Energy and Sustainability Statement
8 Druid Stoke Avenue,
Bristol,
BS9 1DD

For Kathryn Ashby

8 February 2024
Completed by Laura Meehan
Issue 02

M Sustainability
[redacted]

Issued by	M Sustainability [redacted]

Client	Kathryn Ashby
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P01	01/02/2024	Preliminary draft for comment
P02	08/02/2025	With inclusions from client

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1. Introduction

This report has been prepared by M Sustainability in consideration of the Bristol City Council Policies and the Sustainability and Practice note which details the relevant issues for the local authority. The application is for outline approval for a total of 1 new build dwellings.

It assesses expected energy demand for the site showing how energy and carbon dioxide emissions will be reduced through designing for minimum energy use and installing on-site renewable and low carbon energy sources.

It will outline the sustainable construction principles that will be incorporated into the design and outline the proposed developments energy requirements and subsequent CO_2 emissions

Bristol City Council BCS 15 requires residential developments of more than 10 dwellings to provide evidence of energy efficient design and that 20% of predicted energy demand is met through renewable and low carbon sources. A final energy strategy, to outline how the 20% reduction can be met can be finalised through a suitably worded condition.

The development design proposes a 20% reduction on the total CO_2 emissions as outlined within Bristol's Climate Change and Sustainability Practice Note BCS14. The table on page 18 shows that there is proposed a significant improvement on the energy usage and CO2 emissions from Baseline measures.

2. National Policy Requirements

The Climate Change Act 2008

Under the Climate Change Act the UK government is committed by law to reducing greenhouse gas emission by at least 100% of 1990 levels (net zero) by 2050 compared to 1990 levels. The government has set five-yearly carbon budgets which currently run until 2032. Through Climate Change Act the government has set a target to significantly reduce UK greenhouse gas emission by 2050 and a path to get there.

The construction and operation of UK buildings account for approximately 60% of national carbon dioxide emissions. Therefore, planning legislation seeks to mitigate the impact (in particular) of new construction in order to minimise these emissions and to meet the national targets.

National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out the overarching planning policies on the delivery of sustainable development through the planning system. The NPPF was published in early 2012 – updated in early 2019, with limited changes affecting the environmental sustainability requirements. It sets out the Government's planning policies for England and how these are expected to be applied, moreover it compels planning authorities to facilitate and promote good quality and sustainable development.

Para 154

When determining planning applications for renewable and low carbon development, local planning authorities should:

(a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

(b) approve the application if its impacts are (or can be made) acceptable 49 . Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.[1]National Policy Requirements

[1]https://www.gov.uk/guidance/national-planning-policy-framework/14-meeting-the-challenge-of-climate-change-flooding-and-coastal-change

3. Bristol Core Strategy 14 - Sustainable Energy

In Bristol City Council published their "Bristol Development Framework, Core Strategy". This Core Strategy has set out a strong commitment to promote sustainable development and high quality urban design. This publication clearly outlines the objectives and strategy for sustainable communities in Bristol, tackling the causes and effects of climate change, and maximising energy savings and energy efficiency within new buildings.

BCS14 - Sustainable Energy

This sets out the criteria for assessing new renewable energy schemes, with a presumption in favour of large-scale renewable energy installations. BCS14 requires new development to minimise its energy requirements and then incorporate an element of renewable energy to reduce its CO_2 emissions by a further 20%.

From the Bristol Core Strategy:

"Development in Bristol should include measures to reduce carbon dioxide emissions from energy use in accordance with the following energy hierarchy:

1. Minimising energy requirements;

2. Incorporating renewable energy sources;

3. Incorporating low-carbon energy sources.

Heat Hierarchy

Consistent with stage two of the above energy hierarchy, development will be expected to provide sufficient renewable energy generation to reduce carbon dioxide emissions from residual energy use in the buildings by at least 20%. An exception will only be made in the case where a development is appropriate and necessary but where it is demonstrated that meeting the required standard would not be feasible or viable. The use of combined heat and power (CHP), combined cooling, heat and power (CCHP) and district heating will be encouraged. Within Heat Priority Areas, major development will be expected to incorporate, where feasible, infrastructure for district heating, and will be expected to connect to existing systems where available. New development will be expected to demonstrate that the heating and cooling systems have been selected according to the following heat hierarchy:

1. Connection to existing CHP/CCHP distribution networks

2. Site-wide renewable CHP/CCHP

3. Site-wide gas-fired CHP/CCHP

4. Site-wide renewable community heating/cooling

5. Site-wide gas-fired community heating/cooling

6. Individual building renewable heating"

How to comply

Compliance with the requirements of Policy BCS14 can be shown through following the guidance outlined in the Bristol City Council's Climate Change and Sustainability Practice Note, dated July 2020 with addendum July 2023. The Climate Change and Sustainability Practice Note states the following requirements:

"As such, the policy has four main strands:

- *To encourage major freestanding renewable and low carbon energy installations;*
- *To reduce energy demand through the use of energy efficiency and conservation measures, including improvements in fabric efficiency and air permeability and use of passive design principles in new development;*
- *To secure at least a 20% saving in CO2 emissions from energy use in new development through on-site generation of renewable energy; and*
- *To ensure that heating and hot water systems are designed and specified in accordance with the heat hierarchy including, where appropriate, connection to a heat network. "*

In general terms, policy BCS14 aims to push developments towards energy efficiency measures, connection into district CHP systems and/or installing low and zero carbon technologies on site. An exception will only be made in cases where a development is appropriate and necessary but where it is demonstrated that meeting the required standard would not be feasible or viable.

Bristol City council are committed to achieving their goal as part of the climate emergency protocol. Currently all planning applications large or small are required to meet the heat hierarchy. In conjunction with energy efficiency in design, this will lead us towards the goal of carbon neutrality.

BCS15 - Sustainable Design and Construction

- Requires all development to engage with issues around sustainable design and construction.
- Requires larger developments to be assessed against BREEAM and super major developments to be assessed using BREEAM Communities.
- Contains additional policy content relating to refuse storage and broadband provision.

BCS16 - Flood Risk and Water Management

Principally addresses the issues around development in flood risk areas but also requires all development to include water management measures to reduce surface water run-off, including sustainable drainage systems (SUDS). There will be a green roof installed on the first floor roof that will reduce run off and increase biodiversity.

1. The Proposed Site

This report has been structured to demonstrate how the proposed development responds to both the local sustainability policies of Bristol City Council and the principles of sustainable development set out in the National Planing Policy Framework (NPFF)

Site and Surroundings

The application site comprises of proposed new building

Figure 1 Site

Proposed development

The client seeks to create a 2 storey dwelling with a partial 3rd storey basemen below ground level. This house is to be situated behind the exiting house at no. 8 Druid Stoke Avenue

2. Sustainability at 8 Druid Stoke Avenue

Sustainability has been considered for the development under the following chapter headings which reflect the Sustainable Development Themes of the NPPF and the guidance of the Core Strategy from Bristol City Council.

Climate Change

One of the main challenges facing the UK and new development is the need to mitigate and adapt to a changing climate. The government is committed to tackling climate change and has an ambitious long-term goal to reduce carbon emissions by 100% by 2050.

Policies BCS13 through to 16 requires new developments to contribute to both mitigation of and adaption to the impacts of climate change and meet targets to reduce carbon dioxide emissions.

Mitigation

Climate Change Mitigation refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation measures are incorporated throughout this section under various different headings as follows:

- Energy and Carbon - including outline detail on super insulated, air tight and highly efficient services including outline design measures to passively reduce energy demand and finally the use of renewable and low carbon energy systems to meet the lower demand.
- Sustainable Design and Construction - includes the efficient use of natural resources and ensuring that methods of reducing waste are identified at early stages and materials with low embodied carbon are identified
- Sustainable Transport - includes measures to encourage cycling, walking, the use of public transport and use of electric cars instead of journeys by private car.

Adaptation

Policy BCS16 states that developments should be designed to be resilient to extreme weather events including flood risk, rising temperatures and changes in rainfall. The following features will be considered:

- Spacing of the development to allow free air flow for ventilation and comfort
- Use of trees to provide shade, buffer wind and help mitigate against flooding (retaining soil and acting as a natural water retainer)
- Openable windows to allow for cross ventilation whilst keeping dwellings secure.

- Larger capacity building gutters, downpipes and drainage to cope with additional rainfall
- Green roof systems to reduce overheating in the summer months, buffer rainfall and increase biodiversity.
- Water butts to buffer additional rainfall

3. Energy and CO_2 emissions reductions

BCS14 Reducing energy demand and CO2 emissions

Provides criteria for assessing new renewable energy schemes, with a presumption in favour of large-scale renewable energy installations. Requires development to minimise its energy requirements and then incorporate an element of renewable energy to reduce its energy by a further 20%.

The strategy will be considered in line with the energy hierarchy below considering options to demonstrate sufficient renewable energy generation to reduce energy emissions by 20%.

Baseline Energy Use and Carbon Emissions

The exact requirements of the development will be outlined at detailed design stage and then confirmed through energy modelling. The energy performance of the proposed development is therefore a pro rata calculation based on benchmark design stage Part L (SAP) data for dwellings. Therefore at this stage all elements of the energy strategy are preliminary, pending further design work prior to any reserved matters submission.

The proposed new dwellings will be designed and constructed in accordance with the energy hierarchy, aiming to minimise energy use and carbon emissions before considering low carbon energy and renewable energy technologies.

The energy baseline (Part L 2020[2]) is shown in table 1.

These figures are based on building regulations minimum standards, however the part of Bristol City Councils requirement is to provide *"designs that are energy efficient and designed to reduce their energy demands"* this is also in line with government policy to reduce residual emissions.

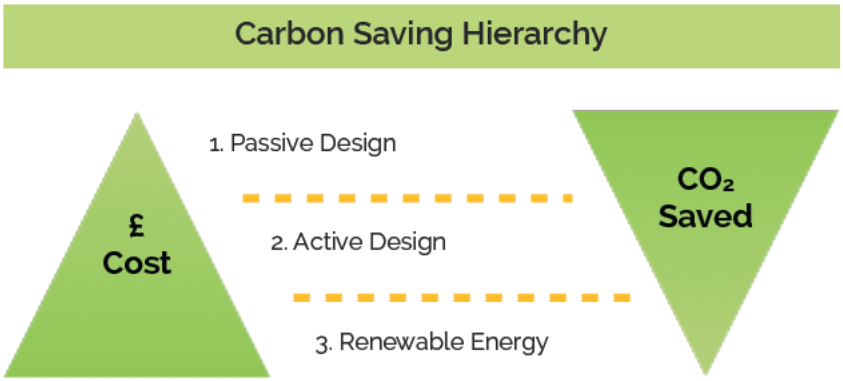
This approach has a number of benefits including:

- Carbon savings delivered are 'locked-in' for the lifetime of the homes (60 years or more) rather than the much shorter lifespan (around 25 years) of a renewable energy technology;
- There are virtually no maintenance and/or replacement costs to maintain carbon reductions through improved fabric; and
- No reliance on an occupier's behaviour to deliver carbon reductions. In contrast, achieving carbon savings from renewable energy technologies requires education, awareness and often, behavioural changes from occupants.

	Fabric energy efficiency (kWh/ yr)	Target Primary Energy Rate (kWh/ yr)	Energy saving (%)	Total Regulated CO_2 emissions (kg CO_2/yr)	Saving achieved on residual CO_2 emissions (%)
Baseline energy demand – "Baseline"	15409	18883	0%	3568.50	0%
Baseline energy efficiency demand (kWh/ yr)			15409		
TPER			18883		
Regulated emissions (kg/yr)			3568.50		

4. Reducing Energy Demand

There are two complementary parts, passive design and provision of efficient building services. The section below outlines our proposal for the measures included for the proposed development.



If we assume that all dwellings will be built to a highly efficient fabric standard the estimated energy demand can be significantly reduced above and beyond our current calculations.

Currently to meet building regulations we assume a specification of:

- Minimal thermal bridges
- Walls at 0.17 w/m²K
- Floors and roofs at 0.13 w/m²K
- Windows at 1.2 w/m²K
- Air pressure test at 3

Building Services

In addition to building fabric, the building services (i.e. lighting, plumbing and wiring) will be highly efficient. Building services are generally installed in buildings to provide comfort conditions. The services that provide comfort conditions are most efficient when they are accurately sized to match the load that they need to provide. Therefore both the efficiency of the items of equipment and their level of control affects overall CO_2 emissions performance.

The following items have been used to show that in conjunction with insulating building fabric, the building's energy use can be reduced by:

- Mechanical Ventilation
- Low energy lighting such as LEDs throughout
- Highly efficient Air Source Heat Pump for heating and hot water

- Programmers and room thermostats

This will mean a reduction in CO2 emissions and reduced running and maintenance costs. The client proposes the use of thermodynamic panels, although not included here it is thought they will be used for reduced the energy required for hot water in the dwelling.

	Fabric Energy Efficiency (kWh/yr)	Target Primary Energy Rate (kWh/ yr)	Energy saving (%)	Total Regulated CO_2 emissions (kg CO_2/yr)	Saving achieved on residual CO_2 emissions (%)
Baseline energy demand – "Baseline"	15409	18883	0%	3568.50	0%
Proposed scheme after energy efficiency measures better than Building Part L1A standards – "Residual"	14399	8790	53.45%	841.80	76.41%

Baseline energy demand (kWh/yr)		15409
Regulated emissions (kg/yr)		3568.50
Energy savings from energy efficiency measures (kWh)		1010
Emission savings from energy efficiency measures		76.41%
Total regulated emissions after energy efficiency measures		841.80

5. Renewable Energy Generation on Site

Of the technologies considered: (PV, Solar Thermal, Air Source Heat Pumps, Wind, District Heating and CHP), Air Source Heat Pumps and PVs were considered the most appropriate option for the site. This was due to the nature of the site in terms of planning restrictions, financial investment required.

CHP

Bristol City Council has plans for mixed use district heating and CHP schemes.

Gas-fired combined heat and power (CHP) schemes in high-density urban areas are the most popular because the costs are viable, the technology is mature and heat networks benefit many users.

CHP systems requires a significant infrastructure, and a substantial heat demand to be viable and therefore has been discounted within development, as the infrastructure is not yet available.

Wind

The first consideration for this technology is local wind speed. The Energy Saving Trust has established the wind speed at Druid Stoke Avenue to be 4.5 metres per second at 10 metres above ground[3]. Wind speeds of less than 5 metres per second are unlikely to provide a cost effective source of electricity (based on current technologies) and considering the neighbouring buildings and suburban environment it may not be the best placed to provide wind power.

A solution may be to mount the turbine beyond the zone of turbulence which may be 15m or more in the air – there may be planning concerns from both an aesthetic and noise perspective. Turbines also carry high capital costs upwards of £35,000 for a 12 kW turbine.

Solar hot water systems

Solar water heating systems use the energy from the sun to heat water stored in a hot water cylinder inside the building.

Typical cost for 4m² of flat plate solar hot water is approximately £2,800 with a payback period of around 6-10 years. This could also benefit from the Renewable Heat Incentive.

There is west facing roof space so it could accommodate both PV and Solar thermal and if the buildings have a low heat demand it will be suited to solar thermal to supplement the hot water demand. This is a suitable technology.

[3] [redacted]

Biomass heating

Biomass boilers such as Woodchip-fed systems remain very costly and the requirements for siting both the boiler and the fuel source were considered impractical for this development.

Therefore use of this technology for the main heating system was considered to be inappropriate for this development.

Heat pumps

Heat pumps take in heat at a certain temperature and release it at a higher temperature, using the same process as a refrigerator. Fluid is circulated through pipes buried in the ground and passes through a heat exchanger in the heat pump that extracts heat from the fluid.

The heat pump raises the temperature of the fluid via the compression cycle to supply hot water to the building as from a normal boiler. Air source heat pumps work in the same way but use the air as the heat source rather than the ground.

Ground-source heat pumps are used to extract heat from the ground to provide space and water heating. The ground pipe system can be horizontal or vertical.

Ground Source heat pumps have a high capital cost and would be very disruptive to install, therefore they are not advised for this site.

Air Source Heat Pumps can deliver up to four units of electricity from one unit, they can be sized to provide heating and hot water and work best with highly insulated and air tight properties with underfloor heating. They are best sited on a South or West facing wall with good air flow.

As general guidance ASHPs require:

- Ample supply of ambient (outdoor) air, enclosed courtyards or alleyways are usually unsuitable. Manufacturers vary but as a guide 350mm gap behind units, 4m space in front of unit and ample air flow at sides
- Easy access for servicing schedule
- Some drainage below outside unit (small 400mm depth soakaway sufficient) to prevent ice build up from condensation dripping in cold weather, if the unit is wall mounted a tray connected to a waste pipe may be needed.

Heat pumps work very well on low energy houses.

Photovoltaic Panels

Photovoltaic Panel systems convert energy from the sun into electricity through semi-conductor cells mounted in collector panels. The panels are connected to an inverter to turn the DC output into AC for use in the building to which they are attached and to be fed back into the grid when not required.

The current Feed in Tariff scheme yields guaranteed payments for 25 years for all electricity generated by the system and payment for electricity exported back to the grid. Typical cost for around 3kWp array is around £5,000 with a payback period of around 12 years.

Photovoltaic arrays provide a quiet and effective renewable energy source with a relatively low aesthetic impact. The major benefit of PV systems is the significant reductions they can achieve in comparison to other technologies, in terms of CO_2 and energy use.

PV are suitable in conjunction with ASHP, PV is a very complementary technology.

Air Source Heat Pump and Photovoltaics, chosen strategy

An Air Source Heat Pump for hot water and space heating is appropriate for dwellings with a low energy demand and this house will be well insulated, air tight. Air Source Heat Pump can provide low temperature hot water and heating. This is well suited as it can provide highly efficient heating and hot water heating in conjunction with around 6 kWp of photovoltaics for the dwelling. The client proposes use of thermo dynamic panels which should further reduce the energy use in the dwelling.

6. Table 1, Proposed renewables and Emissions Reductions for the House[4]

	Primary Energy Rate (kWh/yr)	Energy saving (%)	Total Regulated CO_2 emissions (kg CO_2/yr)	Saving achieved on residual CO_2 emissions (%)
Baseline energy demand – "Baseline"	18883	0%	3568.50	0%
Proposed scheme after energy efficiency measures to achieve pass were it required to comply with Building Part L1A standards – "Residual"	8790	53.45%	841.80	76.41%
Proposed scheme after on-site renewables (compared to strict definition of BCS14 residual)	2007	77%	201.3	76.09%
Proposed scheme offset for financial contribution or other allowable solution	N/A	N/A	N/A	N/A

Baseline energy demand (kWh/yr)	18883
Regulated emissions (kg/yr)	3568.50

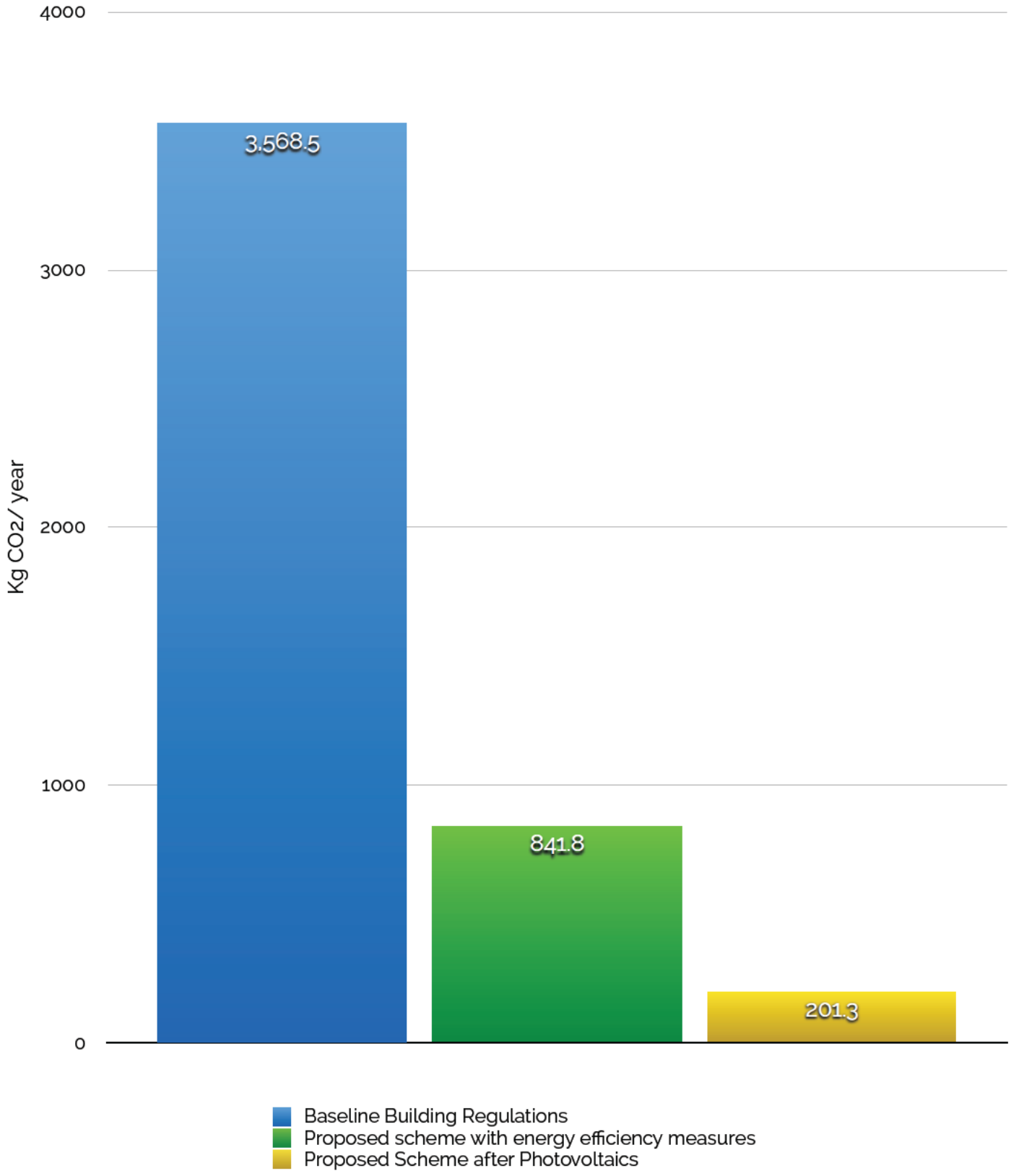
Energy savings from energy efficiency measures (kWh)	10092
Emission savings from energy efficiency measures	76.41%
Total regulated emissions after energy efficiency measures	841.80

Generated Power (kWh)	6783
Saving on residual emissions from use of renewables (kg/yr)	1920.12

Saving on residual emissions from use of renewables (kg/yr)	**1920.12**
Saving on residual emissions from the use of renewables (%)	**76.09%**

4 As the development has reached the 20% the financial contribution is not needed. Information on Photovoltaic generation accessed [redacted]

7. Graph to Show CO2 reduction in Emissions



11. Water

Water

The BCS15 states that the water resources should be conserved. The appliances onsite will be low water use in line with the requirements of planning and Part G, full calculations in appendix A.

The potable water demand will be designed to be less than 125l/person/day as prescribed by Part G of the Building Regulations, this could be achieved by:

Dual flush toilets (6 full flush and 3 part flush)

Basin taps with 5 l/minute flow

Bath capacity of approximately 240 litres

Flow restrictors to bathroom taps of 3 litres per minute

Aerated shower heads for up to 9 litres per minute

Lower water usage dishwashers and washing machines

Water butts will be fitted to drainpipes for watering plants and general cleaning onsite.

Water Efficiency Measures on site

Water is a valuable resource and water conservation is key to environmental and sustainable design. It is proposed that low water usage fittings will be utilised throughout the development to minimise water consumption as well as within the site cabins. This will assist with keeping low usage throughout the construction phase.

Monitoring of water consumption through water metering will take place. Any inefficiency in the water distribution system should be detected in the unlikely event of leakage.

It would be recommended that the site workforce will have tool box talks to cover 'Energy and Fuel Efficiency' as well as being made aware of the standard Environment Agency PPGs for pollution prevention guidance and groundwater pollution prevention. Whilst on site, energy and water consumption could be recorded and monitored.

12. Materials use

Materials will be considered for embodied impact and preferred materials will be locally and responsibly sourced, such as FSC timber, and BES certified roof tiles. Any replaced materials will be increasing efficiency overall for the lifecycle of the building.

Proposed Measures

A number of methods for maximising green infrastructure and procuring responsibly sourced materials will assist with the overall design. A number of methods are being used to assist with having minimal environment impacts including:

- Materials Specification - The building fabric and materials specified will have a low environmental impact. Where appropriate materials may be reviewed using the BRE 'Green Guide to Specification' aiming to maximise the proportion of A+ or A rated materials. Materials may include reclaimed or recycled materials where appropriate.
- Maximise Recycled Content of Materials – A number of materials used commercially in the UK construction industry are manufactured using materials recycled from post consumer waste. A detailed analysis of the materials available in the UK is outlined on the government WRAP website and the National Building Specification (NBS) Greenspec website. The proposed development will be designed to give preference to natural materials and materials with a high percentage of recycled content.
- Responsible Sourcing of Materials: Where possible materials will be responsibly sourced. The green guide will also assist with the materials selection. 100% of the timber used including the timber products will be legally and responsibly sourced.
- FSC Certified Timber – Certain timber products and materials available in the UK use tropical hardwoods from endangered or illegal sources. The development will endeavour to use timber from a temperate, well-managed source or manufactured from recycled timber waste. Timber will as far as possible be certified by the Forest Stewardship Council (FSC), which provides a product- specific chain of custody number confirming that the timber used in the manufacture of the product originates from a sustainably managed source.
- Low solvent / low VOC paints – Certain paints contain high levels of solvents or Volatile Organic Compounds (VOCs). High VOC paints emit the chemical contained in the paint into the internal air of a building, long after the building has been completed. These chemicals that are inhaled by the building occupants are considered to be a contributing factor in sick building syndrome. Low VOC products also have a benefit to construction workers in terms of health and safety. As far as reasonably possible, internal paints which have a low solvent / low VOC content will be used.
- Zero Formaldehyde MDF – Medium Density Fibreboard (MDF) is a timber panel product, which can be manufactured with new or recycled timber. Typically MDF is manufactured using formaldehyde, which is hazardous to health and is emitted into the internal air of a building, long after the building has been completed. MDF can be manufactured without the use of formaldehyde. The proposed development will seek to use zero formaldehyde MDF for internal skirting within the building. The potential for the use of MDF manufactured using recycled materials will also be assessed.
- Zero ODP and GWP Insulation – Certain foamed plastic insulation materials available in the UK are manufactured with substances, which deplete the ozone layer and/or contribute to global warming. The proposed development will give preference to insulation materials such as rock wool and mineral wool, which are manufactured with no ozone depletion potential (ODP) and low global warming

potential (GWP), while still giving consideration to thermal performance and fitness for purpose.

- Flexibility – the internal partitions should allow for adaptation which allows for alternative layout and reconfiguration should any future occupants wish to make changes. This would be subject to the practicalities associated with the choice of building material.
- Construction Site Impacts - The main contractor will have an environmental material policy used for sourcing of construction materials to be used on site.

13. Waste

Waste and recycling

The development will follow the waste management hierarchy (England Waste Strategy 2007 at www.defra.gov.uk), above.

This site will implement measures during the construction phase which aim to reduce substantial environmental impacts as advised in the NPPF (National Planning Policy Framework). Waste impacts will be mitigated through the following means:

Site Waste Management Plan

A SWMP will be used to help benchmarking, procedures and commitments for the minimising of and diversion of the site waste from landfill, as well as target benchmarks for resource efficiency, procedures and commitments to minimise non-hazardous construction waste and procedures for minimising hazardous waste as applicable

There are many opportunities to reduce waste on the site, such as careful storage of site materials, offsite construction where possible, consideration given to sizing in the design stage such as using manufacturers set sizes to reduce waste, take back systems such as those offered by plasterboard manufacturers, and re use of materials where appropriate.

14. Pollution

On site and during construction, the following measures have been recommended:

- Pollution prevention measures and environmental controls to be included in the site specific induction, as well as delivery of relevant tool box talks
- Provision of site specific inductions
- Controls in place to control construction dust

Air Quality Management

During the construction phase of the development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. Good practice dust control measures will be implemented and therefore the residual significance of potential air quality impacts from dust generated by demolition, earthworks, construction and track out activities is predicted to be negligible.

Internal and External Lighting

All fluorescent and compact fluorescent lamps will be fitted with high frequency ballasts to reduce the risk of health problems related to the flicker of fluorescent lighting. All internal fittings will be energy efficient (e.g. LED), and all external fittings will be low energy and controlled to avoid their use during hours throughout the day. The use of time clocks and PIR sensors may be considered where appropriate.

During construction works, any lighting will be kept to a minimum. Task specific lighting will be reviewed and detailed within a Construction Management Plan and monitored accordingly.

Flooding and Surface Water Runoff

The government's flood map shows that there is a low risk of flooding in zone 1. There will be measures in place to reduce the surface water run off, there will be a green roof and attenuation tanks. The green roof should increase the biodiversity onsite.

ICT/Broadband

Broadband is available locally and the house will be designed to incorporate necessary wiring.

Appendix A SAP Calculations

Full SAP Calculation Printout

Property Reference	8 Druid Stoke Avenue	Issued on Date	02/02/2024
Assessment Reference	8 Druid Stoke	Prop Type Ref	
Property	8, Druid Stoke Avenue, Bristol, Avon, BS9 1DD		

SAP Rating	97 A	DER	0.66	TER	11.70
Environmental	99 A	% DER < TER			94.36
CO_2 Emissions (t/year)	0.04	DFEE	47.21	TFEE	50.52
Compliance Check	See BREL	% DFEE < TFEE			6.56
% DPER < TPER	89.37	DPER	6.58	TPER	61.91

Assessor Details	Ms. Laura Meehan	Assessor ID	Z762-0001
Client	Kathy Ashby, Kathy Ashby		

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)	
Basement floor			56.1000	(1a)	x 2.9900	(2a) =	167.7390	(1a) - (3a)
Ground floor			174.8000	(1b)	x 3.2000	(2b) =	559.3600	(1b) - (3b)
First floor			74.1000	(1c)	x 3.2000	(2c) =	237.1200	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		305.0000						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		964.2190	(5)

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2. Ventilation rate

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

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

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)

Effective ac	0.2666	0.2634	0.2602	0.2442	0.2411	0.2251	0.2251	0.2219	0.2315	0.2411	0.2474	0.2538	(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	
Opening Type 2 (Uw = 1.20)			80.7100	1.1450	92.4160			(27)
Opening			1.7300	0.9615	1.6635			(27a)
Opening			0.8600	0.9615	0.8269			(27a)
Heatloss Floor 1			56.1000	0.1300	7.2930	110.0000	6171.0000	(28a)
Heatloss Floor 2			118.7000	0.1300	15.4310	110.0000	13057.0000	(28a)
External Wall 1	378.5100	80.7100	297.8000	0.1700	50.6260	190.0000	56582.0000	(29a)
External Roof 1	92.6200	2.5900	90.0300	0.1300	11.7039	9.0000	810.2700	(30)
External Roof 2	100.7000		100.7000	0.1300	13.0910	9.0000	906.3000	(30)
Total net area of external elements Aum(A, m2)			746.6300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	193.0513			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	77526.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		254.1855 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E5 Ground floor (normal)	33.0300	0.0400	1.3212	
E6 Intermediate floor within a dwelling	70.0000	0.0000	0.0000	
E16 Corner (normal)	37.0000	0.0200	0.7400	
E18 Party wall between dwellings	15.6000	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	50.0000	0.0180	0.9000	
E3 Sill	50.0000	0.0180	0.9000	
E4 Jamb	135.0000	0.0050	0.6750	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.5362	(36)
Point Thermal bridges		(36a) =	12.0000	(36a)
Total fabric heat loss		(33) + (36) + (36a) =	209.5875	(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	84.8181	83.8039	82.7897	77.7185	76.7042	71.6330	71.6330	70.6188	73.6615	76.7042	78.7327	80.7612	(38)
Heat transfer coeff	294.4056	293.3914	292.3772	287.3060	286.2917	281.2205	281.2205	280.2063	283.2490	286.2917	288.3202	290.3487	(39)
Average = Sum(39)m / 12 =												287.0524	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9653	0.9619	0.9586	0.9420	0.9387	0.9220	0.9220	0.9187	0.9287	0.9387	0.9453	0.9520	(40)
HLP (average)												0.9412	
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 3.1384 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
96.0513	94.6079	92.5044	88.4799	85.5100	82.1979	80.3153	82.4028	84.6911	88.2472	92.3582	95.6833	(42a)

Hot water usage for baths

33.1674	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)

Hot water usage for other uses

46.7707	45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42c)

Average daily hot water use (litres/day) 161.8263 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	175.9894	172.3526	167.8547	160.8505	155.2221	149.1473	146.6911	151.1682	155.9072	162.3004	169.4174	175.5092	(44)
Energy conte	278.7241	245.4278	257.9865	220.1963	208.9588	183.3940	177.4102	187.1778	192.2492	220.2402	241.3662	274.8050	(45)
Energy content (annual)										Total = Sum(45)m =		2687.9362	
Distribution loss (46)m = 0.15 x (45)m	41.8086	36.8142	38.6980	33.0294	31.3438	27.5091	26.6115	28.0767	28.8374	33.0360	36.2049	41.2208	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7560 (55)

Total storage loss

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)

If cylinder contains dedicated solar storage

23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(57)
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)
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)

Primary loss

Combi loss

Total heat required for water heating calculated for each month

325.4225	287.6070	304.6849	265.3883	255.6572	228.5860	224.1086	233.8762	237.4412	266.9386	286.5582	321.5034	(62)
-80.5755	-71.2616	-74.6211	-61.7892	-57.5853	-49.2762	-46.1885	-49.1169	-50.9830	-60.1033	-68.0898	-79.0833	(63a)
-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)
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)
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)

WWHRS

PV diverter

Solar input

FGHRS

Output from w/h

244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
										Total per year (kWh/year) = Sum(64)m =	2489.0984	(64)

12Total per year (kWh/year) 2489 (64)

Electric shower(s)

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

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

Heat gains from water heating, kWh/month

130.0345	115.3481	123.1392	109.3689	106.8375	97.1321	96.3476	99.5953	100.0765	110.5886	116.4079	128.7314	(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	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	233.1777	258.1610	233.1777	240.9503	233.1777	240.9503	233.1777	233.1777	240.9503	233.1777	240.9503	233.1777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	462.3008	467.0981	455.0092	429.2734	396.7866	366.2535	345.8556	341.0584	353.1472	378.8830	411.3699	441.9029	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Water heating gains (Table 5)	174.7775	171.6489	165.5097	151.9012	143.5988	134.9057	129.4995	133.8647	138.9951	148.6406	161.6776	173.0261	(72)
Total internal gains	940.3325	966.9844	923.7730	892.2013	843.6395	812.1860	778.6092	778.1772	803.1690	830.7777	884.0742	918.1831	(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	14.2600	11.2829	0.5700	0.7000	0.7700	44.4885	(75)
Southeast	30.0700	36.7938	0.5700	0.7000	0.7700	305.9247	(77)
Southwest	35.5600	36.7938	0.5700	0.7000	0.7700	361.7786	(79)
Northwest	0.8200	11.2829	0.5700	0.7000	0.7700	2.5582	(81)
Northeast	0.8600	18.0708	0.6400	0.7000	1.0000	6.2661	(82)
Northwest	1.7300	26.0000	0.6400	0.7000	1.0000	18.1359	(82)

Solar gains	739.1522	1283.9416	1820.2944	2357.7564	2731.2432	2750.4276	2635.5623	2351.5083	2005.8539	1436.4116	889.9293	629.5530	(83)
Total gains	1679.4847	2250.9260	2744.0674	3249.9577	3574.8827	3562.6135	3414.1716	3129.6855	2809.0230	2267.1893	1774.0034	1547.7361	(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	73.1479	73.4008	73.6554	74.9555	75.2210	76.5775	76.5775	76.8547	76.0291	75.2210	74.6918	74.1700	
alpha	5.8765	5.8934	5.9104	5.9970	6.0147	6.1052	6.1052	6.1236	6.0686	6.0147	5.9795	5.9447	
util living area	0.9988	0.9933	0.9716	0.8843	0.7078	0.5013	0.3620	0.4108	0.6704	0.9457	0.9957	0.9993	(86)
Living	20.5510	20.6187	20.7012	20.7904	20.8332	20.8462	20.8473	20.8476	20.8401	20.7700	20.6425	20.5438	
Non living	19.5663	19.6553	19.7614	19.8805	19.9269	19.9524	19.9530	19.9563	19.9423	19.8626	19.6990	19.5675	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	0	0	0	0	0	0	0	0	0	0	1	
16 / 9	0	28	31	0	0	0	0	0	0	0	12	30	
MIT	21.0000	20.7841	20.8307	20.7904	20.8332	20.8462	20.8473	20.8476	20.8401	20.7700	20.7045	20.7500	(87)
Th 2	20.1124	20.1152	20.1180	20.1320	20.1348	20.1488	20.1488	20.1516	20.1432	20.1348	20.1292	20.1236	(88)
util rest of house	0.9984	0.9912	0.9627	0.8540	0.6534	0.4364	0.2922	0.3356	0.5972	0.9238	0.9940	0.9990	(89)
MIT 2	20.1124	19.9122	19.9606	19.8805	19.9269	19.9524	19.9530	19.9563	19.9423	19.8626	19.7951	19.8860	(90)
Living area fraction									fLA = Living area / (4) =			0.3151	(91)
MIT	20.3921	20.1869	20.2348	20.1672	20.2125	20.2340	20.2348	20.2371	20.2252	20.1485	20.0817	20.1582	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3921	20.1869	20.2348	20.1672	20.2125	20.2340	20.2348	20.2371	20.2252	20.1485	20.0817	20.1582	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9914	0.9641	0.8554	0.6585	0.4430	0.2993	0.3432	0.6045	0.9242	0.9939	0.9990	(94)
Useful gains	1677.0371	2231.4745	2645.4275	2779.9563	2353.9833	1578.1230	1021.7150	1074.1749	1698.0957	2095.3957	1763.2015	1546.2139	(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	4737.5913	4485.0422	4015.7291	3237.1333	2437.0549	1584.3935	1022.1694	1075.1922	1734.9462	2733.6583	3742.8759	4633.4550	(97)
Space heating kWh	2277.0523	1514.3975	1019.5044	329.1674	61.8053	0.0000	0.0000	0.0000	0.0000	474.8674	1425.3656	2296.9074	(98a)
Space heating requirement - total per year (kWh/year)												9399.0672	
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	2277.0523	1514.3975	1019.5044	329.1674	61.8053	0.0000	0.0000	0.0000	0.0000	474.8674	1425.3656	2296.9074	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9399.0672	
Space heating per m2											(98c) / (4) =	30.8166	(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 %)	349.6900	(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	2277.0523	1514.3975	1019.5044	329.1674	61.8053	0.0000	0.0000	0.0000	0.0000	474.8674	1425.3656	2296.9074	(98)
Space heating efficiency (main heating system 1)	349.6900	349.6900	349.6900	349.6900	349.6900	0.0000	0.0000	0.0000	0.0000	349.6900	349.6900	349.6900	(210)
Space heating fuel (main heating system)	651.1632	433.0686	291.5452	94.1312	17.6743	0.0000	0.0000	0.0000	0.0000	135.7967	407.6084	656.8411	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
Efficiency of water heater												186.8280	(216)
(217)m	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	(217)
Fuel for water heating, kWh/month	131.0548	115.7992	123.1420	108.9768	106.0183	95.9759	95.2320	98.8927	99.8020	110.7089	116.9356	129.7557	(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	99.3095	89.6989	99.3095	96.1060	99.3095	96.1060	99.3095	99.3095	96.1060	99.3095	96.1060	99.3095	(231)
Lighting	59.9897	48.1260	43.3321	31.7470	24.5223	20.0349	22.3700	29.0774	37.7687	49.5546	55.9718	61.6570	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-131.4199	-222.7667	-383.1594	-500.8906	-591.7583	-570.1119	-562.6157	-502.7712	-402.6149	-282.4417	-156.3416	-109.2458	(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	-0.8246	-3.9402	-16.3534	-49.7372	-98.5529	-111.9136	-109.0431	-77.9614	-42.0486	-11.2714	-1.7705	-0.5417	(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												2687.8288	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	186.8280	
Water heating fuel used	1332.2939	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)		
mechanical ventilation fans (SFP = 0.9940)	1169.2891	(230a)
Total electricity for the above, kWh/year	1169.2891	(231)
Electricity for lighting (calculated in Appendix L)	484.1516	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4940.0962	(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	733.4671	(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	2687.8288	0.1573	422.9131	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1332.2939	0.1407	187.5122	(264)
Space and water heating			610.4253	(265)
Pumps, fans and electric keep-hot	1169.2891	0.1387	162.1948	(267)
Energy for lighting	484.1516	0.1443	69.8780	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4416.1376	0.1317	-581.5468	
PV Unit electricity exported	-523.9586	0.1142	-59.8272	
Total			-641.3740	(269)
Total CO2, kg/year			201.1241	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.6600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2687.8288	1.5824	4253.3524	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1332.2939	1.5204	2025.6351	(278)
Space and water heating			6278.9875	(279)
Pumps, fans and electric keep-hot	1169.2891	1.5128	1768.9005	(281)
Energy for lighting	484.1516	1.5338	742.6079	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4416.1376	1.4865	-6564.7300	
PV Unit electricity exported	-523.9586	0.4184	-219.2106	
Total			-6783.9406	(283)
Total Primary energy kWh/year			2006.5553	(286)
Dwelling Primary energy Rate (DPER)			6.5800	(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)	
Basement floor	56.1000	(1a)	x 2.9900	(2a) =	167.7390	(1a) - (3a)
Ground floor	174.8000	(1b)	x 3.2000	(2b) =	559.3600	(1b) - (3b)
First floor	74.1000	(1c)	x 3.2000	(2c) =	237.1200	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	305.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		964.2190	(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) =	0.0415 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.2915 (18)
Number of sides sheltered		2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2478 (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	0.3159	0.3097	0.3035	0.2725	0.2663	0.2354	0.2354	0.2292	0.2478	0.2663	0.2787	0.2911	(22b)
Effective ac	0.5499	0.5480	0.5461	0.5371	0.5355	0.5277	0.5277	0.5263	0.5307	0.5355	0.5388	0.5424	(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)			73.8800	1.1450	84.5954			(27)
Opening			1.5800	2.0221	3.1949			(27a)
Opening			0.7900	2.0221	1.5974			(27a)
Heatloss Floor 1			56.1000	0.1300	7.2930			(28a)
Heatloss Floor 2			118.7000	0.1300	15.4310			(28a)
External Wall 1	378.5100	73.8800	304.6300	0.1800	54.8334			(29a)
External Roof 1	92.6200	2.3700	90.2500	0.1100	9.9275			(30)
External Roof 2	100.7000		100.7000	0.1100	11.0770			(30)
Total net area of external elements Aum(A, m2)			746.6300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		187.9496			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 254.1855 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	33.0300	0.1600	5.2848
E6 Intermediate floor within a dwelling	70.0000	0.0000	0.0000
E16 Corner (normal)	37.0000	0.0900	3.3300
E18 Party wall between dwellings	15.6000	0.0600	0.9360
E2 Other lintels (including other steel lintels)	50.0000	0.0500	2.5000
E3 Sill	50.0000	0.0500	2.5000
E4 Jamb	135.0000	0.0500	6.7500

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.3008 (36)
Point Thermal bridges (36a) = 12.0000 (36a)
Total fabric heat loss (33) + (36) + (36a) = 221.2504 (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	174.9724	174.3559	173.7516	170.9133	170.3823	167.9102	167.9102	167.4524	168.8624	170.3823	171.4565	172.5797	(38)
Heat transfer coeff	396.2228	395.6063	395.0020	392.1637	391.6327	389.1606	389.1606	388.7028	390.1128	391.6327	392.7069	393.8301	(39)
Average = Sum(39)m / 12 =												392.1612	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2991	1.2971	1.2951	1.2858	1.2840	1.2759	1.2759	1.2744	1.2791	1.2840	1.2876	1.2912	(40)
HLP (average)												1.2858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.1384 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	76.8411	75.6863	74.0036	70.7840	68.4080	65.7583	64.2522	65.9222	67.7528	70.5978	73.8865	76.5466	(42a)
Hot water usage for baths	33.1674	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)
Hot water usage for other uses	46.7707	45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42c)
Average daily hot water use (litres/day)												144.1151	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.7791	153.4310	149.3539	143.1545	138.1201	132.7078	130.6281	134.6876	138.9690	144.6510	150.9458	156.3726	(44)
Energy conte	248.2998	218.4837	229.5513	195.9714	185.9362	163.1797	157.9834	166.7714	171.3627	196.2900	215.0500	244.8416	(45)
Energy content (annual)										Total = Sum(45)m =		2393.7212	
Distribution loss (46)m = 0.15 x (45)m	37.2450	32.7726	34.4327	29.3957	27.8904	24.4770	23.6975	25.0157	25.7044	29.4435	32.2575	36.7262	(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	299.2259	264.4814	280.4774	245.2547	236.8623	212.4630	208.9094	217.6975	220.6460	247.2161	264.3333	295.7677	(62)
WWHRS	-35.1285	-31.0680	-32.5326	-26.9383	-25.1055	-21.4829	-20.1368	-21.4135	-22.2271	-26.2033	-29.6851	-34.4780	(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	264.0973	233.4135	247.9448	218.3164	211.7568	190.9800	188.7726	196.2840	198.4189	221.0128	234.6481	261.2897	(64)
										Total per year (kWh/year) = Sum(64)m =		2666.9351	(64)
12Total per year (kWh/year)												2667	(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	123.3005	109.4440	117.0667	104.5871	102.5646	93.6839	93.2703	96.1924	96.4047	106.0073	110.9308	122.1507	(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	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	233.1777	258.1610	233.1777	240.9503	233.1777	240.9503	233.1777	233.1777	240.9503	233.1777	240.9503	233.1777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	462.3008	467.0981	455.0092	429.2734	396.7866	366.2535	345.8556	341.0584	353.1472	378.8830	411.3699	441.9029	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	(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)													
	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Water heating gains (Table 5)													
	165.7265	162.8631	157.3477	145.2599	137.8557	130.1165	125.3633	129.2908	133.8955	142.4829	154.0705	164.1811	(72)
Total internal gains													
	934.2815	961.1986	918.6110	888.5600	840.8964	807.3967	774.4731	773.6033	798.0694	827.6201	879.4671	912.3381	(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	13.0500	11.2829	0.6300	0.7000	0.7700	44.9992	(75)
Southeast	27.5300	36.7938	0.6300	0.7000	0.7700	309.5659	(77)
Southwest	32.5500	36.7938	0.6300	0.7000	0.7700	366.0141	(79)
Northwest	0.7500	11.2829	0.6300	0.7000	0.7700	2.5862	(81)
Northeast	0.7900	18.0708	0.6300	0.7000	1.0000	5.6661	(82)
Northwest	1.5800	26.0000	0.6300	0.7000	1.0000	16.3047	(82)

Solar gains	745.1361	1293.3908	1831.5074	2369.1974	2742.1262	2760.4640	2645.5521	2361.9775	2017.1275	1446.3674	896.9549	634.7691	(83)
Total gains	1679.4176	2254.5895	2750.1183	3257.7574	3583.0226	3567.8608	3420.0251	3135.5808	2815.1969	2273.9874	1776.4220	1547.1072	(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	54.3511	54.4358	54.5191	54.9137	54.9882	55.3375	55.3375	55.4026	55.2024	54.9882	54.8377	54.6813	
alpha	4.6234	4.6291	4.6346	4.6609	4.6659	4.6892	4.6892	4.6935	4.6802	4.6659	4.6558	4.6454	
util living area													
	0.9987	0.9947	0.9824	0.9384	0.8302	0.6532	0.4907	0.5519	0.8050	0.9698	0.9964	0.9991	(86)
MIT	19.3313	19.6055	19.9771	20.4283	20.7739	20.9457	20.9885	20.9805	20.8557	20.3674	19.7514	19.2847	(87)
Th 2	19.8415	19.8431	19.8447	19.8520	19.8534	19.8597	19.8597	19.8609	19.8573	19.8534	19.8506	19.8477	(88)
util rest of house													
	0.9982	0.9928	0.9759	0.9158	0.7730	0.5548	0.3687	0.4244	0.7203	0.9544	0.9948	0.9988	(89)
MIT 2	17.8989	18.2503	18.7224	19.2821	19.6693	19.8304	19.8564	19.8546	19.7623	19.2216	18.4432	17.8434	(90)
Living area fraction										fLA = Living area / (4) =		0.3151	(91)
MIT	18.3502	18.6773	19.1177	19.6433	20.0173	20.1818	20.2131	20.2093	20.1068	19.5826	18.8554	18.2975	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3502	18.6773	19.1177	19.6433	20.0173	20.1818	20.2131	20.2093	20.1068	19.5826	18.8554	18.2975	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9901	0.9705	0.9108	0.7821	0.5841	0.4074	0.4648	0.7411	0.9496	0.9928	0.9981	(94)
Useful gains	1674.8106	2232.2199	2668.9184	2967.1849	2802.4104	2084.0536	1393.1704	1457.2764	2086.2029	2159.3210	1763.5554	1544.1554	(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													
	5567.0059	5450.3789	4984.0161	4213.1259	3257.3429	2172.2296	1406.0732	1480.6989	2343.3419	3517.8759	4616.4278	5552.0274	(97)
Space heating kWh													
	2895.7933	2162.6028	1722.4327	897.0775	338.4698	0.0000	0.0000	0.0000	0.0000	1010.7648	2054.0681	2981.8568	(98a)
Space heating requirement - total per year (kWh/year)												14063.0658	
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													
	2895.7933	2162.6028	1722.4327	897.0775	338.4698	0.0000	0.0000	0.0000	0.0000	1010.7648	2054.0681	2981.8568	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14063.0658	
Space heating per m2											(98c) / (4) =	46.1084	(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													
	2895.7933	2162.6028	1722.4327	897.0775	338.4698	0.0000	0.0000	0.0000	0.0000	1010.7648	2054.0681	2981.8568	(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)													
	3137.3709	2343.0150	1866.1243	971.9149	366.7061	0.0000	0.0000	0.0000	0.0000	1095.0865	2225.4259	3230.6141	(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													
	264.0973	233.4135	247.9448	218.3164	211.7568	190.9800	188.7726	196.2840	198.4189	221.0128	234.6481	261.2897	(64)
Efficiency of water heater												79.8000	(216)

(217)m	87.9708	87.8350	87.5574	86.8821	85.1060	79.8000	79.8000	79.8000	79.8000	87.0387	87.7850	88.0004 (217)
Fuel for water heating, kWh/month												
	300.2103	265.7410	283.1798	251.2790	248.8153	239.3233	236.5571	245.9699	248.6452	253.9248	267.2988	296.9188 (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	48.4497	38.8682	34.9965	25.6399	19.8050	16.1809	18.0668	23.4839	30.5033	40.0219	45.2047	49.7963 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-56.4211	-81.6755	-120.4517	-138.9555	-152.6965	-143.3517	-141.3854	-131.9641	-115.9890	-94.7728	-62.7084	-48.5179 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-25.7204	-54.7062	-109.9168	-166.9034	-222.5757	-224.5146	-222.0802	-187.3448	-136.2694	-79.0630	-34.5890	-20.3101 (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	15236.2577	(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	3137.8635	(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)	391.0170	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2772.8831	(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	16078.2551	(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	15236.2577	0.2100	3199.6141	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3137.8635	0.2100	658.9513	(264)
Space and water heating			3858.5654	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	391.0170	0.1443	56.4358	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1288.8895	0.1341	-172.8135	
PV Unit electricity exported	-1483.9936	0.1256	-186.3192	
Total			-359.1327	(269)
Total CO2, kg/year			3567.7978	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.7000	(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	15236.2577	1.1300	17216.9712	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3137.8635	1.1300	3545.7857	(278)
Space and water heating			20762.7569	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	391.0170	1.5338	599.7549	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1288.8895	1.4955	-1927.5426	
PV Unit electricity exported	-1483.9936	0.4608	-683.8925	
Total			-2611.4351	(283)
Total Primary energy kWh/year			18881.1775	(286)
Target Primary Energy Rate (TPER)			61.9100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)			Volume (m3)	
Basement floor	56.1000	(1a)	x 2.9900	(2a)	=	167.7390	(1a) - (3a)
Ground floor	174.8000	(1b)	x 3.2000	(2b)	=	559.3600	(1b) - (3b)
First floor	74.1000	(1c)	x 3.2000	(2c)	=	237.1200	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	305.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		=	964.2190	(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) =	0.0415	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1915	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1628	(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	0.2075	0.2035	0.1994	0.1790	0.1750	0.1546	0.1546	0.1506	0.1628	0.1750	0.1831	0.1912	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5215	0.5207	0.5199	0.5160	0.5153	0.5120	0.5120	0.5113	0.5132	0.5153	0.5168	0.5183	(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	
Opening Type 2 (Uw = 1.20)			80.7100	1.1450	92.4160			(27)
Opening			1.7300	0.9615	1.6635			(27a)
Opening			0.8600	0.9615	0.8269			(27a)
Heatloss Floor 1			56.1000	0.1300	7.2930	110.0000	6171.0000	(28a)
Heatloss Floor 2			118.7000	0.1300	15.4310	110.0000	13057.0000	(28a)
External Wall 1	378.5100	80.7100	297.8000	0.1700	50.6260	190.0000	56582.0000	(29a)
External Roof 1	92.6200	2.5900	90.0300	0.1300	11.7039	9.0000	810.2700	(30)
External Roof 2	100.7000		100.7000	0.1300	13.0910	9.0000	906.3000	(30)
Total net area of external elements Aum(A, m2)			746.6300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		193.0513			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	77526.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		254.1855 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	33.0300	0.0400	1.3212
E6 Intermediate floor within a dwelling	70.0000	0.0000	0.0000
E16 Corner (normal)	37.0000	0.0200	0.7400
E18 Party wall between dwellings	15.6000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	50.0000	0.0180	0.9000
E3 Sill	50.0000	0.0180	0.9000
E4 Jamb	135.0000	0.0050	0.6750

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.5362 (36)
Point Thermal bridges	(36a) =	12.0000 (36a)
Total fabric heat loss	(33) + (36) + (36a) =	209.5875 (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	165.9476	165.6816	165.4208	164.1959	163.9667	162.8999	162.8999	162.7023	163.3108	163.9667	164.4303	164.9150	(38)
Heat transfer coeff	375.5351	375.2691	375.0083	373.7834	373.5542	372.4874	372.4874	372.2898	372.8983	373.5542	374.0178	374.5025	(39)
Average = Sum(39)m / 12 =												373.7823	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2313	1.2304	1.2295	1.2255	1.2248	1.2213	1.2213	1.2206	1.2226	1.2248	1.2263	1.2279	(40)
HLP (average)												1.2255	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		3.1384 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

33.1674	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)

Hot water usage for other uses

46.7707	45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42c)

Average daily hot water use (litres/day)	73.2702 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	79.9380	77.7447	75.3503	72.3706	69.7121	66.9495	66.3759	68.7654	71.2162	74.0532	77.0593	79.8259	(44)
Energy conte	126.6023	110.7074	115.8106	99.0717	93.8459	82.3222	80.2759	85.1460	87.8166	100.4895	109.7851	124.9881	(45)
Energy content (annual)										Total = Sum(45)m =		1216.8613	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary 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	(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													
	107.6120	94.1013	98.4390	84.2109	79.7690	69.9738	68.2345	72.3741	74.6441	85.4161	93.3173	106.2399	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	107.6120	94.1013	98.4390	84.2109	79.7690	69.9738	68.2345	72.3741	74.6441	85.4161	93.3173	106.2399	(64)
										Total per year (kWh/year) = Sum(64)m =		1034.3321	(64)
12Total per year (kWh/year)												1034	(64)
Electric shower(s)													
	61.5369	54.8299	59.8721	57.1352	58.2073	55.5242	57.3750	58.2073	57.1352	59.8721	58.7463	61.5369	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												699.9784	(64a)
Heat gains from water heating, kWh/month													
	42.2872	37.2328	39.5778	35.3365	34.4941	31.3745	31.4024	32.6454	32.9448	36.3220	38.0159	41.9442	(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	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	233.1777	258.1610	233.1777	240.9503	233.1777	240.9503	233.1777	233.1777	240.9503	233.1777	240.9503	233.1777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	462.3008	467.0981	455.0092	429.2734	396.7866	366.2535	345.8556	341.0584	353.1472	378.8830	411.3699	441.9029	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Water heating gains (Table 5)													
	56.8377	55.4059	53.1959	49.0785	46.3630	43.5757	42.2075	43.8782	45.7567	48.8200	52.7999	56.3766	(72)
Total internal gains													
	822.3926	850.7414	811.4592	789.3786	746.4037	720.8559	691.3172	688.1906	709.9307	730.9571	775.1964	801.5336	(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	14.2600	11.2829	0.5700	0.7000	0.7700	44.4885	(75)
Southeast	30.0700	36.7938	0.5700	0.7000	0.7700	305.9247	(77)
Southwest	35.5600	36.7938	0.5700	0.7000	0.7700	361.7786	(79)
Northwest	0.8200	11.2829	0.5700	0.7000	0.7700	2.5582	(81)
Northeast	0.8600	18.0708	0.6400	0.7000	1.0000	6.2661	(82)
Northwest	1.7300	26.0000	0.6400	0.7000	1.0000	18.1359	(82)

Solar gains	739.1522	1283.9416	1820.2944	2357.7564	2731.2432	2750.4276	2635.5623	2351.5083	2005.8539	1436.4116	889.9293	629.5530	(83)
Total gains	1561.5448	2134.6830	2631.7536	3147.1350	3477.6469	3471.2835	3326.8795	3039.6989	2715.7846	2167.3687	1665.1257	1431.0866	(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	57.3453	57.3859	57.4258	57.6140	57.6493	57.8145	57.8145	57.8451	57.7508	57.6493	57.5779	57.5034	
alpha	4.8230	4.8257	4.8284	4.8409	4.8433	4.8543	4.8543	4.8563	4.8501	4.8433	4.8385	4.8336	
util living area													
	0.9991	0.9957	0.9842	0.9402	0.8284	0.6477	0.4845	0.5477	0.8059	0.9729	0.9972	0.9994	(86)
MIT	19.3893	19.6609	20.0263	20.4649	20.7970	20.9536	20.9907	20.9836	20.8684	20.3920	19.7893	19.3370	(87)
Th 2	19.8951	19.8958	19.8964	19.8996	19.9002	19.9030	19.9030	19.9035	19.9019	19.9002	19.8990	19.8978	(88)
util rest of house													
	0.9988	0.9942	0.9785	0.9186	0.7724	0.5526	0.3679	0.4250	0.7235	0.9591	0.9961	0.9992	(89)
MIT 2	18.4260	18.6972	19.0591	19.4819	19.7712	19.8834	19.9009	19.8993	19.8339	19.4226	18.8285	18.3758	(90)
Living area fraction										fLA = Living area / (4) =		0.3151	(91)
MIT	18.7295	19.0009	19.3638	19.7916	20.0944	20.2206	20.2443	20.2410	20.1599	19.7281	19.1312	18.6787	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7295	19.0009	19.3638	19.7916	20.0944	20.2206	20.2443	20.2410	20.1599	19.7281	19.1312	18.6787	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9925	0.9749	0.9161	0.7833	0.5814	0.4049	0.4640	0.7451	0.9563	0.9949	0.9988	(94)
Useful gains	1558.7897	2118.6639	2565.6903	2882.9785	2724.1864	2018.3258	1347.0336	1410.2738	2023.5881	2072.6984	1656.5550	1429.4021	(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													
	5418.8007	5291.6211	4824.0368	4071.1162	3135.7598	2093.6053	1357.4439	1429.9541	2259.7237	3409.8326	4499.8910	5422.3025	(97)
Space heating kWh													
	2871.8482	2132.2273	1680.2099	855.4592	306.2106	0.0000	0.0000	0.0000	0.0000	994.8279	2047.2019	2970.7179	(98a)
Space heating requirement - total per year (kWh/year)												13858.7027	
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													
	2871.8482	2132.2273	1680.2099	855.4592	306.2106	0.0000	0.0000	0.0000	0.0000	994.8279	2047.2019	2970.7179	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13858.7027	
Space heating per m2											(98c) / (4) =	45.4384	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	3501.3815	2756.4067	2829.4027	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8716	0.9287	0.8978	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3051.9134	2559.9509	2540.1277	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3911.3357	3748.8843	3423.7816	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	618.7840	884.5665	657.4385	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	154.6960	221.1416	164.3596	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												540.1973	(107)
Energy for space heating												45.4384	(99)
Energy for space cooling												1.7711	(108)
Total												47.2095	(109)
Fabric Energy Efficiency (DFEE)												47.2	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	56.1000	(1a)	x 2.9900	(2a) =	167.7390	(1a) - (3a)
Ground floor	174.8000	(1b)	x 3.2000	(2b) =	559.3600	(1b) - (3b)
First floor	74.1000	(1c)	x 3.2000	(2c) =	237.1200	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	305.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		964.2190	(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) =	0.0415	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.2915	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2478	(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	0.3159	0.3097	0.3035	0.2725	0.2663	0.2354	0.2354	0.2292	0.2478	0.2663	0.2787	0.2911	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5499	0.5480	0.5461	0.5371	0.5355	0.5277	0.5277	0.5263	0.5307	0.5355	0.5388	0.5424	(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)			73.8800	1.1450	84.5954			(27)
Opening			1.5800	2.0221	3.1949			(27a)
Opening			0.7900	2.0221	1.5974			(27a)
Heatloss Floor 1			56.1000	0.1300	7.2930			(28a)
Heatloss Floor 2			118.7000	0.1300	15.4310			(28a)
External Wall 1	378.5100	73.8800	304.6300	0.1800	54.8334			(29a)
External Roof 1	92.6200	2.3700	90.2500	0.1100	9.9275			(30)
External Roof 2	100.7000		100.7000	0.1100	11.0770			(30)
Total net area of external elements Aum(A, m2)			746.6300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		187.9496			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							254.1855	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	33.0300	0.1600	5.2848
E6 Intermediate floor within a dwelling	70.0000	0.0000	0.0000
E16 Corner (normal)	37.0000	0.0900	3.3300
E18 Party wall between dwellings	15.6000	0.0600	0.9360
E2 Other lintels (including other steel lintels)	50.0000	0.0500	2.5000

E3 Sill									50.0000	0.0500	2.5000		
E4 Jamb									135.0000	0.0500	6.7500		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												21.3008	(36)
Point Thermal bridges											(36a) =	12.0000	(36a)
Total fabric heat loss											(33) + (36) + (36a) =	221.2504	(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	174.9724	174.3559	173.7516	170.9133	170.3823	167.9102	167.9102	167.4524	168.8624	170.3823	171.4565	172.5797	(38)
Heat transfer coeff	396.2228	395.6063	395.0020	392.1637	391.6327	389.1606	389.1606	388.7028	390.1128	391.6327	392.7069	393.8301	(39)
Average = Sum(39)m / 12 =												392.1612	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2991	1.2971	1.2951	1.2858	1.2840	1.2759	1.2759	1.2744	1.2791	1.2840	1.2876	1.2912	(40)
HLP (average)												1.2858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.1384	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	33.1674	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)
Hot water usage for other uses	46.7707	45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42c)
Average daily hot water use (litres/day)												73.2702	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	79.9380	77.7447	75.3503	72.3706	69.7121	66.9495	66.3759	68.7654	71.2162	74.0532	77.0593	79.8259	(44)
Energy conte	126.6023	110.7074	115.8106	99.0717	93.8459	82.3222	80.2759	85.1460	87.8166	100.4895	109.7851	124.9881	(45)
Energy content (annual)										Total = Sum(45)m =		1216.8613	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary 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	(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	107.6120	94.1013	98.4390	84.2109	79.7690	69.9738	68.2345	72.3741	74.6441	85.4161	93.3173	106.2399	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	107.6120	94.1013	98.4390	84.2109	79.7690	69.9738	68.2345	72.3741	74.6441	85.4161	93.3173	106.2399	(64)
										Total per year (kWh/year) = Sum(64)m =		1034.3321	(64)
12Total per year (kWh/year)												1034	(64)
Electric shower(s)	61.5369	54.8299	59.8721	57.1352	58.2073	55.5242	57.3750	58.2073	57.1352	59.8721	58.7463	61.5369	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		699.9784	(64a)
Heat gains from water heating, kWh/month	42.2872	37.2328	39.5778	35.3365	34.4941	31.3745	31.4024	32.6454	32.9448	36.3220	38.0159	41.9442	(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	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	156.9215	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	233.1777	258.1610	233.1777	240.9503	233.1777	240.9503	233.1777	233.1777	240.9503	233.1777	240.9503	233.1777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	462.3008	467.0981	455.0092	429.2734	396.7866	366.2535	345.8556	341.0584	353.1472	378.8830	411.3699	441.9029	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	38.6921	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Water heating gains (Table 5)	56.8377	55.4059	53.1959	49.0785	46.3630	43.5757	42.2075	43.8782	45.7567	48.8200	52.7999	56.3766	(72)
Total internal gains	822.3926	850.7414	811.4592	789.3786	746.4037	720.8559	691.3172	688.1906	709.9307	730.9571	775.1964	801.5336	(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	13.0500	11.2829	0.6300	0.7000	0.7700	44.9992	(75)
Southeast	27.5300	36.7938	0.6300	0.7000	0.7700	309.5659	(77)
Southwest	32.5500	36.7938	0.6300	0.7000	0.7700	366.0141	(79)
Northwest	0.7500	11.2829	0.6300	0.7000	0.7700	2.5862	(81)
Northeast	0.7900	18.0708	0.6300	0.7000	1.0000	5.6661	(82)
Northwest	1.5800	26.0000	0.6300	0.7000	1.0000	16.3047	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	745.1361	1293.3908	1831.5074	2369.1974	2742.1262	2760.4640	2645.5521	2361.9775	2017.1275	1446.3674	896.9549	634.7691	(83)
Total gains	1567.5287	2144.1323	2642.9666	3158.5760	3488.5299	3481.3200	3336.8693	3050.1682	2727.0582	2177.3245	1672.1514	1436.3027	(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	54.3511	54.4358	54.5191	54.9137	54.9882	55.3375	55.3375	55.4026	55.2024	54.9882	54.8377	54.6813	
alpha	4.6234	4.6291	4.6346	4.6609	4.6659	4.6892	4.6892	4.6935	4.6802	4.6659	4.6558	4.6454	
util living area	0.9990	0.9957	0.9849	0.9443	0.8408	0.6657	0.5020	0.5654	0.8185	0.9742	0.9972	0.9994	(86)
MIT	19.2937	19.5690	19.9437	20.4032	20.7598	20.9413	20.9873	20.9785	20.8442	20.3389	19.7167	19.2474	(87)
Th 2	19.8415	19.8431	19.8447	19.8520	19.8534	19.8597	19.8597	19.8609	19.8573	19.8534	19.8506	19.8477	(88)
util rest of house	0.9987	0.9942	0.9792	0.9234	0.7852	0.5669	0.3776	0.4357	0.7359	0.9608	0.9960	0.9991	(89)
MIT 2	18.2901	18.5657	18.9376	19.3852	19.6996	19.8348	19.8569	19.8554	19.7762	19.3344	18.7194	18.2485	(90)
Living area fraction										fLA = Living area / (4) =		0.3151	(91)
MIT	18.6063	18.8818	19.2546	19.7060	20.0337	20.1834	20.2131	20.2093	20.1127	19.6509	19.0336	18.5632	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6063	18.8818	19.2546	19.7060	20.0337	20.1834	20.2131	20.2093	20.1127	19.6509	19.0336	18.5632	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9923	0.9754	0.9202	0.7950	0.5965	0.4171	0.4769	0.7568	0.9576	0.9947	0.9987	(94)
Useful gains	1564.5507	2127.7206	2578.0640	2906.3880	2773.4309	2076.7109	1391.8150	1454.6145	2063.7845	2085.0560	1663.2572	1434.4631	(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	5668.4902	5531.3054	5038.1087	4237.7110	3263.7398	2172.8509	1406.0574	1480.6710	2345.6321	3544.6370	4686.4044	5656.6548	(97)
Space heating kWh	3053.3310	2287.2090	1830.2732	958.5526	364.7899	0.0000	0.0000	0.0000	0.0000	1085.9282	2176.6660	3141.3106	(98a)
Space heating requirement - total per year (kWh/year)												14898.0605	
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	3053.3310	2287.2090	1830.2732	958.5526	364.7899	0.0000	0.0000	0.0000	0.0000	1085.9282	2176.6660	3141.3106	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14898.0605	
Space heating per m2											(98c) / (4) =	48.8461	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	3658.1094	2879.7883	2954.1412	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8521	0.9144	0.8807	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3116.9890	2633.2721	2601.5656	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3926.4272	3763.7252	3438.6090	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	582.7955	841.0571	622.7603	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	145.6989	210.2643	155.6901	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												511.6532	(107)
Energy for space heating												48.8461	(99)
Energy for space cooling												1.6776	(108)
Total												50.5237	(109)
Fabric Energy Efficiency (TFEE)												50.5	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	56.1000	(1a)	x 2.9900	(2a) =	167.7390	(1a) - (3a)
Ground floor	174.8000	(1b)	x 3.2000	(2b) =	559.3600	(1b) - (3b)
First floor	74.1000	(1c)	x 3.2000	(2c) =	237.1200	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	305.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		964.2190	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes

Pressure Test Method												Blower Door	
Measured/design AP50												3.0000	(17)
Infiltration rate												0.1500	(18)
Number of sides sheltered												2	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1275	(21)

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

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2666	0.2634	0.2602	0.2442	0.2411	0.2251	0.2251	0.2219	0.2315	0.2411	0.2474	0.2538	(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	
Opening Type 2 (Uw = 1.20)			80.7100	1.1450	92.4160			(27)
Opening			1.7300	0.9615	1.6635			(27a)
Opening			0.8600	0.9615	0.8269			(27a)
Heatloss Floor 1			56.1000	0.1300	7.2930	110.0000	6171.0000	(28a)
Heatloss Floor 2			118.7000	0.1300	15.4310	110.0000	13057.0000	(28a)
External Wall 1	378.5100	80.7100	297.8000	0.1700	50.6260	190.0000	56582.0000	(29a)
External Roof 1	92.6200	2.5900	90.0300	0.1300	11.7039	9.0000	810.2700	(30)
External Roof 2	100.7000		100.7000	0.1300	13.0910	9.0000	906.3000	(30)
Total net area of external elements Aum(A, m2)			746.6300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	193.0513			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 77526.5700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	254.1855	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	33.0300	0.0400	1.3212
E6 Intermediate floor within a dwelling	70.0000	0.0000	0.0000
E16 Corner (normal)	37.0000	0.0200	0.7400
E18 Party wall between dwellings	15.6000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	50.0000	0.0180	0.9000
E3 Sill	50.0000	0.0180	0.9000
E4 Jamb	135.0000	0.0050	0.6750

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5362	(36)
Point Thermal bridges (36a) =	12.0000	(36a)
Total fabric heat loss (33) + (36) + (36a) =	209.5875	(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	84.8181	83.8039	82.7897	77.7185	76.7042	71.6330	71.6330	70.6188	73.6615	76.7042	78.7327	80.7612	(38)
Heat transfer coeff	294.4056	293.3914	292.3772	287.3060	286.2917	281.2205	281.2205	280.2063	283.2490	286.2917	288.3202	290.3487	(39)
Average = Sum(39)m / 12 =												287.0524	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9653	0.9619	0.9586	0.9420	0.9387	0.9220	0.9220	0.9187	0.9287	0.9387	0.9453	0.9520	(40)
HLP (average)												0.9412	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.1384	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	96.0513	94.6079	92.5044	88.4799	85.5100	82.1979	80.3153	82.4028	84.6911	88.2472	92.3582	95.6833	(42a)
Hot water usage for baths	33.1674	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)
Hot water usage for other uses	46.7707	45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42c)
Average daily hot water use (litres/day)												161.8263	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	175.9894	172.3526	167.8547	160.8505	155.2221	149.1473	146.6911	151.1682	155.9072	162.3004	169.4174	175.5092	(44)
Energy conte	278.7241	245.4278	257.9865	220.1963	208.9588	183.3940	177.4102	187.1778	192.2492	220.2402	241.3662	274.8050	(45)
Energy content (annual)										Total = Sum(45)m =		2687.9362	
Distribution loss (46)m = 0.15 x (45)m	41.8086	36.8142	38.6980	33.0294	31.3438	27.5091	26.6115	28.0767	28.8374	33.0360	36.2049	41.2208	(46)

Water storage loss:		
Store volume	200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.4000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7560	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	325.4225	287.6070	304.6849	265.3883	255.6572	228.5860	224.1086	233.8762	237.4412	266.9386	286.5582	321.5034	(62)
WWHRS	-80.5755	-71.2616	-74.6211	-61.7892	-57.5853	-49.2762	-46.1885	-49.1169	-50.9830	-60.1033	-68.0898	-79.0833	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
										Total per year (kWh/year) = Sum(64)m =		2489.0984	(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

	130.0345	115.3481	123.1392	109.3689	106.8375	97.1321	96.3476	99.5953	100.0765	110.5886	116.4079	128.7314 (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	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	(66)

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

	68.5367	60.8737	49.5058	37.4791	28.0160	23.6523	25.5572	33.2202	44.5881	56.6148	66.0778	70.4415	(67)

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

	690.0012	697.1613	679.1182	640.7065	592.2188	546.6471	516.2024	509.0423	527.0854	565.4971	613.9849	659.5565	(68)

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

	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)

Water heating gains (Table 5)

	174.7775	171.6489	165.5097	151.9012	143.5988	134.9057	129.4995	133.8647	138.9951	148.6406	161.6776	173.0261	(72)

Total internal gains

	1053.0531	1049.4215	1013.8713	949.8244	883.5712	824.9427	790.9967	795.8648	830.4062	890.4900	961.4779	1022.7617	(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	14.2600	11.2829	0.5700	0.7000	0.7700	44.4885	(75)
Southeast	30.0700	36.7938	0.5700	0.7000	0.7700	305.9247	(77)
Southwest	35.5600	36.7938	0.5700	0.7000	0.7700	361.7786	(79)
Northwest	0.8200	11.2829	0.5700	0.7000	0.7700	2.5582	(81)
Northeast	0.8600	18.0708	0.6400	0.7000	1.0000	6.2661	(82)
Northwest	1.7300	26.0000	0.6400	0.7000	1.0000	18.1359	(82)

Solar gains	739.1522	1283.9416	1820.2944	2357.7564	2731.2432	2750.4276	2635.5623	2351.5083	2005.8539	1436.4116	889.9293	629.5530	(83)
Total gains	1792.2052	2333.3631	2834.1657	3307.5808	3614.8144	3575.3703	3426.5590	3147.3731	2836.2601	2326.9016	1851.4071	1652.3148	(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	73.1479	73.4008	73.6554	74.9555	75.2210	76.5775	76.5775	76.8547	76.0291	75.2210	74.6918	74.1700	
alpha	5.8765	5.8934	5.9104	5.9970	6.0147	6.1052	6.1052	6.1236	6.0686	6.0147	5.9795	5.9447	
util living area													
	0.9983	0.9920	0.9673	0.8775	0.7016	0.4996	0.3607	0.4085	0.6650	0.9397	0.9947	0.9989	(86)
Living	20.5610	20.6258	20.7079	20.7930	20.8338	20.8462	20.8473	20.8476	20.8403	20.7739	20.6492	20.5532	
Non living	19.5791	19.6642	19.7696	19.8832	19.9274	19.9524	19.9530	19.9563	19.9425	19.8669	19.7076	19.5795	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	0	0	0	0	0	0	0	0	0	0	1	
16 / 9	0	28	31	0	0	0	0	0	0	0	12	30	
MIT	21.0000	20.7881	20.8346	20.7930	20.8338	20.8462	20.8473	20.8476	20.8403	20.7739	20.7101	20.7551	(87)
Th 2	20.1124	20.1152	20.1180	20.1320	20.1348	20.1488	20.1488	20.1516	20.1432	20.1348	20.1292	20.1236	(88)
util rest of house													
	0.9977	0.9894	0.9573	0.8463	0.6472	0.4349	0.2911	0.3337	0.5920	0.9162	0.9926	0.9986	(89)
MIT 2	20.1124	19.9161	19.9642	19.8832	19.9274	19.9524	19.9530	19.9563	19.9425	19.8669	19.8018	19.8912	(90)
Living area fraction										fLA = Living area / (4) =		0.3151	(91)
MIT	20.3921	20.1909	20.2384	20.1699	20.2130	20.2340	20.2348	20.2371	20.2254	20.1527	20.0880	20.1634	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3921	20.1909	20.2384	20.1699	20.2130	20.2340	20.2348	20.2371	20.2254	20.1527	20.0880	20.1634	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9897	0.9588	0.8478	0.6523	0.4414	0.2982	0.3413	0.5993	0.9167	0.9925	0.9986	(94)
Useful gains	1788.5187	2309.3292	2717.4544	2804.1626	2358.0573	1578.2456	1021.7247	1074.2079	1699.7836	2133.1423	1837.4341	1650.0024	(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													
	4737.5913	4486.2065	4016.8083	3237.9044	2437.1891	1584.3979	1022.1698	1075.1936	1735.0043	2734.8520	3744.6992	4634.9410	(97)
Space heating kWh													
	2194.1100	1462.8615	966.7193	312.2941	58.8741	0.0000	0.0000	0.0000	0.0000	447.6720	1373.2309	2220.7943	(98a)
Space heating requirement - total per year (kWh/year)												9036.5563	
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													
	2194.1100	1462.8615	966.7193	312.2941	58.8741	0.0000	0.0000	0.0000	0.0000	447.6720	1373.2309	2220.7943	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9036.5563	
Space heating per m2											(98c) / (4) =	29.6281	(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 %)	349.6900	(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													
	2194.1100	1462.8615	966.7193	312.2941	58.8741	0.0000	0.0000	0.0000	0.0000	447.6720	1373.2309	2220.7943	(98)
Space heating efficiency (main heating system 1)													

	349.6900	349.6900	349.6900	349.6900	349.6900	0.0000	0.0000	0.0000	0.0000	349.6900	349.6900	349.6900	(210)
Space heating fuel (main heating system)													
	627.4444	418.3310	276.4504	89.3060	16.8361	0.0000	0.0000	0.0000	0.0000	128.0197	392.6996	635.0752	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
Efficiency of water heater												186.8280	(216)
(217)m	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	(217)
Fuel for water heating, kWh/month													
	131.0548	115.7992	123.1420	108.9768	106.0183	95.9759	95.2320	98.8927	99.8020	110.7089	116.9356	129.7557	(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	99.3095	89.6989	99.3095	96.1060	99.3095	96.1060	99.3095	99.3095	96.1060	99.3095	96.1060	99.3095	(231)
Lighting	59.9897	48.1260	43.3321	31.7470	24.5223	20.0349	22.3700	29.0774	37.7687	49.5546	55.9718	61.6570	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-131.4018	-222.6998	-382.8546	-500.5092	-591.6131	-570.1119	-562.6157	-502.7712	-402.6149	-282.3021	-156.3101	-109.2348	(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	-0.8426	-4.0071	-16.6582	-50.1185	-98.6981	-111.9136	-109.0431	-77.9614	-42.0486	-11.4110	-1.8020	-0.5528	(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	2584.1624	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	186.8280	
Water heating fuel used	1332.2939	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)		
mechanical ventilation fans (SFP = 0.9940)	1169.2891	(230a)
Total electricity for the above, kWh/year	1169.2891	(231)
Electricity for lighting (calculated in Appendix L)	484.1516	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4940.0962	(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	629.8007	(238)

10a. Fuel costs using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2584.1624	16.4900	426.1284	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1332.2939	16.4900	219.6953	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	1169.2891	16.4900	192.8158	(249)
Energy for lighting	484.1516	16.4900	79.8366	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4415.0392	16.4900	-728.0400	
PV Unit electricity exported	-525.0570	5.5900	-29.3507	
Total			-757.3907	(252)
Total energy cost			161.0854	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1657	(257)
SAP value		97.3142	
SAP rating (Section 12)		97	(258)
SAP band		A	

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	2584.1624	0.1574	406.7220	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1332.2939	0.1407	187.5122	(264)
Space and water heating			594.2342	(265)
Pumps, fans and electric keep-hot	1169.2891	0.1387	162.1948	(267)
Energy for lighting	484.1516	0.1443	69.8780	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4415.0392	0.1317	-581.3873	
PV Unit electricity exported	-525.0570	0.1143	-60.0006	
Total			-641.3879	(269)

Total CO2, kg/year	184.9191	(272)
CO2 emissions per m2	0.6100	(273)
EI value	99.2920	
EI rating	99	(274)
EI band	A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	56.1000	(1a)	x 2.9900	(2a) =	167.7390	(1a) - (3a)
Ground floor	174.8000	(1b)	x 3.2000	(2b) =	559.3600	(1b) - (3b)
First floor	74.1000	(1c)	x 3.2000	(2c) =	237.1200	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	305.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		964.2190	(5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.7000	4.4000	4.4000	4.1000	4.2000	3.8000	3.9000	3.7000	3.7000	4.0000	4.0000	4.3000	(22)
Wind factor	1.1750	1.1000	1.1000	1.0250	1.0500	0.9500	0.9750	0.9250	0.9250	1.0000	1.0000	1.0750	(22a)
Adj infilt rate	0.1498	0.1403	0.1403	0.1307	0.1339	0.1211	0.1243	0.1179	0.1179	0.1275	0.1275	0.1371	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2538	0.2442	0.2442	0.2347	0.2379	0.2251	0.2283	0.2219	0.2219	0.2315	0.2315	0.2411	(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	
Opening Type 2 (Uw = 1.20)			80.7100	1.1450	92.4160			(27)
Opening			1.7300	0.9615	1.6635			(27a)
Opening			0.8600	0.9615	0.8269			(27a)
Heatloss Floor 1			56.1000	0.1300	7.2930	110.0000	6171.0000	(28a)
Heatloss Floor 2			118.7000	0.1300	15.4310	110.0000	13057.0000	(28a)
External Wall 1	378.5100	80.7100	297.8000	0.1700	50.6260	190.0000	56582.0000	(29a)
External Roof 1	92.6200	2.5900	90.0300	0.1300	11.7039	9.0000	810.2700	(30)
External Roof 2	100.7000		100.7000	0.1300	13.0910	9.0000	906.3000	(30)
Total net area of external elements Aum(A, m2)			746.6300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		193.0513			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 77526.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	254.1855 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	33.0300	0.0400	1.3212
E6 Intermediate floor within a dwelling	70.0000	0.0000	0.0000
E16 Corner (normal)	37.0000	0.0200	0.7400
E18 Party wall between dwellings	15.6000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	50.0000	0.0180	0.9000
E3 Sill	50.0000	0.0180	0.9000
E4 Jamb	135.0000	0.0050	0.6750

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5362	(36)
Point Thermal bridges	(36a) = 12.0000	(36a)
Total fabric heat loss	(33) + (36) + (36a) = 209.5875	(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	80.7612	77.7185	77.7185	74.6757	75.6900	71.6330	72.6473	70.6188	70.6188	73.6615	73.6615	76.7042	(38)
Heat transfer coeff	290.3487	287.3060	287.3060	284.2633	285.2775	281.2205	282.2348	280.2063	280.2063	283.2490	283.2490	286.2917	(39)

Average = Sum(39)m / 12 = 284.2633

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9520	0.9420	0.9420	0.9320	0.9353	0.9220	0.9254	0.9187	0.9187	0.9287	0.9287	0.9387	(40)
HLP (average)												0.9320	
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 3.1384 (42)

Hot water usage for mixer showers

96.0513	94.6079	92.5044	88.4799	85.5100	82.1979	80.3153	82.4028	84.6911	88.2472	92.3582	95.6833	(42a)

Hot water usage for baths

33.1674	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)

Hot water usage for other uses

46.7707	45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42c)

Average daily hot water use (litres/day) 161.8263 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	175.9894	172.3526	167.8547	160.8505	155.2221	149.1473	146.6911	151.1682	155.9072	162.3004	169.4174	175.5092	(44)
Energy conte	278.7241	245.4278	257.9865	220.1963	208.9588	183.3940	177.4102	187.1778	192.2492	220.2402	241.3662	274.8050	(45)
Energy content (annual)										Total = Sum(45)m =		2687.9362	
Distribution loss (46)m = 0.15 x (45)m	41.8086	36.8142	38.6980	33.0294	31.3438	27.5091	26.6115	28.0767	28.8374	33.0360	36.2049	41.2208	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	325.4225	287.6070	304.6849	265.3883	255.6572	228.5860	224.1086	233.8762	237.4412	266.9386	286.5582	321.5034	(62)
WWHRS	-80.5755	-71.2616	-74.6211	-61.7892	-57.5853	-49.2762	-46.1885	-49.1169	-50.9830	-60.1033	-68.0898	-79.0833	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
										Total per year (kWh/year) = Sum(64)m =		2489.0984	(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	130.0345	115.3481	123.1392	109.3689	106.8375	97.1321	96.3476	99.5953	100.0765	110.5886	116.4079	128.7314	(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	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.5367	60.8737	49.5058	37.4791	28.0160	23.6523	25.5572	33.2202	44.5881	56.6148	66.0778	70.4415	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	690.0012	697.1613	679.1182	640.7065	592.2188	546.6471	516.2024	509.0423	527.0854	565.4971	613.9849	659.5565	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Water heating gains (Table 5)	174.7775	171.6489	165.5097	151.9012	143.5988	134.9057	129.4995	133.8647	138.9951	148.6406	161.6776	173.0261	(72)
Total internal gains	1053.0531	1049.4215	1013.8713	949.8244	883.5712	824.9427	790.9967	795.8648	830.4062	890.4900	961.4779	1022.7617	(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	14.2600	13.7804	0.5700	0.7000	0.7700	54.3360	(75)
Southeast	30.0700	43.0593	0.5700	0.7000	0.7700	358.0192	(77)
Southwest	35.5600	43.0593	0.5700	0.7000	0.7700	423.3842	(79)
Northwest	0.8200	13.7804	0.5700	0.7000	0.7700	3.1245	(81)
Northeast	0.8600	22.2520	0.6400	0.7000	1.0000	7.7159	(82)
Northwest	1.7300	32.0000	0.6400	0.7000	1.0000	22.3212	(82)

Solar gains	868.9010	1320.1561	1864.3884	2558.3171	2811.6971	3095.0761	2858.4760	2579.3582	2211.7669	1544.9609	1004.9710	715.6515	(83)
Total gains	1921.9541	2369.5776	2878.2597	3508.1415	3695.2683	3920.0188	3649.4726	3375.2231	3042.1731	2435.4509	1966.4488	1738.4133	(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	74.1700	74.9555	74.9555	75.7578	75.4885	76.5775	76.3023	76.8547	76.8547	76.0291	76.0291	75.2210	
alpha	5.9447	5.9970	5.9970	6.0505	6.0326	6.1052	6.0868	6.1236	6.1236	6.0686	6.0686	6.0147	
util living area	0.9965	0.9878	0.9508	0.8089	0.6177	0.3796	0.2783	0.2987	0.5460	0.8899	0.9882	0.9979	(86)
Living	20.6083	20.6647	20.7418	20.8174	20.8405	20.8472	20.8469	20.8478	20.8461	20.8043	20.6971	20.5989	

Non living	19.6500	19.7295	19.8245	19.9175	19.9360	19.9529	19.9496	19.9564	19.9555	19.9092	19.7816	19.6486	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	30	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	1	28	31	0	0	0	0	0	0	0	11	31	
MIT	20.9928	20.8101	20.8538	20.8174	20.8405	20.8472	20.8469	20.8478	20.8461	20.8043	20.7453	20.7729	(87)
Th 2	20.1236	20.1320	20.1320	20.1404	20.1376	20.1488	20.1460	20.1516	20.1516	20.1432	20.1432	20.1348	(88)
util rest of house	0.9952	0.9837	0.9358	0.7674	0.5584	0.3190	0.2124	0.2284	0.4719	0.8506	0.9834	0.9972	(89)
MIT 2	20.1168	19.9543	19.9963	19.9175	19.9360	19.9529	19.9496	19.9564	19.9555	19.9092	19.8557	19.9202	(90)
Living area fraction									fLA = Living area / (4) =			0.3151	(91)
MIT	20.3928	20.2240	20.2664	20.2010	20.2210	20.2347	20.2324	20.2373	20.2361	20.1912	20.1360	20.1889	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3928	20.2240	20.2664	20.2010	20.2210	20.2347	20.2324	20.2373	20.2361	20.1912	20.1360	20.1889	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9842	0.9384	0.7705	0.5642	0.3251	0.2190	0.2355	0.4794	0.8531	0.9834	0.9972	(94)
Useful gains	1913.6071	2332.1002	2700.9598	2703.0003	2085.0055	1274.3448	799.3285	794.9401	1458.4057	2077.6707	1933.7762	1733.5584	(95)
Ext temp.	5.4000	5.9000	7.5000	9.9000	12.8000	15.7000	17.4000	17.4000	15.0000	11.7000	8.3000	5.4000	(96)
Heat loss rate W	4353.1500	4115.3577	3667.8763	2928.2057	2117.0386	1275.2513	799.3890	795.0269	1467.1889	2405.1291	3352.5267	4233.9258	(97)
Space heating kWh	1815.0199	1198.3490	719.3859	162.1479	23.8326	0.0000	0.0000	0.0000	0.0000	243.6290	1021.5004	1860.2733	(98a)
Space heating requirement - total per year (kWh/year)												7044.1380	
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	1815.0199	1198.3490	719.3859	162.1479	23.8326	0.0000	0.0000	0.0000	0.0000	243.6290	1021.5004	1860.2733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7044.1380	
Space heating per m2											(98c) / (4) =	23.0955	(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 %)												350.3792	(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	1815.0199	1198.3490	719.3859	162.1479	23.8326	0.0000	0.0000	0.0000	0.0000	243.6290	1021.5004	1860.2733	(98)
Space heating efficiency (main heating system 1)	350.3792	350.3792	350.3792	350.3792	350.3792	0.0000	0.0000	0.0000	0.0000	350.3792	350.3792	350.3792	(210)
Space heating fuel (main heating system)	518.0159	342.0149	205.3164	46.2778	6.8019	0.0000	0.0000	0.0000	0.0000	69.5330	291.5414	530.9315	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
Efficiency of water heater												186.8129	(216)
(217)m	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	(217)
Fuel for water heating, kWh/month	131.0654	115.8086	123.1520	108.9856	106.0269	95.9837	95.2397	98.9008	99.8101	110.7179	116.9451	129.7663	(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	99.3095	89.6989	99.3095	96.1060	99.3095	96.1060	99.3095	99.3095	96.1060	99.3095	96.1060	99.3095	(231)
Lighting	59.9897	48.1260	43.3321	31.7470	24.5223	20.0349	22.3700	29.0774	37.7687	49.5546	55.9718	61.6570	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-157.5457	-233.3835	-396.8437	-538.3885	-606.7410	-624.2364	-600.3910	-545.3205	-443.9675	-307.0864	-179.7528	-126.7420	(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	-1.4392	-4.9283	-20.1322	-66.5530	-108.8971	-146.9153	-132.2458	-98.0944	-54.5053	-15.6193	-2.8604	-0.8691	(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												2010.4329	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												186.8129	
Water heating fuel used												1332.4021	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)													
mechanical ventilation fans (SFP = 0.9940)												1169.2891	(230a)
Total electricity for the above, kWh/year												1169.2891	(231)
Electricity for lighting (calculated in Appendix L)												484.1516	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-5413.4585	(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												-417.1827	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2010.4329	25.1600	505.8249	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1332.4021	25.1600	335.2324	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	1169.2891	25.1600	294.1931	(249)
Energy for lighting	484.1516	25.1600	121.8126	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4760.3990	25.1600	-1197.7164	
PV Unit electricity exported	-653.0595	5.8100	-37.9428	
Total			-1235.6591	(252)
Total energy cost			21.4039	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2010.4329	0.1582	318.1091	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1332.4021	0.1407	187.5274	(264)
Space and water heating			505.6365	(265)
Pumps, fans and electric keep-hot	1169.2891	0.1387	162.1948	(267)
Energy for lighting	484.1516	0.1443	69.8780	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4760.3990	0.1317	-627.1748	
PV Unit electricity exported	-653.0595	0.1143	-74.6400	
Total			-701.8149	(269)
Total CO2, kg/year			35.8945	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2010.4329	1.5857	3187.9602	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1332.4021	1.5204	2025.7997	(278)
Space and water heating			5213.7600	(279)
Pumps, fans and electric keep-hot	1169.2891	1.5128	1768.9005	(281)
Energy for lighting	484.1516	1.5338	742.6079	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4760.3990	1.4867	-7077.5070	
PV Unit electricity exported	-653.0595	0.4188	-273.4820	
Total			-7350.9890	(283)
Total Primary energy kWh/year			374.2794	(286)

SAP 10 EPC IMPROVEMENTS

8 Druid Stoke

Current energy efficiency rating: A 97
Current environmental impact rating: A 99

N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.7	-£ 57	-39 kg (108.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South West England):

	Current	Potential	Saving
Electricity	£1257	£1257	£0
Space heating	£800	£800	£0
Water heating	£335	£335	£0
Lighting	£122	£122	£0
Generated (PV)	-£1236	-£1236	£0
Total cost of fuels	£21	£21	£0
Total cost of uses	£21	£21	£0
Delivered energy	-1 kWh/m²	-1 kWh/m²	0 kWh/m²

Carbon dioxide emissions	0.0 tonnes	0.0 tonnes	0.0 tonnes
CO2 emissions per m²	0 kg/m²	0 kg/m²	0 kg/m²
Primary energy	1 kWh/m²	1 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	56.1000	(1a)	x 2.9900	(2a) =	167.7390	(1a) - (3a)
Ground floor	174.8000	(1b)	x 3.2000	(2b) =	559.3600	(1b) - (3b)
First floor	74.1000	(1c)	x 3.2000	(2c) =	237.1200	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	305.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		964.2190	(5)

2. Ventilation rate

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

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

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

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2666	0.2634	0.2602	0.2442	0.2411	0.2251	0.2251	0.2219	0.2315	0.2411	0.2474	0.2538	(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	
Opening Type 2 (Uw = 1.20)			80.7100	1.1450	92.4160			(27)
Opening			1.7300	0.9615	1.6635			(27a)
Opening			0.8600	0.9615	0.8269			(27a)
Heatloss Floor 1			56.1000	0.1300	7.2930	110.0000	6171.0000	(28a)
Heatloss Floor 2			118.7000	0.1300	15.4310	110.0000	13057.0000	(28a)
External Wall 1	378.5100	80.7100	297.8000	0.1700	50.6260	190.0000	56582.0000	(29a)
External Roof 1	92.6200	2.5900	90.0300	0.1300	11.7039	9.0000	810.2700	(30)
External Roof 2	100.7000		100.7000	0.1300	13.0910	9.0000	906.3000	(30)
Total net area of external elements Aum(A, m2)			746.6300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	193.0513			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 77526.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	254.1855 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	33.0300	0.0400	1.3212
E6 Intermediate floor within a dwelling	70.0000	0.0000	0.0000
E16 Corner (normal)	37.0000	0.0200	0.7400
E18 Party wall between dwellings	15.6000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	50.0000	0.0180	0.9000
E3 Sill	50.0000	0.0180	0.9000
E4 Jamb	135.0000	0.0050	0.6750

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5362 (36)
Point Thermal bridges	(36a) = 12.0000 (36a)
Total fabric heat loss	(33) + (36) + (36a) = 209.5875 (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	84.8181	83.8039	82.7897	77.7185	76.7042	71.6330	71.6330	70.6188	73.6615	76.7042	78.7327	80.7612	(38)
Heat transfer coeff	294.4056	293.3914	292.3772	287.3060	286.2917	281.2205	281.2205	280.2063	283.2490	286.2917	288.3202	290.3487	(39)
Average = Sum(39)m / 12 =												287.0524	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9653	0.9619	0.9586	0.9420	0.9387	0.9220	0.9220	0.9187	0.9287	0.9387	0.9453	0.9520	(40)
HLP (average)												0.9412	
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												3.1384	(42)
Hot water usage for mixer showers													
	96.0513	94.6079	92.5044	88.4799	85.5100	82.1979	80.3153	82.4028	84.6911	88.2472	92.3582	95.6833	(42a)
Hot water usage for baths													
	33.1674	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)
Hot water usage for other uses													
	46.7707	45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42c)
Average daily hot water use (litres/day)												161.8263	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	175.9894	172.3526	167.8547	160.8505	155.2221	149.1473	146.6911	151.1682	155.9072	162.3004	169.4174	175.5092	(44)
Energy conte	278.7241	245.4278	257.9865	220.1963	208.9588	183.3940	177.4102	187.1778	192.2492	220.2402	241.3662	274.8050	(45)
Energy content (annual)										Total = Sum(45)m =		2687.9362	
Distribution loss (46)m = 0.15 x (45)m													
	41.8086	36.8142	38.6980	33.0294	31.3438	27.5091	26.6115	28.0767	28.8374	33.0360	36.2049	41.2208	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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													
	325.4225	287.6070	304.6849	265.3883	255.6572	228.5860	224.1086	233.8762	237.4412	266.9386	286.5582	321.5034	(62)
WWHRS	-80.5755	-71.2616	-74.6211	-61.7892	-57.5853	-49.2762	-46.1885	-49.1169	-50.9830	-60.1033	-68.0898	-79.0833	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
										Total per year (kWh/year) = Sum(64)m =		2489.0984	(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													
	130.0345	115.3481	123.1392	109.3689	106.8375	97.1321	96.3476	99.5953	100.0765	110.5886	116.4079	128.7314	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.5367	60.8737	49.5058	37.4791	28.0160	23.6523	25.5572	33.2202	44.5881	56.6148	66.0778	70.4415	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	690.0012	697.1613	679.1182	640.7065	592.2188	546.6471	516.2024	509.0423	527.0854	565.4971	613.9849	659.5565	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Water heating gains (Table 5)													
	174.7775	171.6489	165.5097	151.9012	143.5988	134.9057	129.4995	133.8647	138.9951	148.6406	161.6776	173.0261	(72)
Total internal gains													
	1053.0531	1049.4215	1013.8713	949.8244	883.5712	824.9427	790.9967	795.8648	830.4062	890.4900	961.4779	1022.7617	(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	14.2600	11.2829	0.5700	0.7000	0.7700	44.4885	(75)
Southeast	30.0700	36.7938	0.5700	0.7000	0.7700	305.9247	(77)
Southwest	35.5600	36.7938	0.5700	0.7000	0.7700	361.7786	(79)
Northwest	0.8200	11.2829	0.5700	0.7000	0.7700	2.5582	(81)
Northeast	0.8600	18.0708	0.6400	0.7000	1.0000	6.2661	(82)
Northwest	1.7300	26.0000	0.6400	0.7000	1.0000	18.1359	(82)

Solar gains	739.1522	1283.9416	1820.2944	2357.7564	2731.2432	2750.4276	2635.5623	2351.5083	2005.8539	1436.4116	889.9293	629.5530	(83)
Total gains	1792.2052	2333.3631	2834.1657	3307.5808	3614.8144	3575.3703	3426.5590	3147.3731	2836.2601	2326.9016	1851.4071	1652.3148	(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	73.1479	73.4008	73.6554	74.9555	75.2210	76.5775	76.5775	76.8547	76.0291	75.2210	74.6918	74.1700	
alpha	5.8765	5.8934	5.9104	5.9970	6.0147	6.1052	6.1052	6.1236	6.0686	6.0147	5.9795	5.9447	
util living area													
	0.9983	0.9920	0.9673	0.8775	0.7016	0.4996	0.3607	0.4085	0.6650	0.9397	0.9947	0.9989	(86)
Living	20.5610	20.6258	20.7079	20.7930	20.8338	20.8462	20.8473	20.8476	20.8403	20.7739	20.6492	20.5532	
Non living	19.5791	19.6642	19.7696	19.8832	19.9274	19.9524	19.9530	19.9563	19.9425	19.8669	19.7076	19.5795	

24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	0	0	0	0	0	0	0	0	0	0	1	
16 / 9	0	28	31	0	0	0	0	0	0	0	12	30	
MIT	21.0000	20.7881	20.8346	20.7930	20.8338	20.8462	20.8473	20.8476	20.8403	20.7739	20.7101	20.7551	(87)
Th 2	20.1124	20.1152	20.1180	20.1320	20.1348	20.1488	20.1488	20.1516	20.1432	20.1348	20.1292	20.1236	(88)
util rest of house													
	0.9977	0.9894	0.9573	0.8463	0.6472	0.4349	0.2911	0.3337	0.5920	0.9162	0.9926	0.9986	(89)
MIT 2	20.1124	19.9161	19.9642	19.8832	19.9274	19.9524	19.9530	19.9563	19.9425	19.8669	19.8018	19.8912	(90)
Living area fraction										fLA = Living area / (4) =		0.3151	(91)
MIT	20.3921	20.1909	20.2384	20.1699	20.2130	20.2340	20.2348	20.2371	20.2254	20.1527	20.0880	20.1634	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3921	20.1909	20.2384	20.1699	20.2130	20.2340	20.2348	20.2371	20.2254	20.1527	20.0880	20.1634	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9897	0.9588	0.8478	0.6523	0.4414	0.2982	0.3413	0.5993	0.9167	0.9925	0.9986	(94)
Useful gains	1788.5187	2309.3292	2717.4544	2804.1626	2358.0573	1578.2456	1021.7247	1074.2079	1699.7836	2133.1423	1837.4341	1650.0024	(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	4737.5913	4486.2065	4016.8083	3237.9044	2437.1891	1584.3979	1022.1698	1075.1936	1735.0043	2734.8520	3744.6992	4634.9410	(97)
Space heating kWh	2194.1100	1462.8615	966.7193	312.2941	58.8741	0.0000	0.0000	0.0000	0.0000	447.6720	1373.2309	2220.7943	(98a)
Space heating requirement - total per year (kWh/year)												9036.5563	
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	2194.1100	1462.8615	966.7193	312.2941	58.8741	0.0000	0.0000	0.0000	0.0000	447.6720	1373.2309	2220.7943	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9036.5563	
Space heating per m2											(98c) / (4) =	29.6281	(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 %)	349.6900	(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	2194.1100	1462.8615	966.7193	312.2941	58.8741	0.0000	0.0000	0.0000	0.0000	447.6720	1373.2309	2220.7943	(98)
Space heating efficiency (main heating system 1)	349.6900	349.6900	349.6900	349.6900	349.6900	0.0000	0.0000	0.0000	0.0000	349.6900	349.6900	349.6900	(210)
Space heating fuel (main heating system)	627.4444	418.3310	276.4504	89.3060	16.8361	0.0000	0.0000	0.0000	0.0000	128.0197	392.6996	635.0752	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
Efficiency of water heater												186.8280	(216)
(217)m	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	(217)
Fuel for water heating, kWh/month	131.0548	115.7992	123.1420	108.9768	106.0183	95.9759	95.2320	98.8927	99.8020	110.7089	116.9356	129.7557	(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	99.3095	89.6989	99.3095	96.1060	99.3095	96.1060	99.3095	99.3095	96.1060	99.3095	96.1060	99.3095	(231)
Lighting	59.9897	48.1260	43.3321	31.7470	24.5223	20.0349	22.3700	29.0774	37.7687	49.5546	55.9718	61.6570	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-131.4018	-222.6998	-382.8546	-500.5092	-591.6131	-570.1119	-562.6157	-502.7712	-402.6149	-282.3021	-156.3101	-109.2348	(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	-0.8426	-4.0071	-16.6582	-50.1185	-98.6981	-111.9136	-109.0431	-77.9614	-42.0486	-11.4110	-1.8020	-0.5528	(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	2584.1624	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	186.8280	
Water heating fuel used	1332.2939	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)		
mechanical ventilation fans (SFP = 0.9940)	1169.2891	(230a)
Total electricity for the above, kWh/year	1169.2891	(231)
Electricity for lighting (calculated in Appendix L)	484.1516	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4940.0962	(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	629.8007	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2584.1624	16.4900	426.1284	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1332.2939	16.4900	219.6953	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	1169.2891	16.4900	192.8158	(249)
Energy for lighting	484.1516	16.4900	79.8366	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4415.0392	16.4900	-728.0400	
PV Unit electricity exported	-525.0570	5.5900	-29.3507	
Total			-757.3907	(252)
Total energy cost			161.0854	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1657 (257)
SAP value		97.3142
SAP rating (Section 12)		97 (258)
SAP band		A

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	2584.1624	0.1574	406.7220	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1332.2939	0.1407	187.5122	(264)
Space and water heating			594.2342	(265)
Pumps, fans and electric keep-hot	1169.2891	0.1387	162.1948	(267)
Energy for lighting	484.1516	0.1443	69.8780	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4415.0392	0.1317	-581.3873	
PV Unit electricity exported	-525.0570	0.1143	-60.0006	
Total			-641.3879	(269)
Total CO2, kg/year			184.9191	(272)
CO2 emissions per m2			0.6100	(273)
EI value			99.2920	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)			Volume (m3)	
Basement floor	56.1000	(1a)	x 2.9900	(2a)	=	167.7390	(1a) - (3a)
Ground floor	174.8000	(1b)	x 3.2000	(2b)	=	559.3600	(1b) - (3b)
First floor	74.1000	(1c)	x 3.2000	(2c)	=	237.1200	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	305.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		=	964.2190	(5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.7000	4.4000	4.4000	4.1000	4.2000	3.8000	3.9000	3.7000	3.7000	4.0000	4.0000	4.3000	(22)
Wind factor	1.1750	1.1000	1.1000	1.0250	1.0500	0.9500	0.9750	0.9250	0.9250	1.0000	1.0000	1.0750	(22a)
Adj infilt rate	0.1498	0.1403	0.1403	0.1307	0.1339	0.1211	0.1243	0.1179	0.1179	0.1275	0.1275	0.1371	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000	(23c)
Effective ac	0.2538	0.2442	0.2442	0.2347	0.2379	0.2251	0.2283	0.2219	0.2219	0.2315	0.2315	0.2411	(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	
Opening Type 2 (Uw = 1.20)			80.7100	1.1450	92.4160			(27)
Opening			1.7300	0.9615	1.6635			(27a)
Opening			0.8600	0.9615	0.8269			(27a)
Heatloss Floor 1			56.1000	0.1300	7.2930	110.0000	6171.0000	(28a)
Heatloss Floor 2			118.7000	0.1300	15.4310	110.0000	13057.0000	(28a)
External Wall 1	378.5100	80.7100	297.8000	0.1700	50.6260	190.0000	56582.0000	(29a)
External Roof 1	92.6200	2.5900	90.0300	0.1300	11.7039	9.0000	810.2700	(30)
External Roof 2	100.7000		100.7000	0.1300	13.0910	9.0000	906.3000	(30)
Total net area of external elements Aum(A, m2)			746.6300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		193.0513			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	77526.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		254.1855 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	33.0300	0.0400	1.3212
E6 Intermediate floor within a dwelling	70.0000	0.0000	0.0000
E16 Corner (normal)	37.0000	0.0200	0.7400
E18 Party wall between dwellings	15.6000	0.0000	0.0000
E2 Other lintels (including other steel lintels)	50.0000	0.0180	0.9000
E3 Sill	50.0000	0.0180	0.9000
E4 Jamb	135.0000	0.0050	0.6750

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.5362 (36)
Point Thermal bridges	(36a) =	12.0000 (36a)
Total fabric heat loss	(33) + (36) + (36a) =	209.5875 (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	80.7612	77.7185	77.7185	74.6757	75.6900	71.6330	72.6473	70.6188	70.6188	73.6615	73.6615	76.7042	(38)
Heat transfer coeff	290.3487	287.3060	287.3060	284.2633	285.2775	281.2205	282.2348	280.2063	280.2063	283.2490	283.2490	286.2917	(39)
Average = Sum(39)m / 12 =												284.2633	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9520	0.9420	0.9420	0.9320	0.9353	0.9220	0.9254	0.9187	0.9187	0.9287	0.9287	0.9387	(40)
HLP (average)												0.9320	
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		3.1384 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	96.0513	94.6079	92.5044	88.4799	85.5100	82.1979	80.3153	82.4028	84.6911	88.2472	92.3582	95.6833	(42a)
Hot water usage for baths	33.1674	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)
Hot water usage for other uses	46.7707	45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42c)
Average daily hot water use (litres/day)												161.8263	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	175.9894	172.3526	167.8547	160.8505	155.2221	149.1473	146.6911	151.1682	155.9072	162.3004	169.4174	175.5092	(44)
Energy conte	278.7241	245.4278	257.9865	220.1963	208.9588	183.3940	177.4102	187.1778	192.2492	220.2402	241.3662	274.8050	(45)
Energy content (annual)										Total = Sum(45)m =		2687.9362	
Distribution loss (46)m = 0.15 x (45)m	41.8086	36.8142	38.6980	33.0294	31.3438	27.5091	26.6115	28.0767	28.8374	33.0360	36.2049	41.2208	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7560	(55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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	325.4225	287.6070	304.6849	265.3883	255.6572	228.5860	224.1086	233.8762	237.4412	266.9386	286.5582	321.5034	(62)
WWHRS	-80.5755	-71.2616	-74.6211	-61.7892	-57.5853	-49.2762	-46.1885	-49.1169	-50.9830	-60.1033	-68.0898	-79.0833	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
										Total per year (kWh/year) = Sum(64)m =		2489.0984	(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	130.0345	115.3481	123.1392	109.3689	106.8375	97.1321	96.3476	99.5953	100.0765	110.5886	116.4079	128.7314	(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	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.5367	60.8737	49.5058	37.4791	28.0160	23.6523	25.5572	33.2202	44.5881	56.6148	66.0778	70.4415	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	690.0012	697.1613	679.1182	640.7065	592.2188	546.6471	516.2024	509.0423	527.0854	565.4971	613.9849	659.5565	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Water heating gains (Table 5)													
	174.7775	171.6489	165.5097	151.9012	143.5988	134.9057	129.4995	133.8647	138.9951	148.6406	161.6776	173.0261	(72)
Total internal gains													
	1053.0531	1049.4215	1013.8713	949.8244	883.5712	824.9427	790.9967	795.8648	830.4062	890.4900	961.4779	1022.7617	(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	14.2600	13.7804	0.5700	0.7000	0.7700	54.3360	(75)
Southeast	30.0700	43.0593	0.5700	0.7000	0.7700	358.0192	(77)
Southwest	35.5600	43.0593	0.5700	0.7000	0.7700	423.3842	(79)
Northwest	0.8200	13.7804	0.5700	0.7000	0.7700	3.1245	(81)
Northeast	0.8600	22.2520	0.6400	0.7000	1.0000	7.7159	(82)
Northwest	1.7300	32.0000	0.6400	0.7000	1.0000	22.3212	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	868.9010	1320.1561	1864.3884	2558.3171	2811.6971	3095.0761	2858.4760	2579.3582	2211.7669	1544.9609	1004.9710	715.6515	(83)
Total gains	1921.9541	2369.5776	2878.2597	3508.1415	3695.2683	3920.0188	3649.4726	3375.2231	3042.1731	2435.4509	1966.4488	1738.4133	(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	74.1700	74.9555	74.9555	75.7578	75.4885	76.5775	76.3023	76.8547	76.8547	76.0291	76.0291	75.2210	
alpha	5.9447	5.9970	5.9970	6.0505	6.0326	6.1052	6.0868	6.1236	6.1236	6.0686	6.0686	6.0147	
util living area													
	0.9965	0.9878	0.9508	0.8089	0.6177	0.3796	0.2783	0.2987	0.5460	0.8899	0.9882	0.9979	(86)
Living	20.6083	20.6647	20.7418	20.8174	20.8405	20.8472	20.8469	20.8478	20.8461	20.8043	20.6971	20.5989	
Non living	19.6500	19.7295	19.8245	19.9175	19.9360	19.9529	19.9496	19.9564	19.9555	19.9092	19.7816	19.6486	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	30	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	1	28	31	0	0	0	0	0	0	0	11	31	
MIT	20.9928	20.8101	20.8538	20.8174	20.8405	20.8472	20.8469	20.8478	20.8461	20.8043	20.7453	20.7729	(87)
Th 2	20.1236	20.1320	20.1320	20.1404	20.1376	20.1488	20.1460	20.1516	20.1516	20.1432	20.1432	20.1348	(88)
util rest of house													
	0.9952	0.9837	0.9358	0.7674	0.5584	0.3190	0.2124	0.2284	0.4719	0.8506	0.9834	0.9972	(89)
MIT 2	20.1168	19.9543	19.9963	19.9175	19.9360	19.9529	19.9496	19.9564	19.9555	19.9092	19.8557	19.9202	(90)
Living area fraction									fLA = Living area / (4) =			0.3151	(91)
MIT	20.3928	20.2240	20.2664	20.2010	20.2210	20.2347	20.2324	20.2373	20.2361	20.1912	20.1360	20.1889	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3928	20.2240	20.2664	20.2010	20.2210	20.2347	20.2324	20.2373	20.2361	20.1912	20.1360	20.1889	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9842	0.9384	0.7705	0.5642	0.3251	0.2190	0.2355	0.4794	0.8531	0.9834	0.9972	(94)
Useful gains	1913.6071	2332.1002	2700.9598	2703.0003	2085.0055	1274.3448	799.3285	794.9401	1458.4057	2077.6707	1933.7762	1733.5584	(95)
Ext temp.	5.4000	5.9000	7.5000	9.9000	12.8000	15.7000	17.4000	17.4000	15.0000	11.7000	8.3000	5.4000	(96)
Heat loss rate W													
	4353.1500	4115.3577	3667.8763	2928.2057	2117.0386	1275.2513	799.3890	795.0269	1467.1889	2405.1291	3352.5267	4233.9258	(97)
Space heating kWh													
	1815.0199	1198.3490	719.3859	162.1479	23.8326	0.0000	0.0000	0.0000	0.0000	243.6290	1021.5004	1860.2733	(98a)
Space heating requirement - total per year (kWh/year)												7044.1380	
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													
	1815.0199	1198.3490	719.3859	162.1479	23.8326	0.0000	0.0000	0.0000	0.0000	243.6290	1021.5004	1860.2733	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7044.1380	
Space heating per m2											(98c) / (4) =	23.0955	(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 %)	350.3792	(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													
	1815.0199	1198.3490	719.3859	162.1479	23.8326	0.0000	0.0000	0.0000	0.0000	243.6290	1021.5004	1860.2733	(98)
Space heating efficiency (main heating system 1)													
	350.3792	350.3792	350.3792	350.3792	350.3792	0.0000	0.0000	0.0000	0.0000	350.3792	350.3792	350.3792	(210)
Space heating fuel (main heating system)													
	518.0159	342.0149	205.3164	46.2778	6.8019	0.0000	0.0000	0.0000	0.0000	69.5330	291.5414	530.9315	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
Efficiency of water heater												186.8129	(216)
(217)m	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	186.8129	(217)
Fuel for water heating, kWh/month													
	131.0654	115.8086	123.1520	108.9856	106.0269	95.9837	95.2397	98.9008	99.8101	110.7179	116.9451	129.7663	(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	99.3095	89.6989	99.3095	96.1060	99.3095	96.1060	99.3095	99.3095	96.1060	99.3095	96.1060	99.3095	(231)
Lighting	59.9897	48.1260	43.3321	31.7470	24.5223	20.0349	22.3700	29.0774	37.7687	49.5546	55.9718	61.6570	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-157.5457	-233.3835	-396.8437	-538.3885	-606.7410	-624.2364	-600.3910	-545.3205	-443.9675	-307.0864	-179.7528	-126.7420	(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	-1.4392	-4.9283	-20.1322	-66.5530	-108.8971	-146.9153	-132.2458	-98.0944	-54.5053	-15.6193	-2.8604	-0.8691	(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	2010.4329	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	186.8129	
Water heating fuel used	1332.4021	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9940)		
mechanical ventilation fans (SFP = 0.9940)	1169.2891	(230a)
Total electricity for the above, kWh/year	1169.2891	(231)
Electricity for lighting (calculated in Appendix L)	484.1516	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-5413.4585	(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	-417.1827	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2010.4329	25.1600	505.8249	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1332.4021	25.1600	335.2324	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	1169.2891	25.1600	294.1931	(249)
Energy for lighting	484.1516	25.1600	121.8126	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4760.3990	25.1600	-1197.7164	
PV Unit electricity exported	-653.0595	5.8100	-37.9428	
Total			-1235.6591	(252)
Total energy cost			21.4039	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2010.4329	0.1582	318.1091	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1332.4021	0.1407	187.5274	(264)
Space and water heating			505.6365	(265)
Pumps, fans and electric keep-hot	1169.2891	0.1387	162.1948	(267)
Energy for lighting	484.1516	0.1443	69.8780	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4760.3990	0.1317	-627.1748	
PV Unit electricity exported	-653.0595	0.1143	-74.6400	
Total			-701.8149	(269)
Total CO2, kg/year			35.8945	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2010.4329	1.5857	3187.9602	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1332.4021	1.5204	2025.7997	(278)
Space and water heating			5213.7600	(279)
Pumps, fans and electric keep-hot	1169.2891	1.5128	1768.9005	(281)
Energy for lighting	484.1516	1.5338	742.6079	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4760.3990	1.4867	-7077.5070	
PV Unit electricity exported	-653.0595	0.4188	-273.4820	
Total			-7350.9890	(283)

Total Primary energy kWh/year	374.2794 (286)

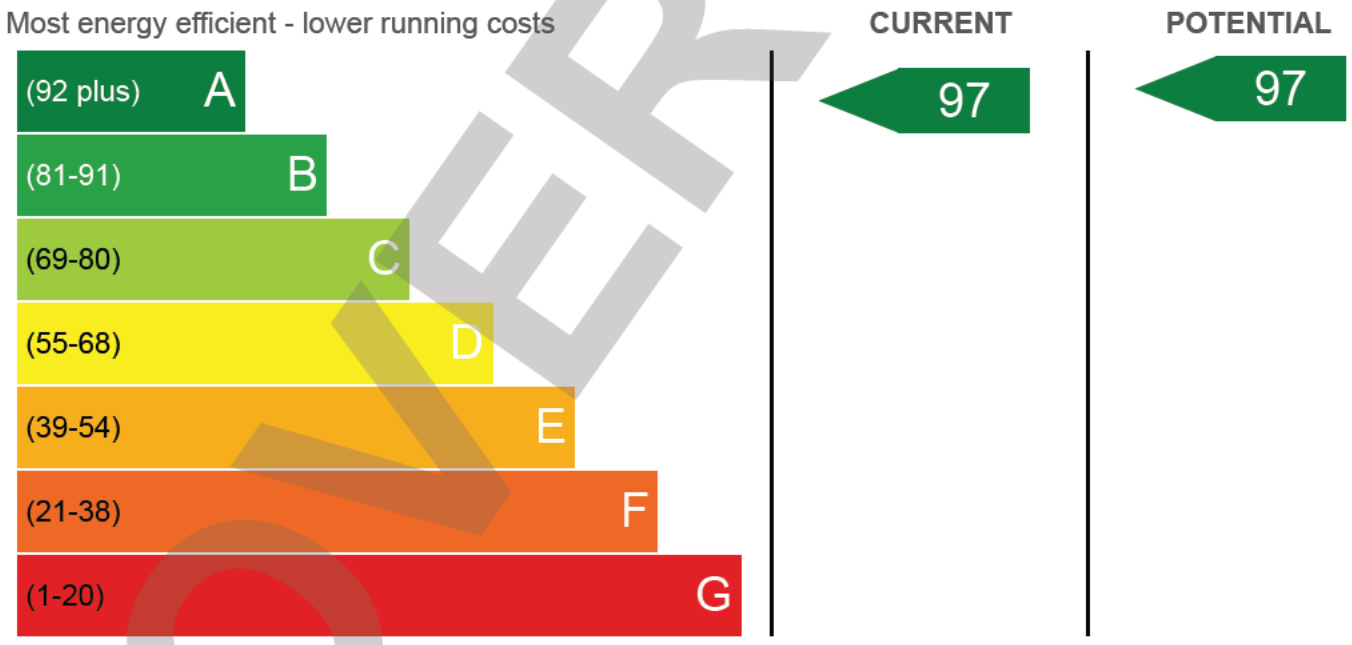
Overview Report

Dwelling Address	8, Druid Stoke Avenue, Bristol, Avon, BS9 1DD
Report Date	02/02/2024
Property Type	House, Detached
Floor Area [m^2]	305

This document is not an Energy Performance Certificat EPC) s required by the Energy Performance of Buildings Reg io

Energy Rating

The current energy rating represents the overall e ergy efficien of the dwelling. The potential energy rating is the overall energy rating of the dw r all he recommend measures provided on the next page have been installed. A higher sco sents a more energy efficient dwelling with lower fuel bills.



Overview Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	gy Performance
Walls	Average thermal transmittance 0.17 W/m²K	Very Good
Roof	Average thermal transmittance 0.13 W/m²K	Very Good
Floor	Average thermal transmittance 0.13 W/m²K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and und	Good
Main heating controls	Time and temperature z contro	Very Good
Secondary heating	None	
Hot water	From main sys m, waste w eat recovery	Good
Lighting	Excelent ting effic y	Very Good
Air tightness	Air perme 50] = 3.0 h.m² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 1 kilowatt hour (kWh) per square metre

Estim ted CO_2 missions of the dwelling

The estimated ing provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.0** per year

Overview Report

With the recommended measures the potential CO emissions could be: **0.0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelli
To reach the dwelling's potential energy rating all of the recommended measures shown w would d to be installed.
Having these measures installed individually or in any other order may give a different result omp d with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Ratin after measure insta	C ulative avings (per year)	Cumulative Potential Rating
Solar water heating			5	A 98
Photovoltaic		98	£79	G 0

Estimated energy use and potential i s

Estimated energy cost for this property over a year

£21

Over a year you could save

£0

The estimated cost and savings sho how much the e household would spen n th perty for heating, lig ng and hot r. It is not based how energy is ed by the peopl ng at the prope

Contacting the assessor and the accreditation scheme

Overview Report

Assessor contact details	
Assessor name	Ms. Laura Meehan
Assessor's accreditation number	EES/024602
Email Address	[redacted]

Accreditation scheme contact details	
Accreditation scheme	Elmhurst Ene y Systems L
Telephone	[redacted]
Email Address	

Assessment details	
Related party disclosure	N lated par y
Date of assessment	02/02 24
Date of certificate	02
Type of assessment	SAP, new dwelling

Summary for Input Data

elmhurst energy

Property Reference	8 Druid Stoke Avenue	Issued on Date	02/02/2024
Assessment Reference	8 Druid Stoke	Prop Type Ref	
Property	8, Druid Stoke Avenue, Bristol, Avon, BS9 1DD		

SAP Rating	97 A	DER	0.66	TER	11.70
Environmental	99 A	% DER < TER			94.36
CO_2 Emissions (t/year)	0.04	DFEE	47.21	TFEE	50.52
Compliance Check	See BREL	% DFEE < TFEE			6.56
% DPER < TPER	89.37	DPER	6.58	TPER	61.91

Assessor Details	Ms. Laura Meehan	Assessor ID	Z762-0001
Client	Kathy Ashby, Kathy Ashby		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	Southeast
Property Tenture	ND
Transaction Type	6
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	3
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	33.08 m	56.10 m²	2.99 m
Ground floor:	70.70 m	174.80 m²	3.20 m
1st Storey:	40.43 m	74.10 m²	3.20 m

8.0 Living Area 96.10 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.17	190.00	378.51	297.80	0.00	None	80.71	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	40.00		None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.13	9.00	92.62	90.03	None	0.00	Enter Gross Area	2.59
External Roof 2	External Flat Roof	Plasterboard, insulated flat roof	0.13	9.00	100.70	100.70	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Basement	Slab on ground, screed over insulation	0.13	None	0.00	110.00	56.10
Heatloss Floor 2	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.13	None	0.00	110.00	118.70

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Solid Door							0.79
Opening Type 2	Manufacturer	Window	Triple Low-E Soft 0.05			0.57		0.70	1.20

Opening Type 3	Manufacturer	Roof Light	Triple Low-E Hard 0.2	0.64	0.70	1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	Opening Type 2	External Wall 1	South West	35.56	
Opening	Opening Type 2	External Wall 1	North East	14.26	
Opening	Opening Type 2	External Wall 1	South East	30.07	
Opening	Opening Type 3	External Roof 1	North West	1.73	0
Opening	Opening Type 3	External Roof 1	North East	0.86	30
Opening	Opening Type 2	External Wall 1	North West	0.82	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E5 Ground floor (normal)	Gov Approved Scheme	33.03	0.04	0.04	No
E6 Intermediate floor within a dwelling	Gov Approved Scheme	70.00	0.00	0.00	No
E16 Corner (normal)	Gov Approved Scheme	37.00	0.02	0.02	No
E18 Party wall between dwellings	Gov Approved Scheme	15.60	0.00	0.00	Yes
E2 Other lintels (including other steel lintels)	Gov Approved Scheme	50.00	0.02	0.02	No
E3 Sill	Gov Approved Scheme	50.00	0.02	0.02	No
E4 Jamb	Gov Approved Scheme	135.00	0.01	0.01	No

Y-value	0.01	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500142
Configuration	2
Manufacturer SFP	0.71
Duct Type	Rigid
MVHR Efficiency	88.00
Wet Rooms	2
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	93.75	8	750	15

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	104638	
Fuel Type	Electricity	
In Winter	349.69	
In Summer	186.83	
Model Name	Ecodan 6.0 kW	

Summary for Input Data

Manufacturer	Mitsubishi Electric Europe B.V.	
System Type	Heat Pump	
Controls SAP Code	2207	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in Concrete	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	

25.0 Main Heating 2 — None

26.0 Heat Networks — None

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1										
Heat source 2										
Heat source 3										
Heat source 4										
Heat source 5										

28.0 Water Heating

Water Heating	Main Heating 1	
SAP Code	901	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	Yes	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	No	

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System Instantaneous System 1

Database ID	80047	
Brand Model	Power-pipe, R4-120	
Details	Year: 2011 + current Efficiency: 73.65 Utilisation factor: 0.879	

29.0 Hot Water Cylinder — Hot Water Cylinder

Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.40	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store — None

32.0 Photovoltaic Unit — One Dwelling

Summary for Input Data

Export Capable Meter?	Yes
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	9.60

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
6.00	South West	30°			Yes	1.00		

34.0 Small-scale Hydro None

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
			A 98	A 99
			0	0
			0	0

Predicted Energy Assessment

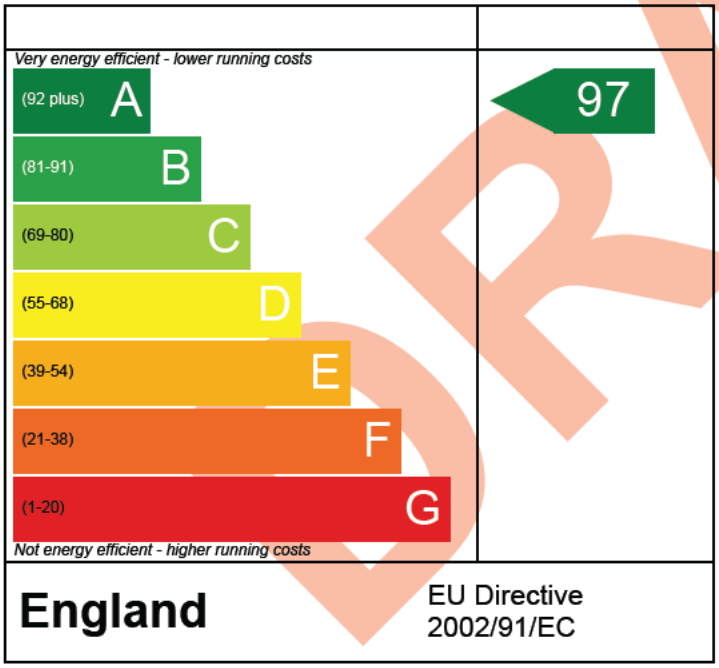
8, Druid Stoke Avenue, Bristol, Avon, BS9 1DD

Dwelling type:	House, Detached
Date of assessment:	02/02/2024
Produced by:	Laura Meehan
Total floor area:	305 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

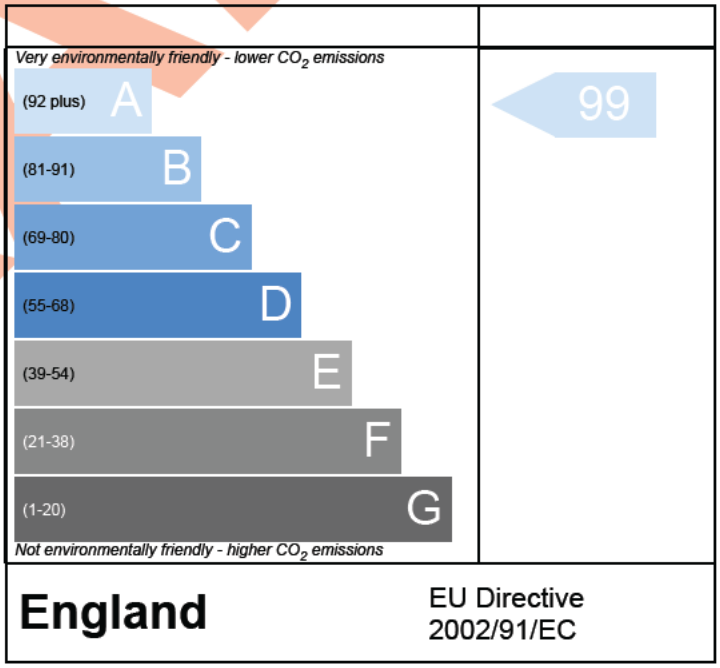
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Appendix B Flood Risk

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**355956/176215**	**2 Feb 2024 13:30**

Your selected location is in flood zone 1, an area with a low probability of flooding.

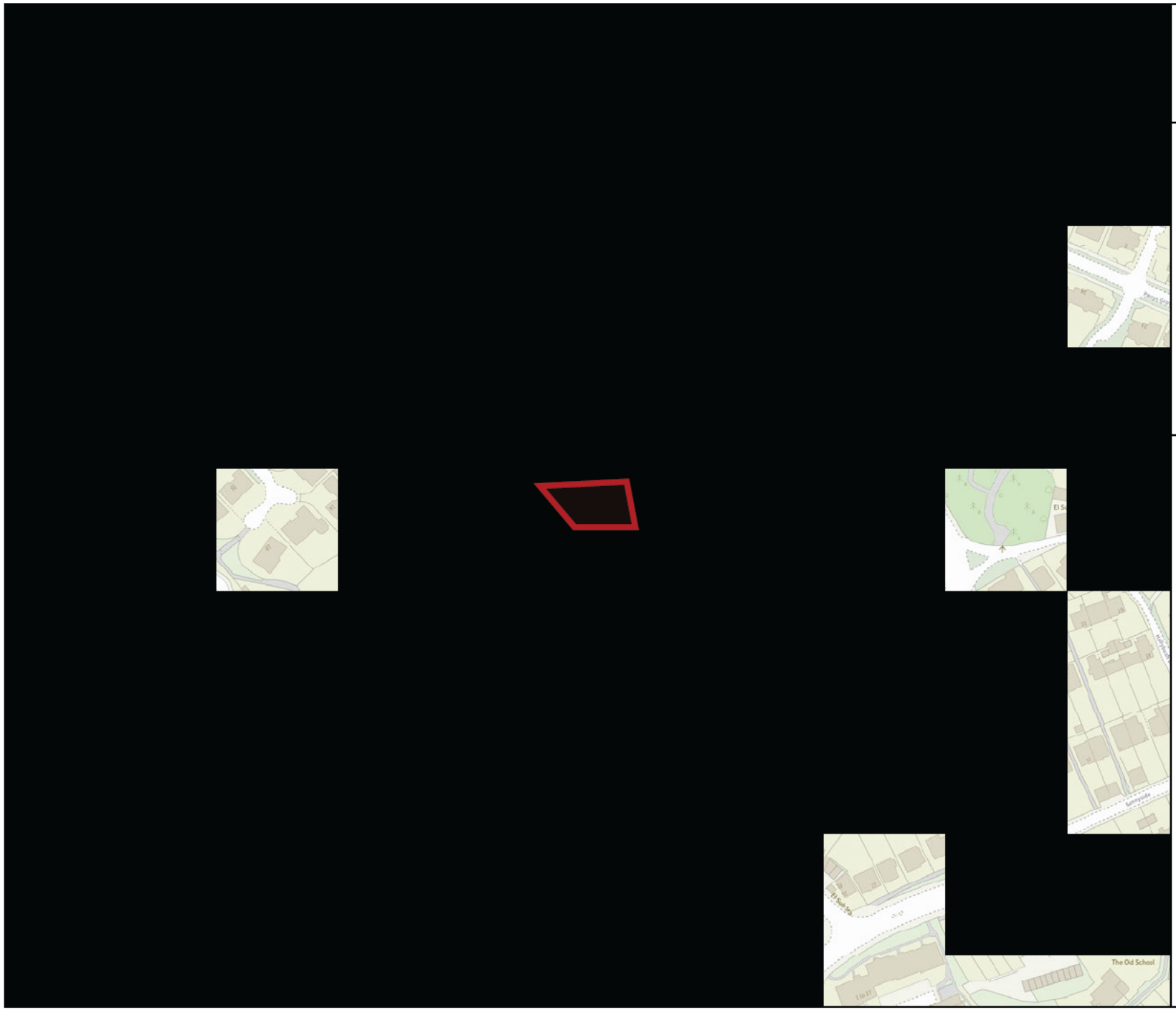
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
355956/176215

Scale
1:2500

Created
2 Feb 2024 13:30

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

Appendix C Broadband

Ofcom making communications work for everyone [redacted]

Mobile and broadband checker English (/en-gb/broadband-coverage) | Cymraeg (/cy-gb/broadband-coverage)

View broadband availability

Use of this checker is subject to Ofcom's terms of use (https://www.ofcom.org.uk/about-ofcom/website/terms-of-use)

Please enter your postcode to see the broadband services that are present at your location, or click the button to enable the site to find your location

BS91DD Change Location

8, DRUID STOKE AVENUE

The speeds indicated on the checker are the fastest estimated speeds predicted by the network operator(s) providing services in this area. Actual service availability at a property or speeds received may be different. More information (https://checker.ofcom.org.uk/en-gb/about-checker).

The table shows the predicted broadband services in your area.

Broadband type	Highest available download speed	Highest available upload speed	Availability
Standard	19 Mbps (Megabits per second)	1 Mbps (Megabits per second)	✓
Superfast	80 Mbps (Megabits per second)	20 Mbps (Megabits per second)	✓

Broadband type	Highest available download speed	Highest available upload speed	Availability
Ultrafast	1000 Mbps (Megabits per second)	100 Mbps (Megabits per second)	✓

Networks in your area - Virgin Media (https://www.virginmedia.com/), Openreach (https://www.openreach.com)

Click on a network's name to be directed to a website where you can find out about service availability and how to request a service from them or one of their partners.

You may be able to obtain broadband service from these Fixed Wireless Access providers covering your area.

[redacted]

Find out what these results mean

About this broadband checker