

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

Issued by	M Sustainability

Client	Kathryn Ashby
Project	8 Druid Stoke Avenue
Title	Energy and Sustainability Statement
Project no.	295
Date	1st February 2024
Production Record	
Issue Number	Poz
Prepared by	Laura Meehan

Revision Record		
Issue Number	Date	Revision details
P01	01/02/2024	Preliminary draft for comment
Po2	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 CO₂ 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.¹National Policy Requirements

¹https://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 CO₂ 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 2020²) 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:

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- 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.

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	Fabric energy efficiency (kWh/ yr)	Target Primary Energy Rate (kWh/ yr)	Energy saving (%)	Total Regulated CO2 emissions (kg CO2/yr)	Saving achieved on residual CO2 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 CO₂ 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

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• Highly efficient Air Source Heat Pump for heating and hot water

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• 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 CO2 emissions (kg CO2/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 ground₃. 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.

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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 semiconductor 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 CO₂ 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 House⁴

	Primary Energy Rate (kWh/yr)	Energy saving (%)	Total Regulated CO2 emissions (kg CO2/yr)	Saving achieved on residual CO2 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

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



Property Referen	ce	8	Druid Stoke Ave	nue					ls	sued on Da	te	02/02/2024	
Assessment Refe	rence	8	Druid Stoke					Prop Type R	ef				
Property		8,	Druid Stoke Ave	nue, Bristol, A	von, BS9 1DD								
SAP Rating					97 A		DER	0.6	6	TER		11 70	
Environmental					99 A		% DER < TER		•			94.36	
CO ₂ Emissions (t/	year)				0.04		DFEE	47.	21	TFEE		50.52	
Compliance Chec	k				See BREL		% DFEE < TFI	E				6.56	
% DPER < TPER					89.37		DPER	6.5	8	TPER		61.91	
Assessor Details		Ms. Lau	ra Meehan							Asses	sor ID	Z762-000	1
Client		Kathy A	shby, Kathy Ashl	ру									
SAP 10 WORKSHEE CALCULATION OF 1	C FOR New Bu WELLING EM	nild (As I ISSIONS FO)esigned))R REGULATIO)	Version 10 IS COMPLIAN	.2, February CE	2022)							
1. Overall dwell	ling charact	teristics											
Basement floor Ground floor First floor Total floor area Dwelling volume	a TFA = (la))+(lb)+(lo	:)+(ld)+(le).	(ln)	30	5.0000		Area (m2) 56.1000 174.8000 74.1000 (3	(la) x (lb) x (lc) x 3a)+(3b)+(3c)+	(m) 2.9900 (3.2000 (3.2000 ((3d)+(3e).	(2a) = (2b) = (2c) = (3n) =	Volume (m3) 167.7390 559.3600 237.1200 964.2190	(1a) - (3a (1b) - (3b (1c) - (3c (4) (5)
2. Ventilation	rate										I	n3 per hour	
Number of open of Number of open i Number of chimme Number of flues Number of block Number of intern Number of passi Number of flues	chimneys flues eys / flues attached to attached to ed chimneys nittent extr ve vents ess gas fire	attached o solid fu o other he ract fans	to closed fi æl boiler æter	re							$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6a) (6b) (6c) (6d) (6e) (6f) (7a) (7b) (7c)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	e to chimney ethod AP50 ce sheltered	ys, flues	and fans =	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+	(6g) + (7a) + ('	7b)+(7c) =		0.0000	Air change / (5) =]	es per hour 0.0000 Yes Blower Door 3.0000 0.1500 2	(8) (17) (18) (19)
Shelter factor Infiltration rat	te adjusted	to includ	le shelter fa	actor					(20) = 1 - (21)	[0.075 x = (18) x	(19)] = (20) =	0.8500 0.1275	(20) (21)
Wind speed Wind factor Adi infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
Balanced mechan If mechanical ve	0.1626 nical ventil entilation	0.1594 Lation wit	0.1562 th heat recov	0.1403 very	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b) (23a) (23b)
If balanced with	heat recov	very: effi	iciency in %	allowing f	or in-use fa	ctor (from	n Table 4h)	= (23				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)
3. Heat losses a	and heat los	s paramet	er										
Element Opening Type 2 Opening Heatloss Floor 2 Heatloss Floor 2 External Roof 1 External Roof 1 External Roof 2 Total net area 6 Fabric heat loss	(Uw = 1.20) L of external a, W/K = Sum	elements a (A x U)	37 9 1(Aum (A, m2)	Gross m2 78.5100 92.6200 00.7000	Openings m2 80.7100 2.5900	Net 80 1 56 118 297 90 100 746	tArea m2 7100 7300 8600 1000 .0000 .8000 .0300 .7000 .6300 (26)(3	U-value W/m2K 1.1450 0.9615 0.1300 0.1300 0.1300 0.1300 0.1300 0.1300 30) + (32)	A x U W/K 92.4160 1.6635 0.8269 7.2930 15.4310 50.6260 11.7039 13.0910 = 193.0513	K- k 110 110 190 9	-value J/m2K 0.0000 0.0000 0.0000 0.0000	A x K kJ/K 6171.0000 13057.0000 56582.0000 810.2700 906.3000	(27) (27a) (27a) (28a) (28a) (29a) (30) (30) (31) (33)
Heat capacity Cr Thermal mass par	n = Sum(A x cameter (TME	k) ? = Cm / 1	[FA) in kJ/m2	ĸ				(28).	(30) + (32)	+ (32a)	.(32e) =	77526.5700 254.1855	(34) (35)



List of Thermal Kl Elem E5 Grou E6 Inte E16 Cor E18 Par E2 Othe E3 Sill E4 Jamb	Bridges ent nd floor (rmediate f ner (norma ty wall be r lintels	normal) loor within l) tween dwell (including	h a dwelling lings other steel	g l lintels)				L 33 70 37 15 50 50 50 135	ength .0300 .0000 .0000 .0000 .0000 .0000	Psi-value 0.0400 0.0200 0.0200 0.0180 0.0180 0.0050	Tot 1.32 0.00 0.74 0.00 0.90 0.90 0.67	al 12 00 00 00 00 00 50	
Thermal bridges Point Thermal b Total fabric he	(Sum(L x ridges at loss	Psi) calcul	lated using	Appendix K	()					(33) + (36)	(36a) = + (36a) =	4.5362 12.0000 209.5875	(36) (36a) (37)
Ventilation head (38)m	t loss cal Jan 84.8181	culated mor. Feb 83.8039	nthly (38)m Mar 82.7897	= 0.33 x (Apr 77.7185	25)m x (5) May 76.7042	Jun 71.6330	Jul 71.6330	Aug 70.6188	Sep 73.6615	Oct 76.7042	Nov 78.7327	Dec 80.7612	(38)
Heat transfer c Average = Sum(3	oeff 294.4056 9)m / 12 =	293.3914	292.3772	287.3060	286.2917	281.2205	281.2205	280.2063	283.2490	286.2917	288.3202	290.3487 287.0524	(39)
HLP HLP (average)	Jan 0.9653	Feb 0.9619	Mar 0.9586	Apr 0.9420	May 0.9387	Jun 0.9220	Jul 0.9220	Aug 0.9187	Sep 0.9287	Oct 0.9387	Nov 0.9453	Dec 0.9520 0.9412	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heating	g energy r	equirement:	s (kWh/year)										
Assumed occupan	 cv											3.1384	(42)
Hot water usage	for mixer 96.0513	showers 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	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	43 3602	41 6694	20.0677	39 2660	20.1050	30 0677	A1 6694	43 3602	45 0600	46 7707	(420)
Average daily h	ot water u	use (litres)	(day)	41.0004	39.9011	30.2009	30.2005	35.5077	41.0004	43.3052	43.0033	161.8263	(420)
Daily hat untar	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte Energy content	175.9894 278.7241 (annual)	172.3526 245.4278	167.8547 257.9865	160.8505 220.1963	155.2221 208.9588	149.1473 183.3940	146.6911 177.4102	151.1682 187.1778	155.9072 192.2492	162.3004 220.2402 Total = S	169.4174 241.3662 um(45)m =	175.5092 274.8050 2687.9362	(44) (45)
Distribution lo	ss (46)m 41.8086	= 0.15 x (4 36.8142	45)m 38.6980	33.0294	31.3438	27.5091	26.6115	28.0767	28.8374	33.0360	36.2049	41.2208	(46)
Water storage 1 Store volume a) If manufact	oss: urer decla	red loss fa	actor is kno	own (kWh/d	lay):							200.0000	(47) (48)
Enter (49) or (54) in (55	i labie 20										0.7560	(55)
lotal storage i	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 con	tains dedi 23.4360	cated solar 21.1680	r storage 23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(57)
Primary loss Combi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	(59) (61)
Total heat requ	ired for w 325.4225	ater heatin 287.6070	ng calculate 304.6849	ed for each 265.3883	1 month 255.6572	228,5860	224.1086	233.8762	237.4412	266,9386	286.5582	321.5034	(62)
WWHRS PV diverter	-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)
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)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(630)
12Total per yea	244.8471 r (kWh/yea	216.3453 (r)	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593 Total p	186.4582 er year (kW	206.8352 Wh/year) = S	218.4684 um(64)m =	242.4201 2489.0984 2489	(64) (64) (64)
Dicourio Snower	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)
Heat gains from	water hea 130.0345	ting, kWh/r 115.3481	nonth 123.1392	109.3689	106.8375	97.1321	96.3476	99.5953	100.0765	1/year) = Su 110.5886	116.4079	128.7314	(64a) (65)
S. Internal gai	(Table 5)	Ustra											
Metabolic gains	Jan	, watts Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	166)
Lighting gains	(calculate	ed in Append	dix L, equat	tion L9 or	L9a), also	see Table 5	130.9213	130.9213	130.9213	130.9213	240.0502	130.9213	(66)
Appliances gain	233.1777 s (calcula	258.1610 ited in Appe	233.1777 endix L, equ	240.9503 ation L13	or L13a), a	240.9503 lso see Tab	233.1777 le 5	233.1777	240.9503	233.1777	240.9503	233.1777	(67)
Cooking gains (462.3008 calculated	467.0981 l in Appendi	455.0092 ix L, equati	429.2734 ion L15 or	396.7866 Ll5a), also	366.2535 see Table !	345.8556 5	341.0584	353.1472	378.8830	411.3699	441.9029	(68)
Pumps, fans Losses e.g. eva	38.6921 0.0000 poration (38.6921 0.0000 negative va	38.6921 0.0000 alues) (Tabl	38.6921 0.0000 Le 5)	38.6921 0.0000	38.6921 0.0000	38.6921 0.0000	38.6921 0.0000	38.6921 0.0000	38.6921 0.0000	38.6921 0.0000	38.6921 0.0000	(69) (70)
Water heating g	125.5372 ains (Tabl	-125.5372 e 5)	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Total internal	174.7775 gains	171.6489	165.5097	151.9012	143.5988	134.9057	129.4995	133.8647	138,9951	148.6406	161.6776	173.0261	(72)
19041 Inclindi	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)

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 Southeast Southwest Northwest Northeast Northwest	14.2600 30.0700 35.5600 0.8200 0.8600 1.7300	11.2829 36.7938 36.7938 11.2829 18.0708 26.0000	0.5700 0.5700 0.5700 0.5700 0.6400 0.6400	0.7000 0.7000 0.7000 0.7000 0.7000 0.7000 0.7000	0.7700 0.7700 0.7700 0.7700 1.0000 1.0000	44.4885 (75) 305.9247 (77) 361.7786 (79) 2.5582 (81) 6.2661 (82) 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)

Temperature during heating periods in the living area from Table 9, Th1 (C) Utilisation factor for gains for living area, nil,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov tau 73.1479 73.4008 73.6554 74.9555 75.2210 76.5775 76.5775 76.8547 76.0291 75.2210 74.6													
tau 73.1479 73.4008 73.6554 74.9555 75.2210 76.5775 76.5775 76.8547 76.0291 75.2210 74.6	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 73.4078 73.6058 74.955 75.2510 76.5775 76.8547 76.0201 75.2210 74.6018 74.1700												
aipna 5.8765 5.8934 5.9104 5.9970 6.0147 6.1052 6.1052 6.1236 6.0686 6.0147 5.9	18 74.1700 795 5.9447												
0.9988 0.9933 0.9716 0.8843 0.7078 0.5013 0.3620 0.4108 0.6704 0.9457 0.9)57 0.9993 ((86)											
Living 20.5510 20.6187 20.7012 20.7904 20.8332 20.8462 20.8473 20.8476 20.8401 20.7700 20.6 Non living 19.5663 19.6553 19.7614 19.8805 19.9269 19.9524 19.9530 19.9563 19.9423 19.8626 19.6 24 / 16 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	25 20.5438 90 19.5675 0 0												
24 / 9 31 0 </td <td>12 30)45 20.7500 () 292 20.1236 ()</td> <td>(87) (88)</td>	12 30)45 20.7500 () 292 20.1236 ()	(87) (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 0.9 MIT 2 20.1124 19.9122 19.9606 19.8805 19.9269 19.9524 19.9530 19.9563 19.9423 19.8626 19.7)40 0.9990 () 951 19.8860 ()	(89) (90)											
MIT 20.3921 20.1869 20.2348 20.1672 20.2125 20.2340 20.2348 20.2371 20.2252 20.1485 20.0	20.1582 (0.0000	(92)											
adjusted MIT 20.3921 20.1869 20.2348 20.1672 20.2125 20.2340 20.2348 20.2371 20.2252 20.1485 20.0	17 20.1582 ((93)											
8. Space heating requirement													
Jan Feb Mar Anr May Jun Jul Aug Sen Oct Nov	Dec												
Utilisation 0.9985 0.9914 0.9641 0.8554 0.6585 0.4430 0.2993 0.3432 0.6045 0.9242 0.9 Useful gains 1677.0371 2231.4745 2645.4275 2779.9563 2353.9833 1578.1230 1021.7150 1074.1749 1698.0957 2095.3957 1763.2 Ext temp. 4.3000 4.9000 6.5000 8.9000 11.7000 14.6000 16.6000 16.4000 14.1000 10.6000 7.1	(39 0.9990 ()15 1546.2139 ()00 4.2000 ((94) (95) (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 3742.8	/59 4633.4550 ((97)											
Space heating kwn 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating requirement - total per year (kWh/year)	56 2296.9074 (9399.0672	(98a)											
0.0000 0.00000 0.000000	000 0.0000 (0.0000	(98b)											
2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating per m2 (98c) / (4)	56 2296.9074 (9399.0672 = 30.8166 ((98c) (99)											
9a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from main system() Fraction of space heat from main system() Efficiency of main space heating system 1 (in %) Efficiency of main space heating system 2 (in %)	1 0000 ((0.0.1.)											
Efficiency of secondary/supplementary heating system, %	349.6900 (0.0000 (0.0000 ()	(201) (202) (206) (207) (208)											
Efficiency of main space heating system 2 (11 %) Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov	349.6900 (0.0000 () 0.0000 () Dec	(201) (202) (206) (207) (208)											
Efficiency of main opace heating system 2 (11 %) Efficiency of main opace heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating efficiency (main heating system 1)	349.6900 (0.0000 (0.0000 (Dec 56 2296.9074 ((201) (202) (206) (207) (208) (98)											
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating reficiency (main heating system 1) 349.6900	349.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (00 349.6900 ((201) (202) (206) (207) (208) (208) (98)											
Instruction of and in space heating system 2 (in %) Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating efficiency (main heating system 1) 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 349.6900 349.6900 Space heating fuel (main heating system) 651.1632 433.0686 291.5452 94.1312 17.6743 0.0000 0.0000 0.0000 135.7967 407.6 Space heating efficiency (main heating system 2) 651.1632 433.0686 291.5452 94.1312 17.6743 0.0000 0.0000 0.0000 135.7967 407.6	349.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (100 349.6900 (184 656.8411 ((201) (202) (206) (207) (208) (208) (208) (208) (208) (201) (211)											
Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating efficiency (main heating system 1) 349.6900 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900 349.6 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 407.6 Space heating efficiency (main heating system 2) 0.0000 0.00	349.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (100 349.6900 (184 656.8411 (100 0.0000 ((201) (202) (206) (207) (208) (98) (210) (211) (212)											
Space heating efficiency (main heating system 1) Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating efficiency (main heating system 1) 349.6900 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 349.6900	349.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (100 349.6900 () 184 656.8411 () 100 0.0000 ()	(201) (202) (206) (207) (208) (98) (210) (211) (212) (213)											
Interving of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating refliciency (main heating system 1) 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900 349.6900 Space heating fuel (main heating system 1) 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900 349.6900 Space heating fuel (main heating system 1) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 349.6900 <td>349.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (349.6900 () 184 656.8411 () 100 0.0000 () 100 0.0000 ()</td> <td>(201) (202) (206) (207) (208) (210) (210) (211) (212) (212) (213) (215)</td>	349.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (349.6900 () 184 656.8411 () 100 0.0000 () 100 0.0000 ()	(201) (202) (206) (207) (208) (210) (210) (211) (212) (212) (213) (215)											
Interving of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating requirement 349.6900 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900 349.6900 Space heating full (main heating system 1) 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900 349.6900 Space heating fuel (main heating system 1) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 349.6900 <td>349.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (349.6900 () 184 656.8411 () 100 0.0000 () 100 0.0000 () 100 0.0000 () 100 0.0000 ()</td> <td>(201) (202) (206) (207) (208) (210) (210) (211) (212) (213) (213) (215)</td>	349.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (349.6900 () 184 656.8411 () 100 0.0000 () 100 0.0000 () 100 0.0000 () 100 0.0000 ()	(201) (202) (206) (207) (208) (210) (210) (211) (212) (213) (213) (215)											
Efficiency of secondary/supplementary heating system, % Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating efficiency (main heating system 1) 349.6900 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900 349.6 Space heating fuel (main heating system 2) 0.0000 0.000	345.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (349.6900 ((201) (202) (206) (207) (208) (210) (211) (212) (212) (213) (213) (215) (64) (216) (217)											
Interview of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating requirement 349.6900 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900 34	345.6900 (0.0000 (0.0000 (Dec 356 2296.9074 (349.6900 ((201) (202) (206) (207) (208) (210) (210) (211) (212) (213) (213) (215) (215) (64) (216) (217) (219)											
Intering by the matrix system, % Jan Feb Mar Apr May Jun Ju	345.6900 (0.0000 (0.0000 (Dec 356 2296.9074 (349.6900 () 349.6900 () 349	(201) (202) (202) (203) (207) (208) (210) (211) (212) (212) (212) (213) (215) (214) (215) (217) (219) (221) (221) (221) (221) (221) (221)											
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 0.0000 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900	345.6900 (0.0000 (0.0000 (Dec 356 2296.9074 (349.6900 ((201) (202) (202) (203) (207) (208) (210) (211) (212) (212) (213) (213) (217) (217) (217) (221) (223) (233a)											
Linear of account space intering system, * Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 0.0000 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 0.0000 0.0000 0.0000 0.0000 349.6900 3	345.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (349.6900 (349.6900 (349.6900 (349.6900 (349.6900 (000 0.0000 (349.6900 ((201) (202) (206) (207) (208) (210) (211) (212) (212) (212) (213) (215) (215) (215) (217) (217) (217) (212) (213) (21) (213) (
Instruction of secondary/supplementary heating system, * Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating efficiency (main heating system 1) 349.6900 349.6900 349.6900 349.6900 0.0000	345.6900 (0.0000 (0.0000 (Dec 356 2296.9074 (349.6900 (349.6900 (349.6900 (349.6900 (349.6900 (300 0.0000 (300 0.0000 (300 0.0000 (300 129.7557 (100 0.0000 (416 -109.2458 (100 0.0000 (300 0.00000 (300 0.0000 (300 0.0000 (300 0.0000 (300 0.00	(201) (202) (202) (203) (207) (208) (210) (211) (212) (212) (213) (215) (213) (215) (217) (219) (221) (233a) (233a) (235a)											
Interview of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 0.0000 474.8674 1425.3 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 0.0000 349.6900 349.690 349.6900 349.690 349.690 349.6900 349.690 349.6900 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0	345.6900 (0.0000 (0.0000 (Dec 356 2296.9074 (000 349.6900 (000 0.0000 (000 0.0000 (000 0.0000 (186.8280 (180.0000 (186.8280 (18	(201) (202) (206) (207) (208) (210) (211) (212) (212) (212) (213) (215) (217) (213) (217) (217) (213) (217) (213) (213) (233a) (233a) (235a) (235c)											
Instruction of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 0.0000 474.8674 1425.3 Space heating file imain heating system 1	349.6900 (0.0000 (0.0000 (Dec 356 2296.9074 (349.6900 ((201) (202) (202) (203) (207) (203) (210) (211) (212) (212) (213) (213) (213) (221) (223) (233a) (233a) (235a) (233b)											
Entrivients of mean openet actual of system, a filter of secondary supplementary heating system, a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 0.0000 349.6900	345.6900 (0.0000 (0.0000 (Dec 556 2296.9074 (900 349.6900 (984 656.8411 (900 0.0000 (900 0.0000 (900 0.0000 (186.8280 ((201) (202) (206) (207) (208) (210) (211) (212) (212) (213) (212) (213) (214) (215) (217) (219) (221) (231) (232) (233a) (235a) (235c) (235b) (235b)											
Instrume Date Par Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 329.1674 61.8053 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 0.0000	345.6900 (0.0000 (0.0000 (0.0000 (0.0000 (0.0000 (0.000 (0.00	(201) (202) (206) (207) (208) (210) (211) (212) (212) (213) (212) (213) (215) (213) (214) (221) (221) (233a) (233a) (233a) (235a) (233b) (235b)											
Efficiency of secondary/supplementary heating system, * Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement 2277.0523 1514.3975 1019.5044 323.1674 61.8053 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 349.6900 0.0000 <t< td=""><td>345.6900 (0.0000 (0.0000 (0.0000 (0.0000 (0.0000 (0.0000 (0.000 (0.000 (0.000 0.0000 (0.0000 (</td><td>(201) (202) (206) (207) (208) (210) (211) (212) (212) (213) (212) (213) (215) (217) (213) (223) (233a) (233a) (235a) (235b) (235b) (235d)</td></t<>	345.6900 (0.0000 (0.0000 (0.0000 (0.0000 (0.0000 (0.0000 (0.000 (0.000 (0.000 0.0000 (0.0000 ((201) (202) (206) (207) (208) (210) (211) (212) (212) (213) (212) (213) (215) (217) (213) (223) (233a) (233a) (235a) (235b) (235b) (235d)											



Efficiency of water heater						186.8280	(01.0)	
Space cooling fuel					1	0.0000	(219)	
Electricity for pumps and fans:								
mechanical ventilation fans (SFP = 0.9940) Total electricity for the showe Wib/year					1	169.2891	(230a	1)
Electricity for lighting (calculated in Appendix L)						484.1516	(232)	
Energy saving/generation technologies (Appendices M ,N and Q) PV generation					-4	940.0962	(233)	
Wind generation Hydro-electric generation (Appendix N)						0.0000	(234) (235a	1)
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features						0.0000	(235)	
Energy saved or generated Energy used						-0.0000 0.0000	(236) (237)	
Total delivered energy for all uses						733.4671	(238)	
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP								
	Energy	Emission fac	ctor		E	missions		
Space heating - main system 1	2687.8288	2 kg CO2	/ KWH 1573		кg	422.9131	(261)	
Noter heating (other fuel)	1332.2939	0.3	1407			187.5122	(264)	
Space and water neating Pumps, fans and electric keep-hot	1169.2891	0.	1387			162.1948	(265) (267)	
Energy for lighting	484.1516) U.	1443			69.8780	(268)	
PV Unit electricity used in dwelling	-4416.1376	0.	1317		-	581.5468		
Total	-525.9500		1142		-	-59.0272	(269)	
EPC Dwelling Carbon Dioxide Emission Rate (DER)						0.6600	(272)	
13a. Primary energy - Individual heating systems including micro-CHP								
	 Energy	V Primarv energy fa	ctor	1	Primar	v enerav		
Space heating - main system 1	kWh/year 2687.8288	kg CO2	/kWh 5824		4	kWh/year 253.3524	(275)	
Total CO2 associated with community systems Water heating (other fuel)	1332.2939	1.	5204		2	0.0000	(473) (278)	
Space and water heating Pumps, fans and electric keep-hot	1169.2891	1.	5128		6	278.9875 768.9005	(279) (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		-6	564.7300		
PV Unit electricity exported Total	-523.9586	. 0.4	4184		-6	219.2106 783.9406	(283)	
Total Primary energy kWh/year Dwelling Primary energy Rate (DPER)					2	6.5800	(286) (287)	
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS								
1 Annull Augustanistics								
vicuum umciling vikitovilovilo	Ares	Storey he	ight			Volume		
Basement floor	(m2) 56.1000	(1a) x 2.0	(m) 9900 ((2a)	=	(m3) 167.7390	(la)	- (3a)
Ground floor First floor	174.8000 74.1000	(1b) x 3.1 (1c) x 3.1	2000 (2000 ((2b) (2c)	=	559.3600 237.1200	(1b) (1c)	- (3b) - (3c)
Total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)(ln) 305.0000 Dwelling volume	(3a)+(3b)+(3c)+(3d)	+(3e).	(3n)	=	964.2190	(4) (5)	
2. Ventilation rate								
					m3	per hour		
Number of open chimneys Number of open flues				0 * 80	=	0.0000	(6a)	
Number of chimneys / flues attached to closed fire Number of flues attached to solid fuel boiler				0 * 10 0 * 20	=	0.0000	(6c) (6d)	
Number of flues attached to other heater Number of blocked chimneys				0 * 35 0 * 20	=	0.0000	(6e) (6f)	
Number of intermittent extract fans Number of passive vents				4 * 10 0 * 10	=	40.0000	(7a) (7b)	
Number of flueless gas fires				0 * 40	=	0.0000	(7c)	
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6a)+(7a)+$	(7b)+(7c) =	. 40	.0000	Air cha / (5) :	anges =	per hour 0.0415	(8)	
Pressure test Pressure Test Method					Blo	Yes wer Door		
Measured/design AP50 Infiltration rate						5.0000 0.2915	(17) (18)	
Number of sides sheltered						2	(19)	



Shelter factor Infiltration rat	te adjuste	d to includ	ie shelter f	actor					(20) = 1 - (2	[0.075 x 1) = (18)	(19)] = x (20) =	0.8500 0.2478	(20) (21)
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
Effective ac	0.3159 0.5499	0.3097 0.5480	0.3035 0.5461	0.2725 0.5371	0.2663 0.5355	0.2354 0.5277	0.2354 0.5277	0.2292 0.5263	0.2478 0.5307	0.2663 0.5355	0.2787 0.5388	0.2911 0.5424	(22b) (25)
3. Heat losses a	and heat 1	oss paramet	er										
Element				Gross	Openings	Ne	tArea	U-value	A x	U K	-value	АхК	
TER Opening Type Opening Dening Heatloss Floor : Heatloss Floor : External Wall 1 External Roof 1 External Roof 2 Total net area (Fabric heat loss	e (Uw = 1. 1 2 of externa s, W/K = S	20) l elements um (A x U)	3 1 Aum (A, m2)	m2 78.5100 92.6200 00.7000	73.8800 2.3700	73 1 0 56 118 304 90 100 746	m2 .8800 .5800 .7900 .1000 .6300 .2500 .7000 .6300 (26)(W/m2K 1.1450 2.0221 2.0221 0.1300 0.1300 0.1800 0.1100 0.1100 30) + (32) =	W/ 84.595 3.194 1.597 7.293 15.431 54.833 9.927 11.077 = 187.949	K 4 9 4 0 0 4 5 0 6	kJ/m2K	kJ/K	(27) (27a) (28a) (28a) (29a) (30) (30) (31) (33)
Thermal mass par List of Thermal	rameter (T	MP = Cm / 1	TFA) in kJ/m	12K								254.1855	(35)
Else of Internal Kl Elemm E5 Groun E6 Inte: E16 Corr E18 Part E2 Othes E3 Sill E4 Jamb	nd floor (rmediate f ner (norma ty wall be r lintels	normal) loor withir l) tween dwell (including	n a dwelling lings other steel	lintels)				L 33 70 37 15 50 50 135	ength P .0300 .0000 .0000 .6000 .0000 .0000 .0000	si-value 0.1600 0.0900 0.0900 0.0600 0.0500 0.0500 0.0500	Tota 5.28 0.00 3.33 0.93 2.50 2.50 6.75	al 48 00 00 60 00 00 00	
Thermal bridges Point Thermal by Total fabric hea	(Sum(L x ridges at loss	Psi) calcul	lated using	Appendix K)				(3	3) + (36)	(36a) = + (36a) =	21.3008 12.0000 221.2504	(36) (36a) (37)
Ventilation heat	t loss cal	culated mor	thly (38)m	= 0.33 x (2	25) m x (5)	Jup	.711	λυσ	San	Oct	Nov	Dec	
(38)m 1 Heat transfer co	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)
Average = Sum(3)	396.2228 9)m / 12 =	395.6063	395.0020	392.1637	391.6327	389.1606	389.1606	388.7028	390.1128	391.6327	392.7069	393.8301 392.1612	(39)
HLP HLP (average) Davs in mont	Jan 1.2991 31	Feb 1.2971 28	Mar 1.2951 31	Apr 1.2858 30	May 1.2840 31	Jun 1.2759 30	Jul 1.2759 31	Aug 1.2744 31	Sep 1.2791 30	Oct 1.2840 31	Nov 1.2876 30	Dec 1.2912 1.2858 31	(40)
4. Water heating	g energy r	equirements	s (kWh/year)										
Assumed occupant Hot water usage	for mixer	showers										3.1384	(42)
Hot water usage	for baths	/5.6863	74.0036	70.7840	68.4080	65./583	64.2522	65.9222	67.7528	70.5978	/3.8865	/6.5466	(42a)
Hot water usage	for other 46.7707	12.0740 uses 45.0699	43.3692	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707	(42D) (42C)
Average daily in	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct.	Nov	Dec	(43)
Daily hot water Energy conte Energy content	use 156.7791 248.2998 (annual)	153.4310 218.4837	149.3539 229.5513	143.1545 195.9714	138.1201 185.9362	132.7078 163.1797	130.6281 157.9834	134.6876 166.7714	138.9690 171.3627	144.6510 196.2900 Total = S	150.9458 215.0500 um(45)m =	156.3726 244.8416 2393.7212	(44) (45)
Distribution los	ss (46)m 37.2450	= 0.15 x (4 32.7726	15)m 34.4327	29.3957	27.8904	24.4770	23.6975	25.0157	25.7044	29.4435	32.2575	36.7262	(46)
a) If manufactu Temperature fa Enter (49) or (5	urer decla actor from 54) in (55	red loss fa Table 2b)	actor is kno	wn (kWh/da	ау):							200.0000 1.6525 0.5400 0.8924	(47) (48) (49) (55)
Iotal storage 10	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)
Primary loss Combi loss	27.6637 23.2624 0.0000	24.9865 21.0112 0.0000	27.6637 23.2624 0.0000	26.7713 22.5120 0.0000	27.6637 23.2624 0.0000	26.7713 22.5120 0.0000	27.6637 23.2624 0.0000	27.6637 23.2624 0.0000	26.7713 22.5120 0.0000	27.6637 23.2624 0.0000	26.7713 22.5120 0.0000	27.6637 23.2624 0.0000	(57) (59) (61)
WWHRS PV diverter Solar input FGHRS	299.2259 -35.1285 -0.0000 0.0000 0.0000	264.4814 -31.0680 -0.0000 0.0000 0.0000	280.4774 -32.5326 -0.0000 0.0000 0.0000	245.2547 -26.9383 -0.0000 0.0000 0.0000	236.8623 -25.1055 -0.0000 0.0000 0.0000	212.4630 -21.4829 -0.0000 0.0000 0.0000	208.9094 -20.1368 -0.0000 0.0000 0.0000	217.6975 -21.4135 -0.0000 0.0000 0.0000	220.6460 -22.2271 -0.0000 0.0000 0.0000	247.2161 -26.2033 -0.0000 0.0000 0.0000	264.3333 -29.6851 -0.0000 0.0000 0.0000	295.7677 -34.4780 -0.0000 0.0000 0.0000	(62) (63a) (63b) (63c) (63d)
output from w/h	264.0973	233.4135	247.9448	218.3164	211.7568	190.9800	188.7726	196.2840 Total pe	198.4189 er year (kWh	221.0128 /year) = S	234.6481 um(64)m =	261.2897 2666.9351	(64) (64)
12Total per year Electric shower	r (kWh/yea (s)	r)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2667	(64)
Heat gains from	water bes	ting Much	o.0000	Tota	al Energy us	ed by inst	antaneous e	lectric show	wer(s) (kWh/	year) = Su	m(64a)m =	0.0000	(64a) (64a)
	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	(calculate	d in Appen	dix L, equat	tion 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 gai	ns (calcula	ted in App	endix L, equ	uation L13	or L13a), a	lso see Tab	le 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	l in Append	ix L, equat:	ion 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. ev	aporation (negative v	alues) (Tabi	le 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 (Tabl	.e 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 gain	15												
[Jan]			2	m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	ss or 6d	Gains W	
Northeast Southeast Northwest Northeast Northwest			13.0 27.5 32.5 0.7 0.7 1.5	500 300 500 500 900 800	11.2829 36.7938 36.7938 11.2829 18.0708 26.0000		0.6300 0.6300 0.6300 0.6300 0.6300 0.6300	0 0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000	0.77 0.77 0.77 1.00 1.00	00 00 00 00 00 00	44.9992 309.5659 366.0141 2.5862 5.6661 16.3047	(75) (77) (79) (81) (82) (82)
Solar gains Total gains	745.1361 1679.4176	1293.3908 2254.5895	1831.5074 2750.1183	2369.1974 3257.7574	2742.1262 3583.0226	2760.4640 3567.8608	2645.5521 3420.0251	2361.9775 3135.5808	2017.1275 2815.1969	1446.3674 2273.9874	896.9549 1776.4220	634.7691 1547.1072	(83) (84)
7. Mean inter	nal tempera	ture (heati	ng season)										
Temperature d Utilisation f tau alpha	during heati Eactor for g Jan 54.3511 4.6234	ng periods yains for li Feb 54.4358 4.6291	in the livi ving area, Mar 54.5191 4.6346	ng area fro nil,m (see Apr 54.9137 4.6609	m Table 9, Table 9a) May 54.9882 4.6659	Thl (C) Jun 55.3375 4.6892	Jul 55.3375 4.6892	Aug 55.4026 4.6935	Sep 55.2024 4.6802	Oct 54.9882 4.6659	Nov 54.8377 4.6558	21.0000 Dec 54.6813 4.6454	(85)
util living a	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 Th 2 util rest of	19.3313 19.8415 house	19.6055 19.8431	19.9771 19.8447	20.4283 19.8520	20.7739 19.8534	20.9457 19.8597	20.9885 19.8597	20.9805 19.8609	20.8557 19.8573	20.3674 19.8534	19.7514 19.8506	19.2847 19.8477	(87) (88)
MIT 2 Living area f MIT	0.9982 17.8989 Traction 18.3502	0.9928 18.2503 18.6773	0.9759 18.7224 19.1177	0.9158 19.2821 19.6433	0.7730 19.6693 20.0173	0.5548 19.8304 20.1818	0.3687 19.8564 20.2131	0.4244 19.8546 20.2093	0.7203 19.7623 fLA = 20.1068	0.9544 19.2216 Living are 19.5826	0.9948 18.4432 a / (4) = 18.8554	0.9988 17.8434 0.3151 18.2975 0.0000	(89) (90) (91) (92)
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 heat	ing require:	ement											
Utilisation Useful gains Ext temp. Heat loss rat	Jan 0.9973 1674.8106 4.3000 20 W	Feb 0.9901 2232.2199 4.9000	Mar 0.9705 2668.9184 6.5000	Apr 0.9108 2967.1849 8.9000	May 0.7821 2802.4104 11.7000	Jun 0.5841 2084.0536 14.6000	Jul 0.4074 1393.1704 16.6000	Aug 0.4648 1457.2764 16.4000	Sep 0.7411 2086.2029 14.1000	Oct 0.9496 2159.3210 10.6000	Nov 0.9928 1763.5554 7.1000	Dec 0.9981 1544.1554 4.2000	(94) (95) (96)
Space heating	5567.0059 rkWh	5450.3789	4984.0161	4213,1259	3257.3429	2172.2296	1406.0732	1480.0989	2343.3419	3517.8759	4016.4278	5552.0274	(97)

 Space heating kwn
 2855.7933 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 contribution - total per year (kWh/year)
 0.0000

9a. Energy re	quirements ·	- Individua	l heating s	ystems, inc	luding micro	D-CHP							
Fraction of s Fraction of s Efficiency of Efficiency of Efficiency of	pace heat f pace heat f main space main space secondary/:	rom seconda rom main sy heating sy heating sy supplementa	ry/supplement stem(s) stem 1 (in stem 2 (in	ntary system %) %) system, %	m (Table 11))						0.0000 1.0000 92.3000 0.0000 0.0000	(201) (202) (206) (207) (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	requirement	t											
	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 heat	ing system 1	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 sy	stem)										
	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 heat	ing system i	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 sy	stem 2)										(0.1.0)
	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	iuel (seco	ndary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
	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	t.											
	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 heat	er										79.8000	(216)
-													



Parissian Francis

(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	r heating, I	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	ruel requi	rement	0.0000	0.0000	0.0000	0 0000	0.0000	0 0000	0.0000	0 0000	0.0000	0 0000	(221)
(221)m	7 2041	6 5072	7 2041	7.0000	7 2041	7.0000	7.2041	7.2041	7.0000	7 2041	7.0605	7.2041	(221)
Fumps and fa	/.3041	20 0202	24 0041	7.0000	10 0050	16 1900	10 0660	7.3041	20 5022	/.3041	/.0003	/.3041	(222)
Electricity of	anerated by	DVs (Appan	34.5503 div M\ (nec:	23.0399	19.0030	10.1009	10.0000	23.4039	30.3033	40.0219	45.2047	49.7903	(232)
(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 ge	enerated by	wind turbin	nes (Appendi	ix M) (negat	tive quanti	ty)							
(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 ge	enerated by	hydro-elec	tric generat	tors (Append	dix M) (neg	gative quant	tity)						
(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 us	sed or net (electricity	generated h	oy micro-CHE	? (Appendix	(N) (negati	ive if net g	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 ge	enerated by	PVs (Appen	dix M) (nega	ative quanti	ity)								
(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 ge	enerated by	wind turbi	nes (Appendi	ix M) (negat	tive quanti	ty)							
(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 ge	enerated by	hydro-elec	tric generat	tors (Append	lix M) (neg	ative quant	tity)		0.0000				(0.051-)
(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)
Electricity us	sed or net (electricity	generated i	by micro-CH	(Appendix	(N) (negati	lve if net g	generation)	0.0000	0.0000	0.0000	0.0000	(0.05-3)
(2350)m	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)
Space heating	fuel - main	evetem 1										15236 2577	(211)
Space heating	fuel - main	n system 1										0.0000	(212)
Space heating	fuel - sec	ndary										0.0000	(215)
Efficiency of	water heat	ar ar										79 8000	(210)
Water heating	fuel used											3137 8635	(219)
Space cooling	fuel											0.0000	(221)
opuee cooring													()
Electricity for	or pumps and	d fans:											
Total electric	city for the	e above, kW	h/vear									86.0000	(231)
Electricity for	or lighting	(calculate	d in Appendi	ix L)								391.0170	(232)
-													
Energy saving,	/generation	technologi	es (Appendio	ces M ,N and	1 Q)								
PV generation												-2772.8831	(233)
Wind generation	on											0.0000	(234)
Hydro-electric	c generation	n (Appendix	N)									0.0000	(235a)
Electricity ge	enerated - 1	Micro CHP (Appendix N)									0.0000	(235)
Appendix Q - s	special fea	tures											
Energy saved (or generate	d										-0.0000	(236)
Energy used												0.0000	(237)
lotal delivere	ea energy f	or all uses										16078.2551	(238)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	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 Prima kWh/year	ry 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

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



2. Ventilation	rate												
Number of open Number of open Number of chimn Number of flues Number of flues Number of block Number of inter Number of fluel	chimneys flues eys / flues attached t attached t ed chimneys mittent ext ve vents ess gas fin	s attached to solid fu to other he tract fans	to closed f lel boiler ater	fire							0 * 80 = 0 * 20 = 0 * 20 = 0 * 20 = 0 * 35 = 0 * 20 = 4 * 10 = 0 * 10 = 0 * 40 =	m3 per hour 0.0000 0.0000 0.0000 0.0000 0.0000 40.0000 0.0000 0.0000	(6a) (6b) (6c) (6d) (6f) (7a) (7b) (7c)
Infiltration du Pressure test Pressure Test M Measured/design Infiltration ra Number of sides	e to chimne ethod AP50 te sheltered	eys, flues	and fans	= (6a)+(6b)+(6c)+(6d)+	(6e) + (6f) +	(6g) + (7a) +	(7b)+(7c) =		40.000	Air chang 0 / (5) =	es per hour 0.0415 Yes Blower Door 3.0000 0.1915 2	(8) (17) (18) (19)
Shelter factor Infiltration ra	te adjusted	l to includ	le shelter f	factor					(20) = 1 - (21	[0.075 :) = (18)	x (19)] = x (20) =	0.8500 0.1628	(20) (21)
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
If exhaust air 1 If balanced wit Effective ac	0.2075 heat pump u h heat reco 0.5215	0.2035 using Appen overy: effi 0.5207	0.1994 dix N, (23) ciency in % 0.5199	0.1790 b) = (23a) allowing 0.5160	0.1750 x Fmv (equati for in-use fa 0.5153	0.1546 ion (N5)), actor (fro 0.5120	0.1546 otherwise m Table 4h) 0.5120	0.1506 (23b) = (23a = 0.5113	0.1628 a) 0.5132	0.1750	0.1831 0.5168	0.1912 0.0000 0.0000 0.5183	(22b) (23b) (23c) (25)
3. Heat losses Element Opening Type 2 Opening Opening Meatloss Floor Heatloss Floor External Roof 1 External Roof 2 Total net area Fabric heat loss Heat capacity C Thermal mass pa List of Thermal K1 Elem E5 Group E6 Inte E16 Corn E18 Par F2 Orba	(Uw = 1.20) (Uw = 1.20) 1 2 of external s, W/K = Su master (IP Bridges ent nd floor (r rmediate fl ner (normal ty wall bet	ss paramet elements m (A x U) k P = Cm / I oormal) oor within) ween dwell	er l Aum(A, m2) FA) in kJ/m h a dwelling other steal	Gross m2 378.5100 92.6200 100.7000 n2K	Openings m2 80.7100 2.5900	Ne 80 1 0 56 118 297 97 90 100 746	tlarea m2 .7100 .7300 .8600 .7000 .6000 .0300 .7000 .6300 (26)	U-value W/m2K 1.1450 0.9615 0.1300 0.1300 0.1300 0.1300 0.1300 (30) + (32) = (28). (28). 12 (28). 33 700 37 15 50	A x U W/K 92.4160 1.6635 0.8269 7.2930 15.4310 50.6260 01.7039 13.0910 = 193.0513 (30) + (32) ength Ps .0300 .0000 .0000 .0000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	K-value kJ/m2K 10.0000 9.0000 9.0000 (32e) = To 1.3 0.0 0.7 0.0	A x K kJ/K 6171.0000 13057.0000 56582.0000 810.2700 906.3000 77526.5700 254.1855 tal 212 200 000	(27) (27a) (28a) (28a) (29a) (30) (30) (31) (33) (33) (34) (35)
E3 Sill E4 Jamb Thermal bridges Point Thermal b Total fabric he	(Sum(L x H ridges at loss	psi) calcul	ated using	Appendix K)			50 135	.0000 .0000	0.0180 0.0050) + (36)	0.9 0.6 (36a) = + (36a) =	4.5362 4.5362 12.0000 209.5875	(36) (36a) (37)
Ventilation hea	t loss calc Jan	rulated mon Feb	Mar	= 0.33 x (Apr	25)m x (5) May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(20)
Heat transfer c	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)
HLP HLP (average) Days in mont	Jan 1.2313 31	Feb 1.2304 28	Mar 1.2295 31	Apr 1.2255 30	May 1.2248 31	Jun 1.2213 30	Jul 1.2213 31	Aug 1.2206 31	Sep 1.2226 30	Oct 1.2248 31	Nov 1.2263 30	Dec 1.2279 1.2255 31	(40)
4. Water heating	g energy re	quirements	(kWh/vear)										
Assumed occupan			(anii) yedi)									3.1384	(42)
Hot water usage	for mixer 0.0000 for baths	showers 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
not water usage	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)



Primary loss 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	(59) (61)
Total heat r	equired for w	ater heating	g calculate	ed for each m	onth								
	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 Total pe	74.6441 r vear (kW1	85.4161 n/year) = Su	93.3173 m(64)m =	106.2399 1034.3321	(64) (64)
12Total per	vear (kWh/vea	r)						-				1034	(64)
Electric sho	wer(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 us	sed by insta	ntaneous el	lectric show	er(s) (kWh,	/year) = Sum	(64a)m =	699.9784	(64a)
Heat gains f	rom water hea	ting, kWh/mo	20 5779	25 2265	24 4041	21 27/5	21 4024	22 6454	22 0449	36 3220	20 0150	41 0442	(65)
	42.2072	37.2320	35.3770	33.3303	24.4241	31.3743	31.4024	32.0434	32.5440	30.3220	30.0135	41.9442	(03)

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

Metabolic gains (Table 5), Watts
 Jan
 Feb
 Mar
 Apr
 May
 Jun
 Jun</th Jul Aug Sep Oct 156.9215 156.9215 Nov Dec 156.9215 156.9215 156.9215 156.9215 (66) 233.1777 233.1777 240.9503 233.1777 240.9503 233,1777 (67) 345.8556 341.0584 353.1472 378,8830 411.3699 441.9029 (68) 38.6921 38.6921 38.6921 38,6921 38.6921 38.6921 (69)
 Pumps, fans
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 0. 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 Southeast Southwest Northwest Northeast Northwest	14.2600 30.0700 35.5600 0.8200 0.8600 1.7300	11.2829 36.7938 36.7938 11.2829 18.0708 26.0000	0.5700 0.5700 0.5700 0.5700 0.6400 0.6400	0.7000 0.7000 0.7000 0.7000 0.7000 0.7000 0.7000	0.7700 0.7700 0.7700 0.7700 1.0000 1.0000	44.4885 (75) 305.9247 (77) 361.7786 (79) 2.5582 (81) 6.2661 (82) 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. Healt Thee			ig season)										
Temperature (during heatin	ng periods i	n the livin	ng area from	1 Table 9, 1	'hl (C)						21.0000	(85)
Utilisation :	factor for ga	ains for liv	ung area, n	111,m (see 1	able 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 a	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 a	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

Dec 0.9988 (94) 9.4021 (95) Feb 0.9925 Mar Apr 0.9749 0.9161 2565.6903 2882.9785 May 0.7833 Jun 0.5814 Jul 0.4049 1347.0336 Aug 0.4640 Sep 0.7451 2023.5881 Oct 0.9563 Nov 0.9949 1656.5550 Jan Utilisation 0.9982 Useful gains 1558.7897 2118.6639 2724.1864 2018.3258 2072.6984 1429.4021 1410.2738 Ext temp. 4.3000 Heat loss rate W 4.9000 6.5000 8,9000 11,7000 14,6000 16,6000 16,4000 14,1000 10,6000 7,1000 4,2000 (96) 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 994.8279 2047.2019 2970.7179 (98a) 13858.7027 306.2106 0.0000 0.0000 0.0000 0.0000 Space heating requirement - total per year (kWh/year) Solar heating kWh 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (98b) 0.0000 0.0000 Solar heating contribution - total per year (kWh/year) 0.0000 Space heating twh 2871.8482 2132.2273 1680.2099 855.4592 306.2106 0.0000 Space heating requirement after solar contribution - total per year (kWh/year) 994.8279 2047.2019 2970.7179 (98c) 13858.7027 (98c) / (4) = 45.4384 (99) 0.0000 0.0000 0.0000 0.0000 Space heating per m2

8c. Space cooling requirement



Calculated for J	une Julva	nd August	See Table 1	0b									
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 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)
Useful loss Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3051.9134 3911.3357	2559.9509 3748.8843	2540.1277 3423.7816	0.0000	0.0000	0.0000	0.0000	(102) (103)
Space cooling kW Cooled fraction	n 0.0000	0.0000	0.0000	0.0000	0.0000	618.7840	884.5665	657.4385	0.0000 fC =	0.0000 cooled are	0.0000 ea / (4) =	0.0000 1.0000	(104) (105)
Space cooling kW	0.2500 h	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 re Energy for space Energy for space Total Fabric Energy Ef	0.0000 quirement heating cooling ficiency (D	0.0000 FEE)	0.0000	0.0000	0.0000	154.6960	221.1416	164.3596	0.0000	0.0000	0.0000	0.0000 540.1973 45.4384 1.7711 47.2095 47.2	(107) (107) (99) (108) (109) (109)
SAP 10 WORKSHEET CALCULATION OF T	FOR New Bu ARGET FABRI	ild (As Des C ENERGY EF	igned) (V FICIENCY	Version 10.2	2, Februa	ry 2022)							
1. Overall dwell	ing charact	eristics											
Basement floor Ground floor First floor Total floor area Dwelling volume	TFA = (la)	+(lb)+(lc)+	(ld)+(le)	(ln)		305.0000		Area (m2) 56.1000 174.8000 74.1000	Sto (1a) x (1b) x (1c) x 3a)+(3b)+(3c	orey height (m) 2.9900 3.2000 3.2000 2.)+(3d)+(3e)	(2a) = (2b) = (2c) = (3n) =	Volume (m3) 167.7390 559.3600 237.1200 964.2190	(la) - (3a) (lb) - (3b) (lc) - (3c) (4) (5)
2. Ventilation r	ate												
Number of open c Number of open f Number of chimme Number of flues Number of flues Number of blocke Number of passiv Number of fluele	himneys lues ys / flues a attached to attached to d chimneys ittent extra e vents ss gas fire:	attached to solid fuel other heat act fans s	closed fir boiler er	re							$\begin{array}{cccccccccccccccccccccccccccccccccccc$	13 per hour 0.0000 0.0000 0.0000 0.0000 0.0000 40.0000 0.0000 0.0000	(6a) (6b) (6d) (6e) (6f) (7a) (7b) (7c)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	to chimney thod AP50 e sheltered	s, flues an	d fans =	(6a)+(6b)+	(6c)+(6d)	+(6e)+(6f)+	(6g) + (7a) + (7b)+(7c) =		40.0000	Air change) / (5) = I	es per hour 0.0415 Yes Blower Door 5.0000 0.2915 2	(8) (17) (18) (19)
Shelter factor Infiltration rat	e adjusted	to include	shelter fac	tor					(20) = 1	- [0.075 x (21) = (18)	x (19)] = x (20) =	0.8500 0.2478	(20) (21)
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
Adj inflit rate If exhaust air h If balanced with Effective ac	0.3159 eat pump us heat recove 0.5499	0.3097 ing Appendi ery: effici 0.5480	0.3035 x N, (23b) ency in % a 0.5461	0.2725 = (23a) x 1 allowing fo: 0.5371	0.2663 Fmv (equa r in-use : 0.5355	0.2354 tion (N5)), factor (fro 0.5277	0.2354 otherwise m Table 4h) 0.5277	0.2292 (23b) = (2 = 0.5263	0.2478 3a) 0.5307	0.2663	0.2787	0.2911 0.0000 0.0000 0.5424	(22b) (23b) (23c) (25)
3. Heat losses a	nd heat los	s parameter											
Element				Gross m2	Opening	s Ne 2	tArea m2	U-value W/m2K	As		(-value kJ/m2K	A x K kJ/K	
TER Opening Type Opening Opening Heatloss Floor 1 Heatloss Floor 2 External Wall 1 External Roof 1 Total net area o Fabric heat loss	(Uw = 1.20 f external , W/K = Sum) elements Au (A x U)	378 92 100 m(A, m2)	8.5100 2.6200 0.7000	73.880 2.370	- 73 1 0 56 118 0 304 0 90 100 746	.8800 .5800 .7900 .1000 .6300 .2500 .7000 .6300 .6300 (26)(1.1450 2.0221 2.0221 0.1300 0.1300 0.1300 0.1800 0.1100 0.1100 30) + (32)	84.59 3.19 1.59 7.29 15.43 54.83 9.99 11.07 = 187.94	554 949 930 930 934 975 970			(27) (27a) (27a) (28a) (28a) (29a) (30) (30) (31) (33)
Thermal mass par List of Thermal	ameter (TMP Bridges	= Cm / TFA) in kJ/m2K	c								254.1855	(35)
Kl Eleme E5 Groun E6 Inter E16 Corn E18 Part E2 Other	nt d floor (no: mediate flo er (normal) y wall betw lintels (i:	rmal) or within a een dwellin ncluding ot	dwelling gs her steel 1	intels)				3 3 7 3 1 5	Length 3.0300 0.0000 7.0000 5.6000 0.0000	Psi-value 0.1600 0.0000 0.0900 0.0600 0.0500	Tot 5.28 0.00 3.33 0.93 2.50	al 348 300 360 300	



E3 Sil E4 Jam Thermal bridge	l b s (Sum (L x	Psi) calcu	lated using	Appendix K				50 135	.0000 .0000	0.0500	2.50 6.75	00 00 21.3008	(36)
Point Thermal Total fabric h	bridges eat loss	,							(;	33) + (36) ·	(36a) = + (36a) =	12.0000 221.2504	(36a) (37)
Ventilation he	at loss cal	culated mon	nthly (38)m	= 0.33 x (2	25)m x (5)	-	71			0			
(38) m	Jan 174.9724	174.3559	Mar 173.7516	Apr 170.9133	May 170.3823	Jun 167.9102	167.9102	Aug 167.4524	5ep 168.8624	170.3823	NOV 171.4565	Dec 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	
HLP HLP (average)	Jan 1.2991	Feb 1.2971	Mar 1.2951	Apr 1.2858	May 1.2840	Jun 1.2759	Jul 1.2759	Aug 1.2744	Sep 1.2791	Oct 1.2840	Nov 1.2876	Dec 1.2912 1.2858	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heati	ng energy r	equirement.	s (kWh/vear)										
Assumed occurs			(,],									2 1294	(42)
Hot water usag	e for mixer 0.0000	showers 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42)
Hot water usag	e for baths	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 usag	e for other	uses 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 u	use (litres,	/day)	41.0004	05.5077	00.2000	00.2005	00.0077	41.0004	40.0002	40.0000	73.2702	(420)
De i las hat antes	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily not wate	r 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 Energy content	126.6023 (annual)	110.7074	115.8106	99.0717	93.8459	82.3222	80.2759	85.1460	87.8166	100.4895 Total = S	109.7851 um(45)m =	124.9881 1216.8613	(45)
Distribution 1	.oss (46)m 0.0000	= 0.15 x (4 0.0000	45)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage Total storage	loss:												
If cylinder co	0.0000 ntains dedi	cated sola:	r storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
	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)
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	(59)
Total heat req	uired for w	ater heatin	ng calculate	ed 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 DV 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	(63a)
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						~~ ~~ ~					100 0000	
	107.6120	94.1013	98.4390	84.2109	79.7690	69.9738	68.2345	72.3741 Total pe	74.6441 er vear (kW	85.4161 h/vear) = Si	93.3173 um(64)m =	106.2399	(64)
12Total per ye Electric showe	ar (kWh/yea r(s)	ir)							1 (-, 1,		1034	(64)
	61.5369	54.8299	59.8721	57.1352 Tota	58.2073 al Energy u	55.5242 sed by insta	57.3750 antaneous ei	58.2073 lectric show	57.1352 ver(s) (kWh	59.8721 (vear) = Su	58.7463 m(64a)m =	61.5369 699.9784	(64a) (64a)
Heat gains fro	m water hea	ting, kWh/n	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 May 156.9215 Jul Aug Sep Oct 156.9215 156.9215 156.9215 Mar 156.9215 Jun 156.9215 Nov Dec 156.9215 156.9215 (66) Jan Feb 156.9215 156.9215 Apr 156.9215 (66)m (66)m 156.9215 156 233.1777 240.9503 233.1777 240.9503 233.1777 (67) 341.0584 353.1472 378.8830 411.3699 441.9029 (68) 38.6921 38.6921 0.0000 38.6921 38.6921 38.6921 (69) 0.0000 (70) 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 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 (71) -125.5372 -125.5372 -125.5372 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 gain	ns												
[Jan]			1	m2	Solar flux Table 6a W/m2	s Speci or	g fic data. Table 6b	Specific or Tab	FF data ble 6c	Acce fact Table	ss or 6d	Gains W	
Northeast Southeast Southwest Northwest Northeast Northwest			13.0 27.5 32.5 0.7 0.7 1.5	500 300 500 500 900 800	11.2829 36.7938 36.7938 11.2829 18.0708 26.0000		0.6300 0.6300 0.6300 0.6300 0.6300 0.6300).7000).7000).7000).7000).7000).7000	0.77 0.77 0.77 1.00 1.00	00 00 00 00 00 00	44.9992 309.5659 366.0141 2.5862 5.6661 16.3047	(75) (77) (79) (81) (82) (82)
Solar gains Total gains	745.1361 1567.5287	1293.3908 2144.1323	1831.5074 2642.9666	2369.1974 3158.5760	2742.1262 3488.5299	2760.4640 3481.3200	2645.5521 3336.8693	2361.9775 3050.1682	2017.1275 2727.0582	1446.3674 2177.3245	896.9549 1672.1514	634.7691 1436.3027	(83) (84)
7. Mean inter	rnal tempera	ture (heati	ng season)										

Temperature during heating periods in the living area from Table 9, Thl (C)

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Calculated fo	or June, Jul Jan	y and Augus. Feb	st. See Tabl Mar	e 10b Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
8c. Space coo	ling requir	ement											
opuse neutring	Per me									(500	, , (1) -		(22)
Space heating Space heating	prequiremen per m2	it after sol	lar contribu	tion - tota	l per year	(kWh/year)				(98c) / (4) =	14898.0605 48.8461	(99)
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)
Solar heating Solar heating	r kWh 0.0000 r contributi	0.0000 on - total	0.0000 per vear (k	0.0000 Wh/vear)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating	3053.3310 requirement	2287.2090 t - total p	1830.2732 per year (kW	958.5526 h/year)	364.7899	0.0000	0.0000	0.0000	0.0000	1085.9282	2176.6660	3141.3106 14898.0605	(98a)
Space heating	5668.4902 kWb	5531.3054	5038.1087	4237.7110	3263.7398	2172.8509	1406.0574	1480.6710	2345.6321	3544.6370	4686.4044	5656.6548	(97)
Heat loss rat	4.5000 e W	4.9000	6.5000	8.9000	11.7000	14.6000	10.0000	16.4000	14.1000	10.0000	7.1000	4.2000	(96)
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)
Utilisation	Jan 0.9981	Feb	Mar 0 9754	Apr 0.9202	May 0.7950	Jun 0 5965	Jul 0 4171	Aug 0 4769	Sep 0.7568	Oct	Nov 0 9947	Dec	(94)
8. Space heat	ing require	ment											
-													
Temperature a adjusted MIT	ldjustment 18.6063	18.8818	19.2546	19.7060	20.0337	20.1834	20.2131	20.2093	20.1127	19.6509	19.0336	0.0000 18.5632	(93)
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)
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)
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)
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)
мтт	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)
util living a	1rea 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)
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	
ton	Jan 54 2511	Feb	Mar 54 5101	Apr	May	Jun EE 227E	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation f	actor for g	ains for li	iving area,	nil,m (see	Table 9a)								

	Jan	reb	LIGT	ADI	ridy	oun	our	Aug	Deb	000	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 k	Wh												
	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	L								fC =	cooled area	/ (4) =	1.0000	(105)
Intermittency f	actor (Tabl	le 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 k	Wh												
	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 r	equirement											511.6532	(107)
Energy for space	e heating											48.8461	(99)
Energy for space	e cooling											1.6776	(108)
Total												50.5237	(109)
Fabric Energy E	fficiency	(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	Storey	height			Volume		
		(m2)		(m)			(m3)		
Basement floor		56.1000 (la)	x	2.9900	(2a)	=	167.7390	(la) -	· (3a)
Ground floor		174.8000 (1b)	x	3.2000	(2b)	=	559.3600	(1b) -	· (3b)
First floor		74.1000 (1c)	х	3.2000	(2c)	=	237.1200	(lc) -	· (3c)
Total floor area $TFA = (la)+(lb)+(lc)+(ld)+(le)\dots(ln)$	305.0000							(4)	
Dwelling volume		(3a) + (3h	o)+(3c)+(3d)+(3e)	(3n)	=	964.2190	(5)	
Dwelling volume		(3a)+(3b	b)+(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 = $(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =$ Pressure test	0.0000 / (5) =	0.0000 (8) Yes



Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 te sheltered										I	3lower Door 3.0000 0.1500 2	(17) (18) (19)
Shelter factor Infiltration rat	te adjuste	d to inclu	de shelter f	actor					(20) = 1 (2)	- [0.075 x 21) = (18) :	(19)] = x (20) =	0.8500 0.1275	(20) (21)
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750 0.1626	Feb 5.0000 1.2500 0.1594	Mar 4.9000 1.2250 0.1562	Apr 4.4000 1.1000 0.1403	May 4.3000 1.0750 0.1371	Jun 3.8000 0.9500 0.1211	Jul 3.8000 0.9500 0.1211	Aug 3.7000 0.9250 0.1179	Sep 4.0000 1.0000 0.1275	Oct 4.3000 1.0750 0.1371	Nov 4.5000 1.1250 0.1434	Dec 4.7000 1.1750 0.1498	(22) (22a) (22b)
If mechanical ve If exhaust air h If balanced with	entilation heat pump h heat rec	using Apper overy: eff:	ndix N, (23) iciency in 9) = (23a) ; allowing ;	x Fmv (equat: for in-use fa	ion (N5)), actor (fro	otherwise m Table 4h)	(23b) = (23 =	a)			0.5000 0.5000 79.2000	(23a) (23b) (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)
3 Heat losses (and heat 1												
Florent						 N						1 V	
Liement				m2	m2	Ne	m2	W/m2K	W.	/K	kJ/m2K	kJ/K	
Opening Type 2 Opening	(Uw = 1.20)				80 1	.7100 .7300	1.1450 0.9615	92.41	60 35			(27) (27a)
Opening Heatloss Floor 1	1					0	.8600	0.9615	0.82	59 30 11	0.0000	6171.0000	(27a) (28a)
Heatloss Floor	2			70 5100	80 7100	118	.7000	0.1300	15.43	10 11	0.0000	13057.0000	(28a)
External Roof 1				92.6200	2.5900	297	.0300	0.1300	11.70	39 IS	9.0000	810.2700	(30)
External Roof 2 Total net area (of externa	l elements	Aum(A, m2)	.00.7000		100 746	.7000 .6300	0.1300	13.09	LO	9.0000	906.3000	(30) (31)
Fabric heat loss	s, W/K = S	um (A x U)					(26)(30) + (32)	= 193.05	13			(33)
Heat capacity Cr Thermal mass par List of Thermal	m = Sum(A : rameter (T Bridges	x k) MP = Cm / 1	IFA) in kJ/m	12K				(28).	(30) + (33	2) + (32a).	(32e) =	77526.5700 254.1855	(34) (35)
K1 Eleme	ent nd floor (normal)						L 33	ength 1	Psi-value	Tot	al	
E6 Inter	rmediate f	loor within	n a dwelling	I				70	.0000	0.0000	0.00	000	
El6 Corr El8 Part	ner (norma tv wall be	1) tween dwell	lings					37 15	.0000	0.0200	0.74	100)00	
E2 Other F3 Sill	r lintels	(including	other steel	lintels)				50	.0000	0.0180	0.9	000	
E4 Jamb Thermal bridges Point Thermal br	(Sum(L x ridges	Psi) calcu	lated using	Appendix K)			135	.0000	0.0050	0.67 (36a) =	4.5362 12.0000	(36) (36a)
Total fabric hea	at loss								(;	33) + (36)	+ (36a) =	209.5875	(37)
Ventilation heat	t loss cal	culated mon Feb	nthly (38)m Mar	= 0.33 x ()	25) m x (5) May	Jun	Jul	Aug	Sen	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)
Average = Sum(3)	oeff 294.4056 9)m / 12 =	293.3914	292.3772	287.3060	286.2917	281.2205	281.2205	280.2063	283.2490	286.2917	288.3202	290.3487 287.0524	(39)
HLP HLP (average)	Jan 0.9653	Feb 0.9619	Mar 0.9586	Apr 0.9420	May 0.9387	Jun 0.9220	Jul 0.9220	Aug 0.9187	Sep 0.9287	Oct 0.9387	Nov 0.9453	Dec 0.9520 0.9412	(40)
Days`in mont'	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heating	g energy r	equirement	s (kWh/year)										
Assumed occupant	су											3.1384	(42)
Hot water usage	for mixer 96.0513	snowers 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	43 3692	41 6684	39 9677	38 2669	38 2669	30 0677	41 6684	13 3692	45 0699	46 7707	(42c)
Average daily ho	ot water u	se (litres,	/day)	41.0004	00.0077	55.2005	55.2005	00.0077	41.0004	40.0052	40.0000	161.8263	(420)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	use 175.9894 278.7241	172.3526 245.4278	167.8547 257.9865	160.8505 220.1963	155.2221 208.9588	149.1473 183.3940	146.6911 177.4102	151.1682 187.1778	155.9072 192.2492	162.3004 220.2402	169.4174 241.3662	175.5092 274.8050	(44) (45)
Energy content Distribution los	(annual) ss (46)m 41.8086	$= 0.15 \times (4)$	45)m 38.6980	33,0294	31,3438	27.5091	26,6115	28,0767	28,8374	Total = S 33.0360	um (45) m = 36, 2049	2687.9362 41.2208	(46)
Water storage 10	055:	50.0142	55.6555	00.0204	51.5455	27.0001	20.0110	20.0707	2010074	00.0000	50.2045	41.2200	(10)
a) If manufactu Temperature fa	urer decla actor from	red loss fa Table 2b	actor is kno	wn (kWh/da	ay):							1.4000 0.5400	(47) (48) (49)
Enter (49) or (5 Total storage 10	54) in (55 oss)										0.7560	(55)
If culinder con	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)
II Cylinder Coll	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)
Combi loss Total heat requi	23.2624 0.0000 ired for w	21.0112 0.0000 ater heatin	23.2624 0.0000 ng calculate	22.5120 0.0000 d for each	23.2624 0.0000 month	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120	23.2624 0.0000	22.5120 0.0000	23.2624	(59) (61)
WWHRS	325.4225 -80.5755	287.6070 -71.2616	304.6849 -74.6211	265.3883 -61.7892	255.6572 -57.5853	228.5860 -49.2762	224.1086 -46.1885	233.8762 -49.1169	237.4412 -50.9830	266.9386 -60.1033	286.5582 -68.0898	321.5034 -79.0833	(62) (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)
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)
Electric shower	(s) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Total p 0.0000	er year (kW) 0.0000	n/year) = S 0.0000	um(64)m = 0.0000	2489.0984 0.0000	(64) (64a)
				Tot	al Energy use	ed by inst	antaneous e	lectric sho	wer(s) (kWh	(vear) = Su	m (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)

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

Metabol	lic gains	s (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)
Lightin	ng gains	(calculate	ed in Appen	dix L, equat	tion 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)
Applian	nces gaim	ns (calcula	ated in App	endix L, equ	ation L13	or L13a), a	lso see Tab	le 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	g gains	(calculated	d in Append	ix L, equat:	ion 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. eva	aporation	(negative v	alues) (Tabi	le 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 1	heating g	gains (Tabl	le 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 i	internal	gains												
	1	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)

б.	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)

7. Mean intern	al temperat	ure (heatin	g season)										
Temperature du Utilisation fa	ring heatin	ug periods i uns for liv	n the livin	ng area from Nil.m (see T	Table 9, T	Thl (C)						21.0000	(85)
tau alpha	Jan 73.1479 5.8765	Feb 73.4008 5.8934	Mar 73.6554 5.9104	Apr 74.9555 5.9970	May 75.2210 6.0147	Jun 76.5775 6.1052	Jul 76.5775 6.1052	Aug 76.8547 6.1236	Sep 76.0291 6.0686	Oct 75.2210 6.0147	Nov 74.6918 5.9795	Dec 74.1700 5.9447	
utii iiving ar	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 Non living	20.5610 19.5791	20.6258 19.6642	20.7079 19.7696	20.7930 19.8832	20.8338	20.8462 19.9524	20.8473 19.9530	20.8476 19.9563	20.8403 19.9425	20.7739	20.6492 19.7076	20.5532 19.5795	
24 / 9	31	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	í	
16 / 9 MIT Th 2	0 21.0000 20.1124	28 20.7881 20.1152	31 20.8346 20.1180	0 20.7930 20.1320	0 20.8338 20.1348	0 20.8462 20.1488	0 20.8473 20.1488	0 20.8476 20.1516	0 20.8403 20.1432	0 20.7739 20.1348	12 20.7101 20.1292	30 20.7551 20.1236	(87) (88)
util rest of h	ouse												
MIT 2	0.9977 20.1124	0.9894 19.9161	0.9573 19.9642	0.8463	0.6472	0.4349 19.9524	0.2911 19.9530	0.3337 19.9563	0.5920 19.9425	0.9162 19.8669	0.9926 19.8018	0.9986 19.8912	(89) (90)
Living area fr	action								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 ad adjusted MIT	justment 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)

8. Space heating requirement

Utilisatio	Jan n 0.9979	Feb 0.9897	Mar 0.9588	Apr 0.8478	May 0.6523	Jun 0.4414	Jul 0.2982	Aug 0.3413	Sep 0.5993	Oct 0.9167	Nov 0.9925	Dec 0.9986	(94)
Useful gain	ns 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 heat:	ing 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 heat:	ing requiremen	t - total p	per year (kW	h/year)								9036.5563	
Solar heat:	ing 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 heat:	ing contributi	on - total	per year (k	Wh/year)								0.0000	
Space heat:	ing 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 heat:	ing requiremen	t after sol	lar contribu	tion - tota	l per year	(kWh/year)						9036.5563	
Space heat:	ing per m2									(98c) / (4) =	29.6281	(99)

9a. Energy re	quirements -	Individual	heating sy	ystems, inclu	uding micro-	-CHP							
Fraction of s Fraction of s Efficiency of Efficiency of Efficiency of	pace heat fr pace heat fr main space main space secondary/s	om secondar om main sys heating sys heating sys upplementar	cy/supplemen stem(s) stem 1 (in 4 stem 2 (in 4 cy heating s	ntary system 8) 8ystem, 8	(Table 11)							0.0000 1.0000 349.6900 0.0000 0.0000	(201) (202) (206) (207) (208)
Space heating	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	2194.1100 efficiency	1462.8615 (main heati	966.7193 ing system 1	312.2941 L)	58.8741	0.0000	0.0000	0.0000	0.0000	447.6720	1373.2309	2220.7943	(98)



349.6900 349.6	900 349.6900	349.6900	349.6900	0.0000	0.0000	0.0000	0.0000	349.6900	349.6900	349.6900	(210)
627.4444 418.3	310 276.4504	89.3060	16.8361	0.0000	0.0000	0.0000	0.0000	128.0197	392.6996	635.0752	(211)
0.0000 0.0	000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
0.0000 0.0	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
0.0000 0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating											
244.8471 216.3 Efficiency of water beater	453 230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201	(64)
(217)m 186.8280 186.82 Fuel for water beating Wb/mon	280 186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	(217)
131.0548 115.7 Space cooling fuel requirement	992 123.1420	108.9768	106.0183	95.9759	95.2320	98.8927	99.8020	110.7089	116.9356	129.7557	(219)
(221)m 0.0000 0.0 Pumps and Fa 99.3095 89.6 Lighting 59.9897 48.1	0.000 989 99.3095 260 43.3321	0.0000 96.1060 31.7470	0.0000 99.3095 24.5223	0.0000 96.1060 20.0349	0.0000 99.3095 22.3700	0.0000 99.3095 29.0774	0.0000 96.1060 37.7687	0.0000 99.3095 49.5546	0.0000 96.1060 55.9718	0.0000 99.3095 61.6570	(221) (231) (232)
Electricity generated by PVs (A (233a)m -131.4018 -222.6	ppendix M) (neg 998 -382.8546	ative quant -500.5092	ity) -591.6131	-570.1119	-562.6157	-502.7712	-402.6149	-282.3021	-156.3101	-109.2348	(233a)
Electricity generated by wind t (234a)m 0.0000 0.0	urbines (Append 000 0.0000	11x M) (nega 0.0000	tive quanti 0.0000	ty) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(235a)m 0.0000 0.0	electric genera 000 0.0000	tors (Appen 0.0000	dix M) (neg 0.0000	ative quant 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
(235c)m 0.0000 0.0	000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(233b)m -0.8426 -4.0	ppendix M) (neg 071 -16.6582 umbinos (Depond	-50.1185	-98.6981	-111.9136	-109.0431	-77.9614	-42.0486	-11.4110	-1.8020	-0.5528	(233b)
(234b)m 0.0000 0.0 Electricity generated by budro-	000 0.0000	0.0000 tors (Arpen	0.0000 div M) (neg	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(235b)m 0.0000 0.0 Electricity yead or pet electric	000 0.0000	0.0000 by micro-CH	0.0000 D (Appendix	0.0000 N) (pegati	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235d)m 0.0000 0.0 Appual totals kWh/year	000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Space heating fuel - main system Space heating fuel - main system Space heating fuel - secondary Efficiency of water heater	n 1 n 2									2584.1624 0.0000 0.0000 186.8280	(211) (213) (215)
Space cooling fuel Electricity for pumps and fans:										0.0000	(221)
(BalancedWithHeatRecovery,) mechanical ventilation fans Total electricity for the above Electricity for lighting (calcu	Database: in-us (SFP = 0. , kWh/year lated in Append	e factor = 9940) lix L)	1.4000, SFP	9 = 0.9940)						1169.2891 1169.2891 484.1516	(230a) (231) (232)
Energy saving/generation techno PV generation Wind generation Hydro-electric generation (Apper Electricity generated - Micro C	logies (Appendi ndix N) HP (Appendix N)	.ces M ,N an	dQ)							-4940.0962 0.0000 0.0000 0.0000	(233) (234) (235a) (235)
Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all i	15es									-0.0000 0.0000 629.8007	(236) (237) (238)
10a. Fuel costs using Table 1	2 prices										
						Fuel kWh/year		Fuel price p/kWh		Fuel cost £/vear	
Space heating - main system 1 Total CO2 associated with commun	nity systems					2584.1624		16.4900		426.1284 0.0000	(240) (473)
Water heating (other fuel) Energy for instantaneous electr	ic shower(s)					1332.2939 0.0000		16.4900 16.4900		219.6953 0.0000	(247) (247a)
Pumps, fans and electric keep-h Energy for lighting	ot					1169.2891 484.1516		16.4900 16.4900		192.8158 79.8366	(249) (250)
Additional standing charges										0.0000	(251)
Energy saving/generation techn PV Unit electricity used in dwe	ologies lling					-4415.0392		16.4900		-728.0400	
PV Unit electricity exported Total						-525.0570		5.5900		-29.3507 -757.3907	(252)
Total energy cost										161.0854	(255)
lla. SAP rating - Individual he	ating systems										
Energy cost deflator (Table 12) Energy cost factor (FCF)						r	(255) x (254	5)] / [(4) +	45.01 =	0.3600	(256)
SAP value SAP rating (Section 12) SAP band							,			97.3142 97 A	(258)
12a. Carbon dioxide emissions -	Individual hea	ting system	s including	micro-CHP							
						Energy	Emiss	ion factor	-	Emissions	
Space heating - main system 1						kWh/year 2584.1624		kg CO2/kWh 0.1574]	406.7220	(261)
Water heating (other fuel)	nity systems					1332.2939		0.1407		0.0000	(373) (264)
Pumps, fans and electric keep-h Energy for lighting	ot					1169.2891 484.1516		0.1387 0.1443		162.1948 69.8780	(265) (267) (268)
Energy saving/generation techn PV Unit electricity used in dwe PV Unit electricity exported	ologies lling					-4415.0392 -525.0570		0.1317 0.1143		-581.3873 -60.0006	
IOTAL										-641.3879	(269)



184.9191 (272) 0.6100 (273) 99.2920 99 (274) A

Total CO2, kg/year CO2 emissions per m2 EI value EI rating EI band

SAP 10 WORKSHEET FOR New Bui	.ld (As D	esigned)	(Version 1)	0.2, February	/ 2022)								
1. Overall dwelling characte	ristics												
Basement floor Ground floor First floor Total floor area TFA = (la)+ Dwelling volume	(lb)+(lc	:)+(ld)+(le)	(ln)	30	05.0000		Area (m2) 56.1000 174.8000 74.1000 (3	(1a) (1b) (1c) 3a)+(3b)+	Storey 1 x x x x (3c)+(3	height (m) 2.9900 3.2000 3.2000 d)+(3e)	(2a) (2b) (2c) (3n)	Volume (m3) = 167.7390 = 559.3600 = 237.1200 = 964.2190	(1a) - (3a) (1b) - (3b) (1c) - (3c) (4) (5)
2. Ventilation rate													
												m3 per hour	
Number of open chimneys Number of open flues Number of chimneys / flues a Number of flues attached to Number of flues attached to Number of blocked chimneys Number of intermittent extra Number of passive vents Number of flueless gas fires	ttached solid fu other he ot fans	to closed f el boiler ater	ïre								0 * 80 0 * 20 0 * 10 0 * 20 0 * 35 0 * 20 0 * 10 0 * 10 0 * 40	= 0.0000 = 0.0000 = 0.0000 = 0.0000 = 0.0000 = 0.0000 = 0.0000 = 0.0000	(6a) (6b) (6c) (6d) (6e) (6f) (7a) (7b) (7c)
Infiltration due to chimneys	, flues	and fans	= (6a)+(6b))+(6c)+(6d)+	(6e)+(6f)+	(6g) + (7a) + ('	7b)+(7c) =			0.0000	Air cha) / (5) =	nges per hour 0.0000	(8)
Pressure test Pressure Test Method Measured/design AP50 Infiltration rate Number of sides sheltered												Yes Blower Door 3.0000 0.1500 2	(17) (18) (19)
Shelter factor Infiltration rate adjusted t	o includ	le shelter f	actor					(20) =	1 - [(21)	0.075 x = (18)	x (19)] x (20)	= 0.8500 = 0.1275	(20) (21)
Jan Wind speed 4.7000 Wind factor 1.1750	Feb 4.4000 1.1000	Mar 4.4000 1.1000	Apr 4.1000 1.0250	May 4.2000 1.0500	Jun 3.8000 0.9500	Jul 3.9000 0.9750	Aug 3.7000 0.9250	Sep 3.70 0.92	000	Dct 4.0000 1.0000	Nov 4.00 1.00	Dec 00 4.3000 00 1.0750	(22) (22a)
Adj infilt rate 0.1498 Balanced mechanical ventila	0.1403	0.1403	0.1307	0.1339	0.1211	0.1243	0.1179	0.11	.79	0.1275	0.12	75 0.1371	(22b)
If mechanical ventilation If exhaust air heat pump usi If balanced with heat recove	ng Appen ry: effi	dix N, (23b ciency in %) = (23a) : allowing :	x Fmv (equati for in-use fa	ion (N5)), actor (from	otherwise n Table 4h)	(23b) = (2:	3a)				0.5000 0.5000 79.2000	(23a) (23b) (23c)
Effective ac 0.2538	0.2442	0.2442	0.2347	0.2379	0.2251	0.2283	0.2219	0.22	219	0.2315	0.23	15 0.2411	(25)
3. Heat losses and heat loss	paramet	er											
Element			Gross m2	Openings m2	Net	Area m2	U-value W/m2K		A x U W/K	ŀ	(-value kJ/m2K	A x K kJ/K	
Opening Type 2 (UW = 1.20) Opening Heatloss Floor 1 Heatloss Floor 2 External Wall 1 External Roof 1 External Roof 2 Total net area of external e	lements	3 1 Aum (A, m2)	78.5100 92.6200 00.7000	80.7100 2.5900	80. 1. 56. 118. 297. 90. 100. 746.	7100 7300 8600 1000 7000 8000 0300 7000 6300	1.1450 0.9615 0.1300 0.1300 0.1700 0.1300 0.1300	92 1 0 7 15 50 11 13	2.4160 1.6635 0.8269 7.2930 5.4310 0.6260 1.7039 8.0910	11 11 19	0.0000 0.0000 9.0000 9.0000 9.0000	6171.0000 13057.0000 56582.0000 810.2700 906.3000	(27) (27a) (27a) (28a) (28a) (29a) (30) (30) (31)
Heat capacity Cm = Sum(A x k	(A X U) :)					(20) (30) + (32) (28)	= 193 (30) +	· (32) +	(32a).	(32e)	= 77526.5700	(33)
Thermal mass parameter (TMP List of Thermal Bridges Kl Element E5 Ground floor (nor E6 Intermediate floo E16 Corner (normal) E18 Party wall betwe E2 Other lintels (in E3 Sill E4 Jamb Thermal bridges (Sum(L x Psi Point Thermal bridges	= Cm / T mal) or within cluding) calcul	FA) in kJ/π a dwelling ings other steel ated using	2K lintels) Appendix K)] 3: 77 3' 14 55 55 13	Length 3.0300 7.0000 5.6000 0.0000 0.0000 5.0000	Psi- 0 0 0 0 0 0 0	value .0400 .0000 .0200 .0000 .0180 .0180 .0050	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	254.1855 Total .3212 .0000 .7400 .0000 .9000 .6750 4.5362 = 12.0000	(35) (36) (36a)
Total fabric heat loss Ventilation heat loss calcul	ated mon	thly (38)m	= 0.33 x ()	25)m x (5)					(33)	+ (36)	+ (36a)	= 209.5875	(37)
Jan (38)m 80.7612 7 Heat transfer coeff	Feb 7.7185	Mar 77.7185	Apr 74.6757	May 75.6900	Jun 71.6330	Jul 72.6473	Aug 70.6188	Sep 70.61	188 7	Det 3.6615	Nov 73.66	Dec 15 76.7042	(38)



Average = Sum	(39)m / 12	=	Man		Marr	T	71	2	5	0	Neer	284.2633	
HLP	0.9520	0.9420	Mar 0.9420	Apr 0.9320	May 0.9353	0.9220	0.9254	Aug 0.9187	Sep 0.9187	0.9287	0.9287	0.9387	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heati	ing energy	requirement	s (kWh/year)									
Assumed occupa Hot water usag	ancy ge for mixe	r showers										3.1384	(42)
Hot water usag	96.0513 ge for bath	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 usag	33.1674 ge for othe	32.6748 r uses	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)
Average daily	46.7707 hot water	45.0699 use (litres	43.3692 s/day)	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707 161.8263	(42c) (43)
Dailv hot wate	Jan er use	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	175.9894	172.3526 245.4278	167.8547 257.9865	160.8505 220.1963	155.2221 208.9588	149.1473 183.3940	146.6911 177.4102	151.1682 187.1778	155.9072 192.2492	162.3004 220.2402	169.4174 241.3662	175.5092 274.8050	(44)
Energy content Distribution 1	t (annual) Loss (46)m	= 0.15 x	(45)m							Total = S	um (45) m =	2687.9362	(,
Water storage	41.8086 loss:	36.8142	38.6980	33.0294	31.3438	27.5091	26.6115	28.0767	28.8374	33.0360	36.2049	41.2208	(46)
Store volume a) If manufac	turer decl	ared loss f	factor is kn	own (kWh/	day):							200.0000 1.4000	(47) (48)
Temperature Enter (49) or	factor fro (54) in (5	m Table 2b 5)										0.5400 0.7560	(49) (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 co	ontains ded 23.4360	licated sola 21.1680	ar storage 23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(57)
Primary loss Combi loss	23.2624	21.0112 0.0000	23.2624	22.5120 0.0000	23.2624 0.0000	22.5120	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	(59) (61)
Total heat rec	uired for 325.4225	287.6070	ing calculat 304.6849	ed for eacl 265.3883	h month 255.6572	228.5860	224.1086	233.8762	237.4412	266.9386	286.5582	321.5034	(62)
WWHRS PV diverter	-80.5755	-71.2616	-74.6211 -0.0000	-61.7892	-57.5853	-49.2762	-46.1885	-49.1169	-50.9830	-60.1033	-68.0898	-79.0833	(63a) (63b)
Solar input 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	(63c) (63d)
Output from w/	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)
Electric showe	er(s)	0 0000	0 0000	0 0000	0.0000	0.0000	0 0000	0 0000	0 0000	0 0000	um(64)m =	0 0000	(64a)
Heat gains fro	om water he	ating, kWh/	month	To	tal Energy us	sed by inst	antaneous e	lectric sho	wer(s) (kWh	/year) = Su	m(64a)m =	0.0000	(64a)
	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)
5. Internal ga	ains (see T	able 5 and	5a)										
Metabolic gair	ns (Table 5), Watts											
(66)m	Jan 188.3058	Feb 188.3058	Mar 188.3058	Apr 188.3058	May 188.3058	Jun 188.3058	Jul 188.3058	Aug 188.3058	Sep 188.3058	Oct 188.3058	Nov 188.3058	Dec 188.3058	(66)
Lighting gains	68.5367	ed in Apper 60.8737	49.5058	10n L9 or 37.4791	L9a), also s 28.0160	23.6523	25.5572	33.2202	44.5881	56.6148	66.0778	70.4415	(67)
Appliances gai	690.0012	697.1613	679.1182	640.7065	or L13a), al 592.2188	546.6471	516.2024	509.0423	527.0854	565.4971	613.9849	659.5565	(68)
Cooking gains	(calculate 56.9690	a in Append 56.9690	56.9690	10n L15 or 56.9690	56.9690	56.9690	5 56.9690	56.9690	56.9690	56.9690	56.9690	56.9690	(69)
Losses e.g. ev	vaporation	(negative v	values) (Tab	1e 5)	0.0000	105.5070	105 5050	105 5050	105 5050	105.5070	105 5070	105.5050	(70)
Water heating	-125.5372 gains (Tab	-125.5372 le 5)	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Total internal	1/4.///5 L gains	1040 4215	1012 0712	151.9012	143.5900	134.9057	700 0067	133.0047	130.9951	140.0400	161.6776	1/3.0201	(72)
	1055.0551	1049.4215	1013.0713	949.0244	003.3/12	024.9427	/90.996/	/95.0040	830.4062	890.4900	901.4779	1022.7617	(73)
 Solar gains 	3												
[Jan]			A	rea	Solar flux		g		FF	Acce	55	Gains	
				m2	Table 6a W/m2	Speci or	fic data Table 6b	Specific or Tab	data le 6c	fact Table	or 6d	W	
Northeast			14.2	600	13.7804		0.5700	 0	.7000	0.77	00	54.3360	(75)
Southwest			35.5	600	43.0593		0.5700	0	.7000	0.77	00	423.3842	(79)
Northeast			0.8	600 600	22.2520		0.6400	0	.7000	1.00	00	7.7159	(82)
Northwest			1.7		32.0000		0.6400		. 7000	1.00	00	22.3212	(02)
Solar gains	868.9010	1320.1561	1864.3884	2558.3171	2811.6971	3095.0761 3920.0189	2858.4760	2579.3582	2211.7669	1544.9609	1004.9710	715.6515	(83)
iotai yaina	1901.9941	2303.3110	2010.2351	3300.1413	3053.2003	3320.0100	3043.4720	3373.2231	3042.1731	2400.4009	1900.4400	1120.4133	(04)
7. Mean interr	nal tempera	ture (heati	ing season)										
Temperature du Utilisation fa	aring heati	ng periods ains_for li	in the livi ving area,	ng area fro nil,m (see	om Table 9, 1 Table 9a)	Thl (C)		_	-	-		21.0000	(85)
tau	Jan 74.1700	Feb 74.9555	Mar 74.9555	Apr 75.7578	May 75.4885	Jun 76.5775	Jul 76.3023	Aug 76.8547	Sep 76.8547	Oct 76.0291	Nov 76.0291	Dec 75.2210	
util living an	.9965	0.9878	0.9508	0.8089	0.6177	0.3796	0.2783	0.2987	0.5460	0,8899	0,9882	0.9979	(86)
													· · · · /

20.6083 20.6647 20.7418 20.8174 20.8405 20.8472 20.8469 20.8478 20.8461 20.8043 20.6971 20.5989

Living



Non living 24 / 16 24 / 9 MIT Th 2 Will rest of h MIT 2 Living area fr MIT Temperature adj adjusted MIT	19.6500 0 30 1 20.9928 20.1236 Duse 0.9952 20.1168 action 20.3928 justment 20.3928	19.7295 0 28 20.8101 20.1320 0.9837 19.9543 20.2240 20.2240	19.8245 0 31 20.8538 20.1320 0.9358 19.9963 20.2664 20.2664	19.9175 0 0 20.8174 20.1404 0.7674 19.9175 20.2010 20.2010	19.9360 0 20.8405 20.1376 0.5584 19.9360 20.2210 20.2210	19.9529 0 0 20.8472 20.1488 0.3190 19.9529 20.2347 20.2347	19.9496 0 20.8469 20.1460 0.2124 19.9496 20.2324 20.2324	19.9564 0 20.8478 20.1516 0.2284 19.9564 20.2373 20.2373	19.9555 0 0 20.8461 20.1516 0.4719 19.9555 20.2361 20.2361	19.9092 0 0 20.8043 20.1432 0.8506 19.9092 Living area 20.1912 20.1912	19.7816 0 11 20.7453 20.1432 0.9834 19.8557 a / (4) = 20.1360 20.1360	19.6486 0 31 20.7729 20.1348 0.9972 19.9202 0.3151 20.1889 0.0000 20.1889	(87) (88) (90) (91) (92) (93)
8. Space heatin	ng requirem	lent											
Utilisation Useful gains I Ext temp. Heat loss rate	Jan 0.9957 1913.6071 5.4000 W	Feb 0.9842 2332.1002 5.9000	Mar 0.9384 2700.9598 7.5000	Apr 0.7705 2703.0003 9.9000	May 0.5642 2085.0055 12.8000	Jun 0.3251 1274.3448 15.7000	Jul 0.2190 799.3285 17.4000	Aug 0.2355 794.9401 17.4000	Sep 0.4794 1458.4057 15.0000	Oct 0.8531 2077.6707 11.7000	Nov 0.9834 1933.7762 8.3000	Dec 0.9972 1733.5584 5.4000	(94) (95) (96)
Space heating i	4353.1500 kWh	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	1815.0199 requirement	1198.3490 ; - total p	719.3859 er year (kW	162.1479 h/year)	23.8326	0.0000	0.0000	0.0000	0.0000	243.6290	1021.5004	1860.2733 7044.1380	(98a)
Solar heating (0.0000 contributio	0.0000 n - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating Space heating Space heating p	kWh 1815.0199 requirement per m2	1198.3490 after sol	719.3859 ar contribu	162.1479 tion - tota	23.8326 1 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	243.6290 (98c)	1021.5004) / (4) =	1860.2733 7044.1380 23.0955	(98c) (99)
		T- 41-14											
Fraction of spi Fraction of spi Efficiency of r Efficiency of r	ace heat fr ace heat fr main space main space	com seconda com main sy heating sy	ry/suppleme stem(s) stem 2 (in	<pre>stems, inc ntary syste %) %)</pre>	m (Table 11	.)						0.0000 1.0000 350.3792 0.0000	(201) (202) (206) (207)
Efficiency of a	secondary/s	mpprementa	ry neating .	System, s	Maria	7	7-1	2	Care	0-+	New	0.0000	(200)
Space heating	requirement	1109 2400	710 2050	ADI 162 1470	114 y	0 0000	0 0000	Aug	0.0000	242 6200	1021 5004	1960 2722	(09)
Space heating (efficiency	(main heat	ing system	102.1475	25.0520	0.0000	0.0000	0.0000	0.0000	243.0250	250 2702	250 2702	(30)
Space heating :	fuel (main	heating sy	stem)	350.3792	550.5792	0.0000	0.0000	0.0000	0.0000	550.5792	350.3792	500.5792	(210)
Space heating (518.0159 efficiency	342.0149 (main heat	205.3164 ing system	46.2778	6.8019	0.0000	0.0000	0.0000	0.0000	69.5330	291.5414	530.9315	(211)
Space heating :	0.0000 fuel (main	0.0000 heating sy	0.0000 stem 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating :	0.0000 fuel (secon	0.0000 idary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
	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	:											
Efficiency of 1	244.8471 water heate	216.3453 r	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593	186.4582	206.8352	218.4684	242.4201 186.8129	(64) (216)
(217)m Fuel for water	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)
Space cooling :	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)
(221)m Pumps and Fa	0.0000 99.3095	0.0000 89.6989	0.0000 99.3095	0.0000 96.1060	0.0000 99.3095	0.0000 96.1060	0.0000 99.3095	0.0000 99.3095	0.0000 96.1060	0.0000 99.3095	0.0000 96.1060	0.0000 99.3095	(221) (231)
Lighting Electricity gen	59.9897 nerated by	48.1260 PVs (Appen	43.3321 dix M) (neg	31.7470 ative quant	24.5223 ity)	20.0349	22.3700	29.0774	37.7687	49.5546	55.9718	61.6570	(232)
(233a)m Electricity gen	-157.5457 nerated by	-233.3835 wind turbi	-396.8437 nes (Append	-538.3885 ix M) (nega	-606.7410 tive quanti	-624.2364 ty)	-600.3910	-545.3205	-443.9675	-307.0864	-179.7528	-126.7420	(233a)
(234a)m Electricity gen	0.0000 nerated by	0.0000 hvdro-elec	0.0000 tric genera	0.0000 tors (Appen	0.0000 dix M) (neg	0.0000 Ative quant	0.0000 itv)	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(235a)m Electricity use	0.0000 ed or net e	0.0000 electricity	0.0000 generated	0.0000 by micro-CH	0.0000 P (Appendix	0.0000 (N) (negati	0.0000 ve if net o	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(235a)
(235c)m Electricity der	0.0000 nerated by	0.0000 PVs (Appen	0.0000 dix M) (neg	0.0000 ative quant	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(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)
(234b)m	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(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 use (235d)m	ed or net e 0.0000	electricity 0.0000	generated 1 0.0000	by micro-CH 0.0000	P (Appendix 0.0000	(N) (negati 0.0000	ve if net g 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals Space heating : Space heating :	kWh/year fuel - main fuel - main	system 1										2010.4329	(211)
Space heating : Efficiency of water heating : Space cooling :	fuel - seco water heate fuel used fuel	ondary er										0.0000 186.8129 1332.4021 0.0000	(215) (219) (221)
Electricity fo: (BalancedW: mechanical Total electric:	r pumps and ithHeatReco ventilation ity for the	l fans: overy, Data 1 fans (SFP 2 above, kW	base: in-us) = 0. h/year	e factor = 9940)	1.4000, SFF	P = 0.9940)						1169.2891 1169.2891	(230a) (231)
Electricity for	r lighting	(calculate	d in Append	ix L) ces M .N an	d 0)							484.1516	(232)
PV generation Wind generation Hydro-electric Electricity gen	n generation nerated - M	(Appendix licro CHP (N) Appendix N)		- */							-5413.4585 0.0000 0.0000 0.0000	(233) (234) (235a) (235)
Appendix Q - sp Energy saved of Energy used Total delivered	pecial feat r generated d energy fo	ures l or all uses										-0.0000 0.0000 -417.1827	(236) (237) (238)



10a. Fuel costs - using BEDF prices (536)			
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600	Fuel cost £/year 505.8249 (240) 0.0000 (473) 335.2324 (247) 0.0000 (247a) 294.1931 (249) 121.8126 (250) 0.0000 (251)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost	-4760.3990 -653.0595	25.1600 5.8100	-1197.7164 -37.9428 -1235.6591 (252) 21.4039 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Energy kWh/year

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

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy Primar kWh/year	y 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	1000 (001		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 U Solar photovoltaic panels V2 Wind turbine	3			SAP increase too small Already installed Not applicable
Recommended measures: (none)		SAP change	Cost change	CO2 change
Measures omitted - SAP chang N Solar water heating	je or cost sav:	ing too small + 0.7	: −£ 57	-39 kg (108.3%)
Recommended measures		Typical annu	al savings	Energy Environmental efficiency impact
(none)	Cotal Savings	£0	0.00 kg/m²	
Potential energy efficiency Potential environmental impa	rating: act rating:			A 97 A 99
Fuel prices for cost data or Recommendation texts revision	n this page from number 6.1	om database r (11 Jun 2019)	evision number 5	36 TEST (31 Jan 2024)

£21 £21 -1 kWh/mª

£0 £0 0 kWh/mª

Typical heating and ligh	ting costs of this home Current	(per year, South Potential	West England): Saving
Electricity	£1257	£1257	£0
Space heating	£800	£800	£0
Water heating	£335	£335	£0
Lighting	£122	£122	£0
Generated (PV)	-£1236	-£1236	£0

£21 £21 -1 kWh/mª

Total cost of fuels Total cost of uses Delivered energy



Carbon dioxide CO2 emissions Primary energy	e emissions per m ^g Y		0.0 ton 0 kg/m ^g 1 kWh/m	nes 0.0 0 k * 1 k) tonnes gg/m ^g Wh/m ^g	0.0 tonnes 0 kg/m ^s 0 kWh/m ^s	3						
SAP 10 WORKSHEET CALCULATION OF P	I FOR New B ENERGY RATI	uild (As I NG FOR IMF)esigned) ROVED DWELL	(Version 10 ING).2, Februar	ry 2022)							
1. Overall dwell	ling charac	teristics											
Basement floor Ground floor First floor Total floor area Dwelling volume	a TFA = (la)+(lb)+(lc	:)+(ld)+(le)	(ln)	:	305.0000		Area (m2) 56.1000 174.8000 74.1000 (3	Store (la) x (lb) x (lc) x 3a)+(3b)+(3c)+	<pre>ty height (m) 2.9900 3.2000 3.2000 (3d)+(3e)</pre>	(2a) = (2b) = (2c) = (3n) =	Volume (m3) 167.7390 559.3600 237.1200 964.2190	(1a) - (3a) (1b) - (3b) (1c) - (3c) (4) (5)
2. Ventilation	rate											-2	
Number of open of Number of open i Number of chimme Number of flues Number of flues Number of blockk Number of passiv Number of flues	chimneys flues eys / flues attached t attached t ed chimneys mittent ext ve vents ess gas fir	attached o solid fu o other he ract fans es	to closed f el boiler ater	ïre							$\begin{array}{cccccccccccccccccccccccccccccccccccc$	m3 per hour 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6a) (6b) (6c) (6d) (6e) (6f) (7a) (7b) (7c)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	e to chimne ethod AP50 te sheltered	ys, flues	and fans	= (6a)+(6b)	+(6c)+(6d)-	+(6e)+(6f)+	(6g) + (7a) + (7b)+(7c) =		0.0000	Air chang) / (5) =	es per hour 0.0000 Yes Blower Door 3.0000 0.1500 2	(8) (17) (18) (19)
Shelter factor Infiltration rat	te adjusted	to includ	le shelter f	actor					(20) = 1 - (2)	[0.075 x .) = (18)	x (19)] = x (20) =	0.8500 0.1275	(20) (21)
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	(22) (22a)
Adj infilt rate Balanced mechar If mechanical ve	0.1626 nical venti entilation	0.1594 lation wit	0.1562 Th heat reco	0.1403 very	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b) (23a)
If balanced with Effective ac	heat pump u h heat reco 0.2666	very: effi 0.2634	0.2602) = (23a) x allowing f 0.2442	or in-use for 0.2411	factor (NS)), factor (from 0.2251	0.2251	(23D) = (2 = 0.2219	0.2315	0.2411	0.2474	0.3000 79.2000 0.2538	(23C) (25)
3. Heat losses a	and heat lo	ss paramet	er										
Element Opening Type 2 Opening Heatloss Floor 1 Heatloss Floor 1 External Wall 1 External Roof 1 External Roof 2 Total net area of Fabric heat loss	(Uw = 1.20) 1 2 of external s, W/K = Sur	elements m (A x U)	3 Aum(A, m2)	Gross m2 78.5100 92.6200 00.7000	0pening: m2 80.7100 2.5900	s Net 2 80, 1, 0, 118, 0, 297, 0, 90, 100, 746,	EArea m2 .7100 .7300 .8600 .1000 .7000 .8000 .0300 .7000 .6300 (26)(U-value W/m2K 1.1450 0.9615 0.9615 0.1300 0.1300 0.1300 0.1300 30) + (32)	A x (W/ 92.4160 1.6633 0.8265 7.2930 15.4310 50.6260 11.7035 13.0910 = 193.0513	1 F	(-value kJ/m2K 0.0000 0.0000 9.0000 9.0000 9.0000	A x K kJ/K 6171.0000 13057.0000 56582.0000 810.2700 906.3000	(27) (27a) (27a) (28a) (28a) (29a) (30) (30) (31) (33)
Heat capacity Cn Thermal mass par	n = Sum(A x rameter (TM	k) P = Cm / I	TFA) in kJ/m	2K				(28)	(30) + (32)	+ (32a).	(32e) =	77526.5700 254.1855	(34) (35)
List of Inermal K1 Elem E5 Grour E6 Inte: E16 Corr E18 Part E2 Othe: E3 Sill E4 Jamb Thermal bridges	Entages ent nd floor (n rmediate fl. ner (normal ty wall bet r lintels ((Sum(L x P	ormal) oor within) ween dwell including si) calcul	h a dwelling lings other steel lated using	lintels) Appendix K)				1 3: 74 3 1 1 5 5 5 1 3: 5 1 3: 5 1 3: 5 1 3:	Length Ps 3.0300 7.0000 5.6000 0.0000 0.0000 5.0000 5.0000	i-value 0.0400 0.0000 0.0200 0.0000 0.0180 0.0180 0.0180 0.0050	To 1.3 0.0 0.7 0.0 0.9 0.9 0.6	tal 212 000 400 000 000 750 4.5362	(36)
Point Thermal by Total fabric heat	ridges at loss t loss celc	ulated mon	thlv (38)m	= 0.33 v /2	(5)m v (5)				(33	3) + (36)	(36a) = + (36a) =	12.0000 209.5875	(36a) (37)
(38)m Heat transfer or	Jan 84.8181	Feb 83.8039	Mar 82.7897	Apr 77.7185	May 76.7042	Jun 71.6330	Jul 71.6330	Aug 70.6188	Sep 73.6615	Oct 76.7042	Nov 78.7327	Dec 80.7612	(38)
Average = Sum(39	294.4056 9)m / 12 =	293.3914	292.3772	287.3060	286.2917	281.2205	281.2205	280.2063	283.2490	286.2917	288.3202	290.3487 287.0524	(39)



HLP HLP (average)	Jan 0.9653	Feb 0.9619	Mar 0.9586	Apr 0.9420	May 0.9387	Jun 0.9220	Jul 0.9220	Aug 0.9187	Sep 0.9287	Oct 0.9387	Nov 0.9453	Dec 0.9520 0.9412	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heati	ng energy r	equirement	s (kWh/year)									
Assumed occupation	ncy e for mixer	showers										3.1384	(42)
Hot water usag	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 usag	33.1674 e for other	32.6748	31.9811	30.7022	29.7445	28.6826	28.1090	28.7978	29.5477	30.6840	31.9894	33.0553	(42b)
Average daily	46.7707 hot water u	45.0699 se (litres	43.3692 s/day)	41.6684	39.9677	38.2669	38.2669	39.9677	41.6684	43.3692	45.0699	46.7707 161.8263	(42c) (43)
Dailv hot wate	Jan r use	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte Energy content	175.9894 278.7241 (annual)	172.3526 245.4278	167.8547 257.9865	160.8505 220.1963	155.2221 208.9588	149.1473 183.3940	146.6911 177.4102	151.1682 187.1778	155.9072 192.2492	162.3004 220.2402 Total = S	169.4174 241.3662 Sum(45)m =	175.5092 274.8050 2687.9362	(44) (45)
Distribution 1 Water storage	oss (46)m 41.8086 loss:	= 0.15 x 36.8142	(45)m 38.6980	33.0294	31.3438	27.5091	26.6115	28.0767	28.8374	33.0360	36.2049	41.2208	(46)
Store volume a) If manufac Temperature Enter (49) or	turer decla factor from (54) in (55	red loss f Table 2b	factor is kn	own (kWh/d	lay):							200.0000 1.4000 0.5400 0.7560	(47) (48) (49) (55)
If culinder co	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)
Primary loss Combi loss	23.4360 23.2624 0.0000	21.1680 21.0112 0.0000	23.4360 23.2624 0.0000	22.6800 22.5120 0.0000	23.4360 23.2624 0.0000	22.6800 22.5120 0.0000	23.4360 23.2624 0.0000	23.4360 23.2624 0.0000	22.6800 22.5120 0.0000	23.4360 23.2624 0.0000	22.6800 22.5120 0.0000	23.4360 23.2624 0.0000	(57) (59) (61)
Total heat req WWHRS PV diverter	uired for w 325.4225 -80.5755 -0.0000	ater heati 287.6070 -71.2616 -0.0000	ing calculat 304.6849 -74.6211 -0.0000	ed for each 265.3883 -61.7892 -0.0000	n month 255.6572 -57.5853 -0.0000	228.5860 -49.2762 -0.0000	224.1086 -46.1885 -0.0000	233.8762 -49.1169 -0.0000	237.4412 -50.9830 -0.0000	266.9386 -60.1033 -0.0000	286.5582 -68.0898 -0.0000	321.5034 -79.0833 -0.0000	(62) (63a) (63b)
Solar input 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	(63c) (63d)
Output from W/	n 244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593 Total p	186.4582 er year (kW	206.8352 h/year) = S	218.4684 Sum(64)m =	242.4201 2489.0984	(64) (64)
Electric snowe	r(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)
Heat gains fro	m water hea 130.0345	ting, kWh/ 115.3481	month 123.1392	109.3689	106.8375	97.1321	96.3476	99.5953	100.0765	110.5886	116.4079	128.7314	(65)
5. Internal ga	ins (see Ta	ble 5 and	5a)										
Metabolic gain	s (Table 5)	, Watts				 Tun			For	Oat	Norr	Dog	
(66)m Lighting gains	188.3058 (calculate	188.3058 d in Apper	188.3058 dix L. equa	188.3058 tion L9 or	188.3058 L9a), also	188.3058 see Table 5	188.3058	188.3058	188.3058	188.3058	188.3058	188.3058	(66)
Appliances gain	68.5367 ns (calcula	60.8737 ted in Apr	49.5058 endix L. eq	37.4791 uation L13	28.0160 or L13a), a	23.6523 lso see Tab	25.5572 le 5	33.2202	44.5881	56.6148	66.0778	70.4415	(67)
Cooking gains	690.0012 (calculated	697.1613 in Append	679.1182 lix L, equat	640.7065 ion L15 or	592.2188 L15a), also	546.6471 see Table	516.2024	509.0423	527.0854	565.4971	613.9849	659.5565	(68)
Pumps, fans Losses e.g. ev	56.9690 0.0000 aporation (56.9690 0.0000 negative v	56.9690 0.0000 values) (Tab	56.9690 0.0000 le 5)	56.9690 0.0000	56.9690 0.0000	56.9690 0.0000	56.9690 0.0000	56.9690 0.0000	56.9690 0.0000	56.9690 0.0000	56.9690 0.0000	(69) (70)
- Water heating	-125.5372 gains (Tabl	-125.5372 e 5)	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	-125.5372	(71)
Total internal	174.7775 gains	171.6489	165.5097	151.9012	143.5988	134.9057	129.4995	133.8647	138.9951	148.6406	161.6776	173.0261	(72)
	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]			A	rea m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	ess or 6d	Gains W	
Northeast			14.2	600	11.2829		0.5700	0	.7000	0.77	100	44.4885	(75)
Southeast Southwest			30.0	600	36.7938		0.5700	0	.7000	0.77	100	305.9247	(77) (79)
Northwest Northeast Northwest			0.8 0.8 1.7	200 600 300	11.2829 18.0708 26.0000		0.6400 0.6400	0	.7000 .7000 .7000	1.00	00 00 00	2.5582 6.2661 18.1359	(81) (82) (82)
Solar gains Total gains	739.1522 1792.2052	1283.9416 2333.3631	1820.2944 2834.1657	2357.7564 3307.5808	2731.2432 3614.8144	2750.4276 3575.3703	2635.5623 3426.5590	2351.5083 3147.3731	2005.8539 2836.2601	1436.4116 2326.9016	889.9293 1851.4071	629.5530 1652.3148	(83) (84)
7. Mean intern	al temperat	ure (heati	ing season)										
Temperature du	ring heatin	g periods	in the livi	ng area fro	om Table 9,	Thl (C)						21.0000	(85)
utilisation fa	Jan 73 1470	Feb	Mar 73 6554	Apr 74 OFFE	May 75 2210	Jun 76 5775	Jul 76 5775	Aug	Sep	Oct	Nov	Dec	

tau alpha util living are	73.1479 5.8765 a	73.4008 5.8934	73.6554 5.9104	74.9555 5.9970	75.2210 6.0147	76.5775 6.1052	76.5775 6.1052	76.8547 6.1236	76.0291 6.0686	75.2210 6.0147	74.6918 5.9795	74.1700 5.9447
-	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 Non living	20.5610 19.5791	20.6258 19.6642	20.7079 19.7696	20.7930 19.8832	20.8338 19.9274	20.8462 19.9524	20.8473 19.9530	20.8476 19.9563	20.8403 19.9425	20.7739 19.8669	20.6492 19.7076	20.5532 19.5795



24 / 16 24 / 9	0 31	0 0	0	0 0	0 0	0	0	0	0 0	0	0 0	0 1	
16 / 9 MIT Th 2	0 21.0000 20.1124	28 20.7881 20.1152	31 20.8346 20.1180	0 20.7930 20.1320	0 20.8338 20.1348	0 20.8462 20.1488	0 20.8473 20 1488	0 20.8476 20.1516	0 20.8403 20.1432	0 20.7739 20.1348	12 20.7101 20.1292	30 20.7551 20.1236	(87)
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 Living area f	20.1124 Traction	19.9161	19.9642	19.8832	19.9274	19.9524	19.9530	19.9563	19.9425 fLA =	19.8669 Living are	19.8018 a / (4) =	19.8912 0.3151	(90) (91)
Temperature a adjusted MIT	20.3921 adjustment 20.3921	20.1909	20.2384	20.1699	20.2130	20.2340	20.2348	20.2371	20.2254	20.1527	20.0880	20.1634 0.0000 20.1634	(92)
													(20)
8. Space heat	ing require	ment.											
Utilisation Useful gains Ext temp.	Jan 0.9979 1788.5187 4.3000	Feb 0.9897 2309.3292 4.9000	Mar 0.9588 2717.4544 6.5000	Apr 0.8478 2804.1626 8.9000	May 0.6523 2358.0573 11.7000	Jun 0.4414 1578.2456 14.6000	Jul 0.2982 1021.7247 16.6000	Aug 0.3413 1074.2079 16.4000	Sep 0.5993 1699.7836 14.1000	Oct 0.9167 2133.1423 10.6000	Nov 0.9925 1837.4341 7.1000	Dec 0.9986 1650.0024 4.2000	(94) (95) (96)
Space heating	4737.5913 kWh	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	2194.1100 requirement	1462.8615 t - total p	966.7193 Der year (kW	312.2941 h/year)	58.8741	0.0000	0.0000	0.0000	0.0000	447.6720	1373.2309	2220.7943 9036.5563	(98a)
Solar heating	g kWh 0.0000 g contributi	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating	<pre># kWh 2194.1100 requirement</pre>	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	j per m2	c arter 501	ui contribu		r per yeur	(xwii/ycur)				(98c) / (4) =	29.6281	(99)
9a. Energy re	quirements	- Individua	al heating s	ystems, inc	luding micr	ro-CHP							
Fraction of s Fraction of s Efficiency of Efficiency of	space heat f space heat f main space main space secondary/	rom seconda rom main sy heating sy heating sy supplementa	ary/suppleme /stem(s) /stem 1 (in /stem 2 (in	ntary system %) %)	m (Table ll	.)						0.0000 1.0000 349.6900 0.0000	(201) (202) (206) (207) (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(200)
Space heating	requiremen 2194.1100	t 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	g efficiency 349.6900 g fuel (main	(main heat 349.6900	349.6900	1) 349.6900	349.6900	0.0000	0.0000	0.0000	0.0000	349.6900	349.6900	349.6900	(210)
Space heating	627.4444	418.3310 (main heat	276.4504	89.3060	16.8361	0.0000	0.0000	0.0000	0.0000	128.0197	392.6996	635.0752	(211)
Space heating	0.0000 fuel (main	0.0000 heating sy	0.0000 /stem 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating	0.0000 fuel (seco	0.0000 ndary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating	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	requiremen 244.8471	t 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 (217)m	water heat 186.8280	er 186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280	186.8280 186.8280	(216) (217)
Fuel for wate	er heating, 131.0548	kWh/month 115.7992	123.1420	108.9768	106.0183	95.9759	95.2320	98.8927	99.8020	110.7089	116.9356	129.7557	(219)
(221)m Pumps and Fa	0.0000 99.3095	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Lighting Electricity g	59.9897 Jenerated by	48.1260 PVs (Appen	43.3321 ndix M) (neg	31.7470 ative quant	24.5223 ity)	20.0349	22.3700	29.0774	37.7687	49.5546	55.9718	61.6570	(232)
(233a)m Electricity g	-131.4018 generated by	-222.6998 wind turbi	-382.8546 ines (Append	-500.5092 ix M) (nega	-591.6131 tive quanti	-570.1119 ty)	-562.6157	-502.7712	-402.6149	-282.3021	-156.3101	-109.2348	(233a)
(234a)m Electricity g	0.0000 generated by	0.0000 hydro-elec	0.0000 tric genera	0.0000 tors (Appen	0.0000 dix M) (neg	0.0000 pative quant	0.0000 ity)	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(235a)m Electricity u (235c)m	used or net (electricity 0.0000	generated 1	by micro-CH 0.0000	P (Appendix	N) (negati	ve if net g	eneration)	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity g (233b)m	enerated by -0.8426	PVs (Appen -4.0071	ndix M) (neg -16.6582	ative quant -50.1185	ity) -98.6981	-111.9136	-109.0431	-77.9614	-42.0486	-11.4110	-1.8020	-0.5528	(233b)
Electricity g (234b)m	enerated by 0.0000	wind turbi 0.0000	ines (Append 0.0000	ix M) (nega 0.0000	tive quanti 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity g (235b)m	enerated by 0.0000	hydro-elec 0.0000	tric genera 0.0000	tors (Appen 0.0000	dix M) (neg 0.0000	ative quant 0.0000	ity) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235d)m Appual totals	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(N) (negati 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Space heating Space heating	fuel - main fuel - main	n system 1 n system 2										2584.1624 0.0000	(211) (213)
Space heating Efficiency of Water heating	fuel - sec water heat fuel used	ondary er										0.0000 186.8280 1332.2939	(215) (219)
Space cooling	fuel											0.0000	(221)
Electricity f (Balanced	or pumps an WithHeatRec	d fans: overy, Data	base: in-us	e factor =	1.4000, SFF	2 = 0.9940)							
mechanical Total electri Electricity f	ventilation city for the for lighting	n fans (SFF e above, kw (calculate	y = 0. Mh/year ed in Append	9940) ix L)								1169.2891 1169.2891 484.1516	(230a) (231) (232)
Energy saving PV generation	g/generation	technologi	ies (Appendi	ces M ,N an	d Q)							-4940.0962	(233)
Wind generati Hydro-electri	lon lo generatio	n (Appendix	« N)									0.0000	(234) (235a)
Electricity g Appendix Q -	special fea	Micro CHP (tures	(Appendix N)									0.0000	(235)
Energy saved Energy used Total deliver	or generate	u or all uses	3									-0.0000 0.0000 629.8007	(236) (237) (238)



10a. Fuel costs - using Table 12 prices			
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 Total CO2 associated with community systems	2584.1624	16.4900	426.1284 (240) 0.0000 (473)
Water heating (other fuel) Energy for instantaneous electric shower(s)	1332.2939	16.4900	219.6953 (247) 0.0000 (247a)
Pumps, fans and electric keep-hot	1169.2891	16.4900	192.8158 (249)
Additional standing charges	484.1516	16.4900	0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling PV Unit electricity exported	-4415.0392 -525.0570	16.4900	-728.0400 -29.3507
Total	02010070		-757.3907 (252)
lotal energy cost			161.0854 (255)
lla. SAP rating - Individual heating systems			
Energy cost deflator (Table 12):		•	0.3600 (256)
Energy cost factor (ECF) SAP value	[$(255) \times (256)] / [(4) + 45.0] =$	0.1657 (257) 97.3142
SAP rating (Section 12)			97 (258)
SAF Daild			A
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
	Energy	Emission factor	Emissions
Space heating - main system 1	kWh/year 2584.1624	kg CO2/kWh 0.1574	kg CO2/year 406.7220 (261)
Total CO2 associated with community systems	1000 0000	0.1407	0.0000 (373)
water heating (other fuel) Space and water heating	1332.2939	0.1407	187.5122 (264) 594.2342 (265)
Pumps, fans and electric keep-hot Energy for lighting	1169.2891 484.1516	0.1387	162.1948 (267) 69.8780 (268)
Energy acting/generation technologica		012110	(200)
PV Unit electricity used in dwelling	-4415.0392	0.1317	-581.3873
PV Unit electricity exported Total	-525.0570	0.1143	-60.0006 -641.3879 (269)
Total CO2, kg/year CO2 emissions per m2			184.9191 (272)
EI value			99.2920
El rating El band			99 (274) A
		•	
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)			
CALCULATION OF EFC COSIS, EMISSIONS AND PRIMARI ENERGI FOR IMPROVED DWELLING			
1. Overall dwelling characteristics			
	Area	Storey height	Volume
Basement floor	(m2) 56,1000	(m) (1a) x 2.9900 (2a) :	(m3) = 167,7390 (1a) - (3a)
Ground floor	174.8000	(1b) x 3.2000 (2b)	= 559.3600 (1b) - (3b)
Total floor area TFA = $(la)+(lb)+(lc)+(ld)+(le)(ln)$ 305.0000	/4.1000	(12) X 3.2000 (22)	= 237.1200 (1C) - (3C) (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 Number of chimneys / flues attached to closed fire		0 * 10 =	= 0.0000 (6D) = 0.0000 (6C)
Number of flues attached to solid fuel boiler Number of flues attached to other heater		0 * 20 = 0 * 35 =	= 0.0000 (6d) = 0.0000 (6e)
Number of blocked chimneys		0 * 20 =	= 0.0000 (6f)
Number of passive vents		0 * 10 = 0 * 10 =	= 0.0000 (7a) = 0.0000 (7b)
Number of flueless gas fires		0 * 40 =	= 0.0000 (7c)
Infiltration due to chimnevs, flues and fans = $(6a) \pm (6b) \pm (6c) \pm (6d) \pm (6c) \pm (6d) \pm (6$	+(7b)+(7c) =	Air char 0 0000 / (5) -	nges per hour
Pressure test	(10) + (10) =	0.0000 / (5) =	Yes
Pressure Test Method Measured/design AP50			Blower Door 3.0000 (17)
Infiltration rate Number of sides sheltered			0.1500 (18)
Chalter Factor		(20) = 1 = [0.075 + (10)]	- 0.8500 (20)
Infiltration rate adjusted to include shelter factor		$(20) = 1 - [0.075 \times (19)] = (21) = (18) \times (20) =$	= 0.8500 (20) = 0.1275 (21)



Wind speed Wind factor Adj infilt rate	Jan 4.7000 1.1750 0.1498	Feb 4.4000 1.1000 0.1403	Mar 4.4000 1.1000 0.1403	Apr 4.1000 1.0250 0.1307	May 4.2000 1.0500 0.1339	Jun 3.8000 0.9500 0.1211	Jul 3.9000 0.9750 0.1243	Aug 3.7000 0.9250 0.1179	Sep 3.7000 0.9250 0.1179	Oct 4.0000 1.0000 0.1275	Nov 4.0000 1.0000 0.1275	Dec 4.3000 1.0750 0.1371	(22) (22a) (22b)
Balanced mecha If mechanical v If exhaust air If balanced wit	nical vent entilation heat pump h heat rec	using Apper overy: eff:	th heat reco ndix N, (23h iciency in ¶	overy c) = (23a) : & allowing :	x Fmv (equat for in-use f	ion (N5)), actor (fro	otherwise m Table 4h)	(23b) = (23a =)			0.5000 0.5000 79.2000	(23a) (23b) (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)
3. Heat losses	and heat 1	oss paramet	ter										
Element				Gross	Openings	Ne	tArea	U-value	ΑxU	K	-value	АхК	
Opening Type 2 Opening Heatloss Floor Heatloss Floor External Wall 1 External Roof 2 Total net area Fabric heat los	(Uw = 1.20 1 2 of externa s, W/K = S) il elements jum (A x U)	3 Aum (A, m2)	m2 378.5100 92.6200 100.7000	m2 80.7100 2.5900	80 1 56 118 297 90 100 746	m2 .7100 .7300 .8600 .1000 .7000 .8000 .0300 .7000 .6300 (26)(W/m2K 1.1450 0.9615 0.9615 0.1300 0.1300 0.1300 0.1300 0.1300 30) + (32) =	W/K 92.4160 1.6635 0.8269 7.2930 15.4310 50.6260 11.7039 13.0910 9	11 11 19	kJ/m2K 0.0000 0.0000 9.0000 9.0000 9.0000	kJ/K 6171.0000 13057.0000 56582.0000 810.2700 906.3000	(27) (27a) (28a) (28a) (29a) (30) (30) (31) (33)
Heat capacity C	m = Sum(A)	x k)						(28)	(30) + (32)	+ (32a).	(32e) =	77526.5700	(34)
Thermal mass pa List of Thermal	rameter (1 Bridges	MP = Cm / 2	TFA) in kJ/m	n2K				(/		. (, .		254.1855	(35)
Kl Elem E5 Grou E6 Inte E16 Cor E18 Par E2 Othe E3 Sill E4 Jamb	ent nd floor (rmediate f ner (norma ty wall be r lintels	normal) loor within l) tween dwel (including	n a dwelling lings other steel	g L lintels)				Le 33. 70. 37. 15. 50. 50. 135.	ngth Ps 0300 0000 6000 0000 0000 0000 0000 000	i-value 0.0400 0.0000 0.0200 0.0000 0.0180 0.0180 0.0050	Tot 1.32 0.00 0.74 0.00 0.90 0.90 0.90	al 212 200 200 200 200 200 250	
Thermal bridges Point Thermal b Total fabric he	(Sum(L x ridges at loss	Psi) calcu	lated using	Appendix K)				(33) + (36)	(36a) = + (36a) =	4.5362 12.0000 209.5875	(36) (36a) (37)
Ventilation hea (38)m Heat transfer c	t loss cal Jan 80.7612 oeff	culated mon Feb 77.7185	nthly (38)m Mar 77.7185	= 0.33 x (Apr 74.6757	25)m x (5) May 75.6900	Jun 71.6330	Jul 72.6473	Aug 70.6188	Sep 70.6188	Oct 73.6615	Nov 73.6615	Dec 76.7042	(38)
Average = Sum(3	290.3487 9)m / 12 =	287.3060	287.3060	284.2633	285.2775	281.2205	282.2348	280.2063	280.2063	283.2490	283.2490	286.2917 284.2633	(39)
HLP HLP (average) Days in mont	Jan 0.9520 31	Feb 0.9420 28	Mar 0.9420 31	Apr 0.9320 30	May 0.9353 31	Jun 0.9220 30	Jul 0.9254 31	Aug 0.9187 31	Sep 0.9187 30	Oct 0.9287 31	Nov 0.9287 30	Dec 0.9387 0.9320 31	(40)
4. Water heatin	g energy r	equirement:	s (kWh/year))									
Assumed occupan Hot water usage	cy for mixer	showers										3.1384	(42)
Hot water usage	96.0513 for baths	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 Average daily h	33.1674 for other 46.7707 ot water u	32.6748 uses 45.0699 se (litres	31.9811 43.3692 /dav)	30.7022 41.6684	29.7445 39.9677	28.6826 38.2669	28.1090 38.2669	28.7978 39.9677	29.5477 41.6684	30.6840 43.3692	31.9894 45.0699	33.0553 46.7707 161.8263	(42b) (42c) (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(/
Daily hot water Energy conte	use 175.9894 278.7241 (appual)	172.3526 245.4278	167.8547 257.9865	160.8505 220.1963	- 155.2221 208.9588	149.1473 183.3940	146.6911 177.4102	151.1682 187.1778	155.9072 192.2492	162.3004 220.2402 Total = S	169.4174 241.3662	175.5092 274.8050 2687 9362	(44) (45)
Distribution lo	ss (46)m	= 0.15 x (4	45)m 38 6980	33 0294	31 3438	27 5091	26 6115	28 0767	28 8374	33 0360	36 2049	41 2208	(46)
Water storage 1 Store volume a) If manufact Temperature f Enter (49) or (oss: urer decla actor from 54) in (55	ared loss fa Table 2b	actor is kno	own (kWh/da	ay):		2010220	2010/01	2010012			200.0000 1.4000 0.5400 0.7560	(47) (48) (49) (55)
Total Storage 1	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)
Primary loss Combi loss	23.4360 23.2624 0.0000	21.1680 21.0112 0.0000	r storage 23.4360 23.2624 0.0000	22.6800 22.5120 0.0000	23.4360 23.2624 0.0000	22.6800 22.5120 0.0000	23.4360 23.2624 0.0000	23.4360 23.2624 0.0000	22.6800 22.5120 0.0000	23.4360 23.2624 0.0000	22.6800 22.5120 0.0000	23.4360 23.2624 0.0000	(57) (59) (61)
WWHRS PV diverter Solar input FGHRS Output from w/h	11ed for W 325.4225 -80.5755 -0.0000 0.0000 0.0000	287.6070 -71.2616 -0.0000 0.0000 0.0000	ng calculate 304.6849 -74.6211 -0.0000 0.0000 0.0000	265.3883 -61.7892 -0.0000 0.0000 0.0000	255.6572 -57.5853 -0.0000 0.0000 0.0000	228.5860 -49.2762 -0.0000 0.0000 0.0000	224.1086 -46.1885 -0.0000 0.0000 0.0000	233.8762 -49.1169 -0.0000 0.0000 0.0000	237.4412 -50.9830 -0.0000 0.0000 0.0000	266.9386 -60.1033 -0.0000 0.0000 0.0000	286.5582 -68.0898 -0.0000 0.0000 0.0000	321.5034 -79.0833 -0.0000 0.0000 0.0000	(62) (63a) (63b) (63c) (63d)
Electric shower	244.8471	216.3453	230.0638	203.5991	198.0719	179.3099	177.9201	184.7593 Total pe	186.4582 r year (kWh/	206.8352 year) = S	218.4684 um(64)m =	242.4201 2489.0984	(64) (64)
Heat gains fr	0.0000	0.0000	0.0000	0.0000 Tota	0.0000 al Energy us	0.0000 ed by inst	0.0000 antaneous e	0.0000 lectric show	0.0000 er(s) (kWh/y	0.0000 ear) = Su	0.0000 m(64a)m =	0.0000 0.0000	(64a) (64a)
gaino 110m	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)

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	(calculate	d in Append	dix L, equat	tion 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 gai	ns (calcula	ted in Appe	endix L, eq	uation L13	or L13a), a	lso see Tab	le 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	l in Append:	ix L, equat:	ion L15 or	Ll5a), 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. ev	aporation (negative va	alues) (Tabi	le 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 (Tabl	.e 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 gai	ns												
[Jan]			А	nca m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data ble 6c	Acce fact Table	ss or 6d	Gains W	
Northeast Southeast Northwest Northeast Northwest			14.2 30.0 35.5 0.8 0.8 1.7	600 700 600 200 600 300	13.7804 43.0593 43.0593 13.7804 22.2520 32.0000		0.5700 0.5700 0.5700 0.5700 0.6400 0.6400	0 0 0 0 0 0	.7000 .7000 .7000 .7000 .7000 .7000	0.77 0.77 0.77 1.00 1.00	00 00 00 00 00 00	54.3360 358.0192 423.3842 3.1245 7.7159 22.3212	(75) (77) (79) (81) (82) (82)
Solar gains Total gains	868.9010 1921.9541	1320.1561 2369.5776	1864.3884 2878.2597	2558.3171 3508.1415	2811.6971 3695.2683	3095.0761 3920.0188	2858.4760 3649.4726	2579.3582 3375.2231	2211.7669 3042.1731	1544.9609 2435.4509	1004.9710 1966.4488	715.6515 1738.4133	(83) (84)
7. Mean inte	rnal tempera	ture (heati	ng season)										
Temperature Utilisation	during heati factor for g	ng periods ains for li	in the livi ving area,	ng area fro nil,m (see	m Table 9, Table 9a)	Thl (C)						21.0000	(85)
tau alpha util living	Jan 74.1700 5.9447	Feb 74.9555 5.9970	Mar 74.9555 5.9970	Apr 75.7578 6.0505	May 75.4885 6.0326	Jun 76.5775 6.1052	Jul 76.3023 6.0868	Aug 76.8547 6.1236	Sep 76.8547 6.1236	Oct 76.0291 6.0686	Nov 76.0291 6.0686	Dec 75.2210 6.0147	
util living	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 Non living 24 / 16 24 / 9 16 / 9 MIT Th 2	20.6083 19.6500 0 30 1 20.9928 20.1236	20.6647 19.7295 0 28 20.8101 20.1320	20.7418 19.8245 0 31 20.8538 20.1320	20.8174 19.9175 0 0 20.8174 20.1404	20.8405 19.9360 0 20.8405 20.1376	20.8472 19.9529 0 20.8472 20.1488	20.8469 19.9496 0 20.8469 20.1460	20.8478 19.9564 0 20.8478 20.1516	20.8461 19.9555 0 0 20.8461 20.1516	20.8043 19.9092 0 0 20.8043 20.1432	20.6971 19.7816 0 11 20.7453 20.1432	20.5989 19.6486 0 31 20.7729 20.1348	(87) (88)
MIT 2 Living area MIT Temperature adjusted MIT	0.9952 20.1168 fraction 20.3928 adjustment 20.3928	0.9837 19.9543 20.2240 20.2240	0.9358 19.9963 20.2664 20.2664	0.7674 19.9175 20.2010 20.2010	0.5584 19.9360 20.2210 20.2210	0.3190 19.9529 20.2347 20.2347	0.2124 19.9496 20.2324 20.2324	0.2284 19.9564 20.2373 20.2373	0.4719 19.9555 fLA = 20.2361 20.2361	0.8506 19.9092 Living are 20.1912 20.1912	0.9834 19.8557 a / (4) = 20.1360 20.1360	0.9972 19.9202 0.3151 20.1889 0.0000 20.1889	(89) (90) (91) (92) (93)
8. Space hea	ting require	ment											
Utilisation Useful gains Ext temp. Heat loss re	Jan 0.9957 1913.6071 5.4000	Feb 0.9842 2332.1002 5.9000	Mar 0.9384 2700.9598 7.5000	Apr 0.7705 2703.0003 9.9000	May 0.5642 2085.0055 12.8000	Jun 0.3251 1274.3448 15.7000	Jul 0.2190 799.3285 17.4000	Aug 0.2355 794.9401 17.4000	Sep 0.4794 1458.4057 15.0000	Oct 0.8531 2077.6707 11.7000	Nov 0.9834 1933.7762 8.3000	Dec 0.9972 1733.5584 5.4000	(94) (95) (96)
Space bestin	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 heatin Solar beatin	1815.0199 Ig requiremen	1198.3490 it - total p	719.3859 er year (kW	162.1479 M/year)	23.8326	0.0000	0.0000	0.0000	0.0000	243.6290	1021.5004	1860.2733 7044.1380	(98a)
Solar heatin	0.0000 g contributi	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)

 Space heating kWh
 1815.0199
 1198.3490
 719.3859
 162.1479
 23.8326
 0.0000
 0.0000
 0.0000
 243.6290
 1021.5004
 1860.2733
 (98c)

 Space heating requirement after solar contribution - total per year (kWh/year)
 0.0000
 0.0000
 0.0000
 243.6290
 1021.5004
 1860.2733
 (98c)

 Space heating per m2
 (98c) / (4) =
 23.0955
 (99)

9a. En	a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11) 0 Fraction of space heat from main system(s) 1 Efficiency of main space heating system 1 (in %) 3500 Efficiency of main space heating system 2 (in %) 0 Efficiency of secondary/supplementary heating system, % 0											0.0000 1.0000 350.3792 0.0000 0.0000	(201) (202) (206) (207) (208)		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space	heating	requirement	t											
_		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 heat	ing system l	.)									
_		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 sys	stem)										
		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 heat)	ing 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 sys	stem 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 (secon	ndary)											
		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						
244.8471 216.3453 230.0638 203.5991 198.0719 179.3099 177	7.9201 184.7593	186.4582	206.8352	218.4684	242.4201	(64)
(217) m 186.8129 186.8129 186.8129 186.8129 186.8129 186.8129 186.8129 186.8129 186.8129	6.8129 186.8129	186.8129	186.8129	186.8129	186.8129	(217)
ruer for water heating, kwn/month 131.0654 115.8086 123.1520 108.9856 106.0269 95.9837 95	5.2397 98.9008	99.8101	110.7179	116.9451	129.7663	(219)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Lighting 59.9897 48.1260 43.3321 31.7470 24.5223 20.0349 22	2.3700 29.0774	37.7687	49.5546	55.9718	61.6570	(232)
(233a)m -157.5457 -233.3835 -396.8437 -538.3885 -606.7410 -624.2364 -600	0.3910 -545.3205	-443.9675	-307.0864	-179.7528	-126.7420	(233a)
(234a)m 0.00000 0.00000 0.000000	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Liectricity 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	0.0000	(235a)
Lectricity used or net electricity generated by micro-CHP (Appendix N) (negative in (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)
(233b)m -1.4392 -4.9283 -20.1322 -66.5530 -108.8971 -146.9153 -132	2.2458 -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)
Liectricity 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 in (235d)m 0.00000 0.00000 0.0000 0.0000 0.00000 0.0000 0.000000	f net generation) 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - main system l					2010.4329	(211)
Space heating fuel – main system 2 Space heating fuel – secondary					0.0000	(213) (215)
Efficiency of water heater Water heating fuel used					186.8129 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) Total electricity for the above, kWh/year					1169.2891 1169.2891	(230a) (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 Hydro-electric generation (Appendix N)					0.0000	(234) (235a)
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features					0.0000	(235)
Energy saved or generated Energy used					-0.0000	(236) (237)
Total delivered energy for all uses					-417.1827	(238)
10a. Fuel costs - using BEDF prices (536)						
10a. Fuel costs - using BEDF prices (536)	Fuel	1	Fuel price		Fuel cost	
10a. Fuel costs - using BEDF prices (536) 	Fuel kWh/year 2010.4329	1	Fuel price p/kWh 25.1600		Fuel cost £/year 505.8249	(240)
10a. Fuel costs - using BEDF prices (536) 	Fuel kWh/year 2010.4329 1332.4021	1	Fuel price p/kWh 25.1600 25.1600		Fuel cost £/year 505.8249 0.0000 335.2324	(240) (473) (247)
10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot	Fuel kWD/year 2010.4329 1332.4021 0.0000 1169.2891	1	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600		Fuel cost £/year 505.8249 0.0000 335.2324 0.0000 294.1931	(240) (473) (247) (247a) (249)
10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instanaeous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516	1	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600		Fuel cost £/year 505.8249 0.0000 335.2324 0.0000 294.1931 121.8126 0.0000	(240) (473) (247) (247a) (249) (250) (251)
10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516	1	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600		Fuel cost £/year 505.8249 0.0000 335.2324 0.0000 294.1931 121.8126 0.0000	(240) (473) (247) (247a) (249) (250) (251)
10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595	1	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100		Fuel cost £/year 505.8249 0.0000 335.2324 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428	(240) (473) (247) (247a) (249) (249) (250) (251)
10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instananeous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity exported Total Total energy cost	Fuel kWD/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595	1	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100		Fuel cost £/year 505.8249 0.0000 335.3224 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039	(240) (473) (247) (247) (242) (250) (251) (251) (252) (255)
10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instanaeous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595	1	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100		Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 21.4039	(240) (473) (247) (247a) (250) (251) (251) (252) (255)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595	1	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100		Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039	(240) (473) (247) (247a) (249) (250) (251) (251) (252) (255)
10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instananeous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP	Fuel kWD/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595	1	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100		Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039	(240) (473) (247) (249) (250) (251) (251) (252) (255)
10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instanaeous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP	Fuel kWh/year 2010.4329 1322.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100		Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 21.4039 Emissions	(240) (473) (247) (249) (250) (251) (251) (252) (255)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instananeous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 653.0595 Energy kWh/year 2010.4329	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 5.8100	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions cg C02/year 318.1091	(240) (473) (247) (247a) (250) (251) (251) (252) (255)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel)</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 ion factor kg C02/kWh 0.1582 0.1407	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions rg C02/year 318.1091 0.0000 127.5274	(240) (473) (247) (249) (250) (251) (252) (255) (255) (255) (261) (373) (264)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instananeous electric shower(s) Pumps, fans and electric keep-hot Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot</pre>	Fuel kWh/year 2010/429 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 5.8100 ion factor kg C02/kWh 0.1582 0.1407 0.1387	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions cg CO2/year 318.1091 0.0000 187.5274 505.6365 162.1948	(240) (473) (247) (249) (250) (251) (252) (255) (255) (255) (261) (261) (265) (267)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instanaeous electric shower(s) Pumps, fans and electric keep-hot Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Pumps, fans and electric keep-hot Pumps, fans and electric keep-hot</pre>	Fuel kWh/year 2010.4329 1322.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891 484.1516	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 5.8100 ion factor kg CO2/kWh 0.1582 0.1407 0.1387 0.1443	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions rg CO2/year 318.1091 0.0000 187.5274 505.6365 162.1948 69.8780	(240) (473) (247) (247a) (250) (251) (251) (252) (255) (255) (255) (261) (263) (264) (267) (268)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instananeous electric shower(s) Pumps, fans and electric keep-hot Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy for lighting Fuel cost = 1 Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling Pumps, fans and electric keep-hot Energy saving/generation technologies PV Unit electricity used in dwelling Pumps, fans and electric keep-hot Energy saving/generation technologies PV Unit electricity used in dwelling Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 25.1600 5.8100 0.1582 0.1407 0.1387 0.1443 0.1317	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 -37.9428 -1235.6591 21.4039 Emissions rg C02/year 318.1091 0.0000 187.5274 505.6365 162.1948 69.8780 -627.1748	(240) (473) (247) (247a) (250) (251) (251) (252) (255) (255) (255) (261) (264) (265) (267) (268)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instananeous electric shower(s) Pumps, fans and electric keep-hot Energy for lighting Additional standing charges Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total core in the fuel of the fuel of</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891 484.1516 -4760.3990 -653.0595	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 5.8100 ion factor kg C02/kWh 0.1582 0.1407 0.1387 0.1443 0.1317 0.1143	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions rg C02/year 318.1091 0.0000 187.5274 505.6365 162.1948 69.8780 -627.1748 -74.640 -70.18149	(240) (473) (247) (247) (250) (251) (252) (252) (255) (255) (267) (266) (267) (268) (269)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling Pumps, fans and electric keep-hot Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Cotal CO2, kg/year</pre>	Fuel kWh/year 2010.482 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891 484.1516 -4760.3990 -653.0595	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 25.1600 5.8100 0.1582 0.1407 0.1387 0.1443 0.1317 0.1143	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions cg CO2/year 318.1091 0.0000 187.5274 505.6365 162.1948 69.8780 -627.1748 -74.6400 -701.8149 35.8945	(240) (473) (247) (249) (250) (251) (252) (255) (255) (255) (267) (268) (267) (269) (272)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Energy for lighting Additional standing charges Energy saving/generation technologies FV Unit electricity used in dwelling FV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy saving/generation technologies FV Unit electricity weep-hot Energy saving/generation technologies FV Unit electricity used in dwelling PV mont electricity exported Total CO2, kg/year Space heating (other fuel) Space heating (other fuel) Space heating (other fuel) Space and water heating Energy saving/generation technologies FV Unit electricity exported Total CO2, kg/year Space heating (other fuel) Space heating (other fuel)</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 5.8100 ion factor kg CO2/kWh 0.1582 0.1407 0.1387 0.1443 0.1317 0.1143	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions rg CO2/year 318.1091 0.0000 187.5274 4.505.6365 162.1948 69.8780 -627.1748 -74.6400 -701.8149 35.8945	(240) (473) (247) (247a) (250) (251) (252) (255) (255) (255) (255) (264) (267) (268) (267) (268) (269) (272)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Mater heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy saving/generation technologies FV Unit electricity used in dwelling FV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Fumps, fans and electric keep-hot Energy saving/generation technologies FV Unit electricity used in dwelling Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Fumps, fans and electric keep-hot Energy saving/generation technologies FV Unit electricity used in dwelling FV Unit electricity used in dwelling FV Unit electricity used in dwelling FV Unit electricity exported Total CO2, kg/year 13a. Primary energy - Individual heating systems including micro-CHP</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891 484.1516 -4760.3990 -653.0595	Emiss	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 25.1600 5.8100 0.1810 0.1582 0.1407 0.1387 0.1443 0.1317 0.1143	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions gr C02/year 318.109 0.0000 187.5274 505.6365 162.1948 69.8780 -627.1748 -74.6400 -701.8149 35.8945	(240) (473) (247) (247a) (250) (251) (251) (252) (255) (255) (265) (266) (266) (268) (268) (269) (272)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy saving/generation technologies FV Unit electricity used in dwelling FV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy saving/generation technologies FV Unit electricity used in dwelling Pumps, fans and electric keep-hot Energy saving/generation technologies FV Unit electricity used in dwelling PU mit electricity used in dwelling PU mit electricity used in dwelling PU Unit electricity energy - Individual heating systems including micro-CHP 13a. Primary energy - Individual heating systems including micro-CHP</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891 484.1516 -4760.3990 -653.0595	Emiss.	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 25.1600 5.8100 0.1582 0.1407 0.1387 0.1443 0.1317 0.1143	Prim	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions rg C02/year 318.1091 0.0000 187.5274 505.6365 162.1948 69.8780 -627.1748 -74.640 -701.8149 35.8945	(240) (473) (247) (247) (250) (251) (252) (252) (255) (255) (267) (268) (267) (268) (269) (272)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Fumps, fans and electric texp-hot Energy saving/generation technologies FV Unit electricity used in dwelling FV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Mater heating (other fuel) Space and water heating FV Unit electricity used in dwelling FV Unit electricity exported Total CO2 associated with community systems Mater heating (other fuel) Space and water heating Energy saving/generation technologies FV Unit electricity used in dwelling FV Unit electricity used in dwelling FV Unit electricity exported Total Total CO2, kg/year 13a. Primary energy - Individual heating systems including micro-CHP Space heating - main system 1 Space heating - m</pre>	Fuel kWh/year 2010.4229 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891 484.1516 -4760.3990 -653.0595 	Emiss T	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 25.1600 5.8100 0.1582 0.1407 0.1387 0.1443 0.1317 0.1443 0.1317 0.1143	k	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions cg CO2/year 318.1091 0.0000 187.5274 505.6365 162.1948 69.8780 -627.1748 -74.6400 -701.8149 35.8945	(240) (473) (247) (247) (250) (251) (252) (252) (255) (255) (267) (268) (269) (269) (272) (272)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Fumps, fans and electric keep-hot Energy saving/generation technologies FV Unit electricity used in dwelling FV Unit electricity exported Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating FV Unit electricity used in dwelling FV Unit electricity exported Total CO2 associated with community systems Water heating (other fuel) Space and water heating Fumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies FV Unit electricity used in dwelling FV Unit electricity used in dwelling FV Unit electricity exported Total Total CO2, kg/year 1a. Primary energy - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Space heating - main system 1 Total CO2 associated with community systems Space heating - main system 1 Total CO2 associated with community systems Space heating - main system 1 Total CO2 associated with community systems Space heating - main system 1 Total CO2 associated with community systems Space heating - main system 1 Total CO2 associated with community systems Space heating - main system 1 Total CO2 associated with community systems Space heating - main system 1 Total CO2 associated with community systems Space heating - main system 1 Total CO2 associated with community systems Space heating (other fuel)</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329	Emiss Primary ene	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 25.1600 5.8100 0.1582 0.1407 0.1582 0.1407 0.1387 0.1443 0.1317 0.1143 0.1317 0.1143	k	Fuel cost £/year 505.6249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions cg CO2/year 318.1091 0.0000 187.5274 505.6365 162.1948 69.8780 -627.1748 -74.6400 -701.8149 35.8945	(240) (473) (247) (247) (250) (251) (251) (252) (255) (255) (255) (267) (268) (269) (272) (275) (473) (278)
<pre>10a. Fuel costs - using BEDF prices (536) Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Energy for instantaneous electric shower(s) Pumps, fans and electric keep-hot Energy soving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total energy cost 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity used in dwelling PV Unit electricity water heating Pumps, fans and electric keep-hot Iotal CO2, kg/year Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Pumps, fans and electric keep-hot</pre>	Fuel kWh/year 2010.4329 1332.4021 0.0000 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891 484.1516 -4760.3990 -653.0595 Energy kWh/year 2010.4329 1332.4021 1169.2891	Emiss Primary ene	Fuel price p/kWh 25.1600 25.1600 25.1600 25.1600 25.1600 25.1600 5.8100 25.1600 5.8100 0.1582 0.1407 0.1387 0.1443 0.1317 0.1143 0.1143 0.1143 0.1143	k Prim	Fuel cost £/year 505.8249 0.0000 294.1931 121.8126 0.0000 -1197.7164 -37.9428 -1235.6591 21.4039 Emissions rg CO2/year 318.1091 0.0000 187.5274 69.8780 -627.1748 -74.6400 -701.8149 35.8945 ary energy KWh/year 3187.9602 0.0000 2025.7997 5213.7600 1768.9005	(240) (473) (247) (247a) (250) (251) (252) (255) (255) (255) (255) (267) (268) (267) (268) (267) (268) (272) (275) (277) (278) (279) (281)

-4760.3990 -653.0595 -7077.5070 -273.4820 -7350.9890 (283)

1.4867 0.4188

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 he recommend measures r all provided on the next page have been installed. A higher sco sents a more energy efficient dwelling with lower fuel bills. Most energy efficient - lower running costs CURRENT POTENTIAL 97 А (92 plus) 97 В (81-91) C (69-80) (55-68)(39-54)F (21-38) (1-20)Least ene efficient - hig r running costs



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 transmi	Average thermal transmittance 0.17 W/m ² K					
Roof	Average thermal transmi	ttance 0.13 W/m²K		Very Good			
Floor	Average thermal transmi	Average thermal transmittance 0.13 W/m ² K					
Windows	ndows High performance glazing						
Main heating	Air source heat pump, ra	diators and und		Good			
Main heating controls	Time and temperature z	contro		Very Good			
Secondary heating	None						
Hot water	From main sys m, wast	e w eat recovery		Good			
Lighting	g Excelent ting effic y			Very Good			
Air tightness	Air perme 50] =	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.

0.0

The	estimated	СО	emissions	for	this	dwellings	is:	
-----	-----------	----	-----------	-----	------	-----------	-----	--

per year



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 d with the omp 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	GO

Estimated energy use and potential



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									

Accreditation scheme contact details									
Accreditation scheme	Elmhurst Ene y Systems L								
Telephone									
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							





Property Reference	8 Druid S	toke Avenue						lssu	ied on Da	te	02/02	/2024	
Assessment Reference	8 Druid Stoke Prop Type Ref												
Property	8, Druid S	Stoke Avenue, B	ristol, Avon, BS9 1DD)									
SAP Rating			97 A	DER		0.66	;		TER		11	.70	
Environmental			99 A	% DEF	R < TER						94	.36	
CO ₂ Emissions (t/year)			0.04	DFEE		47.2	1		TFEE		50	.52	
Compliance Check			See BREL	% DFE	E < TFE	E					6.5	56	
% DPER < TPER			89.37	DPER		6.58			TPER		61	.91	
Assessor Details Ms.	Laura Me	ehan							Assess	or ID	Z7	62-000 ⁻	1
Client Kat	hy Ashby, I	Kathy Ashby											
SUMMARY FOR INPUT DAT	A FOR:	New Build (A	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	1									
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													
			Basemer	Hea nt:	t Loss F 33.08	Perimete m	r Int	ernal F 56.1	Floor Area 0 m ²	n A	verage	2.99 m	Height
			1st Store	у: у:	40.43	m		74.1	0 m ²			3.20 m 3.20 m	
8.0 Living Area			96.10						m²				
9.0 External Walls													
Description Type	С	onstruction		U-Value (W/m²K	e Kappa) (kJ/m²K)	Gross Area(m ²)	Nett Area (m²)	Shelter Res	Shelt	er ()pening:	s Area C T	alculation ype
External Wall 1 Cavity W	all C ca	avity wall : dense pla avity, any outside str	aster, dense block, filled ructure	0.17	190.00	378.51	297.80	0.00	None	9	80.71	Enter G	Gross Area
9.1 Party Walls													
Description Ty	pe	Construc	tion				U-Value (W/m ² K)	Kapp (kJ/m ²	a Area K) (m²)	She Re	lter es	She	lter
Party Wall 1 So	lid Wall	Dense pla fill	aster both sides, dense	e blocks,	cavity or	cavity	0.00	180.0	0 40.00)		No	ne
10.0 External Roofs													
Description Type		Construction		L	l-Value N/m²K)(Kappa k.l/m²K)/	Gross Area(m²)	Nett Area	Shelter Code	Shelte Factor	r Calcu	ulationC	penings
External Roof 1 Extern	nal Plane	Plasterboard	insulated at ceiling lev	vel (*	0.13	9.00	92.62	(m ²)	None	0.00	Enter	Gross	2 59
Roof 2 External Roof 2 External		Plasterboard,	insulated flat mof		0.10	0.00	100.70	100.00	None	0.00	A	rea	0.00
External Roor 2 Extern	iai rial	Flasterboard,	insulated hat tool		0.15	9.00	100.70	100.70	None	0.00	A	rea	0.00
Root													
11.0 Heat Loss Floors		Stores Index	Construction				Value	6 1-	Hor Cod-		holter	Kanaa	Area (
11.0 Heat Loss Floors Description Type Heatloss Floor 1 Ground	Floor - Solid	Storey Index	Construction	over insulat	ion	U (V	-Value //m²K) 0 13	She	iter Code None	e I	Shelter Factor	Kappa (kJ/m²K) 110.00	Area (m²)
Iteat Loss Floors Description Type Heatloss Floor 1 Ground Heatloss Floor 2 Ground	Floor - Solid Floor - Solid	Storey Index Basement Lowest occupied	Construction Slab on ground, screed Slab on ground, screed	over insulat over insulat	ion ion	U (V	Value //m² K) 0.13 0.13	She	lter Code None None	e I	Shelter Factor 0.00 0.00	Kappa (kJ/m²K) 110.00 110.00	Area (m²) 56.10 118.70
11.0 Heat Loss Floors Description Heatloss Floor 1 Heatloss Floor 2 Ground 12.0 Opening Types Description Data	Floor - Solid Floor - Solid Source	Storey Index Basement Lowest occupied	Construction Slab on ground, screed Slab on ground, screed Glazing	over insulat over insulat	ion ion	U (V	Value //m²K) 0.13 0.13 ng Filli	She ng G	liter Code None None	Frame	Shelter Factor 0.00 0.00	Kappa (kJ/m²K) 110.00 110.00	Area (m²) 56.10 118.70



Opening Type 3 Ma	anufacturer	Roof Light		Triple Low-E Hard 0).2			0.64	0.70	1.00
13.0 Openings										
Name Opening Opening Opening Opening Opening Opening	Opening Typ Opening Typ Opening Typ Opening Typ Opening Typ Opening Typ Opening Typ	pe le 2 le 2 le 2 le 3 le 3 le 3 le 2	1 6 6 6 6	Location External Wall 1 External Wall 1 External Wall 1 External Roof 1 External Roof 1 External Wall 1		Orient South North South North North North	tation West East East West East West	Area (m²) 35.56 14.26 30.07 1.73 0.86 0.82	Pit (3	t ch 0 00
14.0 Conservatory				None						
15.0 Draught Proofing			1	100				%		
16.0 Draught Lobby			1	No						
17.0 Thermal Bridging			(Calculate Bridges]		
Bridge Type E5 Ground floor (normal) E6 Intermediate floor within a E16 Corner (normal) E18 Party wall between dwell E2 Other lintels (including oth E3 Sill E4 Jamb	i dwelling lings ner steel lintel	s) (Sour Gov A Gov A Gov A Gov A Gov A Gov A	ce Type Approved Scheme Approved Scheme Approved Scheme Approved Scheme Approved Scheme Approved Scheme Approved Scheme	Length 33.03 70.00 37.00 15.60 50.00 50.00 135.00	Psi 0.04 0.00 0.02 0.00 0.02 0.02 0.02	Adjusted R 0.04 0.00 0.02 0.00 0.02 0.02 0.02 0.02	eference:		Imported No No Yes No No No
Y-value			C	0.01				W/m²K		
18.0 Pressure Testing Designed AP ₅₀			۱ 3	Yes 3.00				m³/(h.m²) @ 50 Pa		
Test Method			E	Blower Door]		
Mechanical Ventilation Mechanical Ventilation Approved Installation Mechanical Ventilation Type MV Reference Number Configuration Manufacturer SFP Duct Type MVHR Efficiency Wet Rooms SFP from Installer Com	System Prese data Type missioning C	ent	\ [2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Yes No Database Balanced mechanical ven 500142 2 2. 0.71 Rigid 38.00 2 No	tilation with he	eat recove	ery			
MVHR System Location				nside heated envelope (i	nstalled exclus	sively)				
Duct Installation Specifi	cation			_evel 1		-11				
20.0 Fans, Open Fireplaces. Flu	ues									
21.0 Fixed Cooling System			1	No						
22.0 Lighting No Fixed Lighting			1	No Name Ef Lighting 1 S	fficacy 93.75	Pc	ower 8	Capacity 750	Co	ount 15
24.0 Main Heating 1 Percentage of Heat			[Database				%		
Database Ref. No.			1	104638						
Fuel Type			E	Electricity						
In Winter			3	349.69]		
In Summer			1	186.83]		
Model Name			E	Ecodan 6.0 kW]		



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 1 Heat source 2 Heat source 3 Heat source 4 Heat source 5	lse Efficiency Percentage Of Heat Heat Elec Heat Power Ratio	ctrical Fuel Factor Efficiency type
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 Typ	e Flow Rate Rated Power C [l/min] [kW]	Connected Connected To
28.3 Waste Water Heat Recovery System		
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
Pines insulation	Fully insulated primary pinework	-

No

None

One Dwelling

In Airing Cupboard

31.0 Thermal Store

32.0 Photovoltaic Unit



J	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oc	t Nov	Dec
34.0 Sma	all-scale Hy	/dro			None							
	6.00		South West	30°				Yes	1.00		Reference	
	PV Cells k	Wp	Orientation	Elevation	n Ove	rshading	FGHRS	MCS Certificate	Overs Facto	shading r	MCS Certificate	Panel Manufacturer
Batter	ry Capacity	[kWh]			9.60							
Divert	ter				No							
Conne	ected To D	welling			Yes							
Expor	rt Capable I	Meter?			Yes							

Recommendations

Lower cost measures None

Further measures to achieve even higher standards

Turied Cost	Torrigal and the second	Ratings after improvement				
Typical Cost	Typical savings per year	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: Date of assessment: Produced by: Total floor area: DRRN: House, Detached 02/02/2024 Laura Meehan <u>3</u>05 m²

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.



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. 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 <Unspecified>

Location (easting/northing) 355956/176215

Created 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.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. https://flood-map-for-planning.service.gov.uk/os-terms



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Appendix C Broadband



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

Home (/) View broadband availability (/en-gb/broadband-coverage)

View mobile availability (/en-gb/mobile-coverage)

About the mobile and broadband checker (/en-gb/about-checker)

View broadband availability Use of this checker is subject to Ofcom's terms of use (https://www.ofcom.org.uk/aboutofcom/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 19 Mbps (Megabits per 1 Mbps (Megabits per Standard second) second) 80 Mbps (Megabits per 20 Mbps (Megabits per

second)

second)

Superfast



Feedback

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