
Bury Old Road, Heywood

Energy Standards Statement

Proposed Development of 28 New Build Dwellings @ Bury Old Road, Heywood,
Rochdale

14 June 2024

Watt Energy & Consulting Engineers Ltd
40 King Street, Manchester, M2 6BA

t. 0161 43 43 103
w. www.wece.co.uk
e. office@wece.co.uk

watt 
Energy & Consulting Engineers

Issue Control

Director

Daniel Watt



Sustainability Consultant

Jude Darnborough

First Issue Date	Revision Issue Date	Issue Revision	Issued By
14 Jun. 24	-	-	AA

Document Disclaimer

© Watt Energy & Consulting Engineers Ltd (WE&CE) own the copyright in this report and it has been written for the sole and confidential use of the client showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. It is not intended for and should not be relied upon by any third party. Any such party relies on this report at their own risk. No part of this report may be copied or duplicated without the express permission of WE&CE and the party for whom it was prepared.



Index

1	Executive Summary	4
2	Planning Statement	6
2.1	The Site and Proposed Development	6
2.2	Relevant Policies and Guidance	8
2.2.1	Local Planning Policy	8
2.2.1.1	Rochdale Core Strategy	8
2.2.2	National Planning Policy	11
2.3	Sustainable Design Strategy	11
2.3.1	Energy and Carbon Emissions	11
2.3.2	Choice and Impact of Renewable Technology	14
2.3.3	Energy and CO ₂ Reduction Summary	15
3	Feasibility Assessment of Renewable Energy and Low Carbon Technologies	19
4	Conclusion	22
5	Appendices	23

1 Executive Summary

This Energy Standards Statement has been prepared by Watt Energy on behalf of BTP Architects to support a planning application for the development at Bury Old Road, Heywood. The statement specifically addresses the following Rochdale Borough Council (RBC) approved climate change planning policies, as stipulated in the Rochdale Core Strategy (October 2016):

- **Core Strategy Policy G1- Tackling and adapting to Climate Change**
- **Core Strategy Policy G2 – Energy and New Development**
- **Core Strategy G3 – Renewable and Low Carbon Developments**

The development was initially assessed under Part L1a 2013 and to address the Rochdale Borough Council policy which pre-dates the recent update to part L of the Building Regulations. As the development will now be subject to being constructed under the new Part L 2021 Building Regulations, and the Rochdale Borough policies were written prior to these coming into force, the initial Energy Statement (ref: 8091 rev B) can be considered superseded. This revised Energy Statement assesses the development in the context of the current Building Regulations (Part L 2021) which provides a significant betterment when compared to the previous requirements in respect to energy efficiency and CO₂ reduction. Compliance with the new regulations typically requires the incorporation of renewable technologies, to achieve this and therefore satisfies by default the Councils low carbon and energy policies.

The statement details how the development will incorporate sustainable design and resource efficiency in line with the Energy Hierarchy, so to meet the policy requirements and council targets whilst reducing its overall environmental impact. The methodology and calculations are consistent with the RBC Appendix A EN6 Energy Target Explanation, and all figures used within this report have been based on the most recent issue of drawings and modelled using SAP 10.2 to accurately predict Energy Usage and CO₂ reductions.

Following the LZC feasibility assessment, it is proposed that the development will also benefit from an ASHP that will be implemented to each dwelling.

As a result of the above the predicted site wide reduction in CO₂ over Part L 2013 of the Building Regulations can be summarised as:

- **60.5%** with SAP 10.2 carbon factors

This statement also examines how the design, specification and characteristics of the proposal will contribute to sustainability and meet the relevant objectives outlined within the National Planning Policy Framework (NPPF) 2021, in addition to the RBC approved core strategy planning policies outlined above. The sustainability measures assessed included:

- Flood Risk Zone
- Green and Blue Infrastructure
- Sustainable Drainage Systems (SUDs)
- Biodiversity / Ecology
- Internal Water Efficiency
- Waste Management
- Materials
- Pollution Control
- Health and Wellbeing
- Sustainable Transport

The development therefore complies with all RBC's current and future policy requirements relating to creating a sustainable development.

In relation to the planning target centred around carbon emissions reduction, the proposed development is achieving a **60.5%** reduction in these emissions, over the Part L1 2022 of the Building Regulations. This surpasses all of RBC's planning targets and therefore allows compliance to be reached.

2 Planning Statement

The following statement relates to the proposed residential development on a portion of Old Bury Road in Heywood.

2.1 The Site and Proposed Development

The sites are located north of the centre of Manchester, within Heywood. The site occupies approximately 0.52 hectares of land. A plan, illustrating both seen in Figure 1 (shown later in this subsection).

Site One, which consists of 22 residential units, is bounded to the north by Bury Old Road, Sutherland Road to the west and is adjacent to 'Our Lady and St Paul's Roman Catholic Primary School'. The current use of the site is open space. The quality of the space is poor and is under-utilised. The area is fenced and not accessible by the public.

Site Two, made up of 6 residential units is bounded to the south and by Aryle Street and Lennox Walk to the east. The site is currently an open space that is not accessible to the public and is currently underutilised.

The proposal is for a residential development consisting of 28 new build houses, across two sites in proximity. The houses will be including a mix of detached and semi-detached houses of which are either two- or three-bedroom units.



Figure 1: Site Plan

2.2 Relevant Policies and Guidance

2.2.1 Local Planning Policy

2.2.1.1 Rochdale Core Strategy

Rochdale's Core Strategy was adopted on 19 October 2016. It's the lead document in the Local Plan is the key Development Plan Document (DPD) guiding the measures assessed in this report.

G21- Tackling and Adapting to Climate Change

G1 - Tackling and adapting to climate change

We will address climate change and ensure growth does not increase CO2 emissions by:

- Locating growth in areas which are likely to minimise the need for travel and which are well served by public transport, services and infrastructure;
- Expecting all development and regeneration schemes to be well connected to surrounding areas and facilities by sustainable means of transport (Policy T2);
- Encouraging and promoting renewable energy developments, including standalone and community developments, that do not, by virtue of their scale, siting, construction or operation, cause harm to the local area, its character and environmental assets and adjoining uses, which cannot be satisfactorily mitigated (Policy G3);
- Promoting the efficient re-use of buildings, especially those of heritage value, and the recycling of construction waste;
- Ensuring that development does not cause unacceptable harm to the borough's peatlands and woodlands, and encouraging their restoration and responsible management;
- Promoting sustainable waste management through the operation of policies in the Core Strategy and Greater Manchester Joint Waste Plan;
- Making the best use of open space to contribute to climate change mitigation and adaptation; and
- Securing planning obligations for energy infrastructure and climate change adaptation measures.

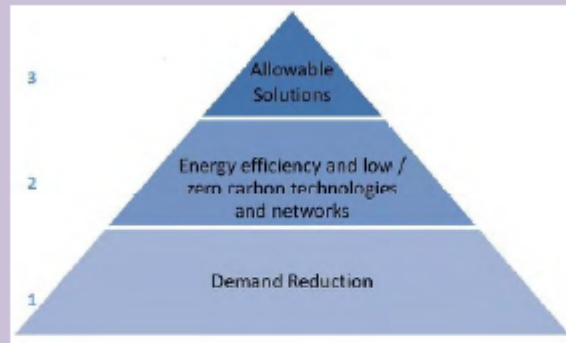
New developments will be expected to:

- a. Be zero carbon in line with national targets and definitions;
- b. Adhere to the 'energy hierarchy' as outlined in policy G2, being designed in such a way that ensures that buildings require the minimum amount of energy to function over their lifetime;
- c. Reduce CO2 emissions through the use of renewable and low carbon decentralised energy technologies and networks. This will be through both on-site provision in new developments and through connection to local networks;
- d. Address the impacts of climate change by incorporating comprehensive adaptation measures, including:
 - i. suitable measures, such as urban greening, for tackling the 'urban heat island' effect;
 - ii. where possible, the opening up of covered and culverted sections of waterways and provision of new water features, to help cooling and provide biodiversity, landscape and flood prevention benefits;
 - iii. the incorporation of appropriate water conservation and management measures, such as Sustainable Drainage Systems (SuDS), including ensuring that the rate of run-off on 'greenfield' sites is not increased and on 'brownfield' sites is significantly reduced, and avoiding the use of impermeable surfaces;
 - iv. the retention of existing trees wherever possible and the taking of all appropriate opportunities to plant trees and other suitable vegetation on site; and
 - v. the incorporation of 'green roofs' wherever possible, such as with flat roofs.

G2 – Energy and New Development

G2 - Energy and new development

All new development will be expected to adhere to the following energy hierarchy to the extent that policy G2 reflects national policy, targets and requirements for that type of development:



1. **Demand Reduction** – Achieve the maximum possible reduction in demand for energy through building design (i.e. the use of passive systems). At the design stage of new developments, every effort should be made to ensure that buildings use as little energy as possible throughout their lifetimes, using siting, orientation, layout, construction and landscaping to optimise use of natural passive systems such as solar gain and natural lighting, shading, ventilation and cooling to minimise heating, cooling and lighting demands. Green roofs and green walls should be incorporated into developments wherever feasible.
2. **Energy efficiency and low / zero carbon technologies and networks** – Design to maximize energy efficiency, and use on-site or linked low or zero carbon technologies or direct connection to a low or zero carbon heat source (not necessarily on-site).
3. **'Allowable solutions'** – use wider energy efficiency / CO2 reduction measures, which could include developer contributions, to compensate for 'residual emissions' not addressed by 1 or 2 above.

G3 – Renewable and Low Carbon Developments

G3 - Renewable and low carbon energy developments

The Council will promote renewable, low and zero carbon energy generating developments, including wind power, biomass, Combined Heat and Power (CHP), hydro and heat pumps in order to help meet CO2 reduction targets and contribute towards energy security for Greater Manchester and the North West.

Any proposal and associated infrastructure must avoid harm to the health and safety of the public, including through nuisance or adverse impact on highway safety by conflict with or undue distraction to road users. Any harm to the following must be minimised and appropriately mitigated:

- The visual character and quality of the landscape or townscape and the physical record of the historic and cultural evolution of the landscape;
- The setting of heritage assets including Scheduled Ancient Monuments, Conservation Areas and Listed Buildings;
- Local residents and their amenity;
- Biodiversity including protected species, statutory and locally designated sites and important habitats, and geodiversity;
- The value of the borough's peatlands as an ecological and hydrological resource and as a carbon sink;
- The value of the surrounding area for relaxation and recreation;
- Water quality;
- Land which is used for water catchment purposes and which is critical to the delivery of water supply; and
- Highway safety.

Any proposal must demonstrate the best use of location, topography, siting, design and colour to minimise its visual and other impacts, including any cumulative impacts. Any ancillary structures and access roads should employ sensitive design and the use of local materials to respect the character and appearance of the setting. The visual impact of infrastructure associated with renewable energy developments should be satisfactorily addressed, including by routing power lines underground wherever possible. All proposals should seek to minimise the length of cable connection in order to reduce the visual impact of such structures when sited above ground. It must be demonstrated that the proposal will not result in electro-magnetic interference with local television reception and specialist radio communication networks.

All the above issues, where relevant, will have to be addressed in a detailed statement of environmental effects submitted with the application.

Planning permission will be subject to a condition that if a wind turbine generator, or other redundant plant or infrastructure, is not producing electricity for six months or more, it shall be removed and the site fully restored to a use and condition appropriate to its surroundings in accordance with this plan.

In the case of wind power developments, in addition to the above criteria the following will also apply.

Planning permission will only be granted if:

- The development site is in an area identified as suitable for wind energy development in

2.2.2 National Planning Policy

The NPPF (Revised July 2023) sets out the Government’s planning policies for England and how these are expected to be applied. The overall emphasis of the NPPF is to reiterate the Government’s key objectives, including securing sustainable development.

The NPPF defines the purpose of the planning system as being to contribute to the achievement of sustainable development. It explains at Paragraph 8 that there are three dimensions to sustainable development. These are economic, social and environmental and should be pursued simultaneously through the planning system.

Paragraph 10 states that at the heart of the Framework is a presumption in favour of sustainable development.

2.3 Sustainable Design Strategy

2.3.1 Energy and Carbon Emissions

Building Services Strategy

In response to the policy requirements and climate change plan targets set out in section 2.2, developments should aim to assist and achieve the following carbon reduction targets:

1. Achieve a Zero Carbon Status for the development.

To achieve the most accurate calculations and estimates, the proposed units have been modelled using *SAP 10.2* the governments Standard Assessment Procedure for residential dwellings.

The proposed strategy for minimising energy use and carbon emissions is based on the energy hierarchy described in CIBSE Guide F 2012 (Energy efficiency in buildings). The energy hierarchy has been adopted for the development to ensure that the correct approach to design is taken to promote an energy-efficient low carbon solution (see figure 2). This has ensured that the benefits of effective methods of energy use reduction have been maximised first. The approach adopted is as follows:



Fig 2: Energy Hierarchy

Minimise energy demand – Implement passive design measures and optimise the building envelope in terms of orientation, air tightness, and insulation. For example, the proposal is targeting a low carbon classification through a holistic low energy design concept as it will be designed with a fabric first approach whereby standards designed to exceed Building Regulations compliancy are aspired to for all fabric U-values and air permeability targets.

Meet demands efficiently – Specification of energy efficient decentralised plant, heating, ventilation, lighting, and system controls to facilitate efficient operation. For example, each dwelling has been designed with an all-electric system in the form of a heat pump to contribute to the de-gasification of the housing stock.

Particular attention is being paid to the wellbeing of occupants. The ventilation strategy has been developed to minimise noise ingress from the proposed location as far as possible while minimising the risk of overheating.

Additional Renewable Energy Measures

Opportunities for incorporating low and zero carbon technologies (LZCT) have been considered for this development. The viability of several separate technologies was examined in a LZCT study (see section 3).

Efficient and Sustainable Design Measures

In line with the above Sustainable Design Strategy, the following Energy Efficient design measures are specified.

- High levels of insulation throughout with minimal thermal bridges
- Passive solar gains and internal heat sources
- Excellent level of airtightness
- Good indoor air quality by openable windows

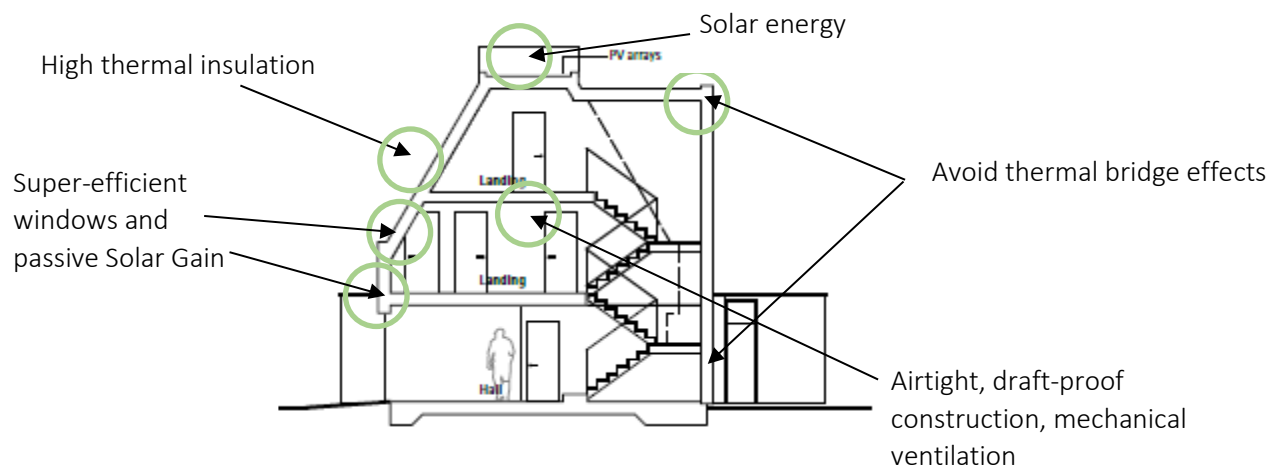


Fig 3. Efficient Design Measure examples

The Proposed specifications and key energy efficient design measures are as follows:

Residential Units:

- Ground floor U-values of 0.12 W/m²K
- External Wall U-values of 0.18 W/m²K
- Pitched Roof U-values of 0.13 W/m²K
- Low Double-Glazed Window U-values of 1.3 W/m²K
- 100% low energy lighting throughout
- Air Source Heat Pumps to all dwellings to satisfy space heating and hot water
- CMV –Vent Axia Sentinel Multivent A
- Air Permeability Rate of 4m³/hm² in all houses
- Hi-Therm+ Lintels to all windows

2.3.2 Choice and Impact of Renewable Technology

All reasonable technologies were investigated for their suitability to the site and development; please refer to section 3 for details.

In addition to energy efficiency measures, it is proposed that the development will feature the following Low/Zero carbon Technologies:

- **Air Source Heat Pump implemented to each house.**

The above LZC contribution has provided an **60.5%** reduction in CO₂ following Energy Efficiency Measures.

- Energy Saving from onsite LZC Technologies = **31,226.5 kWh/Yr**
- CO₂ Saving from onsite LZC Technologies = **15,463.9 kgCO₂/Yr**

2.3.3 Energy and CO₂ Reduction Summary

A summary of all stages of the energy demand assessment from baseline figures to final carbon reduction are shown in Figures 1 & 2 below:

	SAP 10.2
Summary of CO₂ Emission Reductions	Total CO₂ emissions (kgCO₂/year)
Carbon Factors (Gas / Electric)	0.210 / 0.136
Baseline emissions	25565.6
Improved emissions (after incorporation of renewable energy technology) % CO ₂ displaced in total	10101.7
% CO ₂ displaced in total	60.5%
% CO ₂ displaced by renewable energy	60.5%

Table 2: Summary of CO₂ Reductions



	Energy demand (kWh pa)	Energy saving achieved (%)	Regulated CO ₂ emissions (kg pa)	Saving achieved on residual CO ₂ emissions (%)
Building Regulations Part L compliance ("Baseline" energy demand & emissions)	105504.0		25565.6	
Proposed scheme after clean energy supply	74277.5	42.0%	10101.7	60.5%
Proposed scheme after on-site renewables	74277.5	29.6%	10101.7	60.5%
Proposed scheme offset for financial contribution or other "allowable solution"			0	0
Total savings on residual emissions				60.5%

Table 3. Total Energy and Carbon Emissions Savings Based on SAP 10.2 Carbon Factors



For a full Breakdown of the figures and calculations please see Appendix A – Energy Demand Assessment Spreadsheet.

Baseline energy demand

‘Standard Assessment Procedure - SAP 2012’ was used to produce example SAP reports to generate the figures used within the calculations.

Baseline energy demand (kWh pa)	105,504
Baseline carbon emissions (kg pa)	25,565.6

Be Clean stage

The heating and cooling hierarchy has been applied to the design process of the development. It has resulted in large focus on energy efficiency measures and as can be seen in Figure 1.

Energy savings from the use of CHP systems (kWh pa)	-
Emission savings from the use of CHP systems (kg pa)	-
Total regulated emissions after CHP savings (kg pa)	-

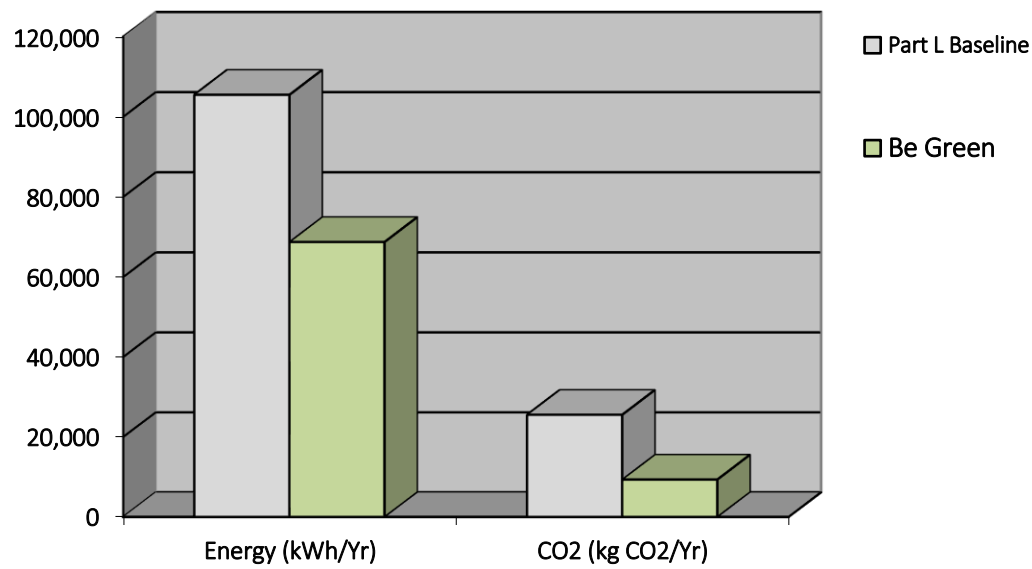
Be Green stage

The following table demonstrates how the development achieves the reduction in carbon dioxide emissions from LZC technologies.

Energy saving from the use of renewables (kWh)	31,226.5
Saving on residual emissions from the use of renewables (kg)	15,463.9
Saving on residual emissions from the use of renewables (%)	60.5



The chart below illustrates the improvements over the Part L Compliant Baseline:



3 Feasibility Assessment of Renewable Energy and Low Carbon Technologies

Solar Hot Water (Thermal)

Solar water heating systems are one of the more familiar renewable technologies used at the moment. They use the energy from the sun to heat water, most commonly for hot water needs. Solar heating systems use a heat collector that is usually mounted on a roof in which the sun heats a fluid. This fluid is used to heat water that is stored in either a separate hot water cylinder or in a twin-coil hot water cylinder (the second coil is used to provide additional heating from a boiler or other heat source).

Solar hot water panels could be used however, PV will provide slightly better savings and avoid the need for water storage cylinders when compared.

Renewable Technology Not Chosen.

Photovoltaic Panels (PV)

Photovoltaic modules convert sunlight directly to DC electricity. The solar cells consist of a thin piece of semiconductor material, in most cases of silicon. Through a process called doping, very small amounts of impurities are added to the semiconductor, which creates two different layers called n-type and p-type layers.

Certain wavelengths of light are able to ionize the silicon atoms, which separates some of the positive charges (holes) from the negative charges (electrons). The holes move into the positive or p-layer and the electrons into the negative or n-layer. These opposite charges are attracted to each other, but most of them can only re-combine by the electrons passing through an external circuit, due to an internal potential energy barrier. This flow of electrons produces a DC current.

Solar panels could be considered further down the line.

Renewable Technology not chosen

Ground Source Heat pumps

A heat pump is a device that takes up heat at a certain temperature and releases it at a higher temperature. The essential components of a heat pump are heat exchangers (through which energy is extracted and emitted) and a means of pumping heat between the exchangers. The effectiveness of the heat pump is measured by the ratio of the heating capacity to the effective power input, usually known as the coefficient of performance (COP). Ground-source heat pumps (GSHP) extract heat from the ground. They are classified as either water-to-air or water-to-water units depending on whether the heat distribution system in the building uses air or water. Ground source heat pumps either use long shallow trenches or deep vertical boreholes to take low grade heat from the ground and then compress it to create higher temperatures.

Ground source heat pumps would not be suitable due to the lack of land space around the properties and the associated costs.

Renewable Technology Not Viable

Air Source Heat pumps

Air source heat pumps absorb heat from the outside air. This is usually used to heat radiators, underfloor heating systems, or warm air convectors and hot water in your home. An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside.

The system performs down to air temperatures of -20°C which means that they are more than suitable for installations within the UK. Hot water and Heating can be provided 365 days a year. The hot water is produced without the aid of electrical immersions and at 55°C is more than hot enough for baths and showers.

There are two main types of air source heat pump system:

- An air-to-water system distributes heat via your wet central heating system. Heat pumps work much more efficiently at a lower temperature than a standard boiler system would. So they are more suitable for under-floor heating systems or larger radiators, which give out heat at lower temperatures over longer periods of time.
- An air-to-air system produces warm air which is circulated by fans to heat your home. They are unlikely to provide you with hot water as well.

Air Source heat pumps are a good option to provide heating and cooling. A conventional ASHP will be proposed to the houses to satisfy the space heating and hot water.

Chosen Renewable Technology

Biomass Heating

Biomass is any plant-derived organic material that renews itself over a short period.

Biomass energy systems are based on either the direct or indirect combustion of fuels derived from those plant sources. The most common form of biomass is the direct combustion of wood in treated or untreated forms. The use of biomass is becoming increasingly common in some European countries.

The environmental benefits relate to the significantly lower amounts of energy used in biomass production and processing compared to the energy released when they are burnt. This can range from a four-fold return for biodiesel to an approximate 20-fold energy return for woody biomass. Biomass-fuels can be used to produce energy on a continuous basis (unlike renewables such as wind or solar energy) and it can be an economic alternative to fossil fuels as it is a potential source of both heat and electricity.

However, Biomass systems have particular design management and maintenance requirements associated with sourcing, transportation and storage and are therefore more commonly used in commercial developments rather than domestic installations. It can be less convenient to operate than mains-supplied fuels such as natural gas and are more management intensive and require expertise in facilities management. Sources of biomass can also fluctuate, so boilers should be specified to operate on a variety of fuels without risk of overheating or tripping out.

A communal biomass system would not be feasible for this development due to the expense associated with the necessary output to heat all dwellings on the site.

Renewable Technology Not Chosen

Wind

Wind turbines convert the kinetic energy in wind into mechanical energy that is then converted to electricity. Turbines are available in a range of sizes and designs and can either be free-standing, mounted on a building or integrated into a building structure.

The wind speed in the area is under the advised minimum and the built-up area means that a wind turbine wouldn't be feasible.

Renewable Technology Not Viable

4 Conclusion

This statement has assessed the proposed development at the Langley site against the relevant climate change and sustainability policies and targets, as outlined within: the Rochdale Core Strategy (October 2016), through the following of the energy hierarchy, the modelling of the dwellings in the FSAP 10.2 software and addressing all aspects of a sustainable development. In addition, the proposal has been assessed against national sustainable design definitions to determine how it can be classified.

As part of this process, the development was designed with a fabric first approach; with U-values, design air permeability and ventilation targets all aspiring to exceed Building Regulations Part L 2022 standards. Following on from this, efficient MVHR systems were proposed for each house, to further reduce the total energy demands whilst simultaneously providing each dwelling with healthy internal environments. This approach demonstrates a holistic low energy design concept, involving very low limiting values and thus led to high-energy performance targets and being defined as a low carbon development.

Furthermore, an LZC feasibility assessment was carried out, with all suitable technologies investigated for their suitability to the site and development. The assessment determined that ASHP would provide a 63.4% reduction in carbon emissions over the residual emissions. In addition to this renewable technology provision, the development can also be defined as carbon neutral by obtaining all the energy used on site from a 100% renewable energy electricity supply provider.

The development will also be adapting to climate change by incorporating sustainable drainage measures into the design, protecting existing ecology, enhancing biodiversity where possible and providing cycle storage provision to residents.

5 Appendices

House Type/Name	2B3P- Type 1	2B3P- Type 2	3B4P-Type 2	F3B4P Type 1	TOTAL (kWh/yr)	SAP 10.2	TOTAL (kgCO2/yr)
Frequency	6	7	7	8	28		
BASELINE Dwelling Emission Rate (DER)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Carbon Emission Factor	Associated Total CO2 (kgCO2/yr)
Main Heating Fuel Requirement (DER)	2,318.12	2,217.50	2,838.00	2,741.13	71226.3	0.210	14957.5
Secondary Main Heating Fuel Requirement (DER)					0.0	0.136	0.0
Secondary Heating Fuel Requirement (DER)					0.0	0.136	0.0
Water Fuel Requirement (DER)	2,784.42	2,788.84	2,955.38	2,929.95	80355.7	0.210	16874.7
Electricity Pumps Fans Requirement (DER)	86	86	86	86	2408.0	0.136	327.5
Electricity Lighting Requirement (DER)	170.28	170.76	209.01	202.37	5299.0	0.136	720.7
PV Energy Produced	-1,723.54	-1,728.48	-2,127.85	-2,056.18	-53785.0	0.136	-7314.8
TOTAL PER DEVELOPMENT					105504.0		25565.6
AFTER ENERGY SAVING MEASURES Dwelling Emission Rate (DER)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Carbon Emission Factor	Associated Total CO2 (kgCO2/yr)
Main Heating Fuel Requirement (DER)					0.0	0.210	0.0
Secondary Main Heating Fuel Requirement (DER)					0.0	0.136	0.0
Secondary Heating Fuel Requirement (DER)					0.0	0.136	0.0
Water Fuel Requirement (DER)					0.0	0.210	0.0
Electricity Pumps Fans Requirement (DER)					0.0	0.136	0.0
Electricity Lighting Requirement (DER)					0.0	0.136	0.0
TOTAL PER DEVELOPMENT					0.0		0.0
FINAL Dwelling Emission Rate (DER)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Carbon Emission Factor	Associated Total CO2 (kgCO2/yr)
Main Heating Fuel Requirement (DER)	833.97	795	991.84	951.11	25120.6	0.136	3416.4
Secondary Main Heating Fuel Requirement (DER)					0.0	0.136	0.0
Secondary Heating Fuel Requirement (DER)					0.0	0.136	0.0
Water Fuel Requirement (DER)	1,482.05	1,483.51	1,580.12	1,565.89	42864.8	0.136	5829.6
Electricity Pumps Fans Requirement (DER)	49.11	46.35	58.24	56.27	1477.0	0.136	200.9
Electricity Lighting Requirement (DER)	150.55	150.98	195.09	186.17	4815.2	0.136	654.9
TOTAL PER DEVELOPMENT					74277.5		10101.7
PV Energy Produced (DER)	0	0	0	0	0.0	0.136	0.0
TOTAL PER DEVELOPMENT					74277.5		10101.7



Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 14 Jun 2024 10:27:20

Project Information			
Assessed By	Daniel Watt	Building Type	House, Semi-detached
OCDEA Registration	EES/027301	Assessment Date	2024-06-14

Dwelling Details			
Assessment Type	As designed	Total Floor Area	70 m ²
Site Reference	2B3P- Type 1	Plot Reference	2B3P- Type 1
Address			

Client Details	
Name	Elliot Denby
Company	BTP Architects
Address	486 Didsbury Road, Stockport, SK4 3BS

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	12.69 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	5.27 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	66.43 kWh _{PE} /m ²		
Dwelling primary energy	55.58 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	38.7 kWh/m ²		
Dwelling fabric energy efficiency	38.2 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	Ground Floor (0.12)	OK
Roofs	0.16	0.13	Roof (1) (0.13)	OK
Windows, doors, and roof windows	1.6	1.3	North Windows (1.3)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	80.38	0.18	
Party wall: Party Wall (1)	46.63	0 (!)	
Ground floor: Ground Floor, Ground Floor	34.87	0.12	
Exposed roof: Roof (1)	34.87	0.13	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
North Windows, Windows	5.09	North	0.7	1.3
Front Door, Front Door	1.91	North	N/A	1.3
Window, Windows	0.53	West	0.7	1.3
South Window, Windows	6.77	South	0.7	1.3
Back Door, Back Door	2.03	South	N/A	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 (!)	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.07	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.002 (!)	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.24	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	249.9%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

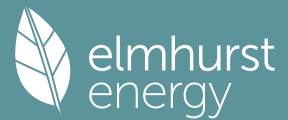
Cylinder/store - type: Cylinder	
Capacity	250 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Programmer and room thermostat	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	120 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.17 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Sentinel Multivent A	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	2B3P- Type 1				Issued on Date	14/06/2024		
Assessment Reference	2B3P- Type 1			Prop Type Ref				
Property								
SAP Rating	79 C		DER	5.27		TER	12.69	
Environmental	96 A		% DER < TER				58.47	
CO ₂ Emissions (t/year)	0.37		DFEE	38.22		TFEE	38.67	
Compliance Check	See BREL		% DFEE < TFEE				1.17	
% DPER < TPER	16.33		DPER	55.58		TPER	66.43	
Assessor Details	Mr. Daniel Watt					Assessor ID	AV75-0001	
Client								

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.8700 (1b)	x 2.1500 (2b)	= 74.9705 (1b) - (3b)
First floor	34.8700 (1c)	x 2.7000 (2c)	= 94.1490 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.1195 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

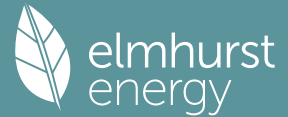
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			12.3900	1.2357	15.3108		(27)
Front Door			1.9100	1.3000	2.4830		(26)
Back Door			2.0300	1.3000	2.6390		(26a)
Ground Floor			34.8700	0.1200	4.1844	110.0000	3835.7000 (28a)
External Brick Wall	96.7100	16.3300	80.3800	0.1800	14.4684	190.0000	15272.2000 (29a)
Roof	34.8700		34.8700	0.1300	4.5331	9.0000	313.8300 (30)
Total net area of external elements Aum(A, m ²)			166.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.6187		(33)
Party Wall			46.6300	0.0000	0.0000	70.0000	3264.1000 (32)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		22685.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							325.2915 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				9.1600	0.0300		0.2748

Full SAP Calculation Printout



E3 Sill								7.2100	0.0400	0.2884		
E4 Jamb								31.2600	0.0500	1.5630		
E5 Ground floor (normal)								16.6600	0.0700	1.1662		
E6 Intermediate floor within a dwelling								16.6600	0.0020	0.0333		
E10 Baves (insulation at ceiling level)								7.7800	0.0600	0.4668		
E12 Gable (insulation at ceiling level)								8.7800	0.2400	2.1072		
E16 Corner (normal)								9.7000	0.0900	0.8730		
P1 Party wall - Ground floor								8.7800	0.0800	0.7024		
P4 Party wall - Roof (insulation at ceiling level)								8.7800	0.1200	1.0536		
E18 Party wall between dwellings								9.7000	0.0600	0.5820		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											9.1107 (36)	
Point Thermal bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	52.7295 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	28.1838	27.9047	27.9047	27.9047	27.9047	27.9047	27.9047	27.9047	27.9047	27.9047	27.9047	27.9047 (38)
Average = Sum(39)m / 12 =	80.9132	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342 (39)
	80.9132	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6342	80.6574
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1602	1.1562	1.1562	1.1562	1.1562	1.1562	1.1562	1.1562	1.1562	1.1562	1.1562	1.1562 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
	31	28	31	30	31	30	31	31	30	31	30	31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.2398 (42)
Hot water usage for mixer showers												
	61.7737	60.8453	59.4925	56.9043	54.9942	52.8641	51.6533	52.9958	54.4675	56.7546	59.3985	61.5370 (42a)
Hot water usage for baths												
	26.6879	26.2916	25.7334	24.7043	23.9337	23.0792	22.6177	23.1719	23.7754	24.6897	25.7400	26.5977 (42b)
Hot water usage for other uses												
	37.5678	36.2017	34.8356	33.4695	32.1034	30.7373	30.7373	32.1034	33.4695	34.8356	36.2017	37.5678 (42c)
Average daily hot water use (litres/day)												115.8497 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	126.0293	123.3385	120.0615	115.0780	111.0312	106.6806	105.0083	108.2711	111.7124	116.2799	121.3402	125.7024 (44)
Energy content (annual)	199.5997	175.6324	184.5301	157.5361	149.4694	131.1762	126.9984	134.0623	137.7525	157.7907	172.8713	196.8196 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1924.2386
	29.9399	26.3449	27.6795	23.6304	22.4204	19.6764	19.0498	20.1093	20.6629	23.6686	25.9307	29.5229 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	256.5747	227.0938	241.5051	212.6732	206.4444	186.3133	183.9734	191.0373	192.8897	214.7657	228.0085	253.7947 (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												
	256.5747	227.0938	241.5051	212.6732	206.4444	186.3133	183.9734	191.0373	192.8897	214.7657	228.0085	253.7947 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2595 (64)
Electric shower(s)												2595.0739 (64)
	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)
												0.0000 (64a)
Heat gains from water heating, kWh/month												
	111.9469	99.5669	106.9363	96.4905	95.2786	87.7258	87.8070	90.1558	89.9124	98.0454	101.5894	111.0226 (65)
5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	101.5414	112.4208	101.5414	104.9261	101.5414	104.9261	101.5414	104.9261	104.9261	101.5414	104.9261	101.5414 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	196.6895	198.7305	193.5872	182.6377	168.8159	155.8254	147.1470	145.1059	150.2492	161.1987	175.0205	188.0110 (68)
Pumps, fans	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918 (71)
Total internal gains	150.4663	148.1650	143.7316	134.0145	128.0627	121.8414	118.0202	121.1771	124.8784	131.7815	141.0964	149.2239 (72)
	508.2941	518.9132	498.4571	481.1753	458.0169	439.1899	423.3055	424.4214	436.6507	454.1186	480.6400	498.3732 (73)
6. Solar gains												
[Jan]												
		Area		Solar flux		g		FF		Access		Gains
		m2		Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
North		5.0900		10.6334		0.7200		0.7000		0.7700		18.9040 (74)
South		6.7700		46.7521		0.7200		0.7000		0.7700		110.5486 (78)
West		0.5300		19.6403		0.7200		0.7000		0.7700		3.6357 (80)

Full SAP Calculation Printout



Solar gains	133.0883	224.2888	303.7262	376.3439	425.3851	425.0265	408.5645	370.8843	328.3462	246.7226	158.8916	114.2733 (83)
Total gains	641.3824	743.2020	802.1833	857.5192	883.4020	864.2163	831.8699	795.3056	764.9968	700.8412	639.5316	612.6465 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	77.8812	78.1507	78.1507	78.1507	78.1507	78.1507	78.1507	78.1507	78.1507	78.1507	78.1507	78.1507
alpha	6.1921	6.2100	6.2100	6.2100	6.2100	6.2100	6.2100	6.2100	6.2100	6.2100	6.2100	6.2100
util living area	0.9948	0.9864	0.9676	0.9103	0.7820	0.5871	0.4253	0.4642	0.6968	0.9257	0.9866	0.9960 (86)
MIT	20.2867	20.4243	20.5844	20.7685	20.8950	20.9419	20.9490	20.9484	20.9283	20.7734	20.4943	20.2574 (87)
Th 2	20.4199	20.4219	20.4219	20.4219	20.4219	20.4219	20.4219	20.4219	20.4219	20.4219	20.4219	20.4219 (88)
util rest of house	0.9937	0.9837	0.9611	0.8933	0.7473	0.5375	0.3700	0.4068	0.6475	0.9081	0.9834	0.9952 (89)
MIT 2	19.7496	19.8876	20.0448	20.2202	20.3318	20.3673	20.3715	20.3712	20.3584	20.2272	19.9577	19.7222 (90)
Living area fraction									fLA = Living area / (4) =			0.2089 (91)
MIT	19.8618	19.9997	20.1576	20.3348	20.4494	20.4874	20.4922	20.4918	20.4775	20.3413	20.0698	19.8340 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8618	19.9997	20.1576	20.3348	20.4494	20.4874	20.4922	20.4918	20.4775	20.3413	20.0698	19.8340 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9924	0.9813	0.9577	0.8905	0.7490	0.5432	0.3767	0.4138	0.6524	0.9053	0.9811	0.9941 (94)
Useful gains	636.5158	729.3044	768.2846	763.6237	661.6832	469.4702	313.3818	329.1182	499.0699	634.4655	627.4663	609.0616 (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	1259.1587	1217.5556	1101.2655	922.0339	705.5034	474.7230	313.8414	329.9377	514.2438	785.4803	1045.8076	1260.6387 (97)
Space heating kWh	463.2463	328.1048	247.7378	114.0553	32.6022	0.0000	0.0000	0.0000	0.0000	112.3550	301.2057	484.7733 (98a)
Space heating requirement - total per year (kWh/year)												2084.0805
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	463.2463	328.1048	247.7378	114.0553	32.6022	0.0000	0.0000	0.0000	0.0000	112.3550	301.2057	484.7733 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2084.0805
Space heating per m2										(98c) / (4) =		29.8836 (99)

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

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

Fraction of space heat from main system(s) 0.0000 (201)

Efficiency of main space heating system 1 (in %) 1.0000 (202)

Efficiency of main space heating system 2 (in %) 249.9000 (206)

Efficiency of secondary/supplementary heating system, % 0.0000 (207)

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	463.2463	328.1048	247.7378	114.0553	32.6022	0.0000	0.0000	0.0000	0.0000	112.3550	301.2057	484.7733 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	185.3727	131.2944	99.1348	45.6404	13.0461	0.0000	0.0000	0.0000	0.0000	44.9600	120.5305	193.9869 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement 256.5747 227.0938 241.5051 212.6732 206.4444 186.3133 183.9734 191.0373 192.8897 214.7657 228.0085 253.7947 (64)

Efficiency of water heater (217)m 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 175.1000 (216)

Fuel for water heating, kWh/month 146.5304 129.6938 137.9241 121.4581 117.9009 106.4040 105.0676 109.1018 110.1597 122.6532 130.2161 144.9427 (219)

Space cooling fuel requirement (221)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (221)

Pumps and Fa 4.1706 3.7670 4.1706 4.0361 4.1706 4.0361 4.1706 4.0361 4.1706 4.0361 4.1706 4.0361 (231)

Lighting 18.6546 14.9654 13.4747 9.8721 7.6255 6.2301 6.9563 9.0420 11.7447 15.4097 17.4052 19.1731 (232)

Electricity generated by PVs (Appendix M) (negative quantity) (233a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity) (233b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1 833.9658 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

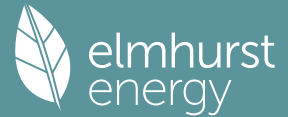
Efficiency of water heater 175.1000

Water heating fuel used 1482.0525 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

Full SAP Calculation Printout



(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2380)
 mechanical ventilation fans (SFP = 0.2380)
 Total electricity for the above, kWh/year
 Electricity for lighting (calculated in Appendix L)

49.1055 (230a)
 49.1055 (231)
 150.5534 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation
 Wind generation
 Hydro-electric generation (Appendix N)
 Electricity generated - Micro CHP (Appendix N)
 Appendix Q - special features
 Energy saved or generated
 Energy used
 Total delivered energy for all uses

0.0000 (233)
 0.0000 (234)
 0.0000 (235a)
 0.0000 (235)
 -0.0000 (236)
 0.0000 (237)
 2515.6772 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	833.9658	0.1566	130.5737 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1482.0525	0.1408	208.7283 (264)
Space and water heating			339.3020 (265)
Pumps, fans and electric keep-hot	49.1055	0.1387	6.8115 (267)
Energy for lighting	150.5534	0.1443	21.7295 (268)
Total CO2, kg/year			367.8430 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.2700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	833.9658	1.5796	1317.3531 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1482.0525	1.5208	2253.8495 (278)
Space and water heating			3571.2026 (279)
Pumps, fans and electric keep-hot	49.1055	1.5128	74.2869 (281)
Energy for lighting	150.5534	1.5338	230.9238 (282)
Total Primary energy kWh/year			3876.4133 (286)
Dwelling Primary energy Rate (DPER)			55.5800 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.8700 (1b)	x 2.1500 (2b)	= 74.9705 (1b) - (3b)
First floor	34.8700 (1c)	x 2.7000 (2c)	= 94.1490 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.1195 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1183 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3683 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3683 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.4695 0.4603 0.4511 0.4051 0.3959 0.3498 0.3498 0.3406 0.3683 0.3959 0.4143 0.4327 (22b)
Effective ac	0.6102 0.6059 0.6018 0.5820 0.5784 0.5612 0.5612 0.5580 0.5678 0.5784 0.5858 0.5936 (25)

Full SAP Calculation Printout



3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opaque door			1.9100	1.0000	1.9100			(26)
TER Semi-glazed door			2.0300	1.0000	2.0300			(26a)
TER Opening Type (Uw = 1.20)			12.3900	1.1450	14.1870			(27)
Ground Floor			34.8700	0.1300	4.5331			(28a)
External Brick Wall	96.7100	16.3300	80.3800	0.1800	14.4684			(29a)
Roof	34.8700		34.8700	0.1100	3.8357			(30)
Total net area of external elements Aum(A, m ²)			166.4500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9642			(33)
Party Wall			46.6300	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							325.2915	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				9.1600	0.0500		0.4580	
E3 Sill				7.2100	0.0500		0.3605	
E4 Jamb				31.2600	0.0500		1.5630	
E5 Ground floor (normal)				16.6600	0.1600		2.6656	
E6 Intermediate floor within a dwelling				16.6600	0.0000		0.0000	
E10 Baves (insulation at ceiling level)				7.7800	0.0600		0.4668	
E12 Gable (insulation at ceiling level)				8.7800	0.0600		0.5268	
E16 Corner (normal)				9.7000	0.0900		0.8730	
P1 Party wall - Ground floor				8.7800	0.0800		0.7024	
P4 Party wall - Roof (insulation at ceiling level)				8.7800	0.1200		1.0536	
E18 Party wall between dwellings				9.7000	0.0600		0.5820	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.2517 (36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	50.2159	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)														
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat transfer coeff	34.0566	33.8177	33.5835	32.4837	32.2780	31.3200	31.3200	31.1427	31.6890	32.2780	32.6942	33.1294	(38)	
Average = Sum(39)m / 12 =	84.2725	84.0336	83.7995	82.6996	82.4939	81.5360	81.5360	81.3586	81.9049	82.4939	82.9101	83.3453	(39)	82.6987
HLP (average)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(40)	1.1858

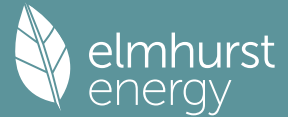
4. Water heating energy requirements (kWh/year)

Assumed occupancy														2.2398 (42)
Hot water usage for mixer showers	61.7737	60.8453	59.4925	56.9043	54.9942	52.8641	51.6533	52.9958	54.4675	56.7546	59.3985	61.5370	(42a)	
Hot water usage for baths	26.6879	26.2916	25.7334	24.7043	23.9337	23.0792	22.6177	23.1719	23.7754	24.6897	25.7400	26.5977	(42b)	
Hot water usage for other uses	37.5678	36.2017	34.8356	33.4695	32.1034	30.7373	30.7373	32.1034	33.4695	34.8356	36.2017	37.5678	(42c)	
Average daily hot water use (litres/day)													(43)	115.8497
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	126.0293	123.3385	120.0615	115.0780	111.0312	106.6806	105.0083	108.2711	111.7124	116.2799	121.3402	125.7024	(44)	
Energy content (annual)	199.5997	175.6324	184.5301	157.5361	149.4694	131.1762	126.9984	134.0623	137.7525	157.7907	172.8713	196.8196	(45)	
Distribution loss (46)m = 0.15 x (45)m	29.9399	26.3449	27.6795	23.6304	22.4204	19.6764	19.0498	20.1093	20.6629	23.6686	25.9307	29.5229	(46)	
Water storage loss:														
Store volume													(47)	250.0000
a) If manufacturer declared loss factor is known (kWh/day):													(48)	1.8903
Temperature factor from Table 2b													(49)	0.5400
Enter (49) or (54) in (55)													(55)	1.0208
Total storage loss													(56)	
If cylinder contains dedicated solar storage													(57)	
Primary loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(59)	
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(61)	
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(62)	
WWHRS	254.5064	225.2257	239.4369	210.6717	204.3762	184.3118	181.9052	188.9691	190.8881	212.6975	226.0069	251.7264	(63a)	
PV diverter	-28.2403	-24.9760	-26.1534	-21.6561	-20.1827	-17.2705	-16.1883	-17.2146	-17.8687	-21.0652	-23.8643	-27.7174	(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	(64)	
Output from w/h	226.2661	200.2497	213.2835	189.0156	184.1935	167.0413	165.7169	171.7544	173.0194	191.6323	202.1426	224.0090	(64)	
12Total per year (kWh/year)													(64)	2308.3244
Electric shower(s)													(64a)	2308
Heat gains from water heating, kWh/month	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)	
	110.2923	98.0724	105.2817	94.8892	93.6240	86.1246	86.1524	88.5011	88.3112	96.3908	99.9882	109.3680	(65)	

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

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	111.9898	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	101.5414	112.4208	101.5414	104.9261	101.5414	104.9261	101.5414	101.5414	104.9261	101.5414	104.9261	101.5414	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	196.6895	198.7305	193.5872	182.6377	168.8159	155.8254	147.1470	145.1059	150.2492	161.1987	175.0205	188.0110	(68)	
Pumps, fans	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	34.1990	(69)	
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)	
Water heating gains (Table 5)	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	-89.5918	(71)	
	148.2424	145.9410	141.5076	131.7906	125.8387	119.6174	115.7962	118.9531	122.6544	129.5576	138.8725	146.9999	(72)	

Full SAP Calculation Printout



Total internal gains
506.0702 516.6893 496.2332 478.9513 455.7930 436.9659 421.0815 422.1974 434.4267 451.8946 478.4160 496.1493 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	5.0900		10.6334		0.6300		0.7000		0.7700		16.5410 (74)	
South	6.7700		46.7521		0.6300		0.7000		0.7700		96.7300 (78)	
West	0.5300		19.6403		0.6300		0.7000		0.7700		3.1812 (80)	
Solar gains	116.4522	196.2527	265.7604	329.3009	372.2120	371.8982	357.4939	324.5237	287.3029	215.8823	139.0301	99.9891 (83)
Total gains	622.5224	712.9420	761.9936	808.2523	828.0050	808.8641	778.5754	746.7212	721.7296	667.7769	617.4462	596.1384 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	74.7767	74.9893	75.1988	76.1989	76.3889	77.2864	77.2864	77.4549	76.9382	76.3889	76.0054	75.6085
alpha	5.9851	5.9993	6.0133	6.0799	6.0926	6.1524	6.1524	6.1637	6.1292	6.0926	6.0670	6.0406
util living area	0.9958	0.9898	0.9766	0.9327	0.8242	0.6290	0.4587	0.4976	0.7371	0.9420	0.9893	0.9967 (86)
MIT	20.0307	20.2028	20.4197	20.6952	20.8953	20.9838	20.9980	20.9967	20.9589	20.7172	20.3314	20.0059 (87)
Th 2	19.9133	19.9160	19.9187	19.9314	19.9337	19.9448	19.9448	19.9468	19.9405	19.9337	19.9289	19.9239 (88)
util rest of house	0.9940	0.9856	0.9668	0.9051	0.7619	0.5332	0.3499	0.3858	0.6438	0.9123	0.9842	0.9953 (89)
MIT 2	18.8124	19.0323	19.3056	19.6450	19.8570	19.9376	19.9443	19.9460	19.9188	19.6789	19.2067	18.7889 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.0669	19.2769	19.5383	19.8644	20.0739	20.1562	20.1644	20.1655	20.1361	19.8958	19.4416	19.0432 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.0669	19.2769	19.5383	19.8644	20.0739	20.1562	20.1644	20.1655	20.1361	19.8958	19.4416	19.0432 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9920	0.9822	0.9623	0.9031	0.7709	0.5530	0.3727	0.4093	0.6622	0.9110	0.9810	0.9937 (94)
Useful gains	617.5574	700.2811	733.2986	729.9070	638.3204	447.3047	290.2061	305.6115	477.9564	608.3646	605.6879	592.3618 (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	1244.4444	1208.1405	1092.6056	906.7490	690.7977	453.0266	290.6306	306.3574	494.3845	766.8473	1023.2478	1237.1097 (97)
Space heating kWh	466.4040	341.2815	267.3244	127.3263	39.0432	0.0000	0.0000	0.0000	0.0000	117.9111	300.6431	479.6924 (98a)
Space heating requirement - total per year (kWh/year)	2139.6260											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	466.4040	341.2815	267.3244	127.3263	39.0432	0.0000	0.0000	0.0000	0.0000	117.9111	300.6431	479.6924 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2139.6260											
Space heating per m ²	(98c) / (4) = 30.6800 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	466.4040	341.2815	267.3244	127.3263	39.0432	0.0000	0.0000	0.0000	0.0000	117.9111	300.6431	479.6924 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	505.3131	369.7524	289.6256	137.9483	42.3003	0.0000	0.0000	0.0000	0.0000	127.7477	325.7239	519.7101 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	226.2661	200.2497	213.2835	189.0156	184.1935	167.0413	165.7169	171.7544	173.0194	191.6323	202.1426	224.0090 (64)
Efficiency of water heater (217)m	85.6448	85.2449	84.5674	83.1938	81.2401	79.8000	79.8000	79.8000	79.8000	83.0045	84.9482	79.8000 (216)
Fuel for water heating, kWh/month	264.1914	234.9111	252.2053	227.1992	226.7274	209.3250	207.6653	215.2311	216.8163	230.8697	237.9600	261.3191 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	21.0983	16.9258	15.2398	11.1654	8.6244	7.0462	7.8675	10.2265	13.2832	17.4283	19.6852	21.6847 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-32.7592	-46.2544	-66.5959	-75.0198	-81.0327	-75.7025	-74.7799	-70.5331	-63.0508	-52.9654	-36.0446	-28.3151 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

Full SAP Calculation Printout



(233b)m	-18.2974	-38.5161	-76.5940	-115.0924	-152.2248	-152.9516	-151.1390	-127.9393	-93.7451	-55.0854	-24.4324	-14.4662	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2318.1213	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2784.4210	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												170.2753	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1723.5371	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3635.2806	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2318.1213	0.2100	486.8055	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2784.4210	0.2100	584.7284	(264)
Space and water heating			1071.5339	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.2753	0.1443	24.5760	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-703.0534	0.1345	-94.5919	
PV Unit electricity exported	-1020.4838	0.1259	-128.4631	
Total			-223.0551	(269)
Total CO2, kg/year			884.9841	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2318.1213	1.1300	2619.4771	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2784.4210	1.1300	3146.3958	(278)
Space and water heating			5765.8729	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.2753	1.5338	261.1740	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-703.0534	1.4973	-1052.6474	
PV Unit electricity exported	-1020.4838	0.4621	-471.5477	
Total			-1524.1951	(283)
Total Primary energy kWh/year			4632.9525	(286)
Target Primary Energy Rate (TPER)			66.4300	(287)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 14 Jun 2024 10:27:20

Project Information			
Assessed By	Daniel Watt	Building Type	House, Semi-detached
OCDEA Registration	EES/027301	Assessment Date	2024-06-14

Dwelling Details			
Assessment Type	As designed	Total Floor Area	70 m ²
Site Reference	2B3P- Type 2	Plot Reference	2B3P- Type 1
Address			

Client Details	
Name	Elliot Denby
Company	BTP Architects
Address	486 Didsbury Road, Stockport, SK4 3BS

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	12.36 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	5.17 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	64.64 kWh _{PE} /m ²		
Dwelling primary energy	54.52 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	37.1 kWh/m ²		
Dwelling fabric energy efficiency	36.6 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	Ground Floor (0.12)	OK
Roofs	0.16	0.13	Roof (1) (0.13)	OK
Windows, doors, and roof windows	1.6	1.3	North Windows (1.3)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	66.83	0.18	
Party wall: Party Wall (1)	43.12	0 (!)	
Ground floor: Ground Floor, Ground Floor	34.97	0.12	
Exposed roof: Roof (1)	34.97	0.13	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
North Windows, Windows	5.09	North	0.7	1.3
Front Door, Front Door	1.91	North	N/A	1.3
Window, Windows	0.53	West	0.7	1.3
South Window, Windows	6.77	South	0.7	1.3
Back Door, Back Door	2.03	South	N/A	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 (!)	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.07	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.002 (!)	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.24	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	249.9%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

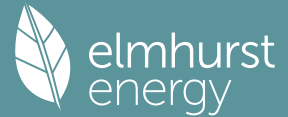
3 Hot water	
Cylinder/store - type: Cylinder	
Capacity	250 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Programmer and room thermostat	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	120 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.16 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Sentinel Multivent A	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	2B3P- Type 2				Issued on Date	14/06/2024		
Assessment Reference	2B3P- Type 1			Prop Type Ref				
Property								
SAP Rating	80 C		DER	5.17		TER	12.36	
Environmental	96 A		% DER < TER				58.17	
CO ₂ Emissions (t/year)	0.37		DFEE	36.64		TFEE	37.12	
Compliance Check	See BREL		% DFEE < TFEE				1.30	
% DPER < TPER	15.65		DPER	54.52		TPER	64.64	
Assessor Details	Mr. Daniel Watt					Assessor ID	AV75-0001	
Client								

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.9700 (1b)	x 2.1500 (2b)	= 75.1855 (1b) - (3b)
First floor	34.9700 (1c)	x 2.7000 (2c)	= 94.4190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.6045 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			12.3900	1.2357	15.3108		(27)
Front Door			1.9100	1.3000	2.4830		(26)
Back Door			2.0300	1.3000	2.6390		(26a)
Ground Floor			34.9700	0.1200	4.1964	110.0000	3846.7000 (28a)
External Brick Wall	83.1600	16.3300	66.8300	0.1800	12.0294	190.0000	12697.7000 (29a)
Roof	34.9700		34.9700	0.1300	4.5461	9.0000	314.7300 (30)
Total net area of external elements Aum(A, m ²)			153.1000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2047		(33)
Party Wall			43.1200	0.0000	0.0000	70.0000	3018.4000 (32)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				19877.5300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							284.2083 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				9.1600	0.0300	0.2748	

Full SAP Calculation Printout



E3 Sill	7.2100	0.0400	0.2884
E4 Jamb	31.2600	0.0500	1.5630
E5 Ground floor (normal)	16.8000	0.0700	1.1760
E6 Intermediate floor within a dwelling	16.8000	0.0020	0.0336
E10 Baves (insulation at ceiling level)	17.4200	0.0600	1.0452
E12 Gable (insulation at ceiling level)	8.0800	0.2400	1.9392
E16 Corner (normal)	9.9000	0.0900	0.8910
P1 Party wall - Ground floor	8.7100	0.0800	0.6968
P4 Party wall - Roof (insulation at ceiling level)	8.7100	0.1200	1.0452
E18 Party wall between dwellings	9.9000	0.0600	0.5940
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.5472 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	50.7519 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	28.2646	27.9847	27.9847	27.9847	27.9847	27.9847	27.9847	27.9847	27.9847	27.9847	27.9847	27.9847 (38)
Average = Sum(39)m / 12 =	79.0165	78.7367	78.7367	78.7367	78.7367	78.7367	78.7367	78.7367	78.7367	78.7367	78.7367	78.7367 (39)
												78.7600

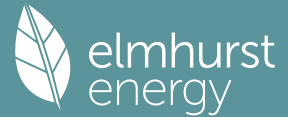
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1298	1.1258	1.1258	1.1258	1.1258	1.1258	1.1258	1.1258	1.1258	1.1258	1.1258	1.1258 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.2447 (42)
Hot water usage for mixer showers												
	61.8553	60.9258	59.5712	56.9795	55.0669	52.9340	51.7216	53.0659	54.5395	56.8296	59.4770	61.6183 (42a)
Hot water usage for baths	26.7230	26.3262	25.7673	24.7368	23.9652	23.1096	22.6475	23.2024	23.8067	24.7222	25.7739	26.6327 (42b)
Hot water usage for other uses	37.6176	36.2497	34.8818	33.5139	32.1460	30.7781	30.7781	32.1460	33.5139	34.8818	36.2497	37.6176 (42c)
Average daily hot water use (litres/day)												116.0029 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	126.1960	123.5017	120.2203	115.2302	111.1781	106.8216	105.1471	108.4143	111.8601	116.4337	121.5006	125.8687 (44)
Energy conte	199.8636	175.8647	184.7741	157.7444	149.6671	131.3497	127.1663	134.2396	137.9347	157.9994	173.0999	197.0799 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												1926.7835
	29.9795	26.3797	27.7161	23.6617	22.4501	19.7024	19.0750	20.1359	20.6902	23.6999	25.9650	29.5620 (46)
Water storage loss:												
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage												
	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	256.8387	227.3261	241.7492	212.8816	206.6421	186.4868	184.1414	191.2146	193.0719	214.9744	228.2371	254.0550 (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												
	256.8387	227.3261	241.7492	212.8816	206.6421	186.4868	184.1414	191.2146	193.0719	214.9744	228.2371	254.0550 (64)
12Total per year (kWh/year)												2597.6189 (64)
Electric shower(s)												2598 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	112.0347	99.6441	107.0174	96.5597	95.3443	87.7835	87.8629	90.2147	89.9730	98.1148	101.6655	111.1091 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	101.8310	112.7415	101.8310	105.2254	101.8310	105.2254	101.8310	105.2254	101.8310	105.2254	101.8310	101.8310 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	197.1570	199.2029	194.0473	183.0718	169.2172	156.1958	147.4967	145.4508	150.6064	161.5819	175.4365	188.4579 (68)
Pumps, fans	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867 (71)
Total internal gains	150.5843	148.2799	143.8407	134.1107	128.1510	121.9215	118.0952	121.2563	124.9625	131.8748	141.2020	149.3402 (72)
	509.2423	519.8942	499.3890	482.0779	458.8692	440.0127	424.0930	425.2082	437.4643	454.9577	481.5339	499.2991 (73)

6. Solar gains						
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.0900	10.6334	0.7200	0.7000	0.7700	18.9040 (74)
South	6.7700	46.7521	0.7200	0.7000	0.7700	110.5486 (78)
West	0.5300	19.6403	0.7200	0.7000	0.7700	3.6357 (80)

Full SAP Calculation Printout



Solar gains	133.0883	224.2888	303.7262	376.3439	425.3851	425.0265	408.5645	370.8843	328.3462	246.7226	158.8916	114.2733 (83)
Total gains	642.3306	744.1830	803.1152	858.4219	884.2543	865.0392	832.6574	796.0924	765.8104	701.6803	640.4255	613.5724 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	69.8782	70.1266	70.1266	70.1266	70.1266	70.1266	70.1266	70.1266	70.1266	70.1266	70.1266	70.1266
alpha	5.6585	5.6751	5.6751	5.6751	5.6751	5.6751	5.6751	5.6751	5.6751	5.6751	5.6751	5.6751
util living area	0.9912	0.9793	0.9555	0.8907	0.7599	0.5709	0.4144	0.4521	0.6767	0.9074	0.9796	0.9931 (86)
MIT	20.2344	20.3841	20.5555	20.7494	20.8826	20.9348	20.9439	20.9430	20.9193	20.7556	20.4589	20.2023 (87)
Th 2	20.4351	20.4371	20.4371	20.4371	20.4371	20.4371	20.4371	20.4371	20.4371	20.4371	20.4371	20.4371 (88)
util rest of house	0.9896	0.9758	0.9479	0.8731	0.7269	0.5243	0.3621	0.3980	0.6304	0.8888	0.9755	0.9919 (89)
MIT 2	19.7150	19.8647	20.0324	20.2170	20.3354	20.3762	20.3818	20.3814	20.3656	20.2253	19.9394	19.6848 (90)
Living area fraction									fLA =	Living area / (4) =		0.2066 (91)
MIT	19.8223	19.9720	20.1405	20.3270	20.4484	20.4916	20.4979	20.4974	20.4800	20.3349	20.0468	19.7917 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8223	19.9720	20.1405	20.3270	20.4484	20.4916	20.4979	20.4974	20.4800	20.3349	20.0468	19.7917 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9876	0.9724	0.9434	0.8694	0.7276	0.5289	0.3678	0.4038	0.6340	0.8850	0.9722	0.9901 (94)
Useful gains	634.3514	723.6320	757.6618	746.3250	643.3433	457.5204	306.2375	321.4723	485.5413	621.0168	622.5995	607.5204 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.1000	14.0000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1226.5166	1186.7179	1074.0075	899.7238	688.8217	463.8837	306.9104	322.6147	502.3365	766.4909	1019.3851	1227.6403 (97)
Space heating kWh	440.5709	311.1937	235.3612	110.4471	33.8360	0.0000	0.0000	0.0000	0.0000	108.2327	285.6856	461.3692 (98a)
Space heating requirement - total per year (kWh/year)												1986.6965
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	440.5709	311.1937	235.3612	110.4471	33.8360	0.0000	0.0000	0.0000	0.0000	108.2327	285.6856	461.3692 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1986.6965
Space heating per m2										(98c) / (4) =		28.4057 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	440.5709	311.1937	235.3612	110.4471	33.8360	0.0000	0.0000	0.0000	0.0000	108.2327	285.6856	461.3692 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	176.2989	124.5273	94.1822	44.1965	13.5398	0.0000	0.0000	0.0000	0.0000	43.3104	114.3200	184.6215 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	256.8387	227.3261	241.7492	212.8816	206.6421	186.4868	184.1414	191.2146	193.0719	214.9744	228.2371	254.0550 (64)
Efficiency of water heater (217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	146.6812	129.8264	138.0635	121.5771	118.0138	106.5030	105.1636	109.2031	110.2638	122.7724	130.3467	145.0914 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	3.9365	3.5556	3.9365	3.8095	3.9365	3.8095	3.9365	3.9365	3.8095	3.9365	3.8095	3.9365 (231)
Lighting	18.7078	15.0081	13.5131	9.9003	7.6473	6.2479	6.9761	9.0678	11.7782	15.4536	17.4548	19.2278 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												794.9966 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1483.5059 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

Full SAP Calculation Printout



(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2240)
 mechanical ventilation fans (SFP = 0.2240)
 Total electricity for the above, kWh/year
 Electricity for lighting (calculated in Appendix L)

46.3495 (230a)
 46.3495 (231)
 150.9828 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation
 Wind generation
 Hydro-electric generation (Appendix N)
 Electricity generated - Micro CHP (Appendix N)
 Appendix Q - special features
 Energy saved or generated
 Energy used
 Total delivered energy for all uses

0.0000 (233)
 0.0000 (234)
 0.0000 (235a)
 0.0000 (235)
 -0.0000 (236)
 0.0000 (237)
 2475.8348 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	794.9966	0.1565	124.4242 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	1483.5059	0.1408	208.9341 (264)
Space and water heating			333.3582 (265)
Pumps, fans and electric keep-hot	46.3495	0.1387	6.4292 (267)
Energy for lighting	150.9828	0.1443	21.7915 (268)
Total CO2, kg/year			361.5789 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.1700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	794.9966	1.5794	1255.6171 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1483.5059	1.5208	2256.0639 (278)
Space and water heating			3511.6810 (279)
Pumps, fans and electric keep-hot	46.3495	1.5128	70.1176 (281)
Energy for lighting	150.9828	1.5338	231.5825 (282)
Total Primary energy kWh/year			3813.3810 (286)
Dwelling Primary energy Rate (DPER)			54.5200 (287)

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

1. Overall dwelling characteristics

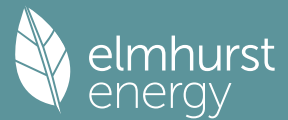
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	34.9700 (1b)	x 2.1500 (2b)	= 75.1855 (1b) - (3b)
First floor	34.9700 (1c)	x 2.7000 (2c)	= 94.4190 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.6045 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1179 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3679 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3679 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4691	0.4599	0.4507	0.4047	0.3955	0.3495	0.3495	0.3403	0.3679	0.3955	0.4139	0.4323 (22b)
Effective ac	0.6100	0.6058	0.6016	0.5819	0.5782	0.5611	0.5611	0.5579	0.5677	0.5782	0.5857	0.5934 (25)

Full SAP Calculation Printout



3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opaque door			1.9100	1.0000	1.9100			(26)
TER Semi-glazed door			2.0300	1.0000	2.0300			(26a)
TER Opening Type (Uw = 1.20)			12.3900	1.1450	14.1870			(27)
Ground Floor			34.9700	0.1300	4.5461			(28a)
External Brick Wall	83.1600	16.3300	66.8300	0.1800	12.0294			(29a)
Roof	34.9700		34.9700	0.1100	3.8467			(30)
Total net area of external elements Aum(A, m ²)			153.1000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5492			(33)
Party Wall			43.1200	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							284.2083	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				9.1600	0.0500		0.4580	
E3 Sill				7.2100	0.0500		0.3605	
E4 Jamb				31.2600	0.0500		1.5630	
E5 Ground floor (normal)				16.8000	0.1600		2.6880	
E6 Intermediate floor within a dwelling				16.8000	0.0000		0.0000	
E10 Baves (insulation at ceiling level)				17.4200	0.0600		1.0452	
E12 Gable (insulation at ceiling level)				8.0800	0.0600		0.4848	
E16 Corner (normal)				9.9000	0.0900		0.8910	
P1 Party wall - Ground floor				8.7100	0.0800		0.6968	
P4 Party wall - Roof (insulation at ceiling level)				8.7100	0.1200		1.0452	
E18 Party wall between dwellings				9.9000	0.0600		0.5940	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.8265 (36)
Point Thermal Bridges								0.0000 (36a)
Total fabric heat loss								(33) + (36) + (36a) = 48.3757 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	34.1429	33.9038	33.6694	32.5684	32.3625	31.4036	31.4036	31.2260	31.7729	32.3625	32.7792	33.2148	(38)
Average = Sum(39)m / 12 =	82.5186	82.2795	82.0451	80.9442	80.7382	79.7793	79.7793	79.6017	80.1487	80.7382	81.1549	81.5905	(39)
												80.9432	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1798	1.1764	1.1731	1.1573	1.1544	1.1407	1.1407	1.1381	1.1460	1.1544	1.1604	1.1666	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

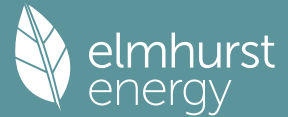
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2447 (42)
Hot water usage for mixer showers													
	61.8553	60.9258	59.5712	56.9795	55.0669	52.9340	51.7216	53.0659	54.5395	56.8296	59.4770	61.6183	(42a)
Hot water usage for baths													
	26.7230	26.3262	25.7673	24.7368	23.9652	23.1096	22.6475	23.2024	23.8067	24.7222	25.7739	26.6327	(42b)
Hot water usage for other uses													
	37.6176	36.2497	34.8818	33.5139	32.1460	30.7781	30.7781	32.1460	33.5139	34.8818	36.2497	37.6176	(42c)
Average daily hot water use (litres/day)													116.0029 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	126.1960	123.5017	120.2203	115.2302	111.1781	106.8216	105.1471	108.4143	111.8601	116.4337	121.5006	125.8687	(44)
Energy conte	199.8636	175.8647	184.7741	157.7444	149.6671	131.3497	127.1663	134.2396	137.9347	157.9994	173.0999	197.0799	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	29.9795	26.3797	27.7161	23.6617	22.4501	19.7024	19.0750	20.1359	20.6902	23.6999	25.9650	29.5620	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	254.7704	225.4580	239.6809	210.8800	204.5738	184.4853	182.0731	189.1464	191.0703	212.9062	226.2356	251.9867	(62)
WVHRS	-28.2777	-25.0090	-26.1880	-21.6847	-20.2094	-17.2933	-16.2097	-17.2374	-17.8923	-21.0931	-23.8959	-27.7540	(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													
	226.4928	200.4489	213.4929	189.1953	184.3645	167.1920	165.8634	171.9090	173.1780	191.8131	202.3397	224.2327	(64)
12Total per year (kWh/year)													2310.5224 (64)
Electric shower(s)													2311 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	110.3801	98.1496	105.3628	94.9585	93.6897	86.1822	86.2082	88.5601	88.3718	96.4602	100.0642	109.4545	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	112.2334	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	101.8310	112.7415	101.8310	105.2254	101.8310	105.2254	101.8310	101.8310	105.2254	101.8310	105.2254	101.8310	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	197.1570	199.2029	194.0473	183.0718	169.2172	156.1958	147.4967	145.4508	150.6064	161.5819	175.4365	188.4579	(68)
Pumps, fans	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	34.2233	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	-89.7867	(71)
Water heating gains (Table 5)													
	148.3603	146.0560	141.6167	131.8868	125.9271	119.6976	115.8713	119.0324	122.7386	129.6508	138.9781	147.1163	(72)

Full SAP Calculation Printout



Total internal gains
507.0183 517.6703 497.1651 479.8540 456.6453 437.7887 421.8690 422.9842 435.2403 452.7337 479.3100 497.0752 (73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	5.0900		10.6334		0.6300		0.7000		0.7700		16.5410 (74)	
South	6.7700		46.7521		0.6300		0.7000		0.7700		96.7300 (78)	
West	0.5300		19.6403		0.6300		0.7000		0.7700		3.1812 (80)	
Solar gains	116.4522	196.2527	265.7604	329.3009	372.2120	371.8982	357.4939	324.5237	287.3029	215.8823	139.0301	99.9891 (83)
Total gains	623.4706	713.9230	762.9255	809.1549	828.8572	809.6869	779.3629	747.5080	722.5432	668.6160	618.3401	597.0643 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.9126	67.1071	67.2988	68.2141	68.3882	69.2101	69.2101	69.3645	68.8912	68.3882	68.0370	67.6737
alpha	5.4608	5.4738	5.4866	5.5476	5.5592	5.6140	5.6140	5.6243	5.5927	5.5592	5.5358	5.5116
util living area	0.9928	0.9841	0.9668	0.9156	0.8027	0.6122	0.4476	0.4853	0.7168	0.9260	0.9835	0.9942 (86)
MIT	19.9552	20.1432	20.3771	20.6704	20.8818	20.9794	20.9969	20.9953	20.9514	20.6952	20.2821	19.9281 (87)
Th 2	19.9362	19.9389	19.9416	19.9543	19.9567	19.9677	19.9677	19.9698	19.9635	19.9567	19.9519	19.9468 (88)
util rest of house	0.9902	0.9785	0.9551	0.8865	0.7426	0.5218	0.3442	0.3791	0.6286	0.8942	0.9767	0.9921 (89)
MIT 2	18.7477	18.9868	19.2800	19.6397	19.8660	19.9576	19.9670	19.9684	19.9355	19.6772	19.1740	18.7213 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9972	19.2257	19.5067	19.8526	20.0759	20.1687	20.1798	20.1806	20.1454	19.8875	19.4029	18.9706 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.9972	19.2257	19.5067	19.8526	20.0759	20.1687	20.1798	20.1806	20.1454	19.8875	19.4029	18.9706 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9870	0.9736	0.9490	0.8832	0.7501	0.5400	0.3656	0.4011	0.6451	0.8917	0.9719	0.9894 (94)
Useful gains	615.3553	695.0959	724.0109	714.6175	621.7268	437.2350	284.9443	299.8617	466.1310	596.1823	600.9936	590.7209 (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	1212.7909	1178.7152	1067.1362	886.5506	676.2524	444.2652	285.5905	300.9418	484.5310	749.8588	998.4409	1205.1405 (97)
Space heating kWh	444.4921	324.9922	255.2852	123.7918	40.5671	0.0000	0.0000	0.0000	0.0000	114.3354	286.1621	457.1282 (98a)
Space heating requirement - total per year (kWh/year)												2046.7540
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	444.4921	324.9922	255.2852	123.7918	40.5671	0.0000	0.0000	0.0000	0.0000	114.3354	286.1621	457.1282 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2046.7540
Space heating per m2												(98c) / (4) = 29.2644 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	444.4921	324.9922	255.2852	123.7918	40.5671	0.0000	0.0000	0.0000	0.0000	114.3354	286.1621	457.1282 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	481.5732	352.1042	276.5820	134.1190	43.9513	0.0000	0.0000	0.0000	0.0000	123.8736	310.0348	495.2635 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	226.4928	200.4489	213.4929	189.1953	184.3645	167.1920	165.8634	171.9090	173.1780	191.8131	202.3397	224.2327 (64)
Efficiency of water heater	85.5434	85.1370	84.4617	83.1325	81.2858	79.8000	79.8000	79.8000	79.8000	82.9393	84.8369	79.8000 (216)
Fuel for water heating, kWh/month	264.7695	235.4428	252.7688	227.5829	226.8101	209.5138	207.8489	215.4248	217.0150	231.2692	238.5044	261.8866 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	21.1585	16.9741	15.2833	11.1972	8.6490	7.0663	7.8899	10.2557	13.3211	17.4780	19.7413	21.7465 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-32.8485	-46.3780	-66.7701	-75.2114	-81.2352	-75.8897	-74.9644	-70.7092	-63.2115	-53.1045	-36.1418	-28.3925 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

Full SAP Calculation Printout



(233b)m	-18.3545	-38.6357	-76.8304	-115.4461	-152.6912	-153.4202	-151.6023	-128.3324	-94.0341	-55.2562	-24.5086	-14.5115	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2217.5016	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2788.8370	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												170.7610	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1728.4799	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3534.6197	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2217.5016	0.2100	465.6753	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2788.8370	0.2100	585.6558	(264)
Space and water heating			1051.3311	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.7610	0.1443	24.6461	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-704.8566	0.1345	-94.8355	
PV Unit electricity exported	-1023.6232	0.1259	-128.8587	
Total			-223.6942	(269)
Total CO2, kg/year			864.2122	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2217.5016	1.1300	2505.7768	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2788.8370	1.1300	3151.3858	(278)
Space and water heating			5657.1626	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.7610	1.5338	261.9189	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-704.8566	1.4973	-1055.3510	
PV Unit electricity exported	-1023.6232	0.4621	-472.9998	
Total			-1528.3507	(283)
Total Primary energy kWh/year			4520.8315	(286)
Target Primary Energy Rate (TPER)			64.6400	(287)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 14 Jun 2024 10:27:20

Project Information			
Assessed By	Daniel Watt	Building Type	House, Semi-detached
OCDEA Registration	EES/027301	Assessment Date	2024-06-14

Dwelling Details			
Assessment Type	As designed	Total Floor Area	86 m ²
Site Reference	3B4P Type 2	Plot Reference	3B4P-Type 2
Address			

Client Details	
Name	Elliot Denby
Company	BTP Architects
Address	486 Didsbury Road, Stockport, SK4 3BS

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	11.42 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.81 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	59.68 kWh _{PE} /m ²		
Dwelling primary energy	50.6 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	37.5 kWh/m ²		
Dwelling fabric energy efficiency	37.0 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	Ground Floor (0.12)	OK
Roofs	0.16	0.13	Roof (1) (0.13)	OK
Windows, doors, and roof windows	1.6	1.29	North Windows (1.3)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	74.5	0.18	
Party wall: Party Wall (1)	46.63	0 (!)	
Ground floor: Ground Floor, Ground Floor	41.6	0.12	
Exposed roof: Roof (1)	43.05	0.13	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
North Windows, Windows	5.09	West	0.7	1.3
Front Door, Front Door	1.91	West	N/A	1.2
Window, Windows	0.53	South	0.7	1.3
South Window, Windows	6.77	East	0.7	1.3
Back Door, Back Door	2.03	East	N/A	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 (!)	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.07	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.002 (!)	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.24	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	249.9%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

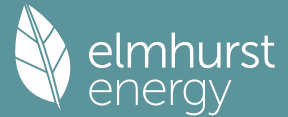
Cylinder/store - type: Cylinder	
Capacity	250 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Programmer and room thermostat	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	120 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.16 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Sentinel Multivent A	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	3B4P Type 2				Issued on Date	14/06/2024
Assessment Reference	3B4P-Type 2		Prop Type Ref			
Property						
SAP Rating	80 C	DER	4.81	TER	11.42	
Environmental	96 A	% DER < TER				57.88
CO ₂ Emissions (t/year)	0.42	DFEE	37.03	TFEE	37.52	
Compliance Check	See BREL	% DFEE < TFEE				1.30
% DPER < TPER	15.22	DPER	50.60	TPER	59.68	
Assessor Details	Mr. Daniel Watt				Assessor ID	AV75-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.0500 (1b)	x 2.2500 (2b)	= 96.8625 (1b) - (3b)
First floor	43.0500 (1c)	x 2.7000 (2c)	= 116.2350 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.0975 (5)

2. Ventilation rate

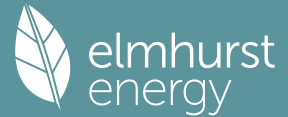
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			12.3900	1.2357	15.3108		(27)
Front Door			1.9100	1.2000	2.2920		(26)
Back Door			2.0300	1.3000	2.6390		(26a)
Ground Floor			41.6000	0.1200	4.9920	110.0000	(28a)
External Brick Wall	90.8300	16.3300	74.5000	0.1800	13.4100	190.0000	(29a)
Roof	43.0500		43.0500	0.1300	5.5965	9.0000	(30)
Total net area of external elements Aum(A, m ²)			175.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.2403		(33)
Party Wall			46.6300	0.0000	0.0000	70.0000	(32)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =		22382.5500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K						259.9599	(35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				9.1600	0.0300	0.2748	

Full SAP Calculation Printout



E3 Sill	7.2100	0.0400	0.2884
E4 Jamb	31.2600	0.0500	1.5630
E5 Ground floor (normal)	18.3500	0.0700	1.2845
E6 Intermediate floor within a dwelling	18.3500	0.0020	0.0367
E10 Baves (insulation at ceiling level)	8.8600	0.0600	0.5316
E12 Gable (insulation at ceiling level)	9.4600	0.2400	2.2704
E16 Corner (normal)	9.9000	0.0900	0.8910
P1 Party wall - Ground floor	9.4600	0.0800	0.7568
P4 Party wall - Roof (insulation at ceiling level)	9.4600	0.1200	1.1352
E18 Party wall between dwellings	9.9000	0.0600	0.5940
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.6264 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	53.8667 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.5127	35.1611	35.1611	35.1611	35.1611	35.1611	35.1611	35.1611	35.1611	35.1611	35.1611	35.1611 (38)
Average = Sum(39)m / 12 =	89.3794	89.0278	89.0278	89.0278	89.0278	89.0278	89.0278	89.0278	89.0278	89.0278	89.0278	89.0278 (39)
												89.0571

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0381	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.5685 (42)
Hot water usage for mixer showers												
Hot water usage for baths	67.2849	66.2737	64.8002	61.9810	59.9005	57.5804	56.2616	57.7239	59.3269	61.8180	64.6978	67.0271 (42a)
Hot water usage for other uses	29.0579	28.6264	28.0187	26.8981	26.0591	25.1288	24.6262	25.2297	25.8868	26.8823	28.0259	28.9597 (42b)
Average daily hot water use (litres/day)	40.9339	39.4454	37.9569	36.4684	34.9799	33.4914	33.4914	34.9799	36.4684	37.9569	39.4454	40.9339 (42c)
												126.1883 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	137.2767	134.3455	130.7758	125.3476	120.9395	116.2005	114.3792	117.9335	121.6820	126.6572	132.1690	136.9207 (44)
Energy content (annual)	217.4127	191.3062	200.9975	171.5946	162.8079	142.8821	138.3318	146.0263	150.0461	171.8726	188.2990	214.3847 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2095.9614
Water storage loss:	32.6119	28.6959	30.1496	25.7392	24.4212	21.4323	20.7498	21.9039	22.5069	25.7809	28.2449	32.1577 (46)
Store volume												250.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.7830 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	274.3878	242.7675	257.9726	226.7317	219.7829	198.0193	195.3068	203.0014	205.1833	228.8477	243.4362	271.3597 (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	274.3878	242.7675	257.9726	226.7317	219.7829	198.0193	195.3068	203.0014	205.1833	228.8477	243.4362	271.3597 (64)
12Total per year (kWh/year)												2766.7967 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	117.8698	104.7784	112.4117	101.1649	99.7137	91.6180	91.5754	94.1338	94.0001	102.7277	106.7191	116.8629 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	124.6416	137.9960	124.6416	128.7963	124.6416	128.7963	124.6416	124.6416	128.7963	124.6416	128.7963	124.6416 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	231.7171	234.1216	228.0623	215.1629	198.8797	183.5757	173.3517	170.9473	177.0065	189.9060	206.1892	221.4931 (68)
Pumps, fans	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396 (71)
Total internal gains	158.4271	155.9202	151.0910	140.5068	134.0237	127.2473	123.0852	126.5239	130.5556	138.0748	148.2210	157.0738 (72)
	579.3131	592.5652	568.3223	548.9934	522.0723	501.1466	482.6058	483.6401	497.8858	517.1497	547.7339	567.7359 (73)

6. Solar gains						
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	6.7700	19.6403	0.7200	0.7000	0.7700	46.4408 (76)
South	0.5300	46.7521	0.7200	0.7000	0.7700	8.6545 (78)
West	5.0900	19.6403	0.7200	0.7000	0.7700	34.9164 (80)

Full SAP Calculation Printout



Solar gains	90.0116	173.3257	280.1553	402.6638	489.7356	500.0278	476.5588	411.5995	323.6941	204.1349	111.7013	74.3824 (83)
Total gains	669.3248	765.8908	848.4776	951.6572	1011.8080	1001.1744	959.1647	895.2395	821.5799	721.2846	659.4352	642.1183 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	69.5616	69.8363	69.8363	69.8363	69.8363	69.8363	69.8363	69.8363	69.8363	69.8363	69.8363	69.8363
alpha	5.6374	5.6558	5.6558	5.6558	5.6558	5.6558	5.6558	5.6558	5.6558	5.6558	5.6558	5.6558
util living area	0.9940	0.9863	0.9660	0.8971	0.7534	0.5588	0.4069	0.4545	0.7051	0.9336	0.9865	0.9952 (86)
MIT	20.1809	20.3186	20.5096	20.7385	20.8844	20.9356	20.9438	20.9427	20.9128	20.7118	20.4027	20.1535 (87)
Th 2	20.4810	20.4830	20.4830	20.4830	20.4830	20.4830	20.4830	20.4830	20.4830	20.4830	20.4830	20.4830 (88)
util rest of house	0.9930	0.9841	0.9605	0.8817	0.7230	0.5167	0.3597	0.4046	0.6627	0.9202	0.9840	0.9944 (89)
MIT 2	19.7041	19.8426	20.0308	20.2505	20.3815	20.4222	20.4275	20.4269	20.4061	20.2284	19.9267	19.6785 (90)
Living area fraction									FLA =	Living area / (4) =		0.2271 (91)
MIT	19.8124	19.9507	20.1395	20.3613	20.4957	20.5387	20.5447	20.5440	20.5212	20.3381	20.0348	19.7864 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8124	19.9507	20.1395	20.3613	20.4957	20.5387	20.5447	20.5440	20.5212	20.3381	20.0348	19.7864 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9914	0.9814	0.9563	0.8777	0.7237	0.5213	0.3654	0.4105	0.6659	0.9159	0.9813	0.9931 (94)
Useful gains	663.5729	751.6747	811.4110	835.2845	732.2938	521.8724	350.4324	367.4884	547.1073	660.6401	647.0931	637.6756 (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	1386.4859	1339.9297	1214.2977	1020.3784	783.0648	528.7120	351.1913	368.9339	571.6630	866.9644	1151.5536	1387.6198 (97)
Space heating kWh	537.8473	395.3074	299.7477	133.2676	37.7736	0.0000	0.0000	0.0000	0.0000	153.5053	363.2115	557.9585 (98a)
Space heating requirement - total per year (kWh/year)												2478.6189
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	537.8473	395.3074	299.7477	133.2676	37.7736	0.0000	0.0000	0.0000	0.0000	153.5053	363.2115	557.9585 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2478.6189
Space heating per m2										(98c) / (4) =		28.7877 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	537.8473	395.3074	299.7477	133.2676	37.7736	0.0000	0.0000	0.0000	0.0000	153.5053	363.2115	557.9585 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	215.2250	158.1862	119.9471	53.3284	15.1155	0.0000	0.0000	0.0000	0.0000	61.4267	145.3428	223.2727 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	274.3878	242.7675	257.9726	226.7317	219.7829	198.0193	195.3068	203.0014	205.1833	228.8477	243.4362	271.3597 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	156.7035	138.6451	147.3287	129.4870	125.5185	113.0892	111.5402	115.9345	117.1806	130.6954	139.0269	154.9741 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	4.9460	4.4674	4.9460	4.7865	4.9460	4.7865	4.9460	4.9460	4.7865	4.9460	4.7865	4.9460 (231)
Lighting	24.1724	19.3920	17.4604	12.7922	9.8811	8.0729	9.0139	11.7165	15.2186	19.9677	22.5534	24.8443 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												991.8443 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1580.1238 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

Full SAP Calculation Printout



(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2240)
 mechanical ventilation fans (SFP = 0.2240)
 Total electricity for the above, kWh/year
 Electricity for lighting (calculated in Appendix L)

58.2353 (230a)
 58.2353 (231)
 195.0855 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation
 Wind generation
 Hydro-electric generation (Appendix N)
 Electricity generated - Micro CHP (Appendix N)
 Appendix Q - special features
 Energy saved or generated
 Energy used
 Total delivered energy for all uses

0.0000 (233)
 0.0000 (234)
 0.0000 (235a)
 0.0000 (235)
 -0.0000 (236)
 0.0000 (237)
 2825.2888 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	991.8443	0.1563	155.0588 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1580.1238	0.1409	222.6130 (264)
Space and water heating			377.6719 (265)
Pumps, fans and electric keep-hot	58.2353	0.1387	8.0780 (267)
Energy for lighting	195.0855	0.1443	28.1569 (268)
Total CO2, kg/year			413.9067 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	991.8443	1.5788	1565.8864 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1580.1238	1.5209	2403.2649 (278)
Space and water heating			3969.1513 (279)
Pumps, fans and electric keep-hot	58.2353	1.5128	88.0983 (281)
Energy for lighting	195.0855	1.5338	299.2286 (282)
Total Primary energy kWh/year			4356.4782 (286)
Dwelling Primary energy Rate (DPER)			50.6000 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.0500 (1b)	x 2.2500 (2b)	= 96.8625 (1b) - (3b)
First floor	43.0500 (1c)	x 2.7000 (2c)	= 116.2350 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.0975 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1408 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.3908 (18)	
Number of sides sheltered		0 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3908 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4982	0.4885	0.4787	0.4299	0.4201	0.3712	0.3712	0.3615	0.3908	0.4201	0.4396	0.4592 (22b)
Effective ac	0.6241	0.6193	0.6146	0.5924	0.5882	0.5689	0.5689	0.5653	0.5764	0.5882	0.5966	0.6054 (25)

Full SAP Calculation Printout



3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opaque door			1.9100	1.0000	1.9100			(26)
TER Semi-glazed door			2.0300	1.0000	2.0300			(26a)
TER Opening Type (Uw = 1.20)			12.3900	1.1450	14.1870			(27)
Ground Floor			41.6000	0.1300	5.4080			(28a)
External Brick Wall	90.8300	16.3300	74.5000	0.1800	13.4100			(29a)
Roof	43.0500		43.0500	0.1100	4.7355			(30)
Total net area of external elements Aum(A, m ²)			175.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.6805			(33)
Party Wall			46.6300	0.0000	0.0000			(32)

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

259.9599 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	9.1600	0.0500	0.4580	
E2 Other lintels (including other steel lintels)	7.2100	0.0500	0.3605	
E3 Sill	31.2600	0.0500	1.5630	
E4 Jamb	18.3500	0.1600	2.9360	
E5 Ground floor (normal)	18.3500	0.0000	0.0000	
E6 Intermediate floor within a dwelling	8.8600	0.0600	0.5316	
E10 Baves (insulation at ceiling level)	9.4600	0.0600	0.5676	
E12 Gable (insulation at ceiling level)	9.9000	0.0900	0.8910	
E16 Corner (normal)	9.4600	0.0800	0.7568	
P1 Party wall - Ground floor	9.4600	0.1200	1.1352	
P4 Party wall - Roof (insulation at ceiling level)	9.9000	0.0600	0.5940	
E18 Party wall between dwellings				

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

9.7937 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 51.4742 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.8898	43.5508	43.2186	41.6581	41.3661	40.0070	40.0070	39.7553	40.5305	41.3661	41.9568	42.5743	(38)
Heat transfer coeff	95.3640	95.0250	94.6928	93.1323	92.8404	91.4812	91.4812	91.2295	92.0047	92.8404	93.4310	94.0485	(39)
Average = Sum(39)m / 12 =												93.1309	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1076	1.1037	1.0998	1.0817	1.0783	1.0625	1.0625	1.0596	1.0686	1.0783	1.0851	1.0923	(40)
HLP (average)												1.0817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

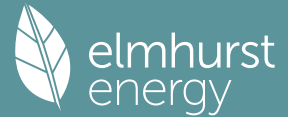
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5685 (42)
Hot water usage for mixer showers	67.2849	66.2737	64.8002	61.9810	59.9005	57.5804	56.2616	57.7239	59.3269	61.8180	64.6978	67.0271	(42a)
Hot water usage for baths	29.0579	28.6264	28.0187	26.8981	26.0591	25.1288	24.6262	25.2297	25.8868	26.8823	28.0259	28.9597	(42b)
Hot water usage for other uses	40.9339	39.4454	37.9569	36.4684	34.9799	33.4914	33.4914	34.9799	36.4684	37.9569	39.4454	40.9339	(42c)
Average daily hot water use (litres/day)												126.1883	(43)
Daily hot water use	137.2767	134.3455	130.7758	125.3476	120.9395	116.2005	114.3792	117.9335	121.6820	126.6572	132.1690	136.9207	(44)
Energy conte	217.4127	191.3062	200.9975	171.5946	162.8079	142.8821	138.3318	146.0263	150.0461	171.8726	188.2990	214.3847	(45)
Energy content (annual)										Total = Sum(45)m =		2095.9614	
Distribution loss (46)m = 0.15 x (45)m	32.6119	28.6959	30.1496	25.7392	24.4212	21.4323	20.7498	21.9039	22.5069	25.7809	28.2449	32.1577	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	272.3195	240.8994	255.9043	224.7302	217.7147	196.0177	193.2386	200.9331	203.1817	226.7794	241.4346	269.2914	(62)
WVHRS	-30.7598	-27.2042	-28.4867	-23.5881	-21.9833	-18.8113	-17.6326	-18.7505	-19.4629	-22.9446	-25.9934	-30.1902	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	241.5597	213.6951	227.4176	201.1420	195.7314	177.2065	175.6060	182.1826	183.7189	203.8348	215.4412	239.1012	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2456.6370	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	116.2152	103.2839	110.7571	99.5637	98.0590	90.0168	89.9207	92.4792	92.3988	101.0731	105.1179	115.2083	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	124.6416	137.9960	124.6416	128.7963	124.6416	128.7963	124.6416	124.6416	128.7963	124.6416	128.7963	124.6416	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.7171	234.1216	228.0623	215.1629	198.8797	183.5757	173.3517	170.9473	177.0065	189.9060	206.1892	221.4931	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	(71)
Water heating gains (Table 5)	156.2032	153.6963	148.8671	138.2829	131.7998	125.0233	120.8612	124.3000	128.3317	135.8509	145.9971	154.8499	(72)

Full SAP Calculation Printout



Total internal gains
577.0892 590.3412 566.0983 546.7694 519.8484 498.9227 480.3819 481.4161 495.6618 514.9258 545.5099 565.5120 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					6.7700	19.6403	0.6300	0.7000	0.7700	40.6357 (76)		
South					0.5300	46.7521	0.6300	0.7000	0.7700	7.5727 (78)		
West					5.0900	19.6403	0.6300	0.7000	0.7700	30.5518 (80)		
Solar gains	78.7602	151.6599	245.1359	352.3308	428.5187	437.5243	416.9890	360.1495	283.2324	178.6180	97.7386	65.0846 (83)
Total gains	655.8494	742.0012	811.2343	899.1003	948.3671	936.4470	897.3709	841.5657	778.8942	693.5438	643.2486	630.5966 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.1963	65.4288	65.6584	66.7585	66.9684	67.9634	67.9634	68.1509	67.5767	66.9684	66.5451	66.1082
alpha	5.3464	5.3619	5.3772	5.4506	5.4646	5.5309	5.5309	5.5434	5.5051	5.4646	5.4363	5.4072
util living area	0.9949	0.9893	0.9750	0.9230	0.8031	0.6069	0.4456	0.4933	0.7486	0.9476	0.9888	0.9958 (86)
MIT	19.8567	20.0314	20.2911	20.6371	20.8755	20.9790	20.9968	20.9945	20.9366	20.6231	20.1909	19.8390 (87)
Th 2	19.9946	19.9978	20.0010	20.0158	20.0186	20.0316	20.0316	20.0340	20.0266	20.0186	20.0130	20.0071 (88)
util rest of house	0.9931	0.9857	0.9665	0.8979	0.7474	0.5230	0.3491	0.3926	0.6674	0.9249	0.9844	0.9944 (89)
MIT 2	18.6755	18.8996	19.2284	19.6585	19.9190	20.0204	20.0306	20.0322	19.9865	19.6532	19.1149	18.6621 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9437	19.1566	19.4697	19.8807	20.1362	20.2380	20.2500	20.2507	20.2023	19.8734	19.3592	18.9293 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.9437	19.1566	19.4697	19.8807	20.1362	20.2380	20.2500	20.2507	20.2023	19.8734	19.3592	18.9293 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9906	0.9817	0.9607	0.8939	0.7546	0.5415	0.3711	0.4155	0.6831	0.9208	0.9805	0.9922 (94)
Useful gains	649.6818	728.4029	779.3562	803.6684	715.6663	507.0407	333.0190	349.6765	532.0975	638.5874	630.6949	625.6909 (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	1396.4796	1354.7347	1228.1379	1022.6576	783.2167	515.7748	333.9051	351.2953	561.4377	860.9460	1145.3886	1385.2707 (97)
Space heating kWh	555.6176	420.8949	333.8936	157.6722	50.2575	0.0000	0.0000	0.0000	0.0000	165.4348	370.5794	565.1274 (98a)
Space heating requirement - total per year (kWh/year)	2619.4774											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	555.6176	420.8949	333.8936	157.6722	50.2575	0.0000	0.0000	0.0000	0.0000	165.4348	370.5794	565.1274 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2619.4774											
Space heating per m2	(98c) / (4) = 30.4237 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	555.6176	420.8949	333.8936	157.6722	50.2575	0.0000	0.0000	0.0000	0.0000	165.4348	370.5794	565.1274 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	601.9692	456.0075	361.7482	170.8258	54.4502	0.0000	0.0000	0.0000	0.0000	179.2360	401.4945	612.2723 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	241.5597	213.6951	227.4176	201.1420	195.7314	177.2065	175.6060	182.1826	183.7189	203.8348	215.4412	239.1012 (64)
Efficiency of water heater	85.8655	85.5509	84.9197	83.5197	81.4874	79.8000	79.8000	79.8000	79.8000	83.5957	85.2647	79.8000 (216)
Fuel for water heating, kWh/month	281.3232	249.7872	267.8032	240.8319	240.1985	222.0632	220.0576	228.2991	230.2241	243.8340	252.6734	278.2866 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	25.8981	20.7764	18.7068	13.7054	10.5865	8.6492	9.6573	12.5530	16.3051	21.3931	24.1635	26.6178 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-39.9361	-56.1213	-80.4039	-90.0850	-96.8579	-90.2897	-89.1629	-84.3116	-75.7071	-64.0207	-43.8373	-34.5475 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

Full SAP Calculation Printout



(233b)m	-23.0976	-48.5352	-96.3763	-144.6249	-191.1183	-192.0035	-189.7532	-160.7195	-117.8709	-69.3773	-30.8267	-18.2697	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2838.0036	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2955.3819	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												209.0122	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2127.8541	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3960.5436	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2838.0036	0.2100	595.9808	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2955.3819	0.2100	620.6302	(264)
Space and water heating			1216.6110	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	209.0122	0.1443	30.1669	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-845.2810	0.1347	-113.8267	
PV Unit electricity exported	-1282.5732	0.1259	-161.5018	
Total			-275.3285	(269)
Total CO2, kg/year			983.3786	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2838.0036	1.1300	3206.9441	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2955.3819	1.1300	3339.5816	(278)
Space and water heating			6546.5257	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	209.0122	1.5338	320.5898	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-845.2810	1.4977	-1265.9687	
PV Unit electricity exported	-1282.5732	0.4622	-592.8240	
Total			-1858.7927	(283)
Total Primary energy kWh/year			5138.4236	(286)
Target Primary Energy Rate (TPER)			59.6800	(287)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Fri 14 Jun 2024 10:27:20

Project Information			
Assessed By	Daniel Watt	Building Type	House, Semi-detached
OCDEA Registration	EES/027301	Assessment Date	2024-06-14

Dwelling Details			
Assessment Type	As designed	Total Floor Area	83 m ²
Site Reference	3B4P-Type 1	Plot Reference	3B4P Type 1
Address			

Client Details	
Name	Elliot Denby
Company	BTP Architects
Address	486 Didsbury Road, Stockport, SK4 3BS

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	11.61 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.85 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	60.68 kWh _{PE} /m ²		
Dwelling primary energy	51.12 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	37.4 kWh/m ²		
Dwelling fabric energy efficiency	36.7 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	Ground Floor (0.12)	OK
Roofs	0.16	0.13	Roof (1) (0.13)	OK
Windows, doors, and roof windows	1.6	1.3	North Windows (1.3)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	76.04	0.18	
Party wall: Party Wall (1)	46.63	0 (!)	
Ground floor: Ground Floor, Ground Floor	41.6	0.12	
Exposed roof: Roof (1)	41.6	0.13	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
North Windows, Windows	5.09	North	0.7	1.3
Front Door, Front Door	1.91	North	N/A	1.3
East Window, Windows	0.53	East	0.7	1.3
South Window, Windows	6.77	South	0.7	1.3
Back Door, Back Door	2.03	South	N/A	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 (!)	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.07	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.002 (!)	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.24	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	249.9%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

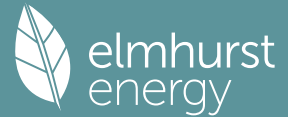
3 Hot water	
Cylinder/store - type: Cylinder	
Capacity	250 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Programmer and room thermostat	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	120 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.16 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Sentinel Multivent A	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	3B4P-Type 1				Issued on Date	14/06/2024
Assessment Reference	3B4P Type 1		Prop Type Ref			
Property						
SAP Rating	80 C	DER	4.85	TER	11.61	
Environmental	96 A	% DER < TER				58.23
CO ₂ Emissions (t/year)	0.41	DFEE	36.70	TFEE	37.37	
Compliance Check	See BREL	% DFEE < TFEE				1.79
% DPER < TPER	15.75	DPER	51.12	TPER	60.68	
Assessor Details	Mr. Daniel Watt				Assessor ID	AV75-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.6000 (1b)	x 2.2500 (2b)	= 93.6000 (1b) - (3b)
First floor	41.6000 (1c)	x 2.7000 (2c)	= 112.3200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 205.9200 (5)

2. Ventilation rate

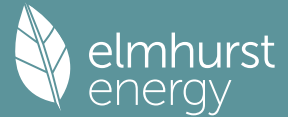
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			12.3900	1.2357	15.3108		(27)
Front Door			1.9100	1.3000	2.4830		(26)
Back Door			2.0300	1.3000	2.6390		(26a)
Ground Floor			41.6000	0.1200	4.9920	110.0000	4576.0000 (28a)
External Brick Wall	92.3700	16.3300	76.0400	0.1800	13.6872	190.0000	14447.6000 (29a)
Roof	41.6000		41.6000	0.1300	5.4080	9.0000	374.4000 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.5200		(33)
Party Wall			46.6300	0.0000	0.0000	70.0000	3264.1000 (32)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		22662.1000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							272.3810 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				9.1600	0.0300	0.2748	

Full SAP Calculation Printout



E3 Sill						7.2100	0.0400	0.2884					
E4 Jamb						31.2600	0.0500	1.5630					
E5 Ground floor (normal)						18.6600	0.0700	1.3062					
E6 Intermediate floor within a dwelling						18.6600	0.0020	0.0373					
E10 Baves (insulation at ceiling level)						8.9000	0.0600	0.5340					
E12 Gable (insulation at ceiling level)						9.4200	0.2400	2.2608					
E16 Corner (normal)						19.8000	0.0900	1.7820					
P1 Party wall - Ground floor						9.4200	0.0800	0.7536					
P4 Party wall - Roof (insulation at ceiling level)						9.4200	0.1200	1.1304					
E18 Party wall between dwellings						4.9500	0.0600	0.2970					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												10.2275	(36)
Point Thermal bridges												0.0000	
Total fabric heat loss												(33) + (36) + (36a) =	54.7476 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	34.3166	33.9768	33.9768	33.9768	33.9768	33.9768	33.9768	33.9768	33.9768	33.9768	33.9768	33.9768	(38)
Average = Sum(39)m / 12 =	89.0641	88.7244	88.7244	88.7244	88.7244	88.7244	88.7244	88.7244	88.7244	88.7244	88.7244	88.7244	(39)
	88.7527												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0705	1.0664	1.0664	1.0664	1.0664	1.0664	1.0664	1.0664	1.0664	1.0664	1.0664	1.0664	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.5208 (42)
Hot water usage for mixer showers													
Hot water usage for baths	66.4849	65.4858	64.0298	61.2442	59.1884	56.8958	55.5927	57.0376	58.6216	61.0831	63.9286	66.2302	(42a)
Hot water usage for other uses	28.7139	28.2875	27.6870	26.5797	25.7506	24.8313	24.3347	24.9310	25.5803	26.5640	27.6941	28.6168	(42b)
Average daily hot water use (litres/day)	40.4453	38.9746	37.5038	36.0331	34.5624	33.0916	33.0916	34.5624	36.0331	37.5038	38.9746	40.4453	(42c)
												124.6876	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	135.6441	132.7478	129.2206	123.8569	119.5013	114.8187	113.0190	116.5310	120.2349	125.1509	130.5972	135.2923	(44)
Energy content (annual)	214.8272	189.0311	198.6073	169.5540	160.8718	141.1830	136.6867	144.2897	148.2617	169.8286	186.0597	211.8351	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	32.2241	28.3547	29.7911	25.4331	24.1308	21.1774	20.5030	21.6435	22.2393	25.4743	27.9090	31.7753	(46)
Store volume													250.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.7830 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.0875 (55)
Total storage loss	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(56)
If cylinder contains dedicated solar storage	33.7127	30.4501	33.7127	32.6252	33.7127	32.6252	33.7127	33.7127	32.6252	33.7127	32.6252	33.7127	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	271.8022	240.4925	255.5823	224.6911	217.8468	196.3201	193.6618	201.2648	203.3989	226.8037	241.1968	268.8102	(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	271.8022	240.4925	255.5823	224.6911	217.8468	196.3201	193.6618	201.2648	203.3989	226.8037	241.1968	268.8102	(64)
12Total per year (kWh/year)													2741.8712 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	117.0101	104.0219	111.6170	100.4864	99.0699	91.0531	91.0284	93.5564	93.4067	102.0481	105.9746	116.0152	(65)

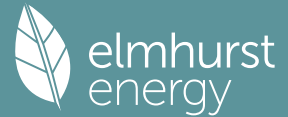
5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	120.6820	133.6122	120.6820	124.7047	120.6820	124.7047	120.6820	124.7047	120.6820	124.7047	120.6820	120.6820	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	225.9983	228.3435	222.4337	209.8527	193.9713	179.0451	169.0734	166.7283	172.6380	185.2191	201.1004	216.0267	(68)
Pumps, fans	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	(71)
Total internal gains	157.2716	154.7945	150.0228	139.5645	133.1585	126.4626	122.3500	125.7478	129.7316	137.1614	147.1869	155.9344	(72)
	567.7636	580.5619	556.9502	537.9335	511.6235	491.0241	472.9171	473.9698	487.8860	506.8741	536.8037	556.4548	(73)

6. Solar gains													

[Jan]													
	Area												
	m2												
	Solar flux												
	Table 6a												
	W/m2												
	Specific data												
	or Table 6b												
	Specific data												
	or Table 6c												
	Access												
	factor												
	Table 6d												
	Gains												
	W												
North	5.0900												18.9040 (74)
East	0.5300												3.6357 (76)
South	6.7700												110.5486 (78)

Full SAP Calculation Printout



Solar gains	133.0883	224.2888	303.7262	376.3439	425.3851	425.0265	408.5645	370.8843	328.3462	246.7226	158.8916	114.2733 (83)
Total gains	700.8519	804.8507	860.6764	914.2775	937.0086	916.0505	881.4815	844.8540	816.2321	753.5967	695.6953	670.7280 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.6797	70.9504	70.9504	70.9504	70.9504	70.9504	70.9504	70.9504	70.9504	70.9504	70.9504	70.9504	
alpha	5.7120	5.7300	5.7300	5.7300	5.7300	5.7300	5.7300	5.7300	5.7300	5.7300	5.7300	5.7300	
util living area	0.9928	0.9833	0.9646	0.9105	0.7924	0.6040	0.4405	0.4792	0.7079	0.9228	0.9833	0.9943 (86)	
MIT	20.2215	20.3627	20.5281	20.7251	20.8702	20.9326	20.9440	20.9428	20.9144	20.7377	20.4431	20.1918 (87)	
Th 2	20.4648	20.4668	20.4668	20.4668	20.4668	20.4668	20.4668	20.4668	20.4668	20.4668	20.4668	20.4668 (88)	
util rest of house	0.9915	0.9806	0.9586	0.8959	0.7622	0.5584	0.3881	0.4252	0.6638	0.9072	0.9800	0.9933 (89)	
MIT 2	19.7291	19.8708	20.0335	20.2230	20.3544	20.4044	20.4118	20.4112	20.3916	20.2371	19.9511	19.7013 (90)	
Living area fraction									fLA = Living area / (4) =				0.2303 (91)
MIT	19.8425	19.9840	20.1474	20.3386	20.4732	20.5260	20.5343	20.5336	20.5119	20.3524	20.0644	19.8143 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.8425	19.9840	20.1474	20.3386	20.4732	20.5260	20.5343	20.5336	20.5119	20.3524	20.0644	19.8143 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9898	0.9776	0.9545	0.8920	0.7626	0.5636	0.3948	0.4320	0.6677	0.9034	0.9771	0.9919 (94)
Useful gains	693.6875	786.8525	821.5425	815.5435	714.5359	516.2520	348.0260	365.0076	545.0074	680.8211	679.7401	665.2665 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	14.0000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1384.2784	1338.3217	1210.8574	1014.8844	778.3929	525.7831	349.0722	366.7538	568.8960	865.2732	1150.2563	1385.3668 (97)
Space heating kWh	513.7996	370.5873	289.6503	143.5255	47.5097	0.0000	0.0000	0.0000	0.0000	137.2324	338.7716	535.7546 (98a)
Space heating requirement - total per year (kWh/year)												2376.8311
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	513.7996	370.5873	289.6503	143.5255	47.5097	0.0000	0.0000	0.0000	0.0000	137.2324	338.7716	535.7546 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2376.8311
Space heating per m2										(98c) / (4) =		28.5677 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	513.7996	370.5873	289.6503	143.5255	47.5097	0.0000	0.0000	0.0000	0.0000	137.2324	338.7716	535.7546 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	205.6021	148.2942	115.9065	57.4332	19.0115	0.0000	0.0000	0.0000	0.0000	54.9149	135.5629	214.3876 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	271.8022	240.4925	255.5823	224.6911	217.8468	196.3201	193.6618	201.2648	203.3989	226.8037	241.1968	268.8102 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	155.2268	137.3458	145.9636	128.3216	124.4128	112.1189	110.6007	114.9428	116.1615	129.5281	137.7481	153.5181 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	4.7794	4.3169	4.7794	4.6252	4.7794	4.6252	4.7794	4.7794	4.6252	4.7794	4.6252	4.7794 (231)
Lighting	23.0673	18.5055	16.6621	12.2074	9.4293	7.7038	8.6018	11.1809	14.5229	19.0548	21.5223	23.7084 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												951.1129 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.1000
Water heating fuel used												1565.8887 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

Full SAP Calculation Printout



(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2240)
 mechanical ventilation fans (SFP = 0.2240)
 Total electricity for the above, kWh/year
 Electricity for lighting (calculated in Appendix L)

56.2738 (230a)
 56.2738 (231)
 186.1665 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation
 Wind generation
 Hydro-electric generation (Appendix N)
 Electricity generated - Micro CHP (Appendix N)
 Appendix Q - special features
 Energy saved or generated
 Energy used
 Total delivered energy for all uses

0.0000 (233)
 0.0000 (234)
 0.0000 (235a)
 0.0000 (235)
 -0.0000 (236)
 0.0000 (237)
 2759.4419 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	951.1129	0.1562	148.5800 (261)
Total CO2 associated with community systems			0.0000 (263)
Water heating (other fuel)	1565.8887	0.1409	220.5977 (264)
Space and water heating			369.1777 (265)
Pumps, fans and electric keep-hot	56.2738	0.1387	7.8059 (267)
Energy for lighting	186.1665	0.1443	26.8696 (268)
Total CO2, kg/year			403.8531 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8500 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	951.1129	1.5783	1501.1682 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1565.8887	1.5209	2381.5773 (278)
Space and water heating			3882.7455 (279)
Pumps, fans and electric keep-hot	56.2738	1.5128	85.1310 (281)
Energy for lighting	186.1665	1.5338	285.5484 (282)
Total Primary energy kWh/year			4253.4249 (286)
Dwelling Primary energy Rate (DPER)			51.1200 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	41.6000 (1b)	x 2.2500 (2b)	= 93.6000 (1b) - (3b)
First floor	41.6000 (1c)	x 2.7000 (2c)	= 112.3200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	205.9200 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1457 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3957 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3957 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5045	0.4946	0.4847	0.4353	0.4254	0.3759	0.3759	0.3660	0.3957	0.4254	0.4451	0.4649 (22b)
Effective ac	0.6273	0.6223	0.6175	0.5947	0.5905	0.5707	0.5707	0.5670	0.5783	0.5905	0.5991	0.6081 (25)

Full SAP Calculation Printout



3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opaque door			1.9100	1.0000	1.9100			(26)
TER Semi-glazed door			2.0300	1.0000	2.0300			(26a)
TER Opening Type (Uw = 1.20)			12.3900	1.1450	14.1870			(27)
Ground Floor			41.6000	0.1300	5.4080			(28a)
External Brick Wall	92.3700	16.3300	76.0400	0.1800	13.6872			(29a)
Roof	41.6000		41.6000	0.1100	4.5760			(30)
Total net area of external elements Aum(A, m ²)			175.5700					(31)
Fabric heat loss, W/K = Sum (A x U)								(33)
Party Wall			46.6300	0.0000	0.0000			(32)

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

272.3810 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	9.1600	0.0500	0.4580	
E2 Other lintels (including other steel lintels)	7.2100	0.0500	0.3605	
E3 Sill	31.2600	0.0500	1.5630	
E4 Jamb	18.6600	0.1600	2.9856	
E5 Ground floor (normal)	18.6600	0.0000	0.0000	
E6 Intermediate floor within a dwelling	8.9000	0.0600	0.5340	
E10 Baves (insulation at ceiling level)	9.4200	0.0600	0.5652	
E12 Gable (insulation at ceiling level)	19.8000	0.0900	1.7820	
E16 Corner (normal)	9.4200	0.0800	0.7536	
P1 Party wall - Ground floor	9.4200	0.1200	1.1304	
P4 Party wall - Roof (insulation at ceiling level)	4.9500	0.0600	0.2970	
E18 Party wall between dwellings				

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

10.4293 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 52.2275 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.6246	42.2888	41.9597	40.4136	40.1244	38.7778	38.7778	38.5285	39.2965	40.1244	40.7096	41.3213	(38)
Heat transfer coeff	94.8522	94.5164	94.1872	92.6412	92.3519	91.0054	91.0054	90.7560	91.5240	92.3519	92.9371	93.5488	(39)
Average = Sum(39)m / 12 =												92.6398	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1401	1.1360	1.1321	1.1135	1.1100	1.0938	1.0938	1.0908	1.1000	1.1100	1.1170	1.1244	(40)
HLP (average)												1.1135	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

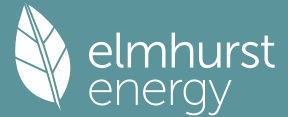
Assumed occupancy													2.5208 (42)
Hot water usage for mixer showers	66.4849	65.4858	64.0298	61.2442	59.1884	56.8958	55.5927	57.0376	58.6216	61.0831	63.9286	66.2302	(42a)
Hot water usage for baths	28.7139	28.2875	27.6870	26.5797	25.7506	24.8313	24.3347	24.9310	25.5803	26.5640	27.6941	28.6168	(42b)
Hot water usage for other uses	40.4453	38.9746	37.5038	36.0331	34.5624	33.0916	33.0916	34.5624	36.0331	37.5038	38.9746	40.4453	(42c)
Average daily hot water use (litres/day)												124.6876	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	135.6441	132.7478	129.2206	123.8569	119.5013	114.8187	113.0190	116.5310	120.2349	125.1509	130.5972	135.2923	(44)
Energy conte	214.8272	189.0311	198.6073	169.5540	160.8718	141.1830	136.6867	144.2897	148.2617	169.8286	186.0597	211.8351	(45)
Energy content (annual)												2071.0358	
Distribution loss (46)m = 0.15 x (45)m	32.2241	28.3547	29.7911	25.4331	24.1308	21.1774	20.5030	21.6435	22.2393	25.4743	27.9090	31.7753	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	269.7339	238.6243	253.5141	222.6896	215.7786	194.3186	191.5935	199.1965	201.3973	224.7354	239.1953	266.7419	(62)
WVHRS	-30.3941	-26.8808	-28.1480	-23.3077	-21.7219	-18.5876	-17.4229	-18.5275	-19.2315	-22.6718	-25.6844	-29.8313	(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	239.3398	211.7435	225.3660	199.3819	194.0566	175.7310	174.1706	180.6690	182.1658	202.0636	213.5109	236.9106	(64)
Total per year (kWh/year)												2435.1095	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	115.3555	102.5274	109.9624	98.8852	97.4153	89.4518	89.3738	91.9018	91.8055	100.3934	104.3733	114.3606	(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	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	126.0390	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	120.6820	133.6122	120.6820	124.7047	120.6820	124.7047	120.6820	120.6820	124.7047	120.6820	124.7047	120.6820	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.9983	228.3435	222.4337	209.8527	193.9713	179.0451	169.0734	166.7283	172.6380	185.2191	201.1004	216.0267	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	35.6039	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	-100.8312	(71)
Water heating gains (Table 5)	155.0477	152.5706	147.7989	137.3405	130.9345	124.2387	120.1260	123.5239	127.5076	134.9374	144.9630	153.7105	(72)

Full SAP Calculation Printout



Total internal gains
565.5396 578.3379 554.7263 535.7096 509.3995 488.8001 470.6931 471.7458 485.6620 504.6502 534.5798 554.2308 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.0900	10.6334	0.6300	0.7000	0.7700	16.5410 (74)
East	0.5300	19.6403	0.6300	0.7000	0.7700	3.1812 (76)
South	6.7700	46.7521	0.6300	0.7000	0.7700	96.7300 (78)
Solar gains	116.4522	196.2527	265.7604	329.3009	372.2120	371.8982
Total gains	681.9919	774.5906	820.4867	865.0105	881.6115	860.6983

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.3667	66.6025	66.8353	67.9507	68.1635	69.1721	69.1721	69.3621	68.7801	68.1635	67.7343	67.2914
alpha	5.4244	5.4402	5.4557	5.5300	5.5442	5.6115	5.6115	5.6241	5.5853	5.5442	5.5156	5.4861
util living area	0.9941	0.9874	0.9743	0.9333	0.8359	0.6502	0.4792	0.5176	0.7513	0.9401	0.9866	0.9952 (86)
MIT	19.9079	20.0871	20.3165	20.6202	20.8523	20.9723	20.9957	20.9935	20.9384	20.6570	20.2410	19.8875 (87)
Th 2	19.9683	19.9715	19.9747	19.9898	19.9927	20.0059	20.0059	20.0083	20.0008	19.9927	19.9869	19.9810 (88)
util rest of house	0.9920	0.9831	0.9652	0.9095	0.7819	0.5607	0.3733	0.4096	0.6673	0.9139	0.9813	0.9936 (89)
MIT 2	18.7161	18.9454	19.2356	19.6160	19.8737	19.9913	20.0047	20.0063	19.9630	19.6679	19.1536	18.6996 (90)
Living area fraction	fLA = Living area / (4) =											0.2303 (91)
MIT	18.9906	19.2083	19.4845	19.8473	20.0990	20.2172	20.2329	20.2336	20.1876	19.8957	19.4040	18.9732 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9906	19.2083	19.4845	19.8473	20.0990	20.2172	20.2329	20.2336	20.1876	19.8957	19.4040	18.9732 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9893	0.9788	0.9596	0.9056	0.7882	0.5805	0.3978	0.4346	0.6843	0.9108	0.9771	0.9912 (94)
Useful gains	674.6969	758.1748	787.3721	783.3188	694.8790	499.6724	329.4616	346.0576	528.9013	656.2718	658.1729	648.4812 (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	1393.4306	1352.3675	1222.9779	1014.1672	775.6676	511.1964	330.6128	347.9264	557.1647	858.4716	1143.5006	1382.0113 (97)
Space heating kWh	534.7378	399.2975	324.0907	166.2109	60.1067	0.0000	0.0000	0.0000	0.0000	150.4367	349.4360	545.7464 (98a)
Space heating requirement - total per year (kWh/year)												2530.0627
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	534.7378	399.2975	324.0907	166.2109	60.1067	0.0000	0.0000	0.0000	0.0000	150.4367	349.4360	545.7464 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2530.0627
Space heating per m2												(98c) / (4) = 30.4094 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	534.7378	399.2975	324.0907	166.2109	60.1067	0.0000	0.0000	0.0000	0.0000	150.4367	349.4360	545.7464 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	579.3476	432.6083	351.1275	180.0768	65.1210	0.0000	0.0000	0.0000	0.0000	162.9867	378.5872	591.2745 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	239.3398	211.7435	225.3660	199.3819	194.0566	175.7310	174.1706	180.6690	182.1658	202.0636	213.5109	236.9106 (64)
Efficiency of water heater	85.8078	85.4600	84.8738	83.6546	81.7597	79.8000	79.8000	79.8000	79.8000	83.4077	85.1574	79.8000 (216)
Fuel for water heating, kWh/month	278.9256	247.7691	265.5306	238.3394	237.3501	220.2143	218.2589	226.4022	228.2780	242.2602	250.7251	275.8993 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	25.0753	20.1164	18.1126	13.2700	10.2502	8.3745	9.3505	12.1542	15.7871	20.7135	23.3959	25.7723 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-38.6839	-54.4108	-78.0259	-87.5094	-94.1688	-87.8170	-86.7247	-81.9674	-73.5409	-62.1122	-42.4815	-33.4588 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

Full SAP Calculation Printout



(233b)m	-22.2267	-46.7207	-92.7999	-139.2950	-184.1079	-184.9680	-182.7970	-154.8107	-113.5170	-66.7927	-29.6677	-17.5794	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2741.1297	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2929.9528	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												202.3723	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2056.1842	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3903.2705	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2741.1297	0.2100	575.6372 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2929.9528	0.2100	615.2901 (264)
Space and water heating			1190.9273 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	202.3723	0.1443	29.2086 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-820.9014	0.1346	-110.5259
PV Unit electricity exported	-1235.2829	0.1259	-155.5380
Total			-266.0639 (269)
Total CO2, kg/year			966.0013 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2741.1297	1.1300	3097.4765 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2929.9528	1.1300	3310.8466 (278)
Space and water heating			6408.3232 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	202.3723	1.5338	310.4054 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-820.9014	1.4976	-1229.3888
PV Unit electricity exported	-1235.2829	0.4622	-570.9323
Total			-1800.3210 (283)
Total Primary energy kWh/year			5048.5083 (286)
Target Primary Energy Rate (TPER)			60.6800 (287)