.0770			(28a)
External Wall 1	127.5000	23.2300	104.2700	0.1800	18.7686			(29a)
External Roof 1	92.9000		92.9000	0.1100	10.2190			(30)
Total net area of external elements Aum(A, m2)			313.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3012			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							230.8611	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E5 Ground floor (normal)									42.5000	0.1600	6.8000		
E16 Corner (normal)									12.0000	0.0900	1.0800		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												7.8800	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) +	(36a) =	75.1812	(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	55.5473	55.1760	54.8121	53.1026	52.7828	51.2939	51.2939	51.0182	51.8674	52.7828	53.4298	54.1062	(38)
Heat transfer coeff	130.7285	130.3572	129.9933	128.2839	127.9640	126.4752	126.4752	126.1995	127.0487	127.9640	128.6111	129.2875	(39)
Average = Sum(39)m / 12 =												128.2823	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4072	1.4032	1.3993	1.3809	1.3774	1.3614	1.3614	1.3584	1.3676	1.3774	1.3844	1.3917	(40)
HLP (average)												1.3809	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6634	(42)
Hot water usage for mixer showers	68.8757	67.8407	66.3324	63.4465	61.3168	58.9418	57.5919	59.0887	60.7296	63.2796	66.2275	68.6118	(42a)
Hot water usage for baths	29.7420	29.3003	28.6783	27.5314	26.6726	25.7204	25.2060	25.8237	26.4962	27.5152	28.6857	29.6415	(42b)
Hot water usage for other uses	41.9056	40.3817	38.8579	37.3341	35.8102	34.2864	34.2864	35.8102	37.3341	38.8579	40.3817	41.9056	(42c)
Average daily hot water use (litres/day)												129.1727	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5233	137.5227	133.8686	128.3120	123.7997	118.9486	117.0843	120.7226	124.5599	129.6527	135.2949	140.1589	(44)
Energy conte	222.5546	195.8305	205.7510	175.6527	166.6581	146.2611	141.6033	149.4798	153.5948	175.9375	192.7524	219.4550	(45)
Energy content (annual)										Total = Sum(45)m =		2145.5309	
Distribution loss (46)m = 0.15 x (45)m	33.3832	29.3746	30.8627	26.3479	24.9987	21.9392	21.2405	22.4220	23.0392	26.3906	28.9129	32.9182	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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	273.4807	241.8283	256.6771	224.9360	217.5842	195.5444	192.5293	200.4059	202.8781	226.8636	242.0357	270.3810	(62)
WWHRS	-31.4871	-27.8475	-29.1603	-24.1458	-22.5031	-19.2560	-18.0495	-19.1938	-19.9230	-23.4870	-26.6080	-30.9040	(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	241.9936	213.9808	227.5168	200.7901	195.0812	176.2884	174.4799	181.2121	182.9551	203.3765	215.4277	239.4770	(64)
										Total per year (kWh/year) = Sum(64)m =		2452.5793	(64)
12Total per year (kWh/year)												2453	(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	114.7403	101.9118	109.1531	97.8312	96.1547	88.0585	87.8239	90.4429	90.4969	99.2401	103.5168	113.7096	(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	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	133.1685	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	123.2258	136.4286	123.2258	127.3334	123.2258	127.3334	123.2258	123.2258	127.3334	123.2258	127.3334	123.2258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.3130	246.8482	240.4595	226.8589	209.6905	193.5547	182.7749	180.2397	186.6284	200.2290	217.3974	233.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	(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)	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	(71)
Water heating gains (Table 5)	154.2208	151.6545	146.7111	135.8766	129.2402	122.3034	118.0429	121.5630	125.6901	133.3872	143.7733	152.8355	(72)
Total internal gains	587.7101	600.8818	576.3470	556.0194	528.1071	506.1420	486.9943	487.9792	502.6024	522.7926	554.4546	575.5451	(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	6.9100	10.6334	0.6300	0.7000	0.7700	22.4554	(74)
South	12.9700	46.7521	0.6300	0.7000	0.7700	185.3159	(78)
West	0.8500	19.6403	0.6300	0.7000	0.7700	5.1020	(80)

Solar gains	212.8733	356.3937	475.9618	578.0480	642.4879	637.1752	614.4701	565.4906	510.6447	390.2785	253.7257	183.0455	(83)
Total gains	800.5834	957.2755	1052.3088	1134.0674	1170.5949	1143.3172	1101.4644	1053.4698	1013.2471	913.0711	808.1804	758.5907	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.5715	45.7013	45.8293	46.4400	46.5560	47.1041	47.1041	47.2070	46.8915	46.5560	46.3218	46.0795	
alpha	4.0381	4.0468	4.0553	4.0960	4.1037	4.1403	4.1403	4.1471	4.1261	4.1037	4.0881	4.0720	
util living area													
	0.9889	0.9769	0.9561	0.9067	0.8106	0.6484	0.4900	0.5291	0.7427	0.9217	0.9783	0.9910	(86)
MIT	19.3721	19.6377	19.9705	20.3840	20.7163	20.9196	20.9802	20.9727	20.8538	20.4244	19.8286	19.3336	(87)
Th 2	19.7578	19.7609	19.7639	19.7780	19.7807	19.7930	19.7930	19.7953	19.7883	19.7807	19.7753	19.7697	(88)
util rest of house													
	0.9855	0.9700	0.9427	0.8772	0.7513	0.5483	0.3630	0.4009	0.6516	0.8906	0.9705	0.9882	(89)
MIT 2	17.9087	18.2455	18.6630	19.1737	19.5473	19.7478	19.7869	19.7860	19.6939	19.2348	18.5002	17.8678	(90)
Living area fraction										fLA = Living area / (4) =		0.1625	(91)
MIT	18.1465	18.4718	18.8755	19.3704	19.7373	19.9383	19.9809	19.9789	19.8824	19.4281	18.7161	18.1060	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1465	18.4718	18.8755	19.3704	19.7373	19.9383	19.9809	19.9789	19.8824	19.4281	18.7161	18.1060	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9600	0.9300	0.8653	0.7489	0.5613	0.3834	0.4213	0.6595	0.8792	0.9611	0.9826	(94)
Useful gains	783.7455	918.9592	978.5973	981.3001	876.6387	641.7013	422.3537	443.8600	668.2717	802.7699	776.7025	745.3626	(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	1810.1362	1769.1810	1608.7386	1343.1840	1028.4909	675.1572	427.5972	451.6558	734.6442	1129.6852	1493.9626	1797.8756	(97)
Space heating kWh	763.6347	571.3491	468.8251	260.5564	112.9780	0.0000	0.0000	0.0000	0.0000	243.2250	516.4273	783.0697	(98a)
Space heating requirement - total per year (kWh/year)												3720.0653	
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	763.6347	571.3491	468.8251	260.5564	112.9780	0.0000	0.0000	0.0000	0.0000	243.2250	516.4273	783.0697	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3720.0653	
Space heating per m2											(98c) / (4) =	40.0438	(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	763.6347	571.3491	468.8251	260.5564	112.9780	0.0000	0.0000	0.0000	0.0000	243.2250	516.4273	783.0697	(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)	827.3399	619.0131	507.9362	282.2930	122.4031	0.0000	0.0000	0.0000	0.0000	263.5157	559.5095	848.3962	(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	241.9936	213.9808	227.5168	200.7901	195.0812	176.2884	174.4799	181.2121	182.9551	203.3765	215.4277	239.4770	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.4537	86.1525	85.6441	84.6451	82.8807	79.8000	79.8000	79.8000	79.8000	84.4621	85.9467	86.5149	(217)
Fuel for water heating, kWh/month	279.9113	248.3744	265.6539	237.2140	235.3760	220.9128	218.6465	227.0829	229.2670	240.7903	250.6526	276.8045	(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	25.6039	20.5404	18.4943	13.5498	10.4662	8.5510	9.5476	12.4104	16.1199	21.1501	23.8890	26.3155	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-70.2305	-91.6063	-121.9514	-126.6847	-128.4283	-117.0482	-115.5094	-112.8099	-107.2226	-99.3661	-74.4829	-61.6201	(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	-65.7934	-134.2378	-259.5323	-379.8089	-493.0118	-492.1280	-486.3793	-415.9565	-310.5101	-188.5009	-86.6388	-52.3570	(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												4030.4066	(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												2930.6862	(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)												206.6381	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4591.8153	(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	2661.9157	(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	4030.4066	0.2100	846.3854	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2930.6862	0.2100	615.4441	(264)
Space and water heating			1461.8295	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	206.6381	0.1443	29.8243	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1226.9604	0.1363	-167.2196	
PV Unit electricity exported	-3364.8548	0.1267	-426.2501	
Total			-593.4696	(269)
Total CO2, kg/year			910.1134	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.8000	(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	4030.4066	1.1300	4554.3595	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2930.6862	1.1300	3311.6754	(278)
Space and water heating			7866.0349	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	206.6381	1.5338	316.9484	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1226.9604	1.5038	-1845.0887	
PV Unit electricity exported	-3364.8548	0.4650	-1564.7459	
Total			-3409.8345	(283)
Total Primary energy kWh/year			4903.2496	(286)
Target Primary Energy Rate (TPER)			52.7800	(287)

Full SAP Calculation Printout

Property Reference	Type B_Lean	Issued on Date	23/10/2024
Assessment Reference	00001	Prop Type Ref	Type B_Lean
Property			

SAP Rating	86 B	DER	13.00	TER	12.17
Environmental	88 B	% DER < TER			-6.82
CO_2 Emissions (t/year)	1.34	DFEE	39.33	TFEE	53.53
Compliance Check	See BREL	% DFEE < TFEE			26.53
% DPER < TPER	-12.05	DPER	71.94	TPER	64.20

Assessor Details	Mr. Oliver Eggenton	Assessor ID	AQ01-0001
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	76.8600 (1b)	x	3.0000 (2b)	=	230.5800	(1b) - (3b)
First floor	42.8000 (1c)	x	2.5500 (2c)	=	109.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	339.7200	(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) =	0.0589 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2089 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2089 (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	0.2663	0.2611	0.2559	0.2298	0.2245	0.1984	0.1984	0.1932	0.2089	0.2245	0.2350	0.2454	(22b)
Effective ac	0.5355	0.5341	0.5327	0.5264	0.5252	0.5197	0.5197	0.5187	0.5218	0.5252	0.5276	0.5301	(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 = 0.80)			26.8900	0.7752	20.8450			(27)
Door			2.3000	1.0000	2.3000			(26)
Heatloss Floor 1			76.8600	0.0800	6.1488	0.0000	0.0000	(28a)
External Wall 1	219.4095	29.1900	190.2195	0.1300	24.7285	140.0000	26630.7300	(29a)
External Roof 1	80.0000		80.0000	0.1000	8.0000	0.0000	0.0000	(30)
Total net area of external elements Aum(A, m2)			376.2695					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.0223			(33)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		26630.7300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							222.5533	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							18.8135	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		80.8358	(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	60.0292	59.8749	59.7236	59.0128	58.8799	58.2609	58.2609	58.1462	58.4993	58.8799	59.1489	59.4301	(38)
Heat transfer coeff	140.8650	140.7106	140.5593	139.8486	139.7156	139.0966	139.0966	138.9820	139.3351	139.7156	139.9846	140.2659	(39)

Average = Sum(39)m / 12 = 139.8480

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1772	1.1759	1.1747	1.1687	1.1676	1.1624	1.1624	1.1615	1.1644	1.1676	1.1699	1.1722	(40)
HLP (average)												1.1687	
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 2.8620 (42)

Hot water usage for mixer showers

72.2060	71.1209	69.5397	66.5143	64.2816	61.7918	60.3765	61.9458	63.6660	66.3393	69.4297	71.9294	(42a)

Hot water usage for baths

31.1742	30.7112	30.0592	28.8571	27.9570	26.9589	26.4197	27.0671	27.7721	28.8401	30.0669	31.0688	(42b)

Hot water usage for other uses

43.9397	42.3418	40.7440	39.1462	37.5484	35.9506	35.9506	37.5484	39.1462	40.7440	42.3418	43.9397	(42c)

Average daily hot water use (litres/day) 135.4200 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3198	144.1739	140.3429	134.5176	129.7870	124.7012	122.7469	126.5614	130.5843	135.9234	141.8385	146.9378	(44)
Energy conte	233.3186	205.3017	215.7018	184.1479	174.7182	153.3347	148.4517	156.7094	161.0235	184.4468	202.0749	230.0691	(45)
Energy content (annual)										Total = Sum(45)m =		2249.2984	
Distribution loss (46)m = 0.15 x (45)m													
	34.9978	30.7953	32.3553	27.6222	26.2077	23.0002	22.2678	23.5064	24.1535	27.6670	30.3112	34.5104	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(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													
	281.6910	248.9929	264.0742	230.9599	223.0906	200.1467	196.8241	205.0818	207.8355	232.8192	248.8869	278.4415	(62)
WWHRS	-66.4577	-58.7758	-61.5466	-50.9630	-47.4957	-40.6424	-38.0958	-40.5110	-42.0502	-49.5725	-56.1597	-65.2270	(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													
	215.2333	190.2172	202.5277	179.9969	175.5950	159.5043	158.7283	164.5708	165.7853	183.2467	192.7273	213.2144	(64)
										Total per year (kWh/year) = Sum(64)m =		2201.3470	(64)
12Total per year (kWh/year)												2201	(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													
	116.2764	103.2158	110.4188	98.6788	96.7917	88.4334	88.0581	90.8038	90.9899	100.0265	104.6395	115.1959	(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	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	144.9153	160.4419	144.9153	149.7458	144.9153	149.7458	144.9153	144.9153	149.7458	144.9153	149.7458	144.9153	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	284.7699	287.7249	280.2784	264.4255	244.4142	225.6063	213.0415	210.0865	217.5330	233.3859	253.3972	272.2051	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	(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)													
	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	(71)
Water heating gains (Table 5)													
	156.2854	153.5949	148.4123	137.0538	130.0964	122.8242	118.3577	122.0481	126.3749	134.4442	145.3327	154.8332	(72)
Total internal gains													
	654.9004	670.6916	642.5358	620.1550	588.3557	564.1061	542.2443	542.9797	559.5835	581.6752	617.4055	640.8834	(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	10.7500	11.2829	0.6800	0.7000	0.7700	40.0102	(75)
Southeast	0.8000	36.7938	0.6800	0.7000	0.7700	9.7097	(77)
Southwest	11.7400	36.7938	0.6800	0.7000	0.7700	142.4896	(79)
Northwest	3.6000	11.2829	0.6800	0.7000	0.7700	13.3988	(81)

Solar gains	205.6083	367.9673	550.5904	761.1910	924.6891	949.7130	902.4281	775.6032	622.7580	419.3875	249.5021	173.8674	(83)
Total gains	860.5088	1038.6589	1193.1263	1381.3460	1513.0448	1513.8191	1444.6724	1318.5829	1182.3415	1001.0627	866.9076	814.7508	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.5143	52.5719	52.6285	52.8959	52.9463	53.1819	53.1819	53.2258	53.0909	52.9463	52.8445	52.7386	
alpha	4.5010	4.5048	4.5086	4.5264	4.5298	4.5455	4.5455	4.5484	4.5394	4.5298	4.5230	4.5159	
util living area													
	0.9931	0.9836	0.9609	0.8913	0.7518	0.5652	0.4187	0.4754	0.7260	0.9341	0.9855	0.9946	(86)
MIT	19.5385	19.7861	20.1296	20.5495	20.8419	20.9661	20.9930	20.9878	20.8993	20.4937	19.9335	19.4900	(87)
Th 2	19.9383	19.9393	19.9403	19.9451	19.9460	19.9502	19.9502	19.9509	19.9486	19.9460	19.9442	19.9423	(88)

util rest of house	0.9911	0.9790	0.9496	0.8616	0.6935	0.4815	0.3213	0.3716	0.6439	0.9091	0.9805	0.9930	(89)
MIT 2	18.2480	18.5625	18.9931	19.5006	19.8171	19.9310	19.9479	19.9465	19.8813	19.4496	18.7556	18.1889	(90)
Living area fraction										fLA = Living area / (4) =		0.1003	(91)
MIT	18.3774	18.6852	19.1071	19.6058	19.9199	20.0348	20.0527	20.0509	19.9834	19.5543	18.8738	18.3194	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2274	18.5352	18.9571	19.4558	19.7699	19.8848	19.9027	19.9009	19.8334	19.4043	18.7238	18.1694	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9861	0.9701	0.9357	0.8451	0.6828	0.4760	0.3168	0.3665	0.6339	0.8923	0.9721	0.9888	(94)
Useful gains	848.5488	1007.5834	1116.4284	1167.4408	1033.1282	720.6530	457.6714	483.2557	749.5355	893.2598	842.6808	805.6308	(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	1961.8897	1918.6222	1750.9586	1476.2100	1127.4915	735.0934	459.3892	486.5639	798.8644	1230.0941	1627.1475	1959.4293	(97)
Space heating kWh	828.3257	612.2181	472.0905	222.3139	70.2064	0.0000	0.0000	0.0000	0.0000	250.6047	564.8160	858.4260	(98a)
Space heating requirement - total per year (kWh/year)												3879.0012	
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	828.3257	612.2181	472.0905	222.3139	70.2064	0.0000	0.0000	0.0000	0.0000	250.6047	564.8160	858.4260	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3879.0012	
Space heating per m2											(98c) / (4) =	32.4169	(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 %)	84.5000	(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	828.3257	612.2181	472.0905	222.3139	70.2064	0.0000	0.0000	0.0000	0.0000	250.6047	564.8160	858.4260	(98)
Space heating efficiency (main heating system 1)	84.5000	84.5000	84.5000	84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210)
Space heating fuel (main heating system)	980.2671	724.5185	558.6869	263.0933	83.0844	0.0000	0.0000	0.0000	0.0000	296.5736	668.4213	1015.8888	(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	215.2333	190.2172	202.5277	179.9969	175.5950	159.5043	158.7283	164.5708	165.7853	183.2467	192.7273	213.2144	(64)
Efficiency of water heater												89.5000	(216)
(217)m	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	(217)
Fuel for water heating, kWh/month	254.7139	225.1091	239.6777	213.0140	207.8047	188.7625	187.8442	194.7583	196.1956	216.8600	228.0796	252.3248	(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	28.0180	22.4771	20.2381	14.8273	11.4531	9.3572	10.4479	13.5805	17.6398	23.1443	26.1414	28.7967	(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	4590.5339	(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	2605.1444	(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)	226.1215	(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	7507.7998	(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	4590.5339	0.2100	964.0121	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2605.1444	0.2100	547.0803	(264)
Space and water heating			1511.0925	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	226.1215	0.1443	32.6363	(268)
Total CO2, kg/year			1555.6580	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.0000	(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	4590.5339	1.1300	5187.3034	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2605.1444	1.1300	2943.8132	(278)
Space and water heating			8131.1165	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	226.1215	1.5338	346.8326	(282)
Total Primary energy kWh/year			8608.0500	(286)
Dwelling Primary energy Rate (DPER)			71.9400	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.8600	(1b)	x 3.0000	(2b) =	230.5800	(1b) - (3b)
First floor	42.8000	(1c)	x 2.5500	(2c) =	109.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		339.7200	(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) =	0.1177 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3677 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3677 (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	0.4689	0.4597	0.4505	0.4045	0.3953	0.3494	0.3494	0.3402	0.3677	0.3953	0.4137	0.4321	(22b)
Effective ac	0.6099	0.6057	0.6015	0.5818	0.5781	0.5610	0.5610	0.5579	0.5676	0.5781	0.5856	0.5934	(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			2.3000	1.0000	2.3000			(26)
TER Opening Type (Uw = 1.20)			26.8900	1.1450	30.7901			(27)
Heatloss Floor 1			76.8600	0.1300	9.9918			(28a)
External Wall 1	219.4095	29.1900	190.2195	0.1800	34.2395			(29a)
External Roof 1	80.0000		80.0000	0.1100	8.8000			(30)
Total net area of external elements Aum(A, m2)			376.2695					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.1214			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							222.5533	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	42.8000	0.1600	6.8480	
E6 Intermediate floor within a dwelling	35.6900	0.0000	0.0000	
E16 Corner (normal)	130.2000	0.0900	11.7180	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				18.5660 (36)
Point Thermal bridges			(36a) =	0.0000

Total fabric heat loss (33) + (36) + (36a) = 104.6874 (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	68.3768	67.8983	67.4292	65.2262	64.8140	62.8952	62.8952	62.5398	63.6343	64.8140	65.6478	66.5196	(38)
Heat transfer coeff	173.0642	172.5857	172.1166	169.9136	169.5014	167.5826	167.5826	167.2272	168.3217	169.5014	170.3352	171.2070	(39)
Average = Sum(39)m / 12 =												169.9116	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4463	1.4423	1.4384	1.4200	1.4165	1.4005	1.4005	1.3975	1.4067	1.4165	1.4235	1.4308	(40)
HLP (average)												1.4200	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8620 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.2060	71.1209	69.5397	66.5143	64.2816	61.7918	60.3765	61.9458	63.6660	66.3393	69.4297	71.9294	(42a)
Hot water usage for baths	31.1742	30.7112	30.0592	28.8571	27.9570	26.9589	26.4197	27.0671	27.7721	28.8401	30.0669	31.0688	(42b)
Hot water usage for other uses	43.9397	42.3418	40.7440	39.1462	37.5484	35.9506	35.9506	37.5484	39.1462	40.7440	42.3418	43.9397	(42c)
Average daily hot water use (litres/day)												135.4200	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3198	144.1739	140.3429	134.5176	129.7870	124.7012	122.7469	126.5614	130.5843	135.9234	141.8385	146.9378	(44)
Energy conte	233.3186	205.3017	215.7018	184.1479	174.7182	153.3347	148.4517	156.7094	161.0235	184.4468	202.0749	230.0691	(45)
Energy content (annual)											Total = Sum(45)m =	2249.2984	
Distribution loss (46)m = 0.15 x (45)m	34.9978	30.7953	32.3553	27.6222	26.2077	23.0002	22.2678	23.5064	24.1535	27.6670	30.3112	34.5104	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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	284.2447	251.2995	266.6279	233.4312	225.6443	202.6180	199.3778	207.6355	210.3068	235.3729	251.3582	280.9951	(62)
WWHRS	-33.0096	-29.1939	-30.5702	-25.3133	-23.5911	-20.1871	-18.9222	-20.1218	-20.8863	-24.6227	-27.8945	-32.3983	(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	251.2351	222.1056	236.0577	208.1178	202.0532	182.4309	180.4556	187.5136	189.4204	210.7502	223.4637	248.5969	(64)
										Total per year (kWh/year) = Sum(64)m =		2542.2007	(64)
12Total per year (kWh/year)												2542	(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	118.3193	105.0610	112.4617	100.6558	98.8347	90.4104	90.1011	92.8467	92.9669	102.0694	106.6166	117.2388	(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	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.6155	159.0029	143.6155	148.4027	143.6155	148.4027	143.6155	143.6155	148.4027	143.6155	148.4027	143.6155	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.7699	287.7249	280.2784	264.4255	244.4142	225.6063	213.0415	210.0865	217.5330	233.3859	253.3972	272.2051	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	(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)	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	(71)
Water heating gains (Table 5)	159.0313	156.3408	151.1582	139.7997	132.8423	125.5700	121.1036	124.7940	129.1208	137.1901	148.0785	157.5791	(72)
Total internal gains	656.3466	671.9985	643.9820	621.5578	589.8019	565.5089	543.6905	544.4259	560.9864	583.1214	618.8084	642.3296	(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	10.7500	11.2829	0.6300	0.7000	0.7700	37.0683	(75)
Southeast	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(77)
Southwest	11.7400	36.7938	0.6300	0.7000	0.7700	132.0125	(79)
Northwest	3.6000	11.2829	0.6300	0.7000	0.7700	12.4136	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	190.4901	340.9109	510.1058	705.2210	856.6973	879.8812	836.0731	718.5735	576.9670	388.5502	231.1563	161.0830	(83)
Total gains	846.8367	1012.9094	1154.0878	1326.7789	1446.4991	1445.3901	1379.7636	1262.9994	1137.9533	971.6715	849.9647	803.4126	(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, nil,m (see Table 9a)

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

tau	42.7438	42.8623	42.9791	43.5364	43.6423	44.1420	44.1420	44.2358	43.9481	43.6423	43.4286	43.2075	
alpha	3.8496	3.8575	3.8653	3.9024	3.9095	3.9428	3.9428	3.9491	3.9299	3.9095	3.8952	3.8805	
util living area													
	0.9937	0.9869	0.9721	0.9273	0.8290	0.6655	0.5124	0.5723	0.8052	0.9538	0.9881	0.9949	(86)
MIT	19.1024	19.3510	19.7256	20.2315	20.6487	20.8966	20.9716	20.9566	20.7712	20.2213	19.5787	19.0706	(87)
Th 2	19.7280	19.7311	19.7340	19.7481	19.7507	19.7630	19.7630	19.7652	19.7582	19.7507	19.7454	19.7398	(88)
util rest of house													
	0.9918	0.9829	0.9630	0.9030	0.7725	0.5641	0.3787	0.4352	0.7209	0.9333	0.9836	0.9933	(89)
MIT 2	17.5528	17.8707	18.3456	18.9774	19.4552	19.7032	19.7539	19.7496	19.6001	18.9807	18.1722	17.5196	(90)
Living area fraction										fLA = Living area / (4) =		0.1003	(91)
MIT	17.7082	18.0192	18.4840	19.1032	19.5749	19.8229	19.8760	19.8706	19.7175	19.1051	18.3133	17.6752	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7082	18.0192	18.4840	19.1032	19.5749	19.8229	19.8760	19.8706	19.7175	19.1051	18.3133	17.6752	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9747	0.9504	0.8869	0.7631	0.5695	0.3915	0.4478	0.7176	0.9185	0.9759	0.9891	(94)
Useful gains	835.6516	987.2498	1096.8156	1176.6930	1103.8834	823.1158	540.1726	565.5128	816.5990	892.5111	829.4384	794.6258	(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													
	2320.4728	2264.1796	2062.6514	1733.6543	1334.8050	875.2595	548.9993	580.3822	945.5504	1441.6230	1910.0178	2307.0439	(97)
Space heating kWh													
	1104.7069	858.0969	718.5818	401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	(98a)
Space heating requirement - total per year (kWh/year)												5565.9989	
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													
	1104.7069	858.0969	718.5818	401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5565.9989	
Space heating per m2											(98c) / (4) =	46.5151	(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													
	1104.7069	858.0969	718.5818	401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	(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)													
	1196.8656	929.6824	778.5285	434.4660	186.1383	0.0000	0.0000	0.0000	0.0000	442.6211	842.9222	1219.1106	(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													
	251.2351	222.1056	236.0577	208.1178	202.0532	182.4309	180.4556	187.5136	189.4204	210.7502	223.4637	248.5969	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.9824	86.7874	86.3907	85.5052	83.6983	79.8000	79.8000	79.8000	79.8000	85.5178	86.6202	87.0240	(217)
Fuel for water heating, kWh/month													
	288.8346	255.9190	273.2443	243.3979	241.4065	228.6102	226.1349	234.9795	237.3690	246.4403	257.9811	285.6647	(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	29.8405	23.9391	21.5545	15.7918	12.1980	9.9659	11.1274	14.4639	18.7871	24.6497	27.8418	30.6698	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-64.4326	-87.2757	-120.5723	-130.0922	-135.7803	-125.0745	-123.3990	-118.5555	-109.5427	-96.9990	-69.5010	-56.1222	(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	-48.1055	-99.5744	-195.0448	-288.9508	-378.3628	-378.9221	-374.5683	-318.9148	-236.0648	-141.1653	-63.8016	-38.1758	(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												6030.3347	(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												3019.9819	(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)												240.8297	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3798.9981	(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												5578.1482	(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	6030.3347	0.2100	1266.3703	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3019.9819	0.2100	634.1962	(264)
Space and water heating			1900.5665	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	240.8297	0.1443	34.7592	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1237.3470	0.1355	-167.6235	
PV Unit electricity exported	-2561.6511	0.1263	-323.5351	
Total			-491.1586	(269)
Total CO2, kg/year			1456.0963	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1700	(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	6030.3347	1.1300	6814.2782	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3019.9819	1.1300	3412.5795	(278)
Space and water heating			10226.8577	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	240.8297	1.5338	369.3926	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1237.3470	1.5007	-1856.9152	
PV Unit electricity exported	-2561.6511	0.4636	-1187.6416	
Total			-3044.5568	(283)
Total Primary energy kWh/year			7681.7943	(286)
Target Primary Energy Rate (TPER)			64.2000	(287)

Full SAP Calculation Printout

Property Reference	Type B_Green	Issued on Date	23/10/2024
Assessment Reference	00001	Prop Type Ref	Type B_Lean
Property			

SAP Rating	99 A	DER	-0.02	TER	12.17
Environmental	100 A	% DER < TER			100.16
CO_2 Emissions (t/year)	-0.1	DFEE	39.33	TFEE	53.53
Compliance Check	See BREL	% DFEE < TFEE			26.53
% DPER < TPER	92.68	DPER	4.70	TPER	64.20

Assessor Details	Mr. Oliver Eggenton	Assessor ID	AQ01-0001
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	76.8600 (1b)	x	3.0000 (2b)	=	230.5800	(1b) - (3b)
First floor	42.8000 (1c)	x	2.5500 (2c)	=	109.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	339.7200	(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) =	0.0589 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2089 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2089 (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	0.2663	0.2611	0.2559	0.2298	0.2245	0.1984	0.1984	0.1932	0.2089	0.2245	0.2350	0.2454	(22b)
Effective ac	0.5355	0.5341	0.5327	0.5264	0.5252	0.5197	0.5197	0.5187	0.5218	0.5252	0.5276	0.5301	(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 = 0.80)			26.8900	0.7752	20.8450			(27)
Door			2.3000	1.0000	2.3000			(26)
Heatloss Floor 1			76.8600	0.0800	6.1488	0.0000	0.0000	(28a)
External Wall 1	219.4095	29.1900	190.2195	0.1300	24.7285	140.0000	26630.7300	(29a)
External Roof 1	80.0000		80.0000	0.1000	8.0000	0.0000	0.0000	(30)
Total net area of external elements Aum(A, m2)			376.2695					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		62.0223			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	26630.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		222.5533 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		18.8135 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	80.8358 (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	60.0292	59.8749	59.7236	59.0128	58.8799	58.2609	58.2609	58.1462	58.4993	58.8799	59.1489	59.4301	(38)
Heat transfer coeff	140.8650	140.7106	140.5593	139.8486	139.7156	139.0966	139.0966	138.9820	139.3351	139.7156	139.9846	140.2659	(39)

Average = Sum(39)m / 12 = 139.8480

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1772	1.1759	1.1747	1.1687	1.1676	1.1624	1.1624	1.1615	1.1644	1.1676	1.1699	1.1722	(40)
HLP (average)												1.1687	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8620 (42)

Hot water usage for mixer showers												
	72.2060	71.1209	69.5397	66.5143	64.2816	61.7918	60.3765	61.9458	63.6660	66.3393	69.4297	71.9294 (42a)
Hot water usage for baths												
	31.1742	30.7112	30.0592	28.8571	27.9570	26.9589	26.4197	27.0671	27.7721	28.8401	30.0669	31.0688 (42b)
Hot water usage for other uses												
	43.9397	42.3418	40.7440	39.1462	37.5484	35.9506	35.9506	37.5484	39.1462	40.7440	42.3418	43.9397 (42c)

Average daily hot water use (litres/day) 135.4200 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	147.3198	144.1739	140.3429	134.5176	129.7870	124.7012	122.7469	126.5614	130.5843	135.9234	141.8385	146.9378	(44)
Energy conte	233.3186	205.3017	215.7018	184.1479	174.7182	153.3347	148.4517	156.7094	161.0235	184.4468	202.0749	230.0691	(45)
Energy content (annual)										Total = Sum(45)m =		2249.2984	
Distribution loss (46)m = 0.15 x (45)m													
	34.9978	30.7953	32.3553	27.6222	26.2077	23.0002	22.2678	23.5064	24.1535	27.6670	30.3112	34.5104	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(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													
	281.6910	248.9929	264.0742	230.9599	223.0906	200.1467	196.8241	205.0818	207.8355	232.8192	248.8869	278.4415	(62)
WWHRS	-66.4577	-58.7758	-61.5466	-50.9630	-47.4957	-40.6424	-38.0958	-40.5110	-42.0502	-49.5725	-56.1597	-65.2270	(63a)
PV diverter	-65.0050	-134.0393	-262.4355	-389.5814	-509.7994	-510.6830	-503.9104	-427.2354	-315.3381	-188.8947	-85.7761	-51.5116	(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													
	150.2283	56.1779	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	106.9511	161.7028	(64)
										Total per year (kWh/year) = Sum(64)m =		475.0601	(64)
12Total per year (kWh/year)												475	(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													
	116.2764	103.2158	110.4188	98.6788	96.7917	88.4334	88.0581	90.8038	90.9899	100.0265	104.6395	115.1959	(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	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	144.9153	160.4419	144.9153	149.7458	144.9153	149.7458	144.9153	144.9153	149.7458	144.9153	149.7458	144.9153	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	284.7699	287.7249	280.2784	264.4255	244.4142	225.6063	213.0415	210.0865	217.5330	233.3859	253.3972	272.2051	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	(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)													
	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	(71)
Water heating gains (Table 5)													
	156.2854	153.5949	148.4123	137.0538	130.0964	122.8242	118.3577	122.0481	126.3749	134.4442	145.3327	154.8332	(72)
Total internal gains													
	654.9004	670.6916	642.5358	620.1550	588.3557	564.1061	542.2443	542.9797	559.5835	581.6752	617.4055	640.8834	(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	10.7500	11.2829	0.6800	0.7000	0.7700	40.0102	(75)
Southeast	0.8000	36.7938	0.6800	0.7000	0.7700	9.7097	(77)
Southwest	11.7400	36.7938	0.6800	0.7000	0.7700	142.4896	(79)
Northwest	3.6000	11.2829	0.6800	0.7000	0.7700	13.3988	(81)

Solar gains	205.6083	367.9673	550.5904	761.1910	924.6891	949.7130	902.4281	775.6032	622.7580	419.3875	249.5021	173.8674	(83)
Total gains	860.5088	1038.6589	1193.1263	1381.3460	1513.0448	1513.8191	1444.6724	1318.5829	1182.3415	1001.0627	866.9076	814.7508	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.5143	52.5719	52.6285	52.8959	52.9463	53.1819	53.1819	53.2258	53.0909	52.9463	52.8445	52.7386	
alpha	4.5010	4.5048	4.5086	4.5264	4.5298	4.5455	4.5455	4.5484	4.5394	4.5298	4.5230	4.5159	
util living area													
	0.9931	0.9836	0.9609	0.8913	0.7518	0.5652	0.4187	0.4754	0.7260	0.9341	0.9855	0.9946	(86)
MIT	19.5385	19.7861	20.1296	20.5495	20.8419	20.9661	20.9930	20.9878	20.8993	20.4937	19.9335	19.4900	(87)
Th 2	19.9383	19.9393	19.9403	19.9451	19.9460	19.9502	19.9502	19.9509	19.9486	19.9460	19.9442	19.9423	(88)

util rest of house	0.9911	0.9790	0.9496	0.8616	0.6935	0.4815	0.3213	0.3716	0.6439	0.9091	0.9805	0.9930	(89)
MIT 2	18.2480	18.5625	18.9931	19.5006	19.8171	19.9310	19.9479	19.9465	19.8813	19.4496	18.7556	18.1889	(90)
Living area fraction										fLA = Living area / (4) =		0.1003	(91)
MIT	18.3774	18.6852	19.1071	19.6058	19.9199	20.0348	20.0527	20.0509	19.9834	19.5543	18.8738	18.3194	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3774	18.6852	19.1071	19.6058	19.9199	20.0348	20.0527	20.0509	19.9834	19.5543	18.8738	18.3194	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9867	0.9712	0.9381	0.8504	0.6920	0.4885	0.3309	0.3817	0.6469	0.8973	0.9733	0.9893	(94)
Useful gains	849.0240	1008.7596	1119.2565	1174.6903	1046.9859	739.4936	478.1016	503.3363	764.8649	898.2076	843.7641	805.9986	(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	1983.0195	1939.7288	1772.0425	1497.1873	1148.4489	755.9579	480.2537	507.4112	819.7647	1251.0514	1648.1452	1980.4692	(97)
Space heating kWh	843.6926	625.6113	485.6728	232.1978	75.4884	0.0000	0.0000	0.0000	0.0000	262.5158	579.1543	873.8061	(98a)
Space heating requirement - total per year (kWh/year)												3978.1392	
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	843.6926	625.6113	485.6728	232.1978	75.4884	0.0000	0.0000	0.0000	0.0000	262.5158	579.1543	873.8061	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3978.1392	
Space heating per m2											(98c) / (4) =	33.2454	(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	843.6926	625.6113	485.6728	232.1978	75.4884	0.0000	0.0000	0.0000	0.0000	262.5158	579.1543	873.8061	(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)	384.7208	285.2765	221.4650	105.8814	34.4225	0.0000	0.0000	0.0000	0.0000	119.7062	264.0923	398.4524	(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	150.2283	56.1779	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	106.9511	161.7028	(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	78.9014	29.5052	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	56.1718	84.9279	(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	28.0180	22.4771	20.2381	14.8273	11.4531	9.3572	10.4479	13.5805	17.6398	23.1443	26.1414	28.7967	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-117.1780	-155.1246	-199.2409	-187.3632	-164.3194	-134.3304	-132.2591	-130.9402	-127.5250	-148.0411	-123.3123	-102.4684	(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	-0.9230	-13.5468	-50.0798	-104.7022	-164.8313	-178.7562	-176.7163	-153.4949	-116.6591	-48.0903	-7.1381	0.4310	(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	1814.0170	(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	249.5064	(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)	226.1215	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2736.6097	(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	-446.9649	(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	1814.0170	0.1560	283.0284	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	249.5064	0.1599	39.9070	(264)
Space and water heating			322.9353	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	226.1215	0.1443	32.6363	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1722.1026	0.1390	-239.3668	
PV Unit electricity exported	-1014.5071	0.1172	-118.8729	
Total			-358.2397	(269)
Total CO2, kg/year			-2.6680	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.0200	(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	1814.0170	1.5776	2861.8215	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	249.5064	1.5917	397.1419	(278)
Space and water heating			3258.9634	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	226.1215	1.5338	346.8326	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1722.1026	1.5140	-2607.2424	
PV Unit electricity exported	-1014.5071	0.4298	-436.0408	
Total			-3043.2832	(283)
Total Primary energy kWh/year			562.5129	(286)
Dwelling Primary energy Rate (DPER)			4.7000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.8600	(1b)	x 3.0000	(2b) =	230.5800	(1b) - (3b)
First floor	42.8000	(1c)	x 2.5500	(2c) =	109.1400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		339.7200	(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) =	0.1177	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3677	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3677	(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	0.4689	0.4597	0.4505	0.4045	0.3953	0.3494	0.3494	0.3402	0.3677	0.3953	0.4137	0.4321	(22b)
Effective ac	0.6099	0.6057	0.6015	0.5818	0.5781	0.5610	0.5610	0.5579	0.5676	0.5781	0.5856	0.5934	(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			2.3000	1.0000	2.3000			(26)
TER Opening Type (Uw = 1.20)			26.8900	1.1450	30.7901			(27)
Heatloss Floor 1			76.8600	0.1300	9.9918			(28a)
External Wall 1	219.4095	29.1900	190.2195	0.1800	34.2395			(29a)
External Roof 1	80.0000		80.0000	0.1100	8.8000			(30)
Total net area of external elements Aum(A, m2)			376.2695					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		86.1214			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 222.5533 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	42.8000	0.1600	6.8480	
E6 Intermediate floor within a dwelling	35.6900	0.0000	0.0000	
E16 Corner (normal)	130.2000	0.0900	11.7180	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.5660	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	104.6874	(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	68.3768	67.8983	67.4292	65.2262	64.8140	62.8952	62.8952	62.5398	63.6343	64.8140	65.6478	66.5196	(38)
Heat transfer coeff	173.0642	172.5857	172.1166	169.9136	169.5014	167.5826	167.5826	167.2272	168.3217	169.5014	170.3352	171.2070	(39)
Average = Sum(39)m / 12 =												169.9116	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4463	1.4423	1.4384	1.4200	1.4165	1.4005	1.4005	1.3975	1.4067	1.4165	1.4235	1.4308	(40)
HLP (average)												1.4200	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8620 (42)

Hot water usage for mixer showers	72.2060	71.1209	69.5397	66.5143	64.2816	61.7918	60.3765	61.9458	63.6660	66.3393	69.4297	71.9294	(42a)
Hot water usage for baths	31.1742	30.7112	30.0592	28.8571	27.9570	26.9589	26.4197	27.0671	27.7721	28.8401	30.0669	31.0688	(42b)
Hot water usage for other uses	43.9397	42.3418	40.7440	39.1462	37.5484	35.9506	35.9506	37.5484	39.1462	40.7440	42.3418	43.9397	(42c)
Average daily hot water use (litres/day)												135.4200	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3198	144.1739	140.3429	134.5176	129.7870	124.7012	122.7469	126.5614	130.5843	135.9234	141.8385	146.9378	(44)
Energy conte	233.3186	205.3017	215.7018	184.1479	174.7182	153.3347	148.4517	156.7094	161.0235	184.4468	202.0749	230.0691	(45)
Energy content (annual)										Total = Sum(45)m =		2249.2984	
Distribution loss (46)m = 0.15 x (45)m	34.9978	30.7953	32.3553	27.6222	26.2077	23.0002	22.2678	23.5064	24.1535	27.6670	30.3112	34.5104	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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	284.2447	251.2995	266.6279	233.4312	225.6443	202.6180	199.3778	207.6355	210.3068	235.3729	251.3582	280.9951	(62)
WWHRS	-33.0096	-29.1939	-30.5702	-25.3133	-23.5911	-20.1871	-18.9222	-20.1218	-20.8863	-24.6227	-27.8945	-32.3983	(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	251.2351	222.1056	236.0577	208.1178	202.0532	182.4309	180.4556	187.5136	189.4204	210.7502	223.4637	248.5969	(64)
										Total per year (kWh/year) = Sum(64)m =		2542.2007	(64)
12Total per year (kWh/year)												2542	(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	118.3193	105.0610	112.4617	100.6558	98.8347	90.4104	90.1011	92.8467	92.9669	102.0694	106.6166	117.2388	(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	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	143.0996	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.6155	159.0029	143.6155	148.4027	143.6155	148.4027	143.6155	143.6155	148.4027	143.6155	148.4027	143.6155	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.7699	287.7249	280.2784	264.4255	244.4142	225.6063	213.0415	210.0865	217.5330	233.3859	253.3972	272.2051	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	37.3100	(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)	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	(71)
Water heating gains (Table 5)	159.0313	156.3408	151.1582	139.7997	132.8423	125.5700	121.1036	124.7940	129.1208	137.1901	148.0785	157.5791	(72)
Total internal gains	656.3466	671.9985	643.9820	621.5578	589.8019	565.5089	543.6905	544.4259	560.9864	583.1214	618.8084	642.3296	(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	10.7500	11.2829	0.6300	0.7000	0.7700	37.0683	(75)
Southeast	0.8000	36.7938	0.6300	0.7000	0.7700	8.9957	(77)
Southwest	11.7400	36.7938	0.6300	0.7000	0.7700	132.0125	(79)
Northwest	3.6000	11.2829	0.6300	0.7000	0.7700	12.4136	(81)

Solar gains	190.4901	340.9109	510.1058	705.2210	856.6973	879.8812	836.0731	718.5735	576.9670	388.5502	231.1563	161.0830	(83)
Total gains	846.8367	1012.9094	1154.0878	1326.7789	1446.4991	1445.3901	1379.7636	1262.9994	1137.9533	971.6715	849.9647	803.4126	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.7438	42.8623	42.9791	43.5364	43.6423	44.1420	44.1420	44.2358	43.9481	43.6423	43.4286	43.2075	
alpha	3.8496	3.8575	3.8653	3.9024	3.9095	3.9428	3.9428	3.9491	3.9299	3.9095	3.8952	3.8805	
util living area	0.9937	0.9869	0.9721	0.9273	0.8290	0.6655	0.5124	0.5723	0.8052	0.9538	0.9881	0.9949	(86)
MIT	19.1024	19.3510	19.7256	20.2315	20.6487	20.8966	20.9716	20.9566	20.7712	20.2213	19.5787	19.0706	(87)
Th 2	19.7280	19.7311	19.7340	19.7481	19.7507	19.7630	19.7630	19.7652	19.7582	19.7507	19.7454	19.7398	(88)
util rest of house	0.9918	0.9829	0.9630	0.9030	0.7725	0.5641	0.3787	0.4352	0.7209	0.9333	0.9836	0.9933	(89)
MIT 2	17.5528	17.8707	18.3456	18.9774	19.4552	19.7032	19.7539	19.7496	19.6001	18.9807	18.1722	17.5196	(90)
Living area fraction									fLA = Living area / (4) =			0.1003	(91)
MIT	17.7082	18.0192	18.4840	19.1032	19.5749	19.8229	19.8760	19.8706	19.7175	19.1051	18.3133	17.6752	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7082	18.0192	18.4840	19.1032	19.5749	19.8229	19.8760	19.8706	19.7175	19.1051	18.3133	17.6752	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9747	0.9504	0.8869	0.7631	0.5695	0.3915	0.4478	0.7176	0.9185	0.9759	0.9891	(94)
Useful gains	835.6516	987.2498	1096.8156	1176.6930	1103.8834	823.1158	540.1726	565.5128	816.5990	892.5111	829.4384	794.6258	(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	2320.4728	2264.1796	2062.6514	1733.6543	1334.8050	875.2595	548.9993	580.3822	945.5504	1441.6230	1910.0178	2307.0439	(97)
Space heating kWh	1104.7069	858.0969	718.5818	401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	(98a)
Space heating requirement - total per year (kWh/year)												5565.9989	
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	1104.7069	858.0969	718.5818	401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5565.9989	
Space heating per m2											(98c) / (4) =	46.5151	(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	1104.7069	858.0969	718.5818	401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	(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)	1196.8656	929.6824	778.5285	434.4660	186.1383	0.0000	0.0000	0.0000	0.0000	442.6211	842.9222	1219.1106	(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	251.2351	222.1056	236.0577	208.1178	202.0532	182.4309	180.4556	187.5136	189.4204	210.7502	223.4637	248.5969	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.9824	86.7874	86.3907	85.5052	83.6983	79.8000	79.8000	79.8000	79.8000	85.5178	86.6202	87.0240	(217)
Fuel for water heating, kWh/month	288.8346	255.9190	273.2443	243.3979	241.4065	228.6102	226.1349	234.9795	237.3690	246.4403	257.9811	285.6647	(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	29.8405	23.9391	21.5545	15.7918	12.1980	9.9659	11.1274	14.4639	18.7871	24.6497	27.8418	30.6698	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-64.4326	-87.2757	-120.5723	-130.0922	-135.7803	-125.0745	-123.3990	-118.5555	-109.5427	-96.9990	-69.5010	-56.1222	(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	-48.1055	-99.5744	-195.0448	-288.9508	-378.3628	-378.9221	-374.5683	-318.9148	-236.0648	-141.1653	-63.8016	-38.1758	(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 6030.3347 (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 3019.9819 (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) 240.8297 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -3798.9981 (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	5578.1482	(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	6030.3347	0.2100	1266.3703	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3019.9819	0.2100	634.1962	(264)
Space and water heating			1900.5665	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	240.8297	0.1443	34.7592	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1237.3470	0.1355	-167.6235	
PV Unit electricity exported	-2561.6511	0.1263	-323.5351	
Total			-491.1586	(269)
Total CO2, kg/year			1456.0963	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1700	(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	6030.3347	1.1300	6814.2782	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3019.9819	1.1300	3412.5795	(278)
Space and water heating			10226.8577	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	240.8297	1.5338	369.3926	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1237.3470	1.5007	-1856.9152	
PV Unit electricity exported	-2561.6511	0.4636	-1187.6416	
Total			-3044.5568	(283)
Total Primary energy kWh/year			7681.7943	(286)
Target Primary Energy Rate (TPER)			64.2000	(287)

Full SAP Calculation Printout

Property Reference	Type C_Lean	Issued on Date	23/10/2024
Assessment Reference	00001	Prop Type Ref	Type C
Property			

SAP Rating	85 B	DER	15.21	TER	11.65
Environmental	88 B	% DER < TER			-30.56
CO_2 Emissions (t/year)	0.96	DFEE	39.32	TFEE	50.66
Compliance Check	See BREL	% DFEE < TFEE			22.37
% DPER < TPER	-35.32	DPER	84.44	TPER	62.40

Assessor Details	Mr. Oliver Eggenton	Assessor ID	AQ01-0001
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		72.3000	(1b)	x 3.0000	(2b) =	216.9000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.3000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		216.9000	(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) =	0.0922 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.2422 (18)
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2422 (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	0.3088	0.3028	0.2967	0.2664	0.2604	0.2301	0.2301	0.2240	0.2422	0.2604	0.2725	0.2846	(22b)
Effective ac	0.5477	0.5458	0.5440	0.5355	0.5339	0.5265	0.5265	0.5251	0.5293	0.5339	0.5371	0.5405	(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 = 0.80)			24.2000	0.7752	18.7597			(27)
Heatloss Floor 1			72.3000	0.0800	5.7840	0.0000	0.0000	(28a)
External Wall 1	111.6300	24.2000	87.4300	0.1300	11.3659	190.0000	16611.7000	(29a)
External Roof 1	72.3000		72.3000	0.1000	7.2300	0.0000	0.0000	(30)
Total net area of external elements Aum(A, m2)			256.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.1396			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16611.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		229.7607 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		12.8115 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	55.9511 (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	39.2015	39.0690	38.9391	38.3289	38.2148	37.6833	37.6833	37.5849	37.8880	38.2148	38.4457	38.6872	(38)
Heat transfer coeff	95.1526	95.0201	94.8902	94.2800	94.1659	93.6344	93.6344	93.5360	93.8391	94.1659	94.3968	94.6383	(39)
Average = Sum(39)m / 12 =												94.2795	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3161	1.3142	1.3125	1.3040	1.3024	1.2951	1.2951	1.2937	1.2979	1.3024	1.3056	1.3090	(40)
HLP (average)												1.3040	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3006	(42)
Hot water usage for mixer showers	62.7939	61.8502	60.4751	57.8441	55.9024	53.7372	52.5064	53.8711	55.3671	57.6919	60.3795	62.5533	(42a)
Hot water usage for baths	27.1267	26.7238	26.1565	25.1104	24.3272	23.4586	22.9895	23.5529	24.1663	25.0956	26.1632	27.0349	(42b)
Hot water usage for other uses	38.1909	36.8021	35.4134	34.0246	32.6359	31.2471	31.2471	32.6359	34.0246	35.4134	36.8021	38.1909	(42c)
Average daily hot water use (litres/day)												117.7635	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.1114	125.3761	122.0449	116.9791	112.8654	108.4429	106.7430	110.0598	113.5579	118.2009	123.3448	127.7791	(44)
Energy conte	202.8972	178.5339	187.5785	160.1385	151.9386	133.3432	129.0964	136.2770	140.0283	160.3975	175.7273	200.0712	(45)
Energy content (annual)										Total = Sum(45)m =		1956.0277	
Distribution loss (46)m = 0.15 x (45)m	30.4346	26.7801	28.1368	24.0208	22.7908	20.0015	19.3645	20.4416	21.0042	24.0596	26.3591	30.0107	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(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	251.2696	222.2251	235.9509	206.9505	200.3110	180.1552	177.4688	184.6494	186.8403	208.7699	222.5393	248.4436	(62)
WWHRS	-44.6651	-39.5022	-41.3644	-34.2514	-31.9210	-27.3151	-25.6035	-27.2268	-28.2612	-33.3169	-37.7440	-43.8380	(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	206.6045	182.7230	194.5865	172.6992	168.3899	152.8401	151.8653	157.4227	158.5791	175.4531	184.7953	204.6057	(64)
									Total per year (kWh/year) = Sum(64)m =			2110.5642	(64)
12Total per year (kWh/year)												2111	(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	106.1612	94.3155	101.0678	90.6957	89.2175	81.7862	81.6225	84.0100	84.0090	92.0301	95.8789	105.2216	(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	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	102.1907	113.1397	102.1907	105.5970	102.1907	105.5970	102.1907	102.1907	105.5970	102.1907	105.5970	102.1907	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.6045	204.7069	199.4089	188.1301	173.8927	160.5115	151.5721	149.4697	154.7676	166.0464	180.2839	193.6650	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	(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)	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	(71)
Water heating gains (Table 5)	142.6898	140.3504	135.8438	125.9662	119.9160	113.5919	109.7076	112.9167	116.6792	123.6964	133.1652	141.4269	(72)
Total internal gains	507.9946	518.7067	497.9530	480.2030	456.5090	437.2102	420.9800	422.0867	434.5535	452.4431	479.5557	497.7923	(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	8.9000	10.6334	0.6800	0.7000	0.7700	31.2178	(74)
East	1.9000	19.6403	0.6800	0.7000	0.7700	12.3095	(76)
South	6.4000	46.7521	0.6800	0.7000	0.7700	98.7009	(78)
West	7.0000	19.6403	0.6800	0.7000	0.7700	45.3509	(80)

Solar gains	187.5790	334.1013	493.0428	666.4741	793.8834	808.0886	770.8488	673.3373	553.0270	379.2089	227.4011	158.7284	(83)
Total gains	695.5737	852.8080	990.9958	1146.6772	1250.3924	1245.2988	1191.8288	1095.4240	987.5805	831.6520	706.9568	656.5207	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.4943	48.5619	48.6284	48.9431	49.0025	49.2806	49.2806	49.3325	49.1731	49.0025	48.8826	48.7579	
alpha	4.2330	4.2375	4.2419	4.2629	4.2668	4.2854	4.2854	4.2888	4.2782	4.2668	4.2588	4.2505	
util living area	0.9827	0.9610	0.9153	0.8079	0.6461	0.4701	0.3433	0.3884	0.6141	0.8699	0.9655	0.9862	(86)
MIT	19.6106	19.9097	20.2801	20.6703	20.8957	20.9787	20.9956	20.9926	20.9368	20.6064	20.0321	19.5519	(87)
Th 2	19.8283	19.8297	19.8311	19.8377	19.8389	19.8447	19.8447	19.8458	19.8425	19.8389	19.8364	19.8338	(88)
util rest of house	0.9778	0.9504	0.8935	0.7647	0.5811	0.3899	0.2544	0.2931	0.5263	0.8279	0.9543	0.9822	(89)

MIT 2	18.2581	18.6319	19.0832	19.5331	19.7604	19.8337	19.8434	19.8434	19.8047	19.4807	18.7954	18.1880	(90)
Living area fraction									fLA = Living area / (4) =			0.1757	(91)
MIT	18.4957	18.8563	19.2934	19.7329	19.9599	20.0348	20.0458	20.0453	20.0036	19.6785	19.0127	18.4276	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3457	18.7063	19.1434	19.5829	19.8099	19.8848	19.8958	19.8953	19.8536	19.5285	18.8627	18.2776	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9688	0.9370	0.8778	0.7541	0.5794	0.3927	0.2583	0.2973	0.5272	0.8145	0.9414	0.9743	(94)
Useful gains	673.8412	799.0638	869.8924	864.7137	724.4910	489.0848	307.9006	325.6469	520.6311	677.3948	665.5501	639.6644	(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	1336.4814	1311.8802	1199.7388	1007.1819	763.6711	494.8422	308.6002	326.9324	539.9085	840.7576	1110.3585	1332.2762	(97)
Space heating kWh	493.0043	344.6127	245.4058	102.5771	29.1500	0.0000	0.0000	0.0000	0.0000	121.5419	320.2620	515.3032	(98a)
Space heating requirement - total per year (kWh/year)												2171.8569	
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	493.0043	344.6127	245.4058	102.5771	29.1500	0.0000	0.0000	0.0000	0.0000	121.5419	320.2620	515.3032	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2171.8569	
Space heating per m2											(98c) / (4) =	30.0395	(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 %)	84.5000	(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	493.0043	344.6127	245.4058	102.5771	29.1500	0.0000	0.0000	0.0000	0.0000	121.5419	320.2620	515.3032	(98)
Space heating efficiency (main heating system 1)	84.5000	84.5000	84.5000	84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210)
Space heating fuel (main heating system)	583.4370	407.8256	290.4210	121.3930	34.4970	0.0000	0.0000	0.0000	0.0000	143.8366	379.0083	609.8263	(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	206.6045	182.7230	194.5865	172.6992	168.3899	152.8401	151.8653	157.4227	158.5791	175.4531	184.7953	204.6057	(64)
Efficiency of water heater												89.5000	(216)
(217)m	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	(217)
Fuel for water heating, kWh/month	244.5023	216.2402	230.2799	204.3777	199.2780	180.8759	179.7222	186.2990	187.6675	207.6367	218.6927	242.1369	(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	20.0399	16.0767	14.4753	10.6052	8.1918	6.6928	7.4728	9.7135	12.6168	16.5540	18.6977	20.5969	(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	2570.2449	(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	2497.7091	(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)	161.7334	(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	5315.6874	(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	2570.2449	0.2100	539.7514	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2497.7091	0.2100	524.5189	(264)
Space and water heating			1064.2703	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	161.7334	0.1443	23.3431	(268)
Total CO2, kg/year			1099.5427	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.2100	(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	2570.2449	1.1300	2904.3767	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2497.7091	1.1300	2822.4113	(278)
Space and water heating			5726.7881	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	161.7334	1.5338	248.0720	(282)
Total Primary energy kWh/year			6104.9609	(286)
Dwelling Primary energy Rate (DPER)			84.4400	(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	72.3000	(1b)	x 3.0000	(2b) =	216.9000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		216.9000	(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) =	0.1383	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3883	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3883	(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	0.4951	0.4854	0.4757	0.4271	0.4174	0.3689	0.3689	0.3592	0.3883	0.4174	0.4369	0.4563	(22b)
Effective ac	0.6226	0.6178	0.6131	0.5912	0.5871	0.5680	0.5680	0.5645	0.5754	0.5871	0.5954	0.6041	(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 Opening Type (Uw = 1.20)			18.0700	1.1450	20.6908			(27)
Heatloss Floor 1			72.3000	0.1300	9.3990			(28a)
External Wall 1	111.6300	18.0700	93.5600	0.1800	16.8408			(29a)
External Roof 1	72.3000		72.3000	0.1100	7.9530			(30)
Total net area of external elements Aum(A, m2)			256.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.8836			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			229.7607	(35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	37.2100	0.1600	5.9536	
E16 Corner (normal)	12.0000	0.0900	1.0800	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.0336	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		61.9172	(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	44.5611	44.2204	43.8865	42.3182	42.0247	40.6588	40.6588	40.4058	41.1849	42.0247	42.6184	43.2389	(38)

Heat transfer coeff

	106.4783	106.1377	105.8038	104.2354	103.9420	102.5760	102.5760	102.3231	103.1022	103.9420	104.5356	105.1562 (39)
Average = Sum(39)m / 12 =												104.2340

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4727	1.4680	1.4634	1.4417	1.4376	1.4188	1.4188	1.4153	1.4260	1.4376	1.4459	1.4544	(40)
HLP (average)												1.4417	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3006 (42)

Hot water usage for mixer showers

	62.7939	61.8502	60.4751	57.8441	55.9024	53.7372	52.5064	53.8711	55.3671	57.6919	60.3795	62.5533 (42a)

Hot water usage for baths

	27.1267	26.7238	26.1565	25.1104	24.3272	23.4586	22.9895	23.5529	24.1663	25.0956	26.1632	27.0349 (42b)

Hot water usage for other uses

	38.1909	36.8021	35.4134	34.0246	32.6359	31.2471	31.2471	32.6359	34.0246	35.4134	36.8021	38.1909 (42c)

Average daily hot water use (litres/day) 117.7635 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.1114	125.3761	122.0449	116.9791	112.8654	108.4429	106.7430	110.0598	113.5579	118.2009	123.3448	127.7791	(44)
Energy conte	202.8972	178.5339	187.5785	160.1385	151.9386	133.3432	129.0964	136.2770	140.0283	160.3975	175.7273	200.0712	(45)
Energy content (annual)										Total = Sum(45)m =		1956.0277	

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

	30.4346	26.7801	28.1368	24.0208	22.7908	20.0015	19.3645	20.4416	21.0042	24.0596	26.3591	30.0107 (46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6525 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8924 (55)

Total storage loss

	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)

If cylinder contains dedicated solar storage

	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (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

	253.8233	224.5317	238.5046	209.4218	202.8647	182.6265	180.0225	187.2031	189.3116	211.3236	225.0106	250.9973 (62)
WWHRS	-28.7067	-25.3885	-26.5854	-22.0137	-20.5160	-17.5557	-16.4557	-17.4989	-18.1638	-21.4131	-24.2584	-28.1751 (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

	225.1165	199.1432	211.9192	187.4081	182.3487	165.0708	163.5668	169.7042	171.1478	189.9105	200.7521	222.8222 (64)
										Total per year (kWh/year) = Sum(64)m =		2288.9101 (64)
12Total per year (kWh/year)												2289 (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

	108.2042	96.1607	103.1107	92.6727	91.2604	83.7632	83.6654	86.0530	85.9860	94.0730	97.8560	107.2645 (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	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	(66)

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

	102.1907	113.1397	102.1907	105.5970	102.1907	105.5970	102.1907	102.1907	105.5970	102.1907	105.5970	102.1907	(67)

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

	202.6045	204.7069	199.4089	188.1301	173.8927	160.5115	151.5721	149.4697	154.7676	166.0464	180.2839	193.6650	(68)

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

	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	(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)

	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	(71)

Water heating gains (Table 5)

	145.4357	143.0963	138.5897	128.7121	122.6619	116.3378	112.4535	115.6626	119.4251	126.4422	135.9110	144.1728	(72)

Total internal gains

	510.7405	521.4525	500.6989	482.9489	459.2549	439.9560	423.7259	424.8326	437.2994	455.1890	482.3016	500.5381	(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	6.6500	10.6334	0.6300	0.7000	0.7700	21.6105	(74)
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(76)
South	4.7800	46.7521	0.6300	0.7000	0.7700	68.2968	(78)
West	5.2200	19.6403	0.6300	0.7000	0.7700	31.3321	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	129.7628	231.1170	341.0554	461.0169	549.1495	558.9776	533.2169	465.7639	382.5453	262.3172	157.3094	109.8055	(83)
Total gains	640.5033	752.5696	841.7543	943.9658	1008.4044	998.9337	956.9428	890.5965	819.8447	717.5062	639.6110	610.3436	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.3362	43.4752	43.6125	44.2686	44.3936	44.9848	44.9848	45.0960	44.7552	44.3936	44.1415	43.8810	
alpha	3.8891	3.8983	3.9075	3.9512	3.9596	3.9990	3.9990	4.0064	3.9837	3.9596	3.9428	3.9254	
util living area	0.9879	0.9767	0.9544	0.8949	0.7812	0.6093	0.4590	0.5083	0.7391	0.9236	0.9776	0.9899	(86)

MIT	19.2927	19.5474	19.9089	20.3757	20.7316	20.9279	20.9818	20.9729	20.8414	20.3726	19.7601	19.2616	(87)
Th 2	19.7080	19.7116	19.7151	19.7315	19.7346	19.7490	19.7490	19.7517	19.7434	19.7346	19.7284	19.7218	(88)
util rest of house													
	0.9841	0.9697	0.9403	0.8626	0.7171	0.5084	0.3346	0.3799	0.6455	0.8927	0.9695	0.9867	(89)
MIT 2	17.7758	18.0992	18.5527	19.1260	19.5190	19.7098	19.7436	19.7427	19.6419	19.1398	18.3830	17.7454	(90)
Living area fraction										fLA = Living area / (4) =		0.1757	(91)
MIT	18.0423	18.3536	18.7909	19.3455	19.7320	19.9237	19.9611	19.9588	19.8526	19.3564	18.6249	18.0117	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0423	18.3536	18.7909	19.3455	19.7320	19.9237	19.9611	19.9588	19.8526	19.3564	18.6249	18.0117	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9593	0.9269	0.8507	0.7170	0.5234	0.3564	0.4021	0.6546	0.8808	0.9596	0.9804	(94)
Useful gains	625.7533	721.9306	780.2149	802.9902	723.0044	522.8291	341.0245	358.0939	536.7047	631.9955	613.7649	598.4038	(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													
	1463.2548	1427.9342	1300.4243	1088.7921	834.8650	546.0886	344.7671	364.1445	593.1084	910.1555	1204.7629	1452.3858	(97)
Space heating kWh													
	623.1011	474.4344	387.0358	205.7774	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626	(98a)
Space heating requirement - total per year (kWh/year)												3041.4053	
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													
	623.1011	474.4344	387.0358	205.7774	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3041.4053	
Space heating per m2											(98c) / (4) =	42.0665	(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													
	623.1011	474.4344	387.0358	205.7774	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626	(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)													
	675.0825	514.0134	419.3237	222.9441	90.1672	0.0000	0.0000	0.0000	0.0000	224.2157	461.0169	688.3669	(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													
	225.1165	199.1432	211.9192	187.4081	182.3487	165.0708	163.5668	169.7042	171.1478	189.9105	200.7521	222.8222	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2193	85.9346	85.3925	84.2699	82.4177	79.8000	79.8000	79.8000	79.8000	84.2529	85.7017	86.2736	(217)
Fuel for water heating, kWh/month													
	261.0977	231.7381	248.1708	222.3902	221.2494	206.8556	204.9710	212.6619	214.4709	225.4053	234.2453	258.2738	(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	21.2332	17.0341	15.3373	11.2368	8.6796	7.0913	7.9178	10.2919	13.3681	17.5397	19.8111	21.8233	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.0583	-73.7992	-99.1712	-104.0617	-106.3791	-97.3270	-96.1129	-93.4647	-88.1264	-80.6535	-59.7353	-49.1057	(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	-49.8032	-101.9654	-197.7208	-290.1200	-377.2605	-376.7681	-372.3107	-318.0510	-236.9766	-143.3808	-65.6587	-39.5977	(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	3295.1303	(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	2741.5299	(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)	171.3641	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3573.6086	(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	2720.4157	(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	3295.1303	0.2100	691.9774	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2741.5299	0.2100	575.7213	(264)
Space and water heating			1267.6986	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	171.3641	0.1443	24.7331	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1003.9951	0.1361	-136.6018	
PV Unit electricity exported	-2569.6135	0.1266	-325.3107	
Total			-461.9126	(269)
Total CO2, kg/year			842.4485	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6500	(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	3295.1303	1.1300	3723.4973	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2741.5299	1.1300	3097.9288	(278)
Space and water heating			6821.4261	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	171.3641	1.5338	262.8440	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1003.9951	1.5029	-1508.9325	
PV Unit electricity exported	-2569.6135	0.4647	-1194.1945	
Total			-2703.1269	(283)
Total Primary energy kWh/year			4511.2440	(286)
Target Primary Energy Rate (TPER)			62.4000	(287)

Full SAP Calculation Printout

Property Reference	Type C_Green	Issued on Date	23/10/2024
Assessment Reference	00001	Prop Type Ref	Type C
Property			

SAP Rating	102 A	DER	-0.76	TER	11.65
Environmental	101 A	% DER < TER			106.52
CO_2 Emissions (t/year)	-0.12	DFEE	39.32	TFEE	50.66
Compliance Check	See BREL	% DFEE < TFEE			22.37
% DPER < TPER	99.84	DPER	0.10	TPER	62.40

Assessor Details	Mr. Oliver Eggenton	Assessor ID	AQ01-0001
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		72.3000	(1b)	x 3.0000	(2b) =	216.9000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.3000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		216.9000	(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) =	0.0922 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2422 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2422 (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	0.3088	0.3028	0.2967	0.2664	0.2604	0.2301	0.2301	0.2240	0.2422	0.2604	0.2725	0.2846	(22b)
Effective ac	0.5477	0.5458	0.5440	0.5355	0.5339	0.5265	0.5265	0.5251	0.5293	0.5339	0.5371	0.5405	(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 = 0.80)			24.2000	0.7752	18.7597			(27)
Heatloss Floor 1			72.3000	0.0800	5.7840	0.0000	0.0000	(28a)
External Wall 1	111.6300	24.2000	87.4300	0.1300	11.3659	190.0000	16611.7000	(29a)
External Roof 1	72.3000		72.3000	0.1000	7.2300	0.0000	0.0000	(30)
Total net area of external elements Aum(A, m2)			256.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.1396			(33)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16611.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							229.7607	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							12.8115	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		55.9511	(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	39.2015	39.0690	38.9391	38.3289	38.2148	37.6833	37.6833	37.5849	37.8880	38.2148	38.4457	38.6872	(38)
Heat transfer coeff	95.1526	95.0201	94.8902	94.2800	94.1659	93.6344	93.6344	93.5360	93.8391	94.1659	94.3968	94.6383	(39)
Average = Sum(39)m / 12 =												94.2795	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3161	1.3142	1.3125	1.3040	1.3024	1.2951	1.2951	1.2937	1.2979	1.3024	1.3056	1.3090	(40)
HLP (average)												1.3040	
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												2.3006	(42)
Hot water usage for mixer showers													
	62.7939	61.8502	60.4751	57.8441	55.9024	53.7372	52.5064	53.8711	55.3671	57.6919	60.3795	62.5533	(42a)
Hot water usage for baths													
	27.1267	26.7238	26.1565	25.1104	24.3272	23.4586	22.9895	23.5529	24.1663	25.0956	26.1632	27.0349	(42b)
Hot water usage for other uses													
	38.1909	36.8021	35.4134	34.0246	32.6359	31.2471	31.2471	32.6359	34.0246	35.4134	36.8021	38.1909	(42c)
Average daily hot water use (litres/day)												117.7635	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	128.1114	125.3761	122.0449	116.9791	112.8654	108.4429	106.7430	110.0598	113.5579	118.2009	123.3448	127.7791	(44)
Energy conte	202.8972	178.5339	187.5785	160.1385	151.9386	133.3432	129.0964	136.2770	140.0283	160.3975	175.7273	200.0712	(45)
Energy content (annual)										Total = Sum(45)m =		1956.0277	
Distribution loss (46)m = 0.15 x (45)m													
	30.4346	26.7801	28.1368	24.0208	22.7908	20.0015	19.3645	20.4416	21.0042	24.0596	26.3591	30.0107	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(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													
	251.2696	222.2251	235.9509	206.9505	200.3110	180.1552	177.4688	184.6494	186.8403	208.7699	222.5393	248.4436	(62)
WWHRS	-44.6651	-39.5022	-41.3644	-34.2514	-31.9210	-27.3151	-25.6035	-27.2268	-28.2612	-33.3169	-37.7440	-43.8380	(63a)
PV diverter	-51.5661	-106.2995	-207.9867	-308.6339	-403.5261	-404.0458	-398.6197	-337.8726	-249.4957	-149.5722	-67.9701	-40.8391	(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													
	155.0383	76.4234	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	25.8808	116.8252	163.7666	(64)
										Total per year (kWh/year) = Sum(64)m =		537.9344	(64)
12Total per year (kWh/year)												538	(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													
	106.1612	94.3155	101.0678	90.6957	89.2175	81.7862	81.6225	84.0100	84.0090	92.0301	95.8789	105.2216	(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	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	102.1907	113.1397	102.1907	105.5970	102.1907	105.5970	102.1907	102.1907	105.5970	102.1907	105.5970	102.1907	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	202.6045	204.7069	199.4089	188.1301	173.8927	160.5115	151.5721	149.4697	154.7676	166.0464	180.2839	193.6650	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	(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)													
	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	(71)
Water heating gains (Table 5)													
	142.6898	140.3504	135.8438	125.9662	119.9160	113.5919	109.7076	112.9167	116.6792	123.6964	133.1652	141.4269	(72)
Total internal gains													
	507.9946	518.7067	497.9530	480.2030	456.5090	437.2102	420.9800	422.0867	434.5535	452.4431	479.5557	497.7923	(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	8.9000	10.6334	0.6800	0.7000	0.7700	31.2178	(74)
East	1.9000	19.6403	0.6800	0.7000	0.7700	12.3095	(76)
South	6.4000	46.7521	0.6800	0.7000	0.7700	98.7009	(78)
West	7.0000	19.6403	0.6800	0.7000	0.7700	45.3509	(80)

Solar gains	187.5790	334.1013	493.0428	666.4741	793.8834	808.0886	770.8488	673.3373	553.0270	379.2089	227.4011	158.7284	(83)
Total gains	695.5737	852.8080	990.9958	1146.6772	1250.3924	1245.2988	1191.8288	1095.4240	987.5805	831.6520	706.9568	656.5207	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.4943	48.5619	48.6284	48.9431	49.0025	49.2806	49.2806	49.3325	49.1731	49.0025	48.8826	48.7579	
alpha	4.2330	4.2375	4.2419	4.2629	4.2668	4.2854	4.2854	4.2888	4.2782	4.2668	4.2588	4.2505	
util living area													
	0.9827	0.9610	0.9153	0.8079	0.6461	0.4701	0.3433	0.3884	0.6141	0.8699	0.9655	0.9862	(86)
MIT	19.6106	19.9097	20.2801	20.6703	20.8957	20.9787	20.9956	20.9926	20.9368	20.6064	20.0321	19.5519	(87)
Th 2	19.8283	19.8297	19.8311	19.8377	19.8389	19.8447	19.8447	19.8458	19.8425	19.8389	19.8364	19.8338	(88)
util rest of house													
	0.9778	0.9504	0.8935	0.7647	0.5811	0.3899	0.2544	0.2931	0.5263	0.8279	0.9543	0.9822	(89)

MIT 2	18.2581	18.6319	19.0832	19.5331	19.7604	19.8337	19.8434	19.8434	19.8047	19.4807	18.7954	18.1880	(90)
Living area fraction									fLA = Living area / (4) =			0.1757	(91)
MIT	18.4957	18.8563	19.2934	19.7329	19.9599	20.0348	20.0458	20.0453	20.0036	19.6785	19.0127	18.4276	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4957	18.8563	19.2934	19.7329	19.9599	20.0348	20.0458	20.0453	20.0036	19.6785	19.0127	18.4276	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9698	0.9390	0.8814	0.7604	0.5883	0.4034	0.2700	0.3098	0.5392	0.8211	0.9437	0.9752	(94)
Useful gains	674.5970	800.7794	873.4774	871.9336	735.5532	502.3289	321.7741	339.3861	532.4615	682.8876	667.1233	640.2638	(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	1350.7543	1326.1333	1213.9724	1021.3239	777.7960	508.8874	322.6454	340.9628	553.9844	854.8825	1124.5180	1346.4720	(97)
Space heating kWh	503.0610	353.0378	253.3283	107.5610	31.4287	0.0000	0.0000	0.0000	0.0000	127.9642	329.3242	525.4189	(98a)
Space heating requirement - total per year (kWh/year)												2231.1240	
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	503.0610	353.0378	253.3283	107.5610	31.4287	0.0000	0.0000	0.0000	0.0000	127.9642	329.3242	525.4189	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2231.1240	
Space heating per m2											(98c) / (4) =	30.8593	(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	503.0610	353.0378	253.3283	107.5610	31.4287	0.0000	0.0000	0.0000	0.0000	127.9642	329.3242	525.4189	(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)	229.3940	160.9840	115.5168	49.0474	14.3314	0.0000	0.0000	0.0000	0.0000	58.3512	150.1706	239.5891	(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	155.0383	76.4234	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	25.8808	116.8252	163.7666	(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	81.4277	40.1383	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	13.5929	61.3578	86.0118	(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	20.0399	16.0767	14.4753	10.6052	8.1918	6.6928	7.4728	9.7135	12.6168	16.5540	18.6977	20.5969	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-89.4840	-115.8189	-141.1034	-129.7193	-115.4717	-97.6723	-96.2541	-95.8171	-94.1317	-108.7488	-93.3391	-78.5148	(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	-3.4797	-16.8104	-54.8390	-99.6702	-143.2142	-148.5291	-146.7897	-128.0908	-98.0401	-45.5975	-9.3680	-1.8499	(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	1017.3844	(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	282.5286	(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)	161.7334	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2152.3541	(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	-690.7078	(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	1017.3844	0.1567	159.3928	(261)
Total CO2 associated with community systems			0.0000	(373)

Water heating (other fuel)	282.5286	0.1587	44.8284	(264)
Space and water heating			204.2212	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	161.7334	0.1443	23.3431	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1256.0755	0.1392	-174.8003	
PV Unit electricity exported	-896.2786	0.1198	-107.3827	
Total			-282.1830	(269)
Total CO2, kg/year			-54.6186	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.7600	(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	1017.3844	1.5800	1607.4471	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	282.5286	1.5871	448.3897	(278)
Space and water heating			2055.8368	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	161.7334	1.5338	248.0720	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1256.0755	1.5146	-1902.4491	
PV Unit electricity exported	-896.2786	0.4397	-394.0646	
Total			-2296.5137	(283)
Total Primary energy kWh/year			7.3952	(286)
Dwelling Primary energy Rate (DPER)			0.1000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.3000	(1b)	x 3.0000	(2b) =	216.9000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		216.9000	(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) =	0.1383 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3883 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3883 (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	0.4951	0.4854	0.4757	0.4271	0.4174	0.3689	0.3689	0.3592	0.3883	0.4174	0.4369	0.4563	(22b)
Effective ac	0.6226	0.6178	0.6131	0.5912	0.5871	0.5680	0.5680	0.5645	0.5754	0.5871	0.5954	0.6041	(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 Opening Type (Uw = 1.20)			18.0700	1.1450	20.6908			(27)
Heatloss Floor 1			72.3000	0.1300	9.3990			(28a)
External Wall 1	111.6300	18.0700	93.5600	0.1800	16.8408			(29a)
External Roof 1	72.3000		72.3000	0.1100	7.9530			(30)
Total net area of external elements Aum(A, m2)			256.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.8836			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							229.7607	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	37.2100	0.1600	5.9536

E16 Corner (normal)									12.0000	0.0900	1.0800		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												7.0336	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	61.9172	(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	44.5611	44.2204	43.8865	42.3182	42.0247	40.6588	40.6588	40.4058	41.1849	42.0247	42.6184	43.2389	(38)
Heat transfer coeff	106.4783	106.1377	105.8038	104.2354	103.9420	102.5760	102.5760	102.3231	103.1022	103.9420	104.5356	105.1562	(39)
Average = Sum(39)m / 12 =												104.2340	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4727	1.4680	1.4634	1.4417	1.4376	1.4188	1.4188	1.4153	1.4260	1.4376	1.4459	1.4544	(40)
HLP (average)												1.4417	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy												2.3006	(42)
Hot water usage for mixer showers	62.7939	61.8502	60.4751	57.8441	55.9024	53.7372	52.5064	53.8711	55.3671	57.6919	60.3795	62.5533	(42a)
Hot water usage for baths	27.1267	26.7238	26.1565	25.1104	24.3272	23.4586	22.9895	23.5529	24.1663	25.0956	26.1632	27.0349	(42b)
Hot water usage for other uses	38.1909	36.8021	35.4134	34.0246	32.6359	31.2471	31.2471	32.6359	34.0246	35.4134	36.8021	38.1909	(42c)
Average daily hot water use (litres/day)												117.7635	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.1114	125.3761	122.0449	116.9791	112.8654	108.4429	106.7430	110.0598	113.5579	118.2009	123.3448	127.7791	(44)
Energy conte	202.8972	178.5339	187.5785	160.1385	151.9386	133.3432	129.0964	136.2770	140.0283	160.3975	175.7273	200.0712	(45)
Energy content (annual)											Total = Sum(45)m =	1956.0277	
Distribution loss (46)m = 0.15 x (45)m	30.4346	26.7801	28.1368	24.0208	22.7908	20.0015	19.3645	20.4416	21.0042	24.0596	26.3591	30.0107	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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	253.8233	224.5317	238.5046	209.4218	202.8647	182.6265	180.0225	187.2031	189.3116	211.3236	225.0106	250.9973	(62)
WWHRS	-28.7067	-25.3885	-26.5854	-22.0137	-20.5160	-17.5557	-16.4557	-17.4989	-18.1638	-21.4131	-24.2584	-28.1751	(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	225.1165	199.1432	211.9192	187.4081	182.3487	165.0708	163.5668	169.7042	171.1478	189.9105	200.7521	222.8222	(64)
											Total per year (kWh/year) = Sum(64)m =	2288.9101	(64)
12Total per year (kWh/year)												2289	(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	108.2042	96.1607	103.1107	92.6727	91.2604	83.7632	83.6654	86.0530	85.9860	94.0730	97.8560	107.2645	(65)

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	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	115.0322	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	102.1907	113.1397	102.1907	105.5970	102.1907	105.5970	102.1907	102.1907	105.5970	102.1907	105.5970	102.1907	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.6045	204.7069	199.4089	188.1301	173.8927	160.5115	151.5721	149.4697	154.7676	166.0464	180.2839	193.6650	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	34.5032	(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)	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	-92.0257	(71)
Water heating gains (Table 5)	145.4357	143.0963	138.5897	128.7121	122.6619	116.3378	112.4535	115.6626	119.4251	126.4422	135.9110	144.1728	(72)
Total internal gains	510.7405	521.4525	500.6989	482.9489	459.2549	439.9560	423.7259	424.8326	437.2994	455.1890	482.3016	500.5381	(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	6.6500	10.6334	0.6300	0.7000	0.7700	21.6105	(74)
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(76)
South	4.7800	46.7521	0.6300	0.7000	0.7700	68.2968	(78)
West	5.2200	19.6403	0.6300	0.7000	0.7700	31.3321	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	129.7628	231.1170	341.0554	461.0169	549.1495	558.9776	533.2169	465.7639	382.5453	262.3172	157.3094	109.8055	(83)
Total gains	640.5033	752.5696	841.7543	943.9658	1008.4044	998.9337	956.9428	890.5965	819.8447	717.5062	639.6110	610.3436	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.3362	43.4752	43.6125	44.2686	44.3936	44.9848	44.9848	45.0960	44.7552	44.3936	44.1415	43.8810	
alpha	3.8891	3.8983	3.9075	3.9512	3.9596	3.9990	3.9990	4.0064	3.9837	3.9596	3.9428	3.9254	
util living area	0.9879	0.9767	0.9544	0.8949	0.7812	0.6093	0.4590	0.5083	0.7391	0.9236	0.9776	0.9899	(86)
MIT	19.2927	19.5474	19.9089	20.3757	20.7316	20.9279	20.9818	20.9729	20.8414	20.3726	19.7601	19.2616	(87)
Th 2	19.7080	19.7116	19.7151	19.7315	19.7346	19.7490	19.7490	19.7517	19.7434	19.7346	19.7284	19.7218	(88)
util rest of house	0.9841	0.9697	0.9403	0.8626	0.7171	0.5084	0.3346	0.3799	0.6455	0.8927	0.9695	0.9867	(89)
MIT 2	17.7758	18.0992	18.5527	19.1260	19.5190	19.7098	19.7436	19.7427	19.6419	19.1398	18.3830	17.7454	(90)
Living area fraction										fLA = Living area / (4) =		0.1757	(91)
MIT	18.0423	18.3536	18.7909	19.3455	19.7320	19.9237	19.9611	19.9588	19.8526	19.3564	18.6249	18.0117	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0423	18.3536	18.7909	19.3455	19.7320	19.9237	19.9611	19.9588	19.8526	19.3564	18.6249	18.0117	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9593	0.9269	0.8507	0.7170	0.5234	0.3564	0.4021	0.6546	0.8808	0.9596	0.9804	(94)
Useful gains	625.7533	721.9306	780.2149	802.9902	723.0044	522.8291	341.0245	358.0939	536.7047	631.9955	613.7649	598.4038	(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	1463.2548	1427.9342	1300.4243	1088.7921	834.8650	546.0886	344.7671	364.1445	593.1084	910.1555	1204.7629	1452.3858	(97)
Space heating kWh	623.1011	474.4344	387.0358	205.7774	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626	(98a)
Space heating requirement - total per year (kWh/year)												3041.4053	
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	623.1011	474.4344	387.0358	205.7774	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3041.4053	
Space heating per m2											(98c) / (4) =	42.0665	(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	623.1011	474.4344	387.0358	205.7774	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626	(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)	675.0825	514.0134	419.3237	222.9441	90.1672	0.0000	0.0000	0.0000	0.0000	224.2157	461.0169	688.3669	(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	225.1165	199.1432	211.9192	187.4081	182.3487	165.0708	163.5668	169.7042	171.1478	189.9105	200.7521	222.8222	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2193	85.9346	85.3925	84.2699	82.4177	79.8000	79.8000	79.8000	79.8000	84.2529	85.7017	86.2736	(217)
Fuel for water heating, kWh/month	261.0977	231.7381	248.1708	222.3902	221.2494	206.8556	204.9710	212.6619	214.4709	225.4053	234.2453	258.2738	(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	21.2332	17.0341	15.3373	11.2368	8.6796	7.0913	7.9178	10.2919	13.3681	17.5397	19.8111	21.8233	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.0583	-73.7992	-99.1712	-104.0617	-106.3791	-97.3270	-96.1129	-93.4647	-88.1264	-80.6535	-59.7353	-49.1057	(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	-49.8032	-101.9654	-197.7208	-290.1200	-377.2605	-376.7681	-372.3107	-318.0510	-236.9766	-143.3808	-65.6587	-39.5977	(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 3295.1303 (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 2741.5299 (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) 171.3641 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -3573.6086 (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	2720.4157	(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	3295.1303	0.2100	691.9774	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2741.5299	0.2100	575.7213	(264)
Space and water heating			1267.6986	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	171.3641	0.1443	24.7331	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1003.9951	0.1361	-136.6018	
PV Unit electricity exported	-2569.6135	0.1266	-325.3107	
Total			-461.9126	(269)
Total CO2, kg/year			842.4485	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6500	(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	3295.1303	1.1300	3723.4973	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2741.5299	1.1300	3097.9288	(278)
Space and water heating			6821.4261	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	171.3641	1.5338	262.8440	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1003.9951	1.5029	-1508.9325	
PV Unit electricity exported	-2569.6135	0.4647	-1194.1945	
Total			-2703.1269	(283)
Total Primary energy kWh/year			4511.2440	(286)
Target Primary Energy Rate (TPER)			62.4000	(287)