

JS LEWIS LTD

141 High St, Staple Hill
Energy and Sustainability Strategy

Revision A

Yellow Giraffe Property Ltd

November 2023

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EXECUTIVE SUMMARY

This statement has been prepared in support of the planning application for 141 High St, Staple Hill. JS Lewis Ltd was engaged by Anderson Parslow to help develop an energy and sustainability strategy to address local policy. This document sets out that strategy.

The proposals are for the development of 5 new apartments in a horizontal and vertical extension to the extant building on the site.

The scheme is mindful of passive design, layout, orientation, and massing whilst working within the constraints of the site itself. Energy efficiency and renewable energy measures have been included. District heating and CHP technologies are considered not to be viable or necessary. The proposed strategy is summarized as follows:

- Efficiency measures including:
 - Highly efficient building form;
 - High percentage of shared party floors and walls, minimizing heat loss;
 - Good levels of fabric efficiency;
 - Use of careful detailing for reduced thermal bridging;
 - Low energy fittings including LED lighting;
 - Energy labeled white goods where provided;
 - Controls on external lighting;
 - Controlled fan power with decentralized mechanical ventilation.
- Renewable energy:
 - All hot water from the use of individual hot water heat pumps for each apartment.

The adopted policy framework expects developments to address climate change, but does not set any specific targets for this type of development. The strategy above demonstrates that policy and regulatory requirements are met, demonstrating good design. As a result, the scheme meets the local policy requirements and national regulatory requirements on energy within new developments.

1 INTRODUCTION

1.1 Scope and Purpose of Report

This statement has been prepared in support of the planning application for 141 High St, Staple Hill. JS Lewis Ltd was engaged by Anderson Parslow to help develop an energy and sustainability strategy to address local policy. This document sets out that strategy.

1.2 Description of Development

The scheme is for the horizontal and vertical extension of the extant building for the development of 5 new apartments. The existing car park is used to develop the horizontal extension, creating a flat at ground floor, one at first floor and one at second floor. The roof of the existing building is removed and a mansard is created which in turn links to the horizontal extension element, and creates 2 new apartments above the existing building.

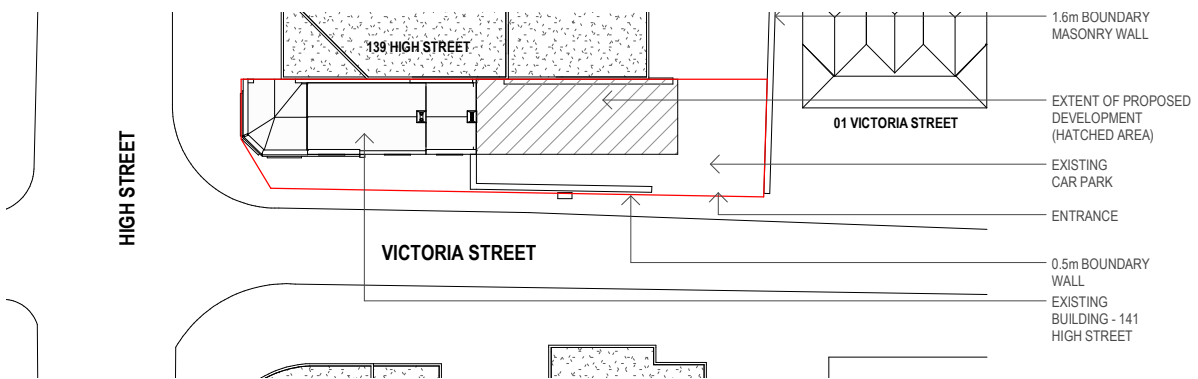


Figure 1 - Proposed Site Layout

In terms of solar access, the site is a linear site on a North-South axis with various mature trees all around the site. The accommodation schedule is as follows:

- GF 01 - 70sqm 2B4P flat
- FF 01 - 71.4sqm 2B4P flat
- SF 01 - 42sqm 1B2P flat
- SF 01 - 37sqm 1B2P flat
- SF 01 - 37sqm 1B2P flat

2 PLANNING POLICY

2.1 National Planning Policy

National Planning Policy Framework (2023)

The National Planning Policy Framework sets out a framework for positive growth, making progress in environmental, social and economic areas, and enhancing existing areas. It is a material consideration in planning decisions and reinforces the need for decisions to be determined in accordance with the local plan, unless material considerations indicate otherwise.

The policies throughout the NPPF constitute the government's view of what sustainable development is, and requires the planning process to perform a number of roles:

1. An economic role – building a strong economy, supporting growth and innovation;
2. A social role – supporting communities through providing housing supply, a high-quality built environment, and accessible local services;
3. An environmental role – contributing to natural and built environments, improving biodiversity, using resources prudently, minimizing waste and addressing climate change, including moving to a low carbon economy.

The 2023 National Planning Policy Framework retains a presumption in favour of sustainable development. Section 14 concerns itself with climate change:

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

154. New development should be planned for in ways that:

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

The NPPF sets out the importance of dealing with climate change, and the use renewable energy. Development should be in sustainable locations to reduce CO2 emissions. It notes the need to align local policies with the national timeline for low carbon buildings.

2.2 Local Policy

The key local policies are set out below:

South Gloucestershire Core Strategy (December 2013)

Policy CS1 (section 8)

8. ensure the design, orientation and location of buildings, roof pitches, windows, habitable rooms, lighting and soft landscaping help to achieve energy conservation, the protection of environmental resources and assist the appropriate siting of renewable and/or low carbon energy installations and infrastructure. Schemes that can demonstrate that they will outperform statutory minima, such as the building regulations, in terms of sustainable construction, at the time of construction commencement, will be considered a primary indicator of good design. All new developments will be required to meet the building regulations current at the time of full planning or reserved matters approval. Until the 'Zero Carbon' building regulations are implemented major residential (10 or more dwellings) and mixed-use schemes will be encouraged to achieve full compliance with each Code level (currently level 3) or above, and/or Building Research Establishment Environmental Assessment Method (BREEAM) 'very good' or other equivalent standard; and

POLICY CS3 - RENEWABLE AND LOW CARBON ENERGY GENERATION

Proposals for the generation of energy from renewable or low carbon sources, provided that the installation would not cause significant demonstrable harm to residential amenity, individually or cumulatively, will be supported.

In assessing proposals significant weight will be given to:

1. the wider environmental benefits associated with increased production of energy from renewable sources
2. proposals that enjoy significant community support and generate an income for community infrastructure purposes by selling heat or electricity to the National Grid
3. the time limited, non-permanent nature of some types of installations; and
4. the need for secure and reliable energy generation capacity, job creation opportunities and local economic benefits.

POLICY CS4 - RENEWABLE OR LOW CARBON DISTRICT HEAT NETWORKS

Any applications to develop a thermal generating station or proposals that have a capacity to generate significant waste heat as part of an industrial or commercial process must either:

1. include heat recovery and re-use technology; and
2. heat distribution infrastructure; or
3. provide evidence that heat distribution has been fully explored and is unfeasible.

Major development proposals (more than 100 dwellings that are wholly or in part greater than 50dph, or non-residential of more than 10,000sqm) should, where practical and viable:

4. include renewable or low carbon heating or CHP generation and distribution infrastructure on-site and demonstrate how opportunities to accommodate an energy and or district heating solution have been maximised, taking into account density, mix of uses, layout and phasing; or
5. connect to an existing renewable or low carbon heat distribution network; or
6. provide a heat distribution network as part of the development where there are firm proposals for renewable or low carbon heat generation or CHP and distribution in the locality within a reasonable time frame; or
7. provide evidence that renewable and low carbon sources of heating or CHP have been fully explored and are unfeasible.

Developments of less than 100 dwellings or 10,000sqm of non-residential floorspace should connect to any existing available district heat network(s) in the vicinity, providing this is practical and would not adversely affect the viability of the development.

Renewable or low carbon energy installations will not be supported in areas covered by national designations and areas of local landscape value unless they do not individually or cumulatively compromise the objectives of the designations especially with regard to landscape character, visual impact and residential amenity.

Developments will also be required to meet objectives of Policy CS1 (High Quality Design), as far as engineering requirements permit.

POLICY CS4A - PRESUMPTION IN FAVOUR OF SUSTAINABLE DEVELOPMENT

There is a presumption in favour of sustainable development. When considering proposals for sustainable development the Council will take a positive approach. It will work pro-actively with applicants to find solutions so that sustainable development can be approved wherever possible.

Planning applications that accord with the policies in this Plan will be approved without delay unless material considerations indicate otherwise.

Where there are no policies relevant to the application, or relevant policies are out of date at the time of making the decision, then the Council will grant permission unless material considerations indicate otherwise. Account will be taken of whether:

1. Any adverse impacts of granting permission would significantly and demonstrably outweigh the benefits when assessed against the policies in the National Planning Policy Framework and other policies in the Council’s Local Plan, neighbourhood development plans, supporting supplementary planning documents and any emerging policy as it may be relevant.
2. Specific policies in the National Planning Policy Framework, other policies in the Council’s Local Plan, neighbourhood development plans, supporting supplementary planning documents and any emerging policy as it may be relevant, indicate that development should be restricted.

South Gloucestershire Local Plan Policies, Sites and Places Plan (November 2017)

POLICY PSP6 - ONSITE RENEWABLE AND LOW CARBON ENERGY

All development proposals will:

1. be encouraged to minimise end-user energy requirements over and above those required by the current building regulations through energy reduction and efficiency measures, and in respect of residential for sale and speculative commercial development offer micro renewables as an optional extra, and
2. be expected to ensure the design and orientation of roofs will assist the potential siting and efficient operation of solar technology.

In addition, all major² greenfield residential development will be required to reduce CO₂ emissions further by at least 20% via the use of renewable and/or low carbon energy generation sources on or near the site providing this is practical and viable.

The Council will also take positive account of and support development that provides further energy reduction, efficiency, renewable and low carbon energy measures on or near site, where measures comply with other policies of the plan.

South Gloucestershire Guidance - Sustainable Energy Requirements

All major (residential and non-residential) development proposals are required (via the [Local Planning Application Requirements list](#)) to include the submission of energy information in the form of a Sustainable Energy Statement or as part of a Design and Access Statement. Major development is defined as residential development comprising 10 or more dwellings, or development comprising over 1000 sqm. of commercial floor space.

The guidance below sets out the minimum information that needs to be included in the Sustainable Energy Statement or Design and Access Statement to enable us to evaluate compliance with relevant planning policies.

The relevant planning policies are:

- Policies, Sites and Places (PSP) Plan Policy 6 “On site renewable and low carbon energy” (Adopted November 2017). Refer to the [PSP plan webpage](#) for further detail.
- [Core Strategy](#) Policies (Adopted December 2013):
 - CS1(8) “High Quality Design”;
 - CS3 “Renewable and Low Carbon Energy Generation”; and
 - CS4 “Renewable or Low Carbon District Heat Networks”
- New development – High quality design

Policy CS1(8) seeks to ensure that all new development minimises the amount of energy and natural resources used during construction and the operation of the development over its lifetime. The design of a development should enhance energy efficiency and enable the addition of renewable and/or low carbon energy technologies (such as solar panels). If schemes outperform statutory minima (i.e. current building regulations in terms of energy conservation) then this will be considered a primary indicator of good design. The policy encourages higher energy efficiency standards to be achieved, for example BREEAM ‘Very Good’.

All developments are expected to ensure the design and orientation of roofs will assist with the potential siting and efficient operation of solar technology.

Parts 1 and 2 of PSP Policy 6 encourages all development proposals to minimise end-user energy requirements over and above those required by current building regulations. This is expected to be achieved through energy efficiency measures. Also, in the same way as Policy CS1, the policy expects the design and orientation of the development to assist the siting of solar technology. In respect of residential for sale and speculative commercial development, micro-renewables should also be offered as an optional extra.

To ensure policy compliance, planning applications should therefore set out the design principles and detailed measures that will be applied to the proposed development to demonstrate: how the current building regulations requirements, in terms of energy reduction and efficiency, will be outperformed; and how the appropriate siting and efficient operation of solar technology, micro-renewables, and/or other renewable / low carbon energy installations and infrastructure will be achieved.

- New development – Sustainable energy information

The specific energy information that we would expect to be included with planning applications for different types of development proposals is detailed below.

- Major residential, commercial and mixed-use developments

1. *State which building regulations the development is to be built to, taking into account any planned changes in the energy requirements of building regulations over the build-out period*
 2. *Provide an estimate of the regulated energy demand and CO2 emissions of the proposed development, assuming construction to the minimum energy performance required by the applicable building regulation standards*
 3. *Demonstrate how landform, layout, building orientation, massing and landscaping will be designed to minimise energy consumption*
 4. *Describe what measures are being included which will reduce the energy demand of the development beyond the building regulations requirement, with quantification of the additional energy expected to be saved and a simple explanation of how this has been calculated*
 5. *Describe what renewable / low carbon energy generation measures are being included, their installed capacity (kW), predicted energy generation (kWh/yr) and associated CO2 savings (tonnes/yr) and a simple explanation of how this has been calculated*
 6. *Provide a concluding section summarising why certain measures were chosen and any additional reduction in energy demand and offset CO2 emissions achieved through the measures being deployed compared with the baseline energy demand and emissions as allowed by the relevant building regulations*
- *Additional information to be provided for proposals for major greenfield residential development (10 or more dwellings)*

For major greenfield residential development proposals, PSP Policy 6 has an additional requirement for proposals to reduce CO2 emissions by at least 20% via the use of renewable and/or low carbon energy generation sources on or near the site.

The following guidance focuses on how applicants are expected to calculate the 20% reduction in CO2 emissions, thereby ensuring compliance with Policy 6.

- *Calculation*

The baseline against which development will be required to reduce CO2 emissions by at least 20% is total residual energy consumption, which includes regulated energy use (space heating, hot water, lighting and ventilation); and unregulated energy use (appliances and cooking).

Therefore, the lower the residual energy consumption of the development, the lower the requirement for renewable and / or low carbon energy generation will be. This provides an incentive to minimise energy requirements through energy efficiency measures beyond that required by Building Regulations (as encouraged by the first part of Policy 6).

In order to calculate total residual energy consumption, applicants should:

1. *Set out projected annual energy demands for heat and power from the proposed development. The projected annual energy demands must include both regulated and unregulated energy use*

2. *Subtract the additional impact of any further energy reduction and energy efficiency measures incorporated into the design. This will give a figure for total residual energy consumption*
3. *Applicants should then demonstrate how they have calculated the onsite renewable/low carbon measures they propose will generate sufficient carbon savings to offset 20% of the total residual energy consumption*

As noted above, projected annual energy demands for heat and power should be calculated to include both regulated and unregulated energy use.

Part L of the Building Regulations sets out the Target Emissions Rate (TER) that must be achieved in order to comply with Part L, and the Dwelling Emission Rate (DER) must not exceed the TER. To avoid double counting energy efficiency measures, the TER is used as the starting point for calculating the projected annual energy demands for heat and power from regulated energy use.

To calculate the unregulated element of projected energy use, the latest Building Regulations Standard Assessment Procedure for Energy Rating of Dwellings (SAP) methodology (currently SAP 2012, which includes guidance in Section 16 on estimating energy use for cooking and appliances) should normally be used. However, alternatively, the emerging guidance (BREEAM GN32 Guidance Note 2018 'Energy Prediction and Verification') issued by BRE may be used to calculate predicted unregulated energy consumption once adopted (expected Spring 2018).

- *Evidence requirements*

In order to demonstrate compliance with the 20% CO2 reduction element of Policy 6, compliance tables (templates set out below) and supporting evidence, should be submitted with a planning application. The information would normally form part of a sustainable energy statement, or can alternatively be included in a Design and Access Statement.

2.3 Policy Analysis

The local policy requires the submission of information regarding energy and CO2 emissions in the proposed development. It also requires 20% renewable energy from major developments (i.e. over 10 dwellings) that are greenfield developments. The proposal does not fall into this category as the site is a town centre site, and is for 5 units. The policy generally supports improvements upon the regulatory minima as 'good design'.

Therefore this document must set out a strategy albeit without specific targets above the regulatory minima in force. Orientation, design and location are design considerations that must be addressed. Any strategy arising needs to be practical and feasible in management terms for the long-term with this in mind.

3 APPROACH AND METHODOLOGY

3.1 Approach

It has been established that the policy aims are to address good design in energy efficiency terms, and to aim to exceed the statutory minima. There are no specific CO2 savings targets that policy requires the development to achieve. The design team approach has been to consider the adopted policy framework and to integrate measures across the disciplines that contribute to good energy performance and climate change mitigation whilst achieving the wider goals of providing new modern affordable housing. Deliverability remains crucial for such a project.

3.2 Assessment Methodology

The methodology for assessing energy and CO2 performance is for an accredited SAP assessor to calculate the likely energy performance and emissions based on planning-stage information. SAP 10 was used for the assessment.

3.3 Viability

It is essential that the proposals remain viable and deliverable, whilst achieving a sustainable development. Viability has two aspects to it – technical viability, and economic viability. Where something is not technically robust, it can be considered not viable. Economic viability itself has two aspects – whether the cost of the proposed measures can be supported by the development, and secondly, whether the measures proposed has an economic operating model that will ensure their ongoing success. The latter is less important with passive measures, but where technologies have significant operating requirements and costs, it is a crucial consideration. If operating the system makes a loss, then it cannot be considered viable.

4 ENERGY, GREENHOUSE GASES AND CO2

4.1 Low CO2 Design and Energy Efficiency

Key planks in the local policy are for new schemes to address design, orientation and location to reduce CO2 emissions. There are design measures than can achieve strategic efficiency objectives such as reduced heat loss areas, reduced thermal bridging and useful solar gain during the heating season; fabric measures that can reduce heating demand; and specification measures selecting the lowest energy technologies for the provision of services.

The site is in a sustainable location with good access to the local retail and commercial offerings at Staple Hill. This will allow future residents to use sustainable modes of transport (walking and cycling) for accessing these facilities, driving down transport-related CO2 emissions.

With regard to the site design and layout, the density of the proposed scheme will ensure that there is a high proportion of party floors and walls, significantly reducing heat loss and resulting emissions. The simple plan form minimizes thermal bridging as well as heat loss surfaces. With regards to the energy efficient specification the key aspects are:

- Good fabric insulation standards;
- Thermal bridging minimisation;
- Construction detailing to reduce unwanted ventilation losses;
- Efficient heating and hot water plant;
- Controls for managing behavioural aspects of demand;
- Efficient plant.

At the planning stage, detailed specifications are not always fully understood and are subject to change. The measures modelled are:

- Fabric efficiency;
 - Demanding wall, floor and roof U-values (in line with Part L);
 - Wall 0.18 W/m2K
 - Floor 0.12 W/m2K
 - Roof 0.12 W/m2K
 - High performance doors/glazing;
 - Windows 1.2 W/m2K
 - Opaque doors 1.5 W/m2K
 - Sealing of party walls;
 - Adoption of construction detailing to minimise linear thermal bridging normally caused by penetrations to the insulating layer;
 - Demanding air tightness levels:
 - 4m3/m2/hr
- Heating efficiency;
 - Use of appropriate heating controls.
- Hot water efficiency;
 - Tap flow rates with appropriate controls;
 - Managed shower flow rates.
- Electrical efficiency;
 - Use of LED lighting throughout;
 - Energy labelled white goods;
 - Controls on external lighting to switch automatically when not required;

- Controlled ventilation fan power with decentralised mechanical extract ventilation.

The specification is likely to be refined and finalised at the building control stage. Windows will be openable.

4.2 CO2 Performance with Efficiency

Part L is a very demanding standard. The efficiency measures set out above achieve Part L1a. (Refer to Figure 2 - South Gloucestershire Table 1)

4.3 District Heating Solutions and CHP

District heating has been assessed for the proposals. It has been dismissed on the basis of economic viability. There is no local system to plug into, and the proposed development is small in scale, which creates a high capital cost for the infrastructure. However, more importantly, the operating model for district heating with gas CHP or biomass is one that makes an annual loss. This results in a redundant investment, and one that would be mothballed immediately. Any theoretical CO2 saving would not occur in reality.

These findings are reflective of the general market for CHP within the UK. As a result, technologies that rely on district heat such as gas CHP and biomass are not viable for the proposed project.

4.4 Renewable Energy

Air source heat pumps for the provision of hot water are proposed for each apartment, providing renewable hot water to all residents. The heat pumps would be individual to each apartment, relying on ducted air feeding the pump which is attached to a hot water cylinder. This approach avoids the complexities associated with communal or district heat systems whilst delivering onsite renewable energy. It also addresses the issue of external condenser units - the proposals have few opportunities to integrate these in a visually acceptable way due to the nature of the site and the development. In addition to this, the roof forms create areas of East/West facing pitches that can accept solar PV panels in the future.

4.5 Summary

Accordingly, the preferred approach for the proposed development is therefore:

- Apply efficiency measures across the scheme;
- Hot water heat pumps for each apartment;
- Scheme designed with roof pitches that are suited to solar PV in the future.

4.6 South Gloucestershire CO2 Tables

The emissions set out in the South Gloucestershire tables format are as follows:

Table 1: PSP 6 Compliance

Regulated CO2 (TER)		4	tCO2
Unregulated CO2		9	tCO2
Total CO2		13	tCO2
CO2 Reduction from Energy Efficiency	-	0.9	tCO2
Total Residual CO2		14	tCO2
CO2 Reduction from Renewables		3	tCO2
CO2 Reduction from Low Carbon Sources	-		tCO2
Total CO2 Reduction from LCR		3	tCO2
CO2 Reduction (%)		19%	tCO2
Renewables Saving vs Regulated Emissions		56%	

Figure 2 - South Gloucestershire Table 1

Table 3: LZC Measures

Technology	Description	Capacity		Output		CO2 Saved	
		kWp		MWh		tCO2	
Air Source Heat Pump	Hot water heat pump	25		10.0		2.6	2.6

Figure 3 - South Gloucestershire Table 3

5 SUSTAINABLE DESIGN

5.1 Climate Change

5.1.1 Mitigation

Energy in building use is a key contributor to the UK's carbon emissions. The proposed development will mitigate climate change through its application of the energy hierarchy:

- Reducing energy use;
 - *See efficiency measures in Energy section;*
- Addressing renewable energy;
 - *See measures in Energy section;*
- Addressing low carbon energy options.

This will help to reduce energy use and associated carbon emissions. Details of how these measures are to be applied are set out in the Energy section. The development will also strive to utilise low impact materials in its construction. Key measures will include:

- Using low climate change impact building materials;
- Sourcing sustainable timber;
- Using low or zero global warming impact insulation materials.

5.1.2 Adaptation

Climate change will impact on the new development. Weather patterns will become less predictable – for example rainfall will become more extreme, and summer temperatures are likely to increase. Biodiversity will alter as conditions change. Water management is a key issue in adaptation, as is designing out the requirement for cooling in buildings. Key mitigation measures employed in the development will be:

- Providing water efficient fittings;
- Integration of appropriate ventilation;
- Metering water use to increase awareness of consumption.

5.2 Transport and Travel

The proposed scheme has cycle storage designed in to facilitate low carbon personal transportation options for the occupants. The site design will promote working from home and cycling as the main opportunities for reducing travel-related CO₂.

5.3 Waste and Recycling

Waste storage has been designed in line with the local requirements for waste and recycling. Construction waste will be segregated and recycled in accordance with a site waste management.

5.4 Water, Materials and Resources

Each apartment should achieve 110lpppd water consumption through an efficient specification. The design makes efficient use of space when compared with individual low

rise houses for example, meaning that the materials used for each dwelling are far less in volume due to the shared party floors and walls involved. Timber frame construction is likely to be used for at least the roof construction element, ensuring that the development uses a renewable building material.

5.5 Green Infrastructure and Biodiversity

The proposals incorporate landscaping and planting areas within amenity spaces. Micro-habitats can be incorporated including bird and bat boxes where appropriate.

5.6 Flexibility and Adaptability

The design carefully takes account of the surrounding buildings whilst inside, it creates flatted living. The floor to ceiling heights allow for flexible uses in the future.

6 CONCLUSION

6.1 Proposals

This statement has been prepared in support of the planning application for 141 High St, Staple Hill. JS Lewis Ltd was engaged by Anderson Parslow to help develop an energy and sustainability strategy to address local policy. This document sets out that strategy.

6.2 Energy

Design considerations are discussed, showing that the location is sustainable. The density and layout of the scheme creates a high level of shared party walls and floors, reducing heat loss areas and thermal bridging; and that orientation and roof design permits solar access. Although district heating and CHP technologies are considered not viable or necessary, efficiency and renewable measures have been incorporated. The proposed energy strategy is as follows:

- Efficiency measures including:
 - Highly efficient building form;
 - High percentage of shared party floors and walls, minimizing heat loss;
 - Good levels of fabric efficiency;
 - Use of careful detailing for reduced thermal bridging;
 - Low energy fittings including LED lighting;
 - Energy labeled white goods where provided;
 - Controls on external lighting;
 - Controlled fan power with decentralized mechanical ventilation.
- Renewable energy:
 - All hot water from the use of individual hot water heat pumps for each apartment.

The strategy above demonstrates that the statutory minima are met and exceeded, demonstrating good design.

6.3 Sustainability

The scheme addresses climate change, sustainable living, travel, biodiversity and materials, resources and waste.

6.4 Compliance

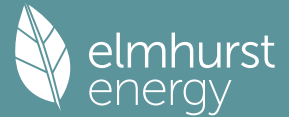
The scheme has addressed the following:

- The NPPF (2023)
- South Gloucestershire Core Strategy (2013)
- South Gloucestershire Places and Sites Policies (2017)

The proposed development has been designed to integrate a range of energy efficiency and renewable energy technology. The proposals can be considered sustainable and compliant with planning policy.

APPENDIX - PLANNING STAGE SAP OUTPUTS

Full SAP Calculation Printout



Property Reference	141 Staple Hill		Issued on Date	10/11/2023	
Assessment Reference	FF01	Prop Type Ref	141 Staple Hill		
Property	-, -, Bristol				
SAP Rating	79 C	DER	5.59	TER	12.17
Environmental	96 A	% DER < TER			54.07
CO ₂ Emissions (t/year)	0.32	DFEE	31.89	TFEE	32.87
Compliance Check	See BREL	% DFEE < TFEE			2.97
% DPER < TPER	9.60	DPER	57.80	TPER	63.94
Assessor Details	Mr. Jonathan Lewis			Assessor ID	AZ32-0001
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	70.0000	2.5000	175.0000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		175.0000
Dwelling volume			175.0000

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		3.5000 (17)
Infiltration rate		0.1750 (18)
Number of sides sheltered		2 (19)

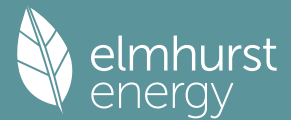
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1487 (21)

	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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (22b)
Mechanical extract ventilation - decentralised												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	0.5000	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 = 1.20)			18.8000	1.1450	21.5267		(27)
Solid Door			2.1000	1.5000	3.1500		(26)
External Wall 1	62.0000	18.8000	43.2000	0.1800	7.7760		(29a)
Communal Wall	22.0000	2.1000	19.9000	0.1700	3.3830		(29a)
Total net area of external elements Aum(A, m ²)			84.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.8357	(33)
Party Floor 1			70.0000				(32d)
Party Ceiling 1			70.0000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				10.0000	0.0410		0.4100
E3 Sill				10.0000	0.0460		0.4600
E4 Jamb				22.0000	0.0470		1.0340
E5 Ground floor (normal)				22.0000	0.0710		1.5620

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.8866	27.8866	27.8866	27.8866	27.8866	27.8866	27.8866	27.8866	27.8866	27.8866	27.8866	27.8866
alpha	2.8591	2.8591	2.8591	2.8591	2.8591	2.8591	2.8591	2.8591	2.8591	2.8591	2.8591	2.8591
util living area	0.9262	0.8835	0.8147	0.6957	0.5527	0.4093	0.3038	0.3429	0.5330	0.7686	0.8925	0.9353 (86)
MIT	19.0741	19.4500	19.9314	20.4364	20.7660	20.9261	20.9766	20.9664	20.8421	20.3568	19.6120	18.9802 (87)
Th 2	20.0866	20.0866	20.0866	20.0866	20.0866	20.0866	20.0866	20.0866	20.0866	20.0866	20.0866	20.0866 (88)
util rest of house	0.9168	0.8697	0.7938	0.6643	0.5107	0.3568	0.2434	0.2788	0.4764	0.7353	0.8772	0.9269 (89)
MIT 2	17.8453	18.3109	18.8998	19.4973	19.8662	20.0296	20.0733	20.0665	19.9553	19.4243	18.5221	17.7281 (90)
Living area fraction									fLA = Living area / (4) =			0.3714 (91)
MIT	18.3018	18.7340	19.2829	19.8461	20.2004	20.3626	20.4088	20.4007	20.2847	19.7706	18.9269	18.1931 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3018	18.7340	19.2829	19.8461	20.2004	20.3626	20.4088	20.4007	20.2847	19.7706	18.9269	18.1931 (93)

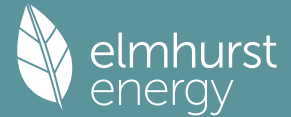
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8937	0.8453	0.7732	0.6555	0.5162	0.3730	0.2650	0.3012	0.4891	0.7225	0.8537	0.9046 (94)
Useful gains	519.7025	592.1460	629.9314	622.4126	534.5500	384.8075	260.9701	272.1917	394.4445	485.1517	495.6667	498.1665 (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	976.2962	964.6006	891.3124	763.2367	592.7027	401.8072	265.5746	278.9590	431.2360	639.4383	824.6526	975.6958 (97)
Space heating kWh	339.7057	250.2894	194.4675	101.3933	43.2656	0.0000	0.0000	0.0000	0.0000	114.7893	236.8699	355.2818 (98a)
Space heating requirement - total per year (kWh/year)												1636.0625
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	339.7057	250.2894	194.4675	101.3933	43.2656	0.0000	0.0000	0.0000	0.0000	114.7893	236.8699	355.2818 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1636.0625
Space heating per m2										(98c) / (4) =		23.3723 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	339.7057	250.2894	194.4675	101.3933	43.2656	0.0000	0.0000	0.0000	0.0000	114.7893	236.8699	355.2818 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	339.7057	250.2894	194.4675	101.3933	43.2656	0.0000	0.0000	0.0000	0.0000	114.7893	236.8699	355.2818 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating requirement	263.6450	232.8243	246.1466	213.1511	204.4876	181.9014	177.6346	185.8938	189.3009	213.9436	231.0389	260.3033 (64)
Efficiency of water heater												337.6164 (216)
(217)m	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164 (217)
Fuel for water heating, kWh/month	78.0901	68.9612	72.9072	63.1341	60.5680	53.8781	52.6143	55.0606	56.0698	63.3688	68.4324	77.1003 (219)
Space cooling fuel requirement	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)
(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	3.1767	2.8693	3.1767	3.0742	3.1767	3.0742	3.1767	3.1767	3.0742	3.1767	3.0742	3.1767 (231)
Lighting	19.2401	15.4351	13.8976	10.1820	7.8648	6.4256	7.1746	9.3258	12.1133	15.8933	17.9514	19.7748 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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												1636.0625 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												337.6164
Water heating fuel used												770.1850 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752)												
mechanical ventilation fans (SFP = 0.1752)												37.4032 (230a)
Total electricity for the above, kWh/year												37.4032 (231)
Electricity for lighting (calculated in Appendix L)												155.2782 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2598.9289 (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	1636.0625	0.1557	254.6718 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	770.1850	0.1412	108.7721 (264)
Space and water heating			363.4439 (265)
Pumps, fans and electric keep-hot	37.4032	0.1387	5.1883 (267)
Energy for lighting	155.2782	0.1443	22.4114 (268)
Total CO2, kg/year			391.0436 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.5900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1636.0625	1.5763	2578.8707 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	770.1850	1.5222	1172.3975 (278)
Space and water heating			3751.2682 (279)
Pumps, fans and electric keep-hot	37.4032	1.5128	56.5835 (281)
Energy for lighting	155.2782	1.5338	238.1709 (282)
Total Primary energy kWh/year			4046.0227 (286)
Dwelling Primary energy Rate (DPER)			57.8000 (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	70.0000 (1b)	x 2.5000 (2b)	= 175.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.0000 (5)

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			15.3900	1.1450	17.6221		(27)
External Wall 1	62.0000	15.3900	46.6100	0.1800	8.3898		(29a)
Communal Wall	22.0000	2.1000	19.9000	0.1800	3.5820		(29a)
Total net area of external elements Aum(A, m2)			84.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.6939		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.0000	0.0500	0.5000
E3 Sill	10.0000	0.0500	0.5000
E4 Jamb	22.0000	0.0500	1.1000
E5 Ground floor (normal)	22.0000	0.1600	3.5200
E16 Corner (normal)	7.5000	0.0900	0.6750
E17 Corner (inverted - internal area greater than external area)	0.0000	-0.0900	-0.0000
E7 Party floor between dwellings (in blocks of flats)	25.0000	0.0700	1.7500
E18 Party wall between dwellings	2.5000	0.0600	0.1500

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.1950 (36)

Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	39.8889 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	33.3755	33.2008	33.0295	32.2249	32.0743	31.3736	31.3736	31.2438	31.6435	32.0743	32.3789	32.6973 (38)
Heat transfer coeff	73.2645	73.0897	72.9184	72.1138	71.9633	71.2625	71.2625	71.1327	71.5324	71.9633	72.2678	72.5862 (39)
Average = Sum(39)m / 12 =												72.1131

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0466	1.0441	1.0417	1.0302	1.0280	1.0180	1.0180	1.0162	1.0219	1.0280	1.0324	1.0369 (40)
HLP (average)												1.0302
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

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

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184 (44)
Energy content (annual)	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578 (45)
Distribution loss (46)m = 0.15 x (45)m	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737 (46)

Water storage loss:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

If cylinder contains dedicated solar storage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	246.5375	218.0199	231.4421	202.8986	196.3211	176.4934	173.8115	180.8875	183.0811	204.6567	218.2602	243.7527 (62)
WWHRS	-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	218.2487	193.0011	205.2437	181.2053	176.1038	159.1933	157.5954	163.6433	165.1817	183.5553	194.3549	215.9878 (64)
Total per year (kWh/year)												2213.3143 (64)

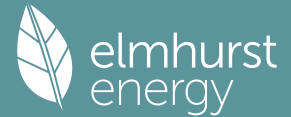
Electric shower(s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	103.7568	92.1667	98.7376	88.5442	87.0599	79.7645	79.5754	81.9282	81.9549	89.8315	93.6520	102.8309 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.5501	110.2161	99.5501	102.8684	99.5501	102.8684	99.5501	99.5501	102.8684	99.5501	102.8684	99.5501 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	139.4581	137.1528	132.7118	122.9781	117.0160	110.7840	106.9562	110.1186	113.8262	120.7412	130.0722	138.2136 (72)
Total internal gains	495.9971	506.4052	486.1390	468.7402	445.5953	426.6511	410.7997	411.9147	424.0999	441.6799	468.1936	486.0473 (73)

6. Solar gains

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[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		1.3900	10.6334	0.6300	0.7000	0.7700	4.5171 (74)
East		12.6100	19.6403	0.6300	0.7000	0.7700	75.6893 (76)
South		1.3900	46.7521	0.6300	0.7000	0.7700	19.8604 (78)

Solar gains	100.0667	189.2228	299.9418	426.0164	516.3713	527.0930	502.3633	434.5873	344.5144	221.0490	123.4893	83.1700 (83)
Total gains	596.0638	695.6280	786.0808	894.7566	961.9666	953.7440	913.1630	846.5019	768.6143	662.7288	591.6829	569.2173 (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	26.5401	26.6035	26.6660	26.9635	27.0200	27.2857	27.2857	27.3354	27.1827	27.0200	26.9061	26.7881
alpha	2.7693	2.7736	2.7777	2.7976	2.8013	2.8190	2.8190	2.8224	2.8122	2.8013	2.7937	2.7859
util living area	0.9250	0.8897	0.8329	0.7274	0.5933	0.4450	0.3321	0.3699	0.5610	0.7800	0.8918	0.9324 (86)
MIT	18.9692	19.3130	19.7813	20.3260	20.7004	20.9034	20.9686	20.9569	20.8099	20.2958	19.5518	18.9118 (87)
Th 2	20.0447	20.0467	20.0487	20.0582	20.0600	20.0683	20.0683	20.0699	20.0651	20.0600	20.0564	20.0527 (88)
util rest of house	0.9153	0.8761	0.8127	0.6964	0.5498	0.3885	0.2657	0.3006	0.5024	0.7468	0.8762	0.9236 (89)
MIT 2	17.6877	18.1157	18.6930	19.3503	19.7762	19.9935	20.0505	20.0440	19.9064	19.3345	18.4279	17.6212 (90)
Living area fraction									FLA = Living area / (4) = 0.3714 (91)			
MIT	18.1637	18.5604	19.0972	19.7127	20.1194	20.3315	20.3915	20.3831	20.2420	19.6916	18.8453	18.1006 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1637	18.5604	19.0972	19.7127	20.1194	20.3315	20.3915	20.3831	20.2420	19.6916	18.8453	18.1006 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8910	0.8504	0.7896	0.6841	0.5527	0.4049	0.2891	0.3244	0.5140	0.7322	0.8518	0.9001 (94)
Useful gains	531.0651	591.5894	620.7031	612.1434	531.6565	386.1826	263.9886	274.6105	395.0523	485.2345	503.9718	512.3530 (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	1015.7155	998.4363	918.5705	779.7465	605.8910	408.4381	270.1910	283.3281	439.3519	654.2589	848.8103	1008.9881 (97)
Space heating kWh	360.5799	273.4011	221.6133	120.6742	55.2304	0.0000	0.0000	0.0000	0.0000	125.7541	248.2838	369.4965 (98a)
Space heating requirement - total per year (kWh/year)												1775.0334
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	360.5799	273.4011	221.6133	120.6742	55.2304	0.0000	0.0000	0.0000	0.0000	125.7541	248.2838	369.4965 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1775.0334
Space heating per m2												(98c) / (4) = 25.3576 (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	360.5799	273.4011	221.6133	120.6742	55.2304	0.0000	0.0000	0.0000	0.0000	125.7541	248.2838	369.4965 (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)	390.6607	296.2092	240.1011	130.7413	59.8380	0.0000	0.0000	0.0000	0.0000	136.2450	268.9965	400.3212 (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	218.2487	193.0011	205.2437	181.2053	176.1038	159.1933	157.5954	163.6433	165.1817	183.5553	194.3549	215.9878 (64)
Efficiency of water heater (217)m	85.1778	84.8405	84.2322	83.1696	81.7788	79.8000	79.8000	79.8000	79.8000	83.2295	84.6101	79.8000 (216)
Fuel for water heating, kWh/month	256.2271	227.4870	243.6642	217.8745	215.3415	199.4903	197.4880	205.0668	206.9946	220.5411	229.7066	85.2530 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	20.6845	16.5939	14.9410	10.9464	8.4553	6.9081	7.7132	10.0259	13.0227	17.0865	19.2991	21.2594 (232)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-23.8072	-34.6451	-51.3903	-59.6953	-66.0345	-62.2483	-61.4889	-57.2272	-49.9865	-40.4682	-26.5559	-20.4586 (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	-10.3574	-22.0793	-44.4255	-67.5187	-90.0502	-90.7561	-89.6852	-75.5810	-54.9338	-31.8342	-13.9124	-8.1686 (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												1923.1131 (211)

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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	2673.2309	(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)	166.9361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1153.3085	(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	3695.9715	(238)

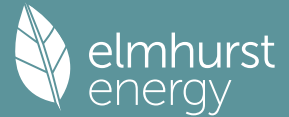
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1923.1131	0.2100	403.8537 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2673.2309	0.2100	561.3785 (264)
Space and water heating			965.2322 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	166.9361	0.1443	24.0940 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-554.0061	0.1339	-74.1907
PV Unit electricity exported	-599.3024	0.1256	-75.2429
Total			-149.4336 (269)
Total CO2, kg/year			851.8219 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1923.1131	1.1300	2173.1178 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2673.2309	1.1300	3020.7509 (278)
Space and water heating			5193.8687 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	166.9361	1.5338	256.0521 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-554.0061	1.4949	-828.1814
PV Unit electricity exported	-599.3024	0.4608	-276.1834
Total			-1104.3649 (283)
Total Primary energy kWh/year			4475.6567 (286)
Target Primary Energy Rate (TPER)			63.9400 (287)

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Property Reference	141 Staple Hill		Issued on Date	10/11/2023	
Assessment Reference	GF01	Prop Type Ref	141 Staple Hill		
Property	-, -, Bristol				
SAP Rating	76 C	DER	6.39	TER	13.44
Environmental	95 A	% DER < TER			52.46
CO ₂ Emissions (t/year)	0.37	DFEE	37.22	TFEE	38.77
Compliance Check	See BREL	% DFEE < TFEE			3.99
% DPER < TPER	6.64	DPER	66.06	TPER	70.76
Assessor Details	Mr. Jonathan Lewis			Assessor ID	AZ32-0001
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	70.0000	2.5000	175.0000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		175.0000
Dwelling volume			175.0000

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			3.5000 (17)
Infiltration rate			0.1750 (18)
Number of sides sheltered			2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1487 (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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (22b)
Mechanical extract ventilation - decentralised												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	0.5000	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

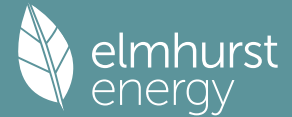
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			18.8000	1.1450	21.5267		(27)
Solid Door			2.1000	1.5000	3.1500		(26)
Heatloss Floor 1			70.0000	0.1200	8.4000		(28a)
External Wall 1	62.0000	18.8000	43.2000	0.1800	7.7760		(29a)
Communal Wall	22.0000	2.1000	19.9000	0.1700	3.3830		(29a)
Total net area of external elements Aum(A, m ²)			154.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.2357	(33)
Party Ceiling 1			70.0000				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.0000	0.0410	0.4100
E3 Sill	10.0000	0.0460	0.4600
E4 Jamb	22.0000	0.0470	1.0340
E5 Ground floor (normal)	22.0000	0.0710	1.5620

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.8883	24.8883	24.8883	24.8883	24.8883	24.8883	24.8883	24.8883	24.8883	24.8883	24.8883	24.8883
alpha	2.6592	2.6592	2.6592	2.6592	2.6592	2.6592	2.6592	2.6592	2.6592	2.6592	2.6592	2.6592
util living area	0.9318	0.8941	0.8332	0.7251	0.5893	0.4455	0.3349	0.3763	0.5700	0.7918	0.9021	0.9399 (86)
MIT	18.7513	19.1385	19.6617	20.2429	20.6573	20.8809	20.9590	20.9431	20.7659	20.1722	19.3427	18.6566 (87)
Th 2	19.9877	19.9877	19.9877	19.9877	19.9877	19.9877	19.9877	19.9877	19.9877	19.9877	19.9877	19.9877 (88)
util rest of house	0.9226	0.8805	0.8123	0.6926	0.5433	0.3849	0.2627	0.3005	0.5072	0.7579	0.8870	0.9316 (89)
Living area fraction	17.3810	17.8622	18.5054	19.1986	19.6669	19.8974	19.9653	19.9547	19.7951	19.1386	18.1271	17.2626 (90)
MIT 2	17.8900	18.3363	18.9349	19.5865	20.0348	20.2627	20.3344	20.3218	20.1556	19.5225	18.5786	17.7804 (91)
Temperature adjustment												0.0000
adjusted MIT	17.8900	18.3363	18.9349	19.5865	20.0348	20.2627	20.3344	20.3218	20.1556	19.5225	18.5786	17.7804 (93)

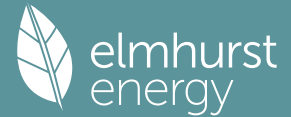
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8974	0.8531	0.7871	0.6785	0.5456	0.4018	0.2880	0.3262	0.5182	0.7402	0.8606	0.9075 (94)
Useful gains	521.8851	597.6069	641.3256	644.2381	565.0126	414.5589	283.5775	294.7657	417.9147	497.0221	499.6910	499.7617 (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	1061.7420	1049.7319	971.4947	834.8987	651.1676	442.4090	291.7541	306.4003	473.1076	697.0891	896.7864	1060.9925 (97)
Space heating kWh	401.6535	303.8280	245.6458	137.2756	64.0993	0.0000	0.0000	0.0000	0.0000	148.8498	285.9087	417.5557 (98a)
Space heating requirement - total per year (kWh/year)												2004.8165
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	401.6535	303.8280	245.6458	137.2756	64.0993	0.0000	0.0000	0.0000	0.0000	148.8498	285.9087	417.5557 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2004.8165
Space heating per m2										(98c) / (4) =		28.6402 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	401.6535	303.8280	245.6458	137.2756	64.0993	0.0000	0.0000	0.0000	0.0000	148.8498	285.9087	417.5557 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	401.6535	303.8280	245.6458	137.2756	64.0993	0.0000	0.0000	0.0000	0.0000	148.8498	285.9087	417.5557 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating requirement	263.6450	232.8243	246.1466	213.1511	204.4876	181.9014	177.6346	185.8938	189.3009	213.9436	231.0389	260.3033 (64)
Efficiency of water heater (217)m	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164	337.6164 (216)
Fuel for water heating, kWh/month	78.0901	68.9612	72.9072	63.1341	60.5680	53.8781	52.6143	55.0606	56.0698	63.3688	68.4324	77.1003 (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	3.1767	2.8693	3.1767	3.0742	3.1767	3.0742	3.1767	3.1767	3.0742	3.1767	3.0742	3.1767 (231)
Lighting	19.2401	15.4351	13.8976	10.1820	7.8648	6.4256	7.1746	9.3258	12.1133	15.8933	17.9514	19.7748 (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												2004.8165 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												337.6164
Water heating fuel used												770.1850 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752) mechanical ventilation fans (SFP = 0.1752)												37.4032 (230a)
Total electricity for the above, kWh/year												37.4032 (231)
Electricity for lighting (calculated in Appendix L)												155.2782 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2967.6829 (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	2004.8165	0.1552	311.2347 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	770.1850	0.1412	108.7721 (264)
Space and water heating			420.0068 (265)
Pumps, fans and electric keep-hot	37.4032	0.1387	5.1883 (267)
Energy for lighting	155.2782	0.1443	22.4114 (268)
Total CO2, kg/year			447.6065 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.3900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2004.8165	1.5747	3157.0421 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	770.1850	1.5222	1172.3975 (278)
Space and water heating			4329.4396 (279)
Pumps, fans and electric keep-hot	37.4032	1.5128	56.5835 (281)
Energy for lighting	155.2782	1.5338	238.1709 (282)
Total Primary energy kWh/year			4624.1941 (286)
Dwelling Primary energy Rate (DPER)			66.0600 (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	70.0000 (1b)	2.5000 (2b)	175.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 175.0000 (5)

2. Ventilation rate

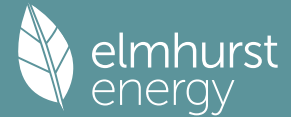
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number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

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

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
---------	-------	----------	---------	---------	-------	---------	-------

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	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			15.3900	1.1450	17.6221		(27)
Heatloss Floor 1			70.0000	0.1300	9.1000		(28a)
External Wall 1	62.0000	15.3900	46.6100	0.1800	8.3898		(29a)
Communal Wall	22.0000	2.1000	19.9000	0.1800	3.5820		(29a)
Total net area of external elements Aum(A, m2)			154.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 40.7939		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	10.0000	0.0500	0.5000
E2 Other lintels (including other steel lintels)	10.0000	0.0500	0.5000
E3 Sill	22.0000	0.0500	1.1000
E4 Jamb	22.0000	0.1600	3.5200
E5 Ground floor (normal)	7.5000	0.0900	0.6750
E16 Corner (normal)	0.0000	-0.0900	-0.0000
E17 Corner (inverted - internal area greater than external area)	25.0000	0.0700	1.7500
E7 Party floor between dwellings (in blocks of flats)	2.5000	0.0600	0.1500
E18 Party wall between dwellings			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.1950 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 48.9889 (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	33.3755	33.2008	33.0295	32.2249	32.0743	31.3736	31.3736	31.2438	31.6435	32.0743	32.3789	32.6973 (38)
Average = Sum(39)m / 12 =	82.3645	82.1897	82.0184	81.2138	81.0633	80.3625	80.3625	80.2327	80.6324	81.0633	81.3678	81.6862 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1766	1.1741	1.1717	1.1602	1.1580	1.1480	1.1480	1.1462	1.1519	1.1580	1.1624	1.1669 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

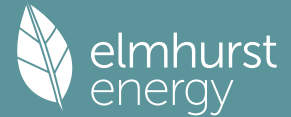
Assumed occupancy													2.2461 (42)
Hot water usage for mixer showers	61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	61.6427 (42a)
Hot water usage for baths	26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	26.6432 (42b)
Hot water usage for other uses	37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	37.6326 (42c)
Average daily hot water use (litres/day)													116.0487 (43)
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	125.9184 (44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	197.1578 (45)
Energy content (annual)													Total = Sum(45)m = 1927.5450
Distribution loss (46)m = 0.15 x (45)m	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	29.5737 (46)
Water storage loss:													150.0000 (47)
Store volume													1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.7527 (55)
Enter (49) or (54) in (55)													
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (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	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	0.0000 (61)
Total heat required for water heating calculated for each month	246.5375	218.0199	231.4421	202.8986	196.3211	176.4934	173.8115	180.8875	183.0811	204.6567	218.2602	243.7527	243.7527 (62)
WWHRS	-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650	-27.7650 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-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	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	0.0000 (63d)
Output from w/h	218.2487	193.0011	205.2437	181.2053	176.1038	159.1933	157.5954	163.6433	165.1817	183.5553	194.3549	215.9878	215.9878 (64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2213.3143 (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	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	103.7568	92.1667	98.7376	88.5442	87.0599	79.7645	79.5754	81.9282	81.9549	89.8315	93.6520	102.8309	102.8309 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.5501	110.2161	99.5501	102.8684	99.5501	102.8684	99.5501	99.5501	102.8684	99.5501	102.8684	99.5501 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	139.4581	137.1528	132.7118	122.9781	117.0160	110.7840	106.9562	110.1186	113.8262	120.7412	130.0722	138.2136 (72)
Total internal gains	495.9971	506.4052	486.1390	468.7402	445.5953	426.6511	410.7997	411.9147	424.0999	441.6799	468.1936	486.0473 (73)

6. Solar gains

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[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	1.3900	10.6334	0.6300	0.7000	0.7700	4.5171 (74)
East	12.6100	19.6403	0.6300	0.7000	0.7700	75.6893 (76)
South	1.3900	46.7521	0.6300	0.7000	0.7700	19.8604 (78)

Solar gains	100.0667	189.2228	299.9418	426.0164	516.3713	527.0930	502.3633	434.5873	344.5144	221.0490	123.4893	83.1700 (83)
Total gains	596.0638	695.6280	786.0808	894.7566	961.9666	953.7440	913.1630	846.5019	768.6143	662.7288	591.6829	569.2173 (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	23.6078	23.6580	23.7074	23.9423	23.9867	24.1959	24.1959	24.2351	24.1149	23.9867	23.8970	23.8038
alpha	2.5739	2.5772	2.5805	2.5962	2.5991	2.6131	2.6131	2.6157	2.6077	2.5991	2.5931	2.5869
util living area	0.9307	0.8995	0.8493	0.7549	0.6297	0.4838	0.3667	0.4065	0.5988	0.8025	0.9015	0.9373 (86)
MIT	18.6309	18.9848	19.4917	20.1080	20.5695	20.8459	20.9453	20.9271	20.7202	20.0959	19.2666	18.5706 (87)
Th 2	19.9387	19.9407	19.9427	19.9520	19.9537	19.9618	19.9618	19.9633	19.9587	19.9537	19.9502	19.9465 (88)
util rest of house	0.9210	0.8861	0.8293	0.7231	0.5825	0.4189	0.2871	0.3244	0.5342	0.7688	0.8861	0.9285 (89)
MIT 2	17.2012	17.6430	18.2706	19.0185	19.5485	19.8443	19.9319	19.9210	19.7276	19.0266	18.0098	17.1305 (90)
Living area fraction	fLA = Living area / (4) = 0.3714 (91)											
MIT	17.7322	18.1414	18.7241	19.4231	19.9277	20.2163	20.3083	20.2947	20.0963	19.4238	18.4766	17.6654 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.7322	18.1414	18.7241	19.4231	19.9277	20.2163	20.3083	20.2947	20.0963	19.4238	18.4766	17.6654 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8946	0.8574	0.8018	0.7052	0.5813	0.4354	0.3144	0.3515	0.5433	0.7491	0.8587	0.9031 (94)
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	1106.3385	1088.3052	1002.6048	854.6246	666.9661	451.3426	298.0087	312.4845	483.4983	715.2840	925.6909	1099.9365 (97)
Space heating kWh	426.4076	330.5475	277.0225	161.0443	80.2056	0.0000	0.0000	0.0000	0.0000	162.8049	300.7021	435.8944 (98a)
Space heating requirement - total per year (kWh/year)	2174.6289											
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	426.4076	330.5475	277.0225	161.0443	80.2056	0.0000	0.0000	0.0000	0.0000	162.8049	300.7021	435.8944 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2174.6289											
Space heating per m2	(98c) / (4) = 31.0661 (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)

Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	426.4076	330.5475	277.0225	161.0443	80.2056	0.0000	0.0000	0.0000	0.0000	162.8049	300.7021	435.8944 (98)
Space heating fuel (main heating system)	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 efficiency (main heating system 2)	461.9801	358.1230	300.1327	174.4791	86.8966	0.0000	0.0000	0.0000	0.0000	176.3867	325.7878	472.2583 (211)
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 (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 requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water heating requirement	218.2487	193.0011	205.2437	181.2053	176.1038	159.1933	157.5954	163.6433	165.1817	183.5553	194.3549	215.9878 (64)
Efficiency of water heater (217)m	85.5341	85.2554	84.7330	83.7963	82.4138	79.8000	79.8000	79.8000	79.8000	83.7918	85.0349	79.8000 (216)
Fuel for water heating, kWh/month	255.1598	226.3798	242.2241	216.2450	213.6824	199.4903	197.4880	205.0668	206.9946	219.0612	228.5590	252.3184 (219)
Space cooling fuel requirement	0.0000 (221)											
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	20.6845	16.5939	14.9410	10.9464	8.4553	6.9081	7.7132	10.0259	13.0227	17.0865	19.2991	21.2594 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 (233a)											
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 (234a)											
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 (235a)											
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000 (235c)											
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 (233b)											
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 (234b)											
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 (235b)											
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000 (235d)											
Annual totals kWh/year												

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Space heating fuel - main system 1	2356.0443 (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	2662.6696 (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)	166.9361 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1153.3085 (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	4118.3415 (238)

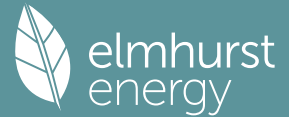
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2356.0443	0.2100	494.7693 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2662.6696	0.2100	559.1606 (264)
Space and water heating			1053.9299 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	166.9361	0.1443	24.0940 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-554.0061	0.1339	-74.1907
PV Unit electricity exported	-599.3024	0.1256	-75.2429
Total			-149.4336 (269)
Total CO2, kg/year			940.5196 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.4400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2356.0443	1.1300	2662.3301 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2662.6696	1.1300	3008.8166 (278)
Space and water heating			5671.1467 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	166.9361	1.5338	256.0521 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-554.0061	1.4949	-828.1814
PV Unit electricity exported	-599.3024	0.4608	-276.1834
Total			-1104.3649 (283)
Total Primary energy kWh/year			4952.9347 (286)
Target Primary Energy Rate (TPER)			70.7600 (287)

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Property Reference	141 Staple Hill		Issued on Date	10/11/2023	
Assessment Reference	SF01	Prop Type Ref	141 Staple Hill		
Property	-, -, Bristol				
SAP Rating	79 C	DER	7.08	TER	16.68
Environmental	96 A	% DER < TER			57.55
CO ₂ Emissions (t/year)	0.25	DFEE	38.62	TFEE	38.91
Compliance Check	See BREL	% DFEE < TFEE			0.76
% DPER < TPER	17.22	DPER	73.42	TPER	88.69
Assessor Details	Mr. Jonathan Lewis			Assessor ID	AZ32-0001
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	42.0000 (1b)	2.5000 (2b)	105.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.0000		105.0000 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 105.0000 (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		3.5000 (17)
Infiltration rate		0.1750 (18)
Number of sides sheltered		2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1487 (21)

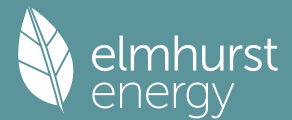
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	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 = 1.20)			7.0000	1.1450	8.0153		(27)
Solid Door			2.1000	1.5000	3.1500		(26)
External Wall 1	59.0000	7.0000	52.0000	0.1800	9.3600		(29a)
Communal Wall	4.5000	2.1000	2.4000	0.1700	0.4080		(29a)
External Roof 1	42.0000		42.0000	0.1200	5.0400		(30)
Total net area of external elements Aum(A, m ²)			105.5000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.9733	(33)
Party Floor 1			40.0000				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)

List of Thermal Bridges	K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)		6.0000	0.0410	0.2460
E3 Sill		6.0000	0.0460	0.2760
E4 Jamb		8.0000	0.0470	0.3760
E5 Ground floor (normal)		0.0000	0.0710	0.0000

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E16 Corner (normal)	13.0000	0.0320	0.4160
E17 Corner (inverted - internal area greater than external area)	13.2000	-0.0310	-0.4092
E7 Party floor between dwellings (in blocks of flats)	27.0000	0.0490	1.3230
E18 Party wall between dwellings	0.0000	0.0340	0.0000
E11 Eaves (insulation at rafter level)	27.0000	0.0400	1.0800
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.3078 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	29.2811 (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	17.3250	17.3250	17.3250	17.3250	17.3250	17.3250	17.3250	17.3250	17.3250	17.3250	17.3250	17.3250
Average = Sum(39)m / 12 =	46.6061	46.6061	46.6061	46.6061	46.6061	46.6061	46.6061	46.6061	46.6061	46.6061	46.6061	46.6061

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1097	1.1097	1.1097	1.1097	1.1097	1.1097	1.1097	1.1097	1.1097	1.1097	1.1097	1.1097
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.4605 (42)

Hot water usage for mixer showers 66.9713 65.9648 64.4982 61.6922 59.6214 57.3120 55.9994 57.4549 59.0504 61.5299 64.3962 66.7147 (42a)

Hot water usage for baths 21.0686 20.7557 20.3150 19.5026 18.8943 18.2197 17.8553 18.2929 18.7693 19.4911 20.3203 20.9973 (42b)

Hot water usage for other uses 29.5865 28.5106 27.4347 26.3589 25.2830 24.2071 24.2071 25.2830 26.3589 27.4347 28.5106 29.5865 (42c)

Average daily hot water use (litres/day) 108.1759 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	117.6263	115.2311	112.2480	107.5536	103.7986	99.7388	98.0618	101.0308	104.1785	108.4557	113.2271	117.2985
Energy content (annual)	186.2913	164.0875	172.5210	147.2355	139.7329	122.6405	118.5973	125.0972	128.4625	147.1734	161.3127	183.6610
Distribution loss (46)m = 0.15 x (45)m	27.9437	24.6131	25.8781	22.0853	20.9599	18.3961	17.7896	18.7646	19.2694	22.0760	24.1969	27.5492
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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
Total heat required for water heating calculated for each month	213.2427	188.4307	199.4724	173.3175	166.6843	148.7225	145.5487	152.0486	154.5445	174.1248	187.3947	210.6124
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
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
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
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
Output from w/h	213.2427	188.4307	199.4724	173.3175	166.6843	148.7225	145.5487	152.0486	154.5445	174.1248	187.3947	210.6124
12Total per year (kWh/year)												2114.1439 (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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	61.9419	54.5591	57.3632	48.9558	46.4612	40.7780	39.4336	41.5948	42.7138	48.9352	53.6365	61.0673

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

Metabolic gains (Table 5), Watts

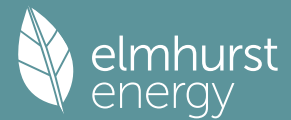
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0225	73.0225	73.0225	73.0225	73.0225	73.0225	73.0225	73.0225	73.0225	73.0225	73.0225	73.0225
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	66.0952	73.1768	66.0952	68.2984	66.0952	68.2984	66.0952	66.0952	68.2984	66.0952	68.2984	66.0952
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	126.5943	127.9080	124.5976	117.5502	108.6542	100.2932	94.7075	93.3938	96.7042	103.7516	112.6476	121.0086
Pumps, fans	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water heating gains (Table 5)	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180
Total internal gains	83.2552	81.1891	77.1011	67.9942	62.4478	56.6361	53.0022	55.9070	59.3247	65.7731	74.4951	82.0797
	320.8514	327.1807	312.7006	298.7495	282.1039	270.1344	258.7116	260.3028	269.2340	280.5266	300.3478	314.0903

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	7.0000	19.6403	0.6300	0.7000	0.7700	42.0162 (76)
Solar gains	42.0162	82.1927	135.3596	197.4140	241.9382	247.6668
Total gains	362.8677	409.3733	448.0603	496.1635	524.0422	517.8012

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.0325	25.0325	25.0325	25.0325	25.0325	25.0325	25.0325	25.0325	25.0325	25.0325	25.0325	25.0325
alpha	2.6688	2.6688	2.6688	2.6688	2.6688	2.6688	2.6688	2.6688	2.6688	2.6688	2.6688	2.6688
util living area	0.9258	0.8989	0.8555	0.7722	0.6553	0.5115	0.3906	0.4293	0.6185	0.8105	0.8992	0.9325 (86)
MIT	18.8218	19.1171	19.5598	20.1097	20.5568	20.8354	20.9413	20.9227	20.7160	20.1221	19.3719	18.7454 (87)
Th 2	19.9929	19.9929	19.9929	19.9929	19.9929	19.9929	19.9929	19.9929	19.9929	19.9929	19.9929	19.9929 (88)
util rest of house	0.9160	0.8857	0.8365	0.7422	0.6098	0.4464	0.3092	0.3461	0.5554	0.7784	0.8839	0.9234 (89)
MIT 2	17.4718	17.8394	18.3878	19.0531	19.5701	19.8652	19.9600	19.9471	19.7548	19.0862	18.1662	17.3764 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.1146	18.4478	18.9459	19.5563	20.0400	20.3272	20.4273	20.4117	20.2125	19.5795	18.7404	18.0283 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1146	18.4478	18.9459	19.5563	20.0400	20.3272	20.4273	20.4117	20.2125	19.5795	18.7404	18.0283 (93)

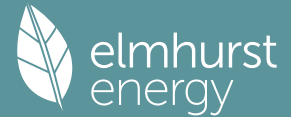
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8924	0.8610	0.8134	0.7278	0.6121	0.4688	0.3452	0.3817	0.5700	0.7633	0.8603	0.9005 (94)
Useful gains	323.8274	352.4821	364.4485	361.1017	320.7712	242.7317	170.6901	176.6806	243.1971	288.5593	303.4702	313.9482 (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	643.8455	631.4116	580.0524	496.6468	388.6930	266.9211	178.3744	186.9684	284.8799	418.4977	542.5121	644.4836 (97)
Space heating kWh	238.0935	187.4406	160.4093	97.5924	50.5338	0.0000	0.0000	0.0000	0.0000	96.6742	172.1101	245.9184 (98a)
Space heating requirement - total per year (kWh/year)	1248.7723											
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	238.0935	187.4406	160.4093	97.5924	50.5338	0.0000	0.0000	0.0000	0.0000	96.6742	172.1101	245.9184 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1248.7723											
Space heating per m2	(98c) / (4) = 29.7327 (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)												
Fraction of main heating from main system 2												
Fraction of total heating from main system 1												
Fraction of total heating from main system 2												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	238.0935	187.4406	160.4093	97.5924	50.5338	0.0000	0.0000	0.0000	0.0000	96.6742	172.1101	245.9184 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	238.0935	187.4406	160.4093	97.5924	50.5338	0.0000	0.0000	0.0000	0.0000	96.6742	172.1101	245.9184 (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)
Space heating fuel used, main system 2	0.0000 (213)											
Water heating												
Water heating requirement	213.2427	188.4307	199.4724	173.3175	166.6843	148.7225	145.5487	152.0486	154.5445	174.1248	187.3947	210.6124 (64)
Efficiency of water heater	346.8843 (216)											
(217)m	346.8843	346.8843	346.8843	346.8843	346.8843	346.8843	346.8843	346.8843	346.8843	346.8843	346.8843	346.8843 (217)
Fuel for water heating, kWh/month	61.4737	54.3209	57.5040	49.9641	48.0518	42.8738	41.9589	43.8327	44.5522	50.1968	54.0223	60.7155 (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	1.9060	1.7216	1.9060	1.8445	1.9060	1.8445	1.9060	1.9060	1.8445	1.9060	1.8445	1.9060 (231)
Lighting	12.7789	10.2517	9.2305	6.7627	5.2237	4.2678	4.7652	6.1940	8.0454	10.5560	11.9230	13.1341 (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	1248.7723 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	346.8843											
Water heating fuel used	609.4666 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752)												
mechanical ventilation fans (SFP = 0.1752)												
Total electricity for the above, kWh/year	22.4419 (230a)											
Electricity for lighting (calculated in Appendix L)	103.1330 (232)											

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Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1983.8137	(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	1248.7723	0.1547	193.1895 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	609.4666	0.1411	86.0250 (264)
Space and water heating			279.2146 (265)
Pumps, fans and electric keep-hot	22.4419	0.1387	3.1130 (267)
Energy for lighting	103.1330	0.1443	14.8853 (268)
Total CO2, kg/year			297.2128 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.0800 (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	1248.7723	1.5727	1963.9992 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	609.4666	1.5219	927.5636 (278)
Space and water heating			2891.5628 (279)
Pumps, fans and electric keep-hot	22.4419	1.5128	33.9501 (281)
Energy for lighting	103.1330	1.5338	158.1888 (282)
Total Primary energy kWh/year			3083.7017 (286)
Dwelling Primary energy Rate (DPER)			73.4200 (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	42.0000 (1b)	x 2.5000 (2b)	= 105.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	105.0000 (5)

2. Ventilation rate

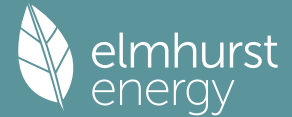
		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1905 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4405	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3744 (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	0.4774	0.4680	0.4586	0.4118	0.4025	0.3557	0.3557	0.3463	0.3744	0.4025	0.4212	0.4399 (22b)
Effective ac	0.6139	0.6095	0.6052	0.5848	0.5810	0.5633	0.5633	0.5600	0.5701	0.5810	0.5887	0.5968 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
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TER Opaque door			2.1000	1.0000	2.1000							(26)
TER Opening Type (Uw = 1.20)			7.0000	1.1450	8.0153							(27)
External Wall 1	59.0000	7.0000	52.0000	0.1800	9.3600							(29a)
Communal Wall	4.5000	2.1000	2.4000	0.1800	0.4320							(29a)
External Roof 1	42.0000		42.0000	0.1100	4.6200							(30)
Total net area of external elements Aum(A, m2)			105.5000									(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		24.5273							(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges				Length	Psi-value	Total	
K1 Element				6.0000	0.0500	0.3000	
E2 Other lintels (including other steel lintels)				6.0000	0.0500	0.3000	
E3 Sill				8.0000	0.0500	0.4000	
E4 Jamb				0.0000	0.1600	0.0000	
E5 Ground floor (normal)				13.0000	0.0900	1.1700	
E6 Corner (normal)				13.2000	-0.0900	-1.1880	
E7 Party floor between dwellings (in blocks of flats)				27.0000	0.0700	1.8900	
E8 Party wall between dwellings				0.0000	0.0600	0.0000	
E11 Eaves (insulation at rafter level)				27.0000	0.0400	1.0800	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9520 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 28.4793 (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	21.2730	21.1197	20.9694	20.2636	20.1316	19.5168	19.5168	19.4030	19.7536	20.1316	20.3987	20.6780
Average = Sum(39)m / 12 =	49.7523	49.5990	49.4487	48.7429	48.6108	47.9961	47.9961	47.8822	48.2329	48.6108	48.8780	49.1573

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1846	1.1809	1.1773	1.1605	1.1574	1.1428	1.1428	1.1401	1.1484	1.1574	1.1638	1.1704
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

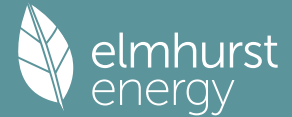
Assumed occupancy													1.4605 (42)
Hot water usage for mixer showers	48.7064	47.9744	46.9078	44.8670	43.3610	41.6815	40.7268	41.7854	42.9457	44.7490	46.8336	48.5198	48.5198 (42a)
Hot water usage for baths	21.0686	20.7557	20.3150	19.5026	18.8943	18.2197	17.8553	18.2929	18.7693	19.4911	20.3203	20.9973	20.9973 (42b)
Hot water usage for other uses	29.5865	28.5106	27.4347	26.3589	25.2830	24.2071	24.2071	25.2830	26.3589	27.4347	28.5106	29.5865	29.5865 (42c)
Average daily hot water use (litres/day)													91.3363 (43)
Daily hot water use	99.3614	97.2407	94.6576	90.7285	87.5382	84.1083	82.7893	85.3612	88.0739	91.6748	95.6645	99.1036	99.1036 (44)
Energy conte	157.3642	138.4694	145.4851	124.2028	117.8433	103.4210	100.1265	105.6950	108.6039	124.4019	136.2916	155.1722	155.1722 (45)
Energy content (annual)													Total = Sum(45)m = 1517.0768
Distribution loss (46)m = 0.15 x (45)m	23.6046	20.7704	21.8228	18.6304	17.6765	15.5131	15.0190	15.8543	16.2906	18.6603	20.4437	23.2758	23.2758 (46)
Water storage loss:													150.0000 (47)
Store volume													1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.7527 (55)
Enter (49) or (54) in (55)													
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (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	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	0.0000 (61)
Total heat required for water heating calculated for each month	203.9591	180.5551	192.0800	169.2946	164.4382	148.5128	146.7214	152.2900	153.6957	170.9968	181.3834	201.7671	201.7671 (62)
WWHRS	-22.2665	-19.6927	-20.6210	-17.0750	-15.9133	-13.6171	-12.7639	-13.5731	-14.0888	-16.6092	-18.8162	-21.8542	-21.8542 (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	-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	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	0.0000 (63d)
Output from w/h	181.6926	160.8624	171.4590	152.2196	148.5249	134.8956	133.9575	138.7168	139.6069	154.3876	162.5673	179.9129	179.9129 (64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 1858.8031 (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	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	89.5995	79.7097	85.6497	77.3709	76.4588	70.4609	70.5680	72.4195	72.1843	78.6395	81.3904	88.8707	88.8707 (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	66.0952	73.1768	66.0952	68.2984	66.0952	68.2984	66.0952	66.0952	68.2984	66.0952	68.2984	66.0952
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	126.5943	127.9080	124.5976	117.5502	108.6542	100.2932	94.7075	93.3938	96.7042	103.7516	112.6476	121.0086
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023	30.3023
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
Losses e.g. evaporation (negative values) (Table 5)	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180	-58.4180
Water heating gains (Table 5)	120.4294	118.6156	115.1206	107.4596	102.7672	97.8624	94.8494	97.3381	100.2559	105.6983	113.0423	119.4498
Total internal gains	361.0257	367.6071	353.7201	341.2149	325.4234	311.3607	300.5589	301.7338	310.1652	323.4518	341.8950	354.4604

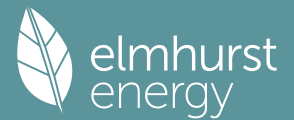
6. Solar gains

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[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												7.0000	19.6403	0.6300	0.7000	0.7700	42.0162 (76)
Solar gains	42.0162	82.1927	135.3596	197.4140	241.9382	247.6668	235.7889	202.5392	157.4289	97.5285	52.3893	34.5521 (83)					
Total gains	403.0419	449.7998	489.0798	538.6289	567.3616	559.0275	536.3478	504.2730	467.5941	420.9804	394.2843	389.0125 (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	23.4495	23.5220	23.5935	23.9351	24.0001	24.3075	24.3075	24.3653	24.1882	24.0001	23.8690	23.7334					
alpha	2.5633	2.5681	2.5729	2.5957	2.6000	2.6205	2.6205	2.6244	2.6125	2.6000	2.5913	2.5822					
util living area	0.9128	0.8852	0.8406	0.7538	0.6362	0.4913	0.3723	0.4073	0.5924	0.7847	0.8806	0.9188 (86)					
MIT	18.7787	19.0766	19.5287	20.1110	20.5588	20.8416	20.9439	20.9277	20.7290	20.1514	19.3948	18.7417 (87)					
Th 2	19.9324	19.9353	19.9382	19.9517	19.9542	19.9661	19.9661	19.9683	19.9615	19.9542	19.9491	19.9437 (88)					
util rest of house	0.9012	0.8703	0.8197	0.7219	0.5892	0.4260	0.2920	0.3255	0.5280	0.7495	0.8628	0.9080 (89)					
MIT 2	17.3802	17.7515	18.3114	19.0216	19.5380	19.8449	19.9353	19.9262	19.7380	19.0891	18.1643	17.3411 (90)					
Living area fraction	FLA = Living area / (4) =											0.4762 (91)					
MIT	18.0462	18.3825	18.8910	19.5403	20.0241	20.3195	20.4156	20.4031	20.2099	19.5950	18.7503	18.0080 (92)					
Temperature adjustment												0.0000					
adjusted MIT	18.0462	18.3825	18.8910	19.5403	20.0241	20.3195	20.4156	20.4031	20.2099	19.5950	18.7503	18.0080 (93)					
8. Space heating requirement																	
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Useful gains	0.8751	0.8438	0.7957	0.7081	0.5925	0.4491	0.3277	0.3609	0.5443	0.7358	0.8381	0.8826 (94)					
Ext temp.	352.7175	379.5528	389.1522	381.4060	336.1656	251.0589	175.7638	182.0013	254.4909	309.7472	330.4458	343.3501 (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	683.9036	668.7193	612.7204	518.6401	404.6411	274.5147	183.1324	191.6760	294.6983	437.2532	569.4408	678.7647 (97)					
Space heating kWh	246.4025	194.3199	166.3347	98.8086	50.9458	0.0000	0.0000	0.0000	0.0000	94.8645	172.0764	249.5484 (98a)					
Space heating requirement - total per year (kWh/year)												1273.3007					
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	246.4025	194.3199	166.3347	98.8086	50.9458	0.0000	0.0000	0.0000	0.0000	94.8645	172.0764	249.5484 (98c)					
Space heating requirement after solar contribution - total per year (kWh/year)												1273.3007					
Space heating per m2												(98c) / (4) = 30.3167 (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	246.4025	194.3199	166.3347	98.8086	50.9458	0.0000	0.0000	0.0000	0.0000	94.8645	172.0764	249.5484 (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)	266.9583	210.5307	180.2110	107.0515	55.1958	0.0000	0.0000	0.0000	0.0000	102.7784	186.4316	270.3667 (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	181.6926	160.8624	171.4590	152.2196	148.5249	134.8956	133.9575	138.7168	139.6069	154.3876	162.5673	179.9129 (64)					
Efficiency of water heater (217)m	84.7436	84.4846	83.9918	83.1158	81.9206	79.8000	79.8000	79.8000	79.8000	83.0017	84.1875	79.8000 (216)					
Fuel for water heating, kWh/month	214.4027	190.4044	204.1378	183.1416	181.3035	169.0422	167.8665	173.8306	174.9460	186.0054	193.1014	212.1772 (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	7.0685	7.3041	7.0685	7.3041	7.0685 (231)					
Lighting	13.7333	11.0173	9.9199	7.2677	5.6138	4.5865	5.1211	6.6566	8.6463	11.3444	12.8135	14.1150 (232)					
Electricity generated by PVs (Appendix M) (negative quantity)																	
(233a)m	-14.5676	-21.3504	-31.9037	-37.3628	-41.6259	-39.3858	-38.9470	-36.1274	-31.3451	-25.1121	-16.3166	-12.5046 (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	-5.9311	-12.6842	-25.5858	-38.9656	-52.0249	-52.4168	-51.7575	-43.5575	-31.6071	-18.2693	-7.9643	-4.6717 (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												1379.5241 (211)					
Space heating fuel - main system 2												0.0000 (213)					

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2250.3594 (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)	110.8354 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-691.9851 (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	3134.7338 (238)

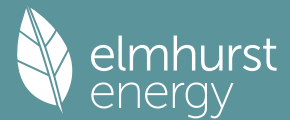
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1379.5241	0.2100	289.7001 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2250.3594	0.2100	472.5755 (264)
Space and water heating			762.2755 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	110.8354	0.1443	15.9970 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-346.5491	0.1337	-46.3464
PV Unit electricity exported	-345.4360	0.1255	-43.3559
Total			-89.7024 (269)
Total CO2, kg/year			700.4994 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.6800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1379.5241	1.1300	1558.8622 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2250.3594	1.1300	2542.9061 (278)
Space and water heating			4101.7683 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	110.8354	1.5338	170.0030 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-346.5491	1.4942	-517.8209
PV Unit electricity exported	-345.4360	0.4607	-159.1405
Total			-676.9614 (283)
Total Primary energy kWh/year			3724.9107 (286)
Target Primary Energy Rate (TPER)			88.6900 (287)

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Property Reference	141 Staple Hill		Issued on Date	10/11/2023	
Assessment Reference	SF02	Prop Type Ref	141 Staple Hill		
Property	-, -, Bristol				
SAP Rating	82 B	DER	6.49	TER	16.77
Environmental	96 A	% DER < TER			61.30
CO ₂ Emissions (t/year)	0.2	DFEE	33.46	TFEE	33.66
Compliance Check	See BREL	% DFEE < TFEE			0.62
% DPER < TPER	24.51	DPER	67.54	TPER	89.47
Assessor Details	Mr. Jonathan Lewis			Assessor ID	AZ32-0001
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	37.0000	2.5000	92.5000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.0000		92.5000
Dwelling volume			92.5000

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		3.5000 (17)
Infiltration rate		0.1750 (18)
Number of sides sheltered		2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1487 (21)

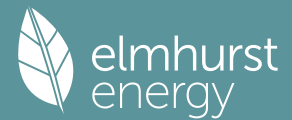
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	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 = 1.20)			4.7000	1.1450	5.3817		(27)
Solid Door			2.1000	1.5000	3.1500		(26)
External Wall 1	31.0000	4.7000	26.3000	0.1800	4.7340		(29a)
Communal Wall	12.0000	2.1000	9.9000	0.1700	1.6830		(29a)
External Roof 1	37.0000		37.0000	0.1200	4.4400		(30)
Total net area of external elements Aum(A, m ²)			80.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	19.3887	(33)
Party Floor 1			40.0000				(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				4.0000	0.0410	0.1640	
E3 Sill				4.0000	0.0460	0.1840	
E4 Jamb				5.0000	0.0470	0.2350	
E5 Ground floor (normal)				0.0000	0.0710	0.0000	

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E16 Corner (normal)	11.0000	0.0320	0.3520
E17 Corner (inverted - internal area greater than external area)	8.8000	-0.0310	-0.2728
E7 Party floor between dwellings (in blocks of flats)	14.0000	0.0490	0.6860
E18 Party wall between dwellings	0.0000	0.0340	0.0000
E11 Eaves (insulation at rafter level)	14.0000	0.0400	0.5600
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			1.9082 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	21.2969 (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	15.2625	15.2625	15.2625	15.2625	15.2625	15.2625	15.2625	15.2625	15.2625	15.2625	15.2625	15.2625
Average = Sum(39)m / 12 =	36.5594	36.5594	36.5594	36.5594	36.5594	36.5594	36.5594	36.5594	36.5594	36.5594	36.5594	36.5594

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3291 (42)

Hot water usage for mixer showers 63.9427 62.9817 61.5815 58.9023 56.9251 54.7202 53.4670 54.8566 56.3800 58.7474 61.4841 63.6977 (42a)

Hot water usage for baths 20.1214 19.8225 19.4017 18.6258 18.0448 17.4006 17.0526 17.4705 17.9255 18.6148 19.4067 20.0533 (42b)

Hot water usage for other uses 28.2412 27.2142 26.1873 25.1603 24.1333 23.1064 23.1064 24.1333 25.1603 26.1873 27.2142 28.2412 (42c)

Average daily hot water use (litres/day) 103.2825 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.3052	110.0185	107.1704	102.6884	99.1033	95.2272	93.6260	96.4605	99.4658	103.5495	108.1050	111.9922
Energy content (annual)	177.8640	156.6648	164.7170	140.5753	133.4121	117.0930	113.2325	119.4382	122.6512	140.5156	154.0154	175.3527
Distribution loss (46)m = 0.15 x (45)m	26.6796	23.4997	24.7075	21.0863	20.0118	17.5639	16.9849	17.9157	18.3977	21.0773	23.1023	26.3029
Water storage loss:												201.0000
Store volume												1.6100
a) If manufacturer declared loss factor is known (kWh/day):												0.5400
Temperature factor from Table 2b												0.8694
Enter (49) or (54) in (55)												0.8694
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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
Total heat required for water heating calculated for each month	204.8154	181.0080	191.6684	166.6573	160.3635	143.1750	140.1839	146.3896	148.7332	167.4670	180.0974	202.3041
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
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
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
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
Output from w/h	204.8154	181.0080	191.6684	166.6573	160.3635	143.1750	140.1839	146.3896	148.7332	167.4670	180.0974	202.3041
12Total per year (kWh/year)												2032.8629
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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												2033
Heat gains from water heating, kWh/month	59.1398	52.0911	54.7684	46.7413	44.3595	38.9334	37.6498	39.7132	40.7815	46.7214	51.2101	58.3048

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

Metabolic gains (Table 5), Watts

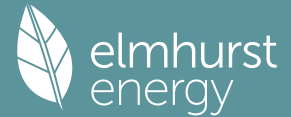
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	63.0607	69.8172	63.0607	65.1628	63.0607	65.1628	63.0607	63.0607	65.1628	63.0607	65.1628	63.0607
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	114.0692	115.2529	112.2701	105.9199	97.9041	90.3703	85.3372	84.1536	87.1364	93.4865	101.5024	109.0362
Pumps, fans	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water heating gains (Table 5)	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634
Total internal gains	79.4889	77.5165	73.6134	64.9185	59.6230	54.0742	50.6046	53.3780	56.6410	62.7976	71.1252	78.3666
	299.5551	305.5229	291.8805	278.9374	263.5241	252.5435	241.9388	243.5285	251.8764	262.2811	280.7266	293.3998

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	
East		4.7000	19.6403	0.6300	0.7000	0.7700	28.2109
Solar gains	28.2109	55.1865	90.8843	132.5494	162.4442	166.2906	158.3154
Total gains	327.7660	360.7094	382.7648	411.4868	425.9683	418.8341	400.2542
							135.9906
							105.7022
							65.4834
							35.1757
							23.1993
							316.5991

7. Mean internal temperature (heating season)

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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	28.1126	28.1126	28.1126	28.1126	28.1126	28.1126	28.1126	28.1126	28.1126	28.1126	28.1126	28.1126
alpha	2.8742	2.8742	2.8742	2.8742	2.8742	2.8742	2.8742	2.8742	2.8742	2.8742	2.8742	2.8742
util living area	0.9149	0.8885	0.8479	0.7681	0.6535	0.5070	0.3839	0.4183	0.6026	0.7941	0.8853	0.9219 (86)
MIT	19.1859	19.4345	19.7998	20.2625	20.6401	20.8736	20.9579	20.9449	20.7853	20.2997	19.6658	19.1179 (87)
Th 2	20.0933	20.0933	20.0933	20.0933	20.0933	20.0933	20.0933	20.0933	20.0933	20.0933	20.0933	20.0933 (88)
util rest of house	0.9044	0.8752	0.8295	0.7398	0.6113	0.4475	0.3108	0.3438	0.5445	0.7627	0.8694	0.9122 (89)
MIT 2	17.9882	18.2968	18.7487	19.3081	19.7451	19.9927	20.0685	20.0592	19.9103	19.3659	18.5919	17.9036 (90)
Living area fraction	fLA = Living area / (4) = 0.5405 (91)											
MIT	18.6356	18.9118	19.3168	19.8240	20.2289	20.4689	20.5493	20.5380	20.3832	19.8707	19.1724	18.5600 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6356	18.9118	19.3168	19.8240	20.2289	20.4689	20.5493	20.5380	20.3832	19.8707	19.1724	18.5600 (93)

8. Space heating requirement

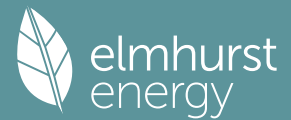
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8840	0.8547	0.8115	0.7307	0.6179	0.4728	0.3482	0.3811	0.5639	0.7542	0.8503	0.8920 (94)
Useful gains	289.7348	308.3049	310.6221	300.6719	263.2097	198.0195	139.3601	144.6241	201.6309	247.1912	268.6185	282.4065 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	524.1018	512.2618	468.5754	399.3743	311.8112	214.5632	144.3823	151.2822	229.7115	338.9302	441.3595	524.9912 (97)
Space heating kWh	174.3690	137.0590	117.5173	71.0657	36.1595	0.0000	0.0000	0.0000	0.0000	68.2538	124.3735	180.4830 (98a)
Space heating requirement - total per year (kWh/year)	909.2809											
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	174.3690	137.0590	117.5173	71.0657	36.1595	0.0000	0.0000	0.0000	0.0000	68.2538	124.3735	180.4830 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	909.2809											
Space heating per m2	(98c) / (4) = 24.5752 (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)
 Fraction of main heating from main system 2 0.0000 (203)
 Fraction of total heating from main system 1 1.0000 (204)
 Fraction of total heating from main system 2 0.0000 (205)
 Efficiency of main space heating system 1 (in %) 100.0000 (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	174.3690	137.0590	117.5173	71.0657	36.1595	0.0000	0.0000	0.0000	0.0000	68.2538	124.3735	180.4830 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	174.3690	137.0590	117.5173	71.0657	36.1595	0.0000	0.0000	0.0000	0.0000	68.2538	124.3735	180.4830 (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)
Space heating fuel used, main 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)
Water heating												
Water heating requirement	204.8154	181.0080	191.6684	166.6573	160.3635	143.1750	140.1839	146.3896	148.7332	167.4670	180.0974	202.3041 (64)
Efficiency of water heater (217)m	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339 (216)
Fuel for water heating, kWh/month	58.7817	51.9490	55.0085	47.8304	46.0241	41.0910	40.2326	42.0136	42.6862	48.0628	51.6877	58.0610 (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	1.6791	1.5166	1.6791	1.6250	1.6791	1.6250	1.6791	1.6791	1.6250	1.6791	1.6250	1.6791 (231)
Lighting	12.1922	9.7810	8.8067	6.4522	4.9839	4.0719	4.5464	5.9096	7.6760	10.0714	11.3756	12.5311 (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												909.2809 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												348.4339
Water heating fuel used												583.4286 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752)												19.7702 (230a)
mechanical ventilation fans (SFP = 0.1752)												19.7702 (231)
Total electricity for the above, kWh/year												98.3981 (232)
Electricity for lighting (calculated in Appendix L)												98.3981 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1610.8778 (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	909.2809	0.1548	140.7488 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	583.4286	0.1411	82.3398 (264)
Space and water heating			223.0886 (265)
Pumps, fans and electric keep-hot	19.7702	0.1387	2.7424 (267)
Energy for lighting	98.3981	0.1443	14.2019 (268)
Total CO2, kg/year			240.0329 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.4900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	909.2809	1.5731	1430.3635 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	583.4286	1.5219	887.8980 (278)
Space and water heating			2318.2615 (279)
Pumps, fans and electric keep-hot	19.7702	1.5128	29.9084 (281)
Energy for lighting	98.3981	1.5338	150.9263 (282)
Total Primary energy kWh/year			2499.0962 (286)
Dwelling Primary energy Rate (DPER)			67.5400 (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	37.0000 (1b)	x 2.5000 (2b)	= 92.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	92.5000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.2162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3963 (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	0.5053	0.4954	0.4854	0.4359	0.4260	0.3765	0.3765	0.3666	0.3963	0.4260	0.4458	0.4656 (22b)
Effective ac	0.6276	0.6227	0.6178	0.5950	0.5907	0.5709	0.5709	0.5672	0.5785	0.5907	0.5994	0.6084 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
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TER Opaque door			2.1000		1.0000	2.1000							(26)
TER Opening Type (Uw = 1.20)			4.7000		1.1450	5.3817							(27)
External Wall 1	31.0000		4.7000	26.3000	0.1800	4.7340							(29a)
Communal Wall	12.0000		2.1000	9.9000	0.1800	1.7820							(29a)
External Roof 1	37.0000			37.0000	0.1100	4.0700							(30)
Total net area of external elements Aum(A, m2)				80.0000									(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =		18.0677							(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges				
K1 Element		Length	Psi-value	Total
E2 Other lintels (including other steel lintels)		4.0000	0.0500	0.2000
E3 Sill		4.0000	0.0500	0.2000
E4 Jamb		5.0000	0.0500	0.2500
E5 Ground floor (normal)		0.0000	0.1600	0.0000
E16 Corner (normal)		11.0000	0.0900	0.9900
E17 Corner (inverted - internal area greater than external area)		8.8000	-0.0900	-0.7920
E7 Party floor between dwellings (in blocks of flats)		14.0000	0.0700	0.9800
E18 Party wall between dwellings		0.0000	0.0600	0.0000
E11 Eaves (insulation at rafter level)		14.0000	0.0400	0.5600

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.3880 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 20.4557 (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	(38)
Heat transfer coeff	19.1589	19.0076	18.8593	18.1627	18.0323	17.4256	17.4256	17.3133	17.6593	18.0323	18.2960	18.5716	(38)
Average = Sum(39)m / 12 =	39.6145	39.4632	39.3149	38.6184	38.4880	37.8813	37.8813	37.7690	38.1150	38.4880	38.7517	39.0273	(39)
													38.6177

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.0707	1.0666	1.0626	1.0437	1.0402	1.0238	1.0238	1.0208	1.0301	1.0402	1.0473	1.0548	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

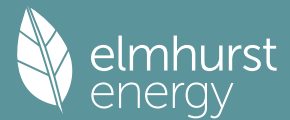
Assumed occupancy													1.3291 (42)	
Hot water usage for mixer showers														46.3256 (42a)
Hot water usage for baths														20.0533 (42b)
Hot water usage for other uses														28.2412 (42c)
Average daily hot water use (litres/day)														87.2044 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	94.8663	92.8416	90.3755	86.6242	83.5783	80.3035	79.0441	81.4996	84.0894	87.5274	91.3366	94.6201	(44)	
Energy content (annual)	150.2450	132.2053	138.9038	118.5841	112.5124	98.7426	95.5970	100.9135	103.6906	118.7739	130.1257	148.1522	(45)	
Distribution loss (46)m = 0.15 x (45)m													1448.4461	
Water storage loss:	22.5367	19.8308	20.8356	17.7876	16.8769	14.8114	14.3395	15.1370	15.5536	17.8161	19.5189	22.2228	(46)	
Store volume													150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)	
Temperature factor from Table 2b													0.5400 (49)	
Enter (49) or (54) in (55)													0.7527 (55)	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)	
If cylinder contains dedicated solar storage														
Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	196.8399	174.2910	185.4987	163.6760	159.1073	143.8344	142.1919	147.5084	148.7825	165.3688	175.2176	194.7471	(62)	
WWHRS	-21.2596	-18.8021	-19.6885	-16.3029	-15.1937	-13.0013	-12.1867	-12.9593	-13.4517	-15.8581	-17.9653	-20.8659	(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	175.5803	155.4888	165.8101	147.3731	143.9136	130.8331	130.0052	134.5491	135.3308	149.5107	157.2523	173.8812	(64)	
12Total per year (kWh/year)													1799.5284 (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	1800 (64)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)	
Heat gains from water heating, kWh/month	87.2324	77.6268	83.4614	75.5027	74.6863	68.9054	69.0619	70.8297	70.5506	76.7682	79.3403	86.5365	(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	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.0607	69.8172	63.0607	65.1628	63.0607	65.1628	63.0607	63.0607	65.1628	63.0607	65.1628	63.0607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	114.0692	115.2529	112.2701	105.9199	97.9041	90.3703	85.3372	84.1536	87.1364	93.4865	101.5024	109.0362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	(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)	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	(71)
Water heating gains (Table 5)	117.2478	115.5161	112.1793	104.8649	100.3848	95.7019	92.8252	95.2012	97.9870	103.1831	110.1948	116.3125	(72)
Total internal gains	340.3140	346.5225	333.4464	321.8838	307.2859	294.1712	284.1594	285.3517	293.2224	305.6666	322.7962	334.3457	(73)

6. Solar gains

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[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			
East	4.7000				19.6403		0.6300		0.7000		0.7700		28.2109 (76)	
Solar gains	28.2109	55.1865	90.8843	132.5494	162.4442	166.2906	158.3154	135.9906	105.7022	65.4834	35.1757	23.1993	(83)	
Total gains	368.5249	401.7090	424.3307	454.4332	469.7301	460.4618	442.4748	421.3423	398.9246	371.1501	357.9719	357.5450	(84)	

7. Mean internal temperature (heating season)														

Temperature during heating periods in the living area from Table 9, Th1 (C)														
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	25.9445	26.0439	26.1422	26.6137	26.7038	27.1315	27.1315	27.2122	26.9652	26.7038	26.5222	26.3348		
alpha	2.7296	2.7363	2.7428	2.7742	2.7803	2.8088	2.8088	2.8141	2.7977	2.7803	2.7681	2.7557		
util living area	0.8989	0.8720	0.8299	0.7452	0.6293	0.4815	0.3612	0.3916	0.5711	0.7626	0.8622	0.9047	(86)	
MIT	19.1282	19.3822	19.7615	20.2639	20.6430	20.8804	20.9605	20.9496	20.7978	20.3283	19.6856	19.1068	(87)	
Th 2	20.0249	20.0282	20.0315	20.0470	20.0500	20.0635	20.0635	20.0661	20.0583	20.0500	20.0441	20.0379	(88)	
util rest of house	0.8865	0.8568	0.8094	0.7148	0.5854	0.4220	0.2896	0.3189	0.5118	0.7280	0.8436	0.8930	(89)	
MIT 2	17.8707	18.1869	18.6564	19.2714	19.7090	19.9699	20.0409	20.0356	19.8892	19.3624	18.5802	17.8526	(90)	
Living area fraction	FLA = Living area / (4) =												0.5405 (91)	
MIT	18.5504	18.8330	19.2538	19.8079	20.2138	20.4621	20.5379	20.5296	20.3803	19.8845	19.1777	18.5305	(92)	
Temperature adjustment													0.0000	
adjusted MIT	18.5504	18.8330	19.2538	19.8079	20.2138	20.4621	20.5379	20.5296	20.3803	19.8845	19.1777	18.5305	(93)	

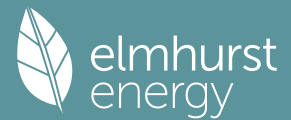
8. Space heating requirement														

Utilisation	0.8639	0.8347	0.7907	0.7066	0.5934	0.4479	0.3264	0.3556	0.5329	0.7214	0.8239	0.8708	(94)	
Useful gains	318.3543	335.3144	335.5016	321.0976	278.7224	206.2554	144.4342	149.8397	212.5875	267.7380	294.9391	311.3483	(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	564.5232	549.8412	501.4136	421.2460	327.6812	222.0639	149.1745	155.9722	239.3746	357.3423	468.0325	559.2821	(97)	
Space heating kWh	183.1497	144.1620	123.4385	72.1069	36.4253	0.0000	0.0000	0.0000	0.0000	66.6656	124.6273	184.4628	(98a)	
Space heating requirement - total per year (kWh/year)													935.0381	
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	183.1497	144.1620	123.4385	72.1069	36.4253	0.0000	0.0000	0.0000	0.0000	66.6656	124.6273	184.4628	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													935.0381	
Space heating per m2													(98c) / (4) = 25.2713 (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)														
Efficiency of main space heating system 1 (in %)														
Efficiency of main space heating system 2 (in %)														
Efficiency of secondary/supplementary heating system, %														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	183.1497	144.1620	123.4385	72.1069	36.4253	0.0000	0.0000	0.0000	0.0000	66.6656	124.6273	184.4628	(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)	198.4287	156.1886	133.7362	78.1223	39.4641	0.0000	0.0000	0.0000	0.0000	72.2271	135.0241	199.8513	(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	175.5803	155.4888	165.8101	147.3731	143.9136	130.8331	130.0052	134.5491	135.3308	149.5107	157.2523	173.8812	(64)	
Efficiency of water heater (217)m	84.1546	83.8905	83.4076	82.5487	81.4677	79.8000	79.8000	79.8000	79.8000	82.3746	83.5436	79.8000	(216)	
Fuel for water heating, kWh/month	208.6403	185.3473	198.7951	178.5288	176.6511	163.9512	162.9138	168.6079	169.5874	181.5009	188.2278	206.5281	(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	13.1028	10.5115	9.4645	6.9341	5.3561	4.3760	4.8860	6.3510	8.2493	10.8236	12.2252	13.4669	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-12.9202	-18.9804	-28.4282	-33.3752	-37.2608	-35.2925	-34.9122	-32.3570	-28.0203	-22.3755	-14.4916	-11.0864	(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	-5.1382	-11.0025	-22.2173	-33.8665	-45.2411	-45.5812	-44.9941	-37.8416	-27.4376	-15.8415	-6.8988	-4.0451	(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													1013.0424 (211)	
Space heating fuel - main system 2													0.0000 (213)	

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2189.2797 (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)	105.7469 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-609.6059 (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	2784.4630 (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	1013.0424	0.2100	212.7389 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2189.2797	0.2100	459.7487 (264)
Space and water heating			672.4876 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	105.7469	0.1443	15.2625 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-309.5004	0.1337	-41.3747
PV Unit electricity exported	-300.1055	0.1255	-37.6606
Total			-79.0353 (269)
Total CO2, kg/year			620.6441 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.7700 (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	1013.0424	1.1300	1144.7379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2189.2797	1.1300	2473.8860 (278)
Space and water heating			3618.6239 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	105.7469	1.5338	162.1981 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-309.5004	1.4940	-462.3981
PV Unit electricity exported	-300.1055	0.4606	-138.2354
Total			-600.6336 (283)
Total Primary energy kWh/year			3310.2892 (286)
Target Primary Energy Rate (TPER)			89.4700 (287)

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Property Reference	141 Staple Hill		Issued on Date	10/11/2023	
Assessment Reference	SF03	Prop Type Ref	141 Staple Hill		
Property	-, -, Bristol				
SAP Rating	80 C	DER	7.20	TER	17.81
Environmental	96 A	% DER < TER			59.57
CO ₂ Emissions (t/year)	0.22	DFEE	38.92	TFEE	39.17
Compliance Check	See BREL	% DFEE < TFEE			0.65
% DPER < TPER	21.18	DPER	74.81	TPER	94.91
Assessor Details	Mr. Jonathan Lewis			Assessor ID	AZ32-0001
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	37.0000	2.5000	92.5000
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.0000		92.5000
Dwelling volume			92.5000

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		3.5000 (17)
Infiltration rate		0.1750 (18)
Number of sides sheltered		2 (19)

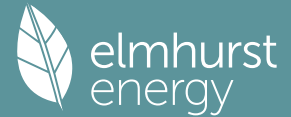
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1487 (21)

	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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	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 = 1.20)			7.0000	1.1450	8.0153		(27)
Solid Door			2.1000	1.5000	3.1500		(26)
External Wall 1	47.0000	7.0000	40.0000	0.1800	7.2000		(29a)
Communal Wall	12.0000	2.1000	9.9000	0.1700	1.6830		(29a)
External Roof 1	37.0000		37.0000	0.1200	4.4400		(30)
Total net area of external elements Aum(A, m ²)			96.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.4883	(33)
Party Floor 1			40.0000				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				6.0000	0.0410	0.2460	
E3 Sill				6.0000	0.0460	0.2760	
E4 Jamb				8.0000	0.0470	0.3760	
E5 Ground floor (normal)				0.0000	0.0710	0.0000	

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.1627	24.1627	24.1627	24.1627	24.1627	24.1627	24.1627	24.1627	24.1627	24.1627	24.1627	24.1627
alpha	2.6108	2.6108	2.6108	2.6108	2.6108	2.6108	2.6108	2.6108	2.6108	2.6108	2.6108	2.6108
util living area	0.9105	0.8757	0.8274	0.7448	0.6326	0.4938	0.3747	0.4066	0.5810	0.7746	0.8778	0.9190 (86)
MIT	18.8706	19.2007	19.6372	20.1505	20.5698	20.8377	20.9422	20.9266	20.7411	20.1886	19.4343	18.7846 (87)
Th 2	19.9605	19.9605	19.9605	19.9605	19.9605	19.9605	19.9605	19.9605	19.9605	19.9605	19.9605	19.9605 (88)
util rest of house	0.8988	0.8601	0.8058	0.7127	0.5857	0.4281	0.2937	0.3243	0.5167	0.7387	0.8598	0.9082 (89)
MIT 2	17.5115	17.9195	18.4562	19.0730	19.5548	19.8364	19.9289	19.9180	19.7480	19.1355	18.2197	17.4047 (90)
Living area fraction									fLA = Living area / (4) =			0.5405 (91)
MIT	18.2462	18.6121	19.0946	19.6554	20.1035	20.3777	20.4766	20.4632	20.2848	19.7047	18.8762	18.1506 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2462	18.6121	19.0946	19.6554	20.1035	20.3777	20.4766	20.4632	20.2848	19.7047	18.8762	18.1506 (93)

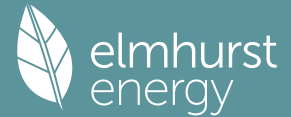
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8748	0.8361	0.7852	0.7023	0.5925	0.4553	0.3348	0.3650	0.5377	0.7289	0.8373	0.8847 (94)
Useful gains	311.3482	342.1989	350.6626	339.9883	297.4282	223.8604	157.8304	163.7309	228.1638	277.7570	293.0143	301.0164 (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	593.2118	583.2534	535.7208	457.4897	357.4487	245.7576	164.8941	172.8312	263.0741	387.2775	500.9118	593.3988 (97)
Space heating kWh	209.7066	161.9886	137.6833	84.6010	44.6553	0.0000	0.0000	0.0000	0.0000	81.4832	149.6862	217.5325 (98a)
Space heating requirement - total per year (kWh/year)												1087.3368
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	209.7066	161.9886	137.6833	84.6010	44.6553	0.0000	0.0000	0.0000	0.0000	81.4832	149.6862	217.5325 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1087.3368
Space heating per m2										(98c) / (4) =		29.3875 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (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	209.7066	161.9886	137.6833	84.6010	44.6553	0.0000	0.0000	0.0000	0.0000	81.4832	149.6862	217.5325 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	209.7066	161.9886	137.6833	84.6010	44.6553	0.0000	0.0000	0.0000	0.0000	81.4832	149.6862	217.5325 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating requirement	204.8154	181.0080	191.6684	166.6573	160.3635	143.1750	140.1839	146.3896	148.7332	167.4670	180.0974	202.3041 (64)
Efficiency of water heater												348.4339 (216)
(217)m	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339	348.4339 (217)
Fuel for water heating, kWh/month	58.7817	51.9490	55.0085	47.8304	46.0241	41.0910	40.2326	42.0136	42.6862	48.0628	51.6877	58.0610 (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	1.6791	1.5166	1.6791	1.6250	1.6791	1.6250	1.6791	1.6791	1.6250	1.6791	1.6250	1.6791 (231)
Lighting	11.2777	9.0474	8.1462	5.9682	4.6100	3.7664	4.2054	5.4664	7.1003	9.3160	10.5224	11.5912 (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												1087.3368 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												348.4339
Water heating fuel used												583.4286 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.6790, total flow = 21.0000, SFP = 0.1752)												
mechanical ventilation fans (SFP = 0.1752)												19.7702 (230a)
Total electricity for the above, kWh/year												19.7702 (231)
Electricity for lighting (calculated in Appendix L)												91.0177 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1781.5532 (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	1087.3368	0.1548	168.3005 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	583.4286	0.1411	82.3398 (264)
Space and water heating			250.6403 (265)
Pumps, fans and electric keep-hot	19.7702	0.1387	2.7424 (267)
Energy for lighting	91.0177	0.1443	13.1367 (268)
Total CO2, kg/year			266.5193 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.2000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1087.3368	1.5730	1710.4112 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	583.4286	1.5219	887.8980 (278)
Space and water heating			2598.3093 (279)
Pumps, fans and electric keep-hot	19.7702	1.5128	29.9084 (281)
Energy for lighting	91.0177	1.5338	139.6059 (282)
Total Primary energy kWh/year			2767.8236 (286)
Dwelling Primary energy Rate (DPER)			74.8100 (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	37.0000 (1b)	x 2.5000 (2b)	= 92.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 92.5000 (5)

2. Ventilation rate

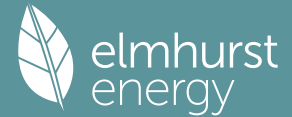
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.2162 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4662 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3963 (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	0.5053	0.4954	0.4854	0.4359	0.4260	0.3765	0.3765	0.3666	0.3963	0.4260	0.4458	0.4656 (22b)
Effective ac	0.6276	0.6227	0.6178	0.5950	0.5907	0.5709	0.5709	0.5672	0.5785	0.5907	0.5994	0.6084 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
---------	-------	----------	---------	---------	-------	---------	-------

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	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
TER Opaque door			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.20)			7.0000	1.1450	8.0153		(27)
External Wall 1	47.0000	7.0000	40.0000	0.1800	7.2000		(29a)
Communal Wall	12.0000	2.1000	9.9000	0.1800	1.7820		(29a)
External Roof 1	37.0000		37.0000	0.1100	4.0700		(30)
Total net area of external elements Aum(A, m2)			96.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	23.1673	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	6.0000	0.0500	0.3000
E2 Other lintels (including other steel lintels)	6.0000	0.0500	0.3000
E3 Sill	8.0000	0.0500	0.4000
E4 Jamb	0.0000	0.1600	0.0000
E5 Ground floor (normal)	18.0000	0.0900	1.6200
E16 Corner (normal)	18.0000	-0.0900	-1.6200
E17 Corner (inverted - internal area greater than external area)	21.0000	0.0700	1.4700
E7 Party floor between dwellings (in blocks of flats)	0.0000	0.0600	0.0000
E18 Party wall between dwellings	21.0000	0.0400	0.8400
E11 Eaves (insulation at rafter level)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.3100 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 26.4773 (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	19.1589	19.0076	18.8593	18.1627	18.0323	17.4256	17.4256	17.3133	17.6593	18.0323	18.2960	18.5716 (38)
Average = Sum(39)m / 12 =	45.6361	45.4848	45.3365	44.6399	44.5096	43.9029	43.9029	43.7906	44.1366	44.5096	44.7733	45.0489 (39)
												44.6393
HLP	1.2334	1.2293	1.2253	1.2065	1.2030	1.1866	1.1866	1.1835	1.1929	1.2030	1.2101	1.2175 (40)
HLP (average)												1.2065
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

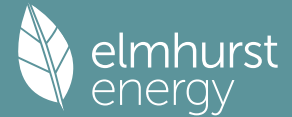
Assumed occupancy 1.3291 (42)												
Hot water usage for mixer showers	46.5038	45.8049	44.7865	42.8380	41.4001	39.7965	38.8851	39.8957	41.0036	42.7254	44.7157	46.3256 (42a)
Hot water usage for baths	20.1214	19.8225	19.4017	18.6258	18.0448	17.4006	17.0526	17.4705	17.9255	18.6148	19.4067	20.0533 (42b)
Hot water usage for other uses	28.2412	27.2142	26.1873	25.1603	24.1333	23.1064	23.1064	24.1333	25.1603	26.1873	27.2142	28.2412 (42c)
Average daily hot water use (litres/day)												87.2044 (43)
Daily hot water use	94.8663	92.8416	90.3755	86.6242	83.5783	80.3035	79.0441	81.4996	84.0894	87.5274	91.3366	94.6201 (44)
Energy conte	150.2450	132.2053	138.9038	118.5841	112.5124	98.7426	95.5970	100.9135	103.6906	118.7739	130.1257	148.1522 (45)
Energy content (annual)												Total = Sum(45)m = 1448.4461
Distribution loss (46)m = 0.15 x (45)m	22.5367	19.8308	20.8356	17.7876	16.8769	14.8114	14.3395	15.1370	15.5536	17.8161	19.5189	22.2228 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	196.8399	174.2910	185.4987	163.6760	159.1073	143.8344	142.1919	147.5084	148.7825	165.3688	175.2176	194.7471 (62)
WWHRS	-21.2596	-18.8021	-19.6885	-16.3029	-15.1937	-13.0013	-12.1867	-12.9593	-13.4517	-15.8581	-17.9653	-20.8659 (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	175.5803	155.4888	165.8101	147.3731	143.9136	130.8331	130.0052	134.5491	135.3308	149.5107	157.2523	173.8912 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1799.5284 (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	1800 (64)
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	87.2324	77.6268	83.4614	75.5027	74.6863	68.9054	69.0619	70.8297	70.5506	76.7682	79.3403	86.5365 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542	66.4542 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.3308	64.5805	58.3308	60.2752	58.3308	60.2752	58.3308	58.3308	60.2752	58.3308	60.2752	58.3308 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	114.0692	115.2529	112.2701	105.9199	97.9041	90.3703	85.3372	84.1536	87.1364	93.4865	101.5024	109.0362 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454	29.6454 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634	-53.1634 (71)
Water heating gains (Table 5)	117.2478	115.5161	112.1793	104.8649	100.3848	95.7019	92.8252	95.2012	97.9870	103.1831	110.1948	116.3125 (72)
Total internal gains	335.5841	341.2858	328.7165	316.9962	302.5560	289.2836	279.4295	280.6218	288.3348	300.9367	317.9087	329.6158 (73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East			4.7000	19.6403	0.6300	0.7000	0.7700	28.2109 (76)
South			2.3000	46.7521	0.6300	0.7000	0.7700	32.8625 (78)

Solar gains	61.0734	109.0068	159.4418	210.0342	243.1882	243.9957	234.2380	209.7220	177.3186	123.5337	74.1289	51.5955 (83)
Total gains	396.6575	450.2926	488.1583	527.0305	545.7442	533.2793	513.6675	490.3438	465.6534	424.4704	392.0376	381.2113 (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	22.5211	22.5961	22.6700	23.0237	23.0911	23.4102	23.4102	23.4703	23.2863	23.0911	22.9552	22.8147
alpha	2.5014	2.5064	2.5113	2.5349	2.5394	2.5607	2.5607	2.5647	2.5524	2.5394	2.5303	2.5210
util living area	0.8958	0.8609	0.8120	0.7259	0.6130	0.4731	0.3563	0.3850	0.5557	0.7478	0.8571	0.9033 (86)
MIT	18.8209	19.1513	19.5980	20.1481	20.5703	20.8438	20.9447	20.9311	20.7514	20.2127	19.4541	18.7786 (87)
Th 2	19.8934	19.8966	19.8998	19.9148	19.9176	19.9308	19.9308	19.9332	19.9257	19.9176	19.9119	19.9060 (88)
util rest of house	0.8822	0.8435	0.7884	0.6918	0.5646	0.4073	0.2764	0.3041	0.4904	0.7091	0.8365	0.8906 (89)
MIT 2	17.4073	17.8159	18.3653	19.0332	19.5173	19.8132	19.9012	19.8941	19.7251	19.1277	18.2099	17.3627 (90)
Living area fraction									fLA = Living area / (4) =			0.5405 (91)
MIT	18.1714	18.5377	19.0317	19.6359	20.0865	20.3703	20.4652	20.4546	20.2799	19.7142	18.8824	18.1281 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1714	18.5377	19.0317	19.6359	20.0865	20.3703	20.4652	20.4546	20.2799	19.7142	18.8824	18.1281 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8560	0.8180	0.7671	0.6823	0.5725	0.4352	0.3171	0.3446	0.5129	0.7010	0.8134	0.8649 (94)
Useful gains	339.5398	368.3411	374.4906	359.5773	312.4602	232.0586	162.8983	168.9570	238.8350	297.5680	318.8742	329.7045 (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	633.0373	620.3105	568.1421	479.2490	373.2796	253.3323	169.6947	177.5551	272.7593	405.6696	527.5381	627.4436 (97)
Space heating kWh	218.3621	169.3234	144.0767	86.1636	45.2496	0.0000	0.0000	0.0000	0.0000	80.4276	150.2380	221.5179 (98a)
Space heating requirement - total per year (kWh/year)												1115.3590
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	218.3621	169.3234	144.0767	86.1636	45.2496	0.0000	0.0000	0.0000	0.0000	80.4276	150.2380	221.5179 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1115.3590
Space heating per m2										(98c) / (4) =		30.1448 (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	218.3621	169.3234	144.0767	86.1636	45.2496	0.0000	0.0000	0.0000	0.0000	80.4276	150.2380	221.5179 (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)	236.5787	183.4490	156.0961	93.3517	49.0245	0.0000	0.0000	0.0000	0.0000	87.1372	162.7714	239.9977 (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 requirement 175.5803 155.4888 165.8101 147.3731 143.9136 130.8331 130.0052 134.5491 135.3308 149.5107 157.2523 173.8812 (64)

Efficiency of water heater (217)m 84.5499 84.2513 83.7463 82.8999 81.7828 79.8000 79.8000 79.8000 79.8000 82.7329 83.9576 84.6039 (217)

Fuel for water heating, kWh/month 207.6647 184.5535 197.9911 177.7723 175.9706 163.9512 162.9138 168.6079 169.5874 180.7149 187.2998 205.5239 (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 12.1200 9.7231 8.7546 6.4140 4.9543 4.0477 4.5195 5.8746 7.6306 10.0117 11.3082 12.4568 (232)

Electricity generated by PVs (Appendix M) (negative quantity) (233a)m -12.9068 -18.9564 -28.3900 -33.3314 -37.2161 -35.2525 -34.8677 -32.3069 -27.9711 -22.3391 -14.4730 -11.0750 (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 -5.1517 -11.0265 -22.2555 -33.9103 -45.2858 -45.6212 -45.0386 -37.8918 -27.4868 -15.8779 -6.9174 -4.0565 (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

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Space heating fuel - main system 1	1208.4063 (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	2182.5511 (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)	97.8153 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-609.6059 (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	2965.1667 (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	1208.4063	0.2100	253.7653 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2182.5511	0.2100	458.3357 (264)
Space and water heating			712.1010 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	97.8153	0.1443	14.1178 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-309.0860	0.1337	-41.3196
PV Unit electricity exported	-300.5199	0.1255	-37.7158
Total			-79.0355 (269)
Total CO2, kg/year			659.1126 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.8100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1208.4063	1.1300	1365.4991 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2182.5511	1.1300	2466.2827 (278)
Space and water heating			3831.7818 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	97.8153	1.5338	150.0323 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-309.0860	1.4940	-461.7804
PV Unit electricity exported	-300.5199	0.4607	-138.4381
Total			-600.2185 (283)
Total Primary energy kWh/year			3511.6964 (286)
Target Primary Energy Rate (TPER)			94.9100 (287)

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