

Energy Assessment

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Document information

Document prepared for
Phillip Pank Partnership LLP

Date of issue
25/02/2025

Issue no.
1

Our reference
10942-Haydon Drive-Energy Assessment 2021-25.02.21

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Contents:

Document information	1
Executive summary	2
Establishing Carbon Emissions	5
Baseline.....	7
Demand Reduction.....	8
Heating Infrastructure	13
Renewable Energy	15
Appendix A	25

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Executive summary

About the Scheme

The proposal comprises the demolition of the existing bungalows and the development of 21 new houses consisting of 4 types. The development is located in the London Borough of Hillingdon with a total site-wide GIA of 2,680 sqm.

Planning policy

The scheme has been developed in accordance with the London Plan 2021 "The Spatial Development Strategy for Greater London, March 2021" and with the Sustainable, Design and Construction SPG. The assessment also considers Hillingdon's Local Plan Part 2: Development Management Policies (January 2020). According to the planning policies, the scheme should achieve:

- Zero carbon target
- A minimum on-site CO₂ reduction of at least 35% beyond Building Regulations
- Residential development should achieve 10% CO₂ improvement through energy efficiency measures, 'Be Lean' stage
- Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
 - through a cash in lieu contribution to the borough's carbon offset fund, or
 - off-site provided that an alternative proposal is identified, and delivery is certain

Summary

A sample of houses has been modelled for the purposes of the energy assessment. One of each dwelling type from Blocks A, B, C, and D have been analysed. High energy efficiency performance building services have been used for these units to achieve the required carbon emission targets

The scheme complies with the 2021 Building Regulations Part L and the minimum energy efficiency targets in the following documents have been followed:

- New build CO₂ emissions – The actual CO₂ Dwelling Emissions Rate (DER) is no greater than the notional building CO₂ Target Emissions Rate (TER).
- New dwelling Fabric efficiency – The Dwelling Fabric Energy Efficiency (DFEE) is not greater than the Target Fabric Energy Efficiency (TFEE).
- New build Primary energy – The Dwelling Primary Energy Rate (DPER) is no greater than the Target Primary Energy Rate (TPER).

In addition, the CO₂ emissions of the scheme have been calculated using the SAP 10.2 carbon emission factors, and the scheme can achieve:

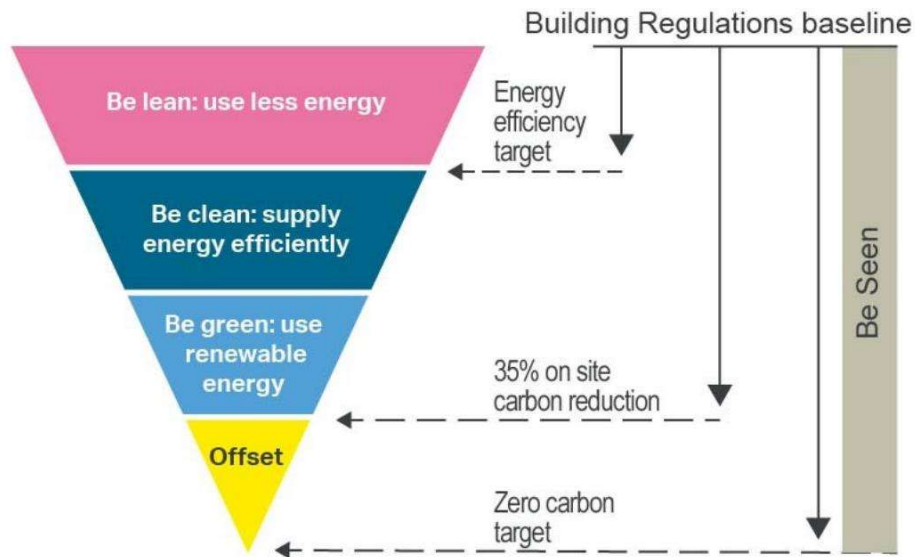
- An on-site CO₂ reduction of 80% beyond Building Regulations through energy efficiency measures and inclusion of renewable technologies (Air Source Heat Pumps and PV panels)
- An improvement of 22% CO₂ improvement through energy efficiency measures, 'Be Lean' stage
- A further improvement of 58% CO₂ has been achieved through renewable technologies 'Be Green' stage (Air Source Heat Pumps and PV panels)
- Zero-carbon target can be achieved through a cash in lieu contribution to the borough's carbon offset fund. The carbon offset payment cost has been calculated as £17,546.

Energy Assessment

Haydon Drive, Northwood

Energy hierarchy

The proposed scheme has followed the energy hierarchy that is illustrated below:



Source: Greater London Authority

Key measures

Key measures identified for each stage are shown below:

- **Be Lean:**
 - Low U-values for opaque elements and fenestration
 - Low g-value
 - Low air permeability
 - High efficiency lighting and sensors
 - Mechanical ventilation with heat recovery
 - Green roof
- **Be Green:**
 - Air Source Heat Pumps to provide space heating and hot water
 - Photovoltaic panels

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GLA's Energy Hierarchy: Regulated carbon emissions

The proposed scheme has followed the energy hierarchy. A graphical illustration of how the scheme performs in relation to Building Regulations and the Energy Hierarchy is shown below. Carbon dioxide emission factors for SAP 10.2 have been used for the calculation.

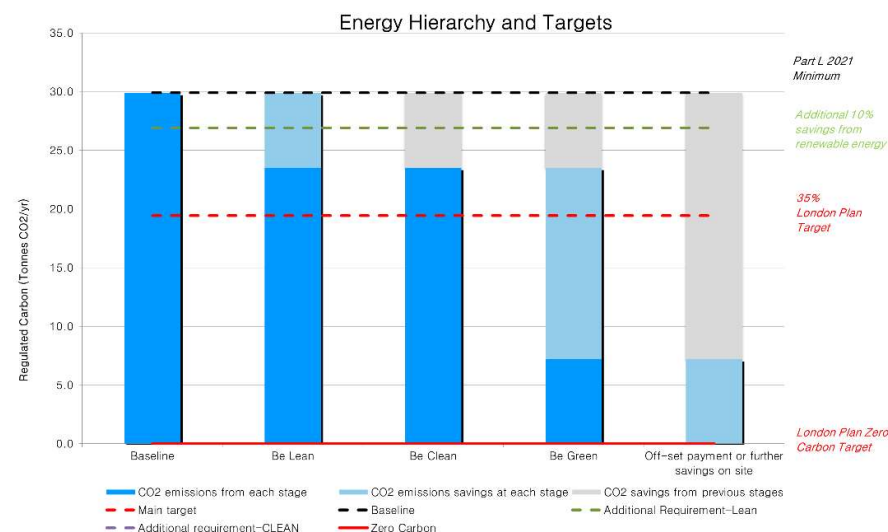
As demonstrated in the figure the proposed scheme will reduce carbon emissions by 22% from the fabric energy efficiency measures described in the 'Be Lean' section and will reduce total carbon emissions by 58% over Existing Building and Building Regulations (using SAP 10.2 carbon dioxide emission factors) with the further inclusion of low and zero carbon technology (Air source heat pumps and photovoltaic panels).

Therefore, the scheme meets and exceeds the planning policy carbon reduction target and complies with London Plan 2021 Policy SI2 and Part L 2021.

The carbon offset payment to meet the zero-carbon target has been calculated as £17,546.

Regulated CO₂ emissions - Site-wide

Site-wide				
GLA's Energy Hierarchy: Regulated CO ₂ - Calculated using SAP 10.2 CO ₂ factors				
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	30.3	23.7	-	6.1
CO ₂ emissions saving (tCO ₂ /yr)	-	6.6	-	17.5
Saving from each stage (%)	-	22	-	58
Total CO ₂ emissions saving (tCO ₂ /yr)	24.1			
80% total CO ₂ savings over 2021 Building Regulations Part L achieved				



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Establishing Carbon Emissions

Methodology

The purpose of an energy assessment is to demonstrate that climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy. It also ensures energy remains an integral part of the scheme's design and evolution.

The methodology followed in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the document. "Energy Assessment Guidance: Greater London Authority guidance on preparing energy assessments as part of planning applications (June 2022)". The scheme has been developed in accordance with the London Plan 2021.

This report has followed these documents and comprises the following components:

- **Baseline:** A calculation of the Part L 2021 Building Regulations compliant CO₂ emission baseline using approved software. The baseline assumes a gas boiler would provide heating and any active cooling would be electrically powered. Photovoltaic panels are included in the baseline in line with Part L 2021.
- **Be Lean:** A calculation of the impact of demand reduction measures. For example, passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading, and active design measures such as high efficacy lighting and efficient mechanical ventilation with heat recovery.
- **Cooling Hierarchy:** In accordance with London Plan 2021 Policy SI4, measures that are proposed to reduce the demand for cooling have been set out such as minimisation of solar and internal gains and night cooling strategies.
- **Be Clean:** In accordance with London Plan 2021 Policy SI3, this report has demonstrated how the scheme has selected heating, cooling and power systems to minimise carbon emissions. This comprises an evaluation of the feasibility of connecting to existing low carbon heat networks, planned networks, site-wide and communal heat networks, and CHP.
- **Be Green:** In accordance with London Plan 2021 Policy SI2, this report has conducted a feasibility assessment of renewable energy technologies. This comprised a site-specific analysis of the technologies and, if applicable, how they would be integrated into the heating and cooling strategy for the scheme.

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Establishing CO₂ emissions

As required by the GLA both the regulated and unregulated emissions of the development must be quantified and demonstrated. The total emissions for the scheme are shown below.

CO ₂ Emissions – Regulated and Unregulated (tonnes CO ₂ /yr) - SAP 10.2 – Site-wide			
	Regulated Emissions	Unregulated Emissions	Total Emissions
Baseline: Part L 2021	30.3	10.2	40.5
Be Lean: Use less energy	23.7	10.2	32.9
Be Clean: Supply energy efficiently	-	-	-
Be Green: Use renewable energy	6.1	10.2	16.3
CO ₂ Emissions – Regulated and Unregulated (tonnes CO ₂ /yr) - SAP 10.2 – Residential			

Carbon offsetting

London Plan 2021 Policy SI2, requires carbon dioxide reductions to be achieved as far as possible on-site and a cash in lieu contribution will be considered acceptable only in instances where it has been clearly demonstrated that no further savings can be achieved on-site. The remaining savings to reach zero carbon can be achieved either off-site or via a cash in lieu contribution.

The annual shortfall is determined by subtracting the overall regulated carbon dioxide savings from the target savings. The result is then multiplied by the assumed lifetime of the development's services (30 years) to give the cumulative shortfall. The cumulative shortfall is multiplied by the carbon dioxide offset price to determine the required cash-in-lieu contribution, as shown below. The cumulative savings for offset payment and the cash-in-lieu contribution have been anticipated and tabulated below, using SAP 10.2 carbon emission factors and an offset price of £95 per tonne.

Regulated carbon dioxide savings from each stage of the energy hierarchy - SAP 10.2		
	(tonnes CO ₂ /yr)	%
Be Lean: Savings from energy demand reduction	6.6	22%
Be Clean: Savings from heat networks	0.0	0%
Be Green: Savings from renewable energy	17.5	58%
Cumulative on-site savings	24.1	80%
Carbon shortfall	6.2	-
(tonnes CO ₂)		
Cumulative savings for offset	185	
Cash-in-lieu contribution	17,546	

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Baseline

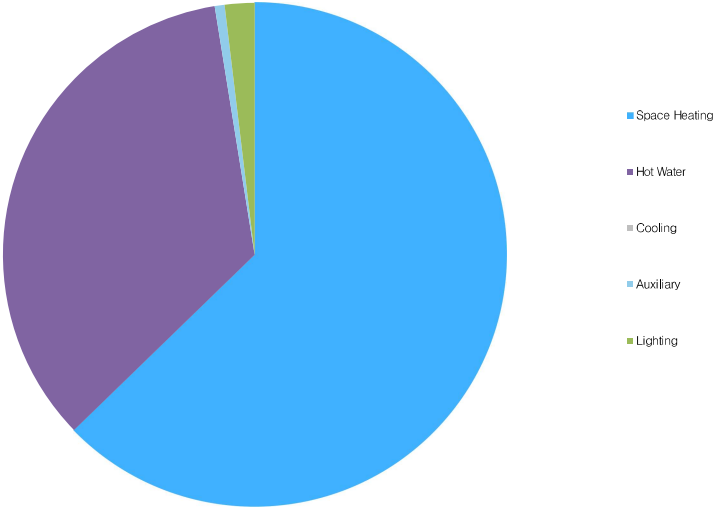
Building regulations Part L 2021 minimum compliance

The total baseline carbon emissions for the whole scheme is 29.9 tonnes CO₂/yr (using SAP 10.2 carbon dioxide emission factors).

The pie chart provides a breakdown of the specific carbon emissions by system over the course of one year. The chart shows that space heating is the primary source of carbon dioxide emissions, and hot water is the second largest, across the scheme as a whole.

Carbon Emissions in tonnes CO ₂ /yr.				
Heating	Hot Water	Cooling	Auxiliary	Lighting
5.65	3.17	0.00	0.06	0.17

Baseline CO2 Breakdown



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Demand Reduction

Be Lean: summary

Demand reduction measures have reduced the scheme's carbon emissions by 22% (using SAP 10.2 figures) over the minimum Part L 2021 Building Regulations baseline.

U-values

Element	Domestic	
	Minimum 2021 Building Regulations U-value W/m ² K	Proposed U-value W/m ² K
Flat roof	0.16	0.10
Pitched roof	0.16	0.10
Wall	0.26	0.16
Ground floor	0.18	0.10
Windows	1.60	1.2
	(g-value 0.63)	(g-value 0.4)
Rooflights	2.20	1.2
	(g-value 0.63)	(g-value 0.4)
Doors	1.60	1.0

Party walls will be fully filled cavity with effective sealing at all exposed edges and in line with insulation layers in abutting elements.

Air permeability

A reduced air permeability has been targeted as per the table below:

Air permeability (m ³ /hm ² @50 Pa)	Minimum 2021 Building Regulations	Proposed
Domestic	8	3

This will require careful attention to two key areas:

- Structural leakage
- Services leakage

Structural leakage occurs at joints in the building fabric and around window and door openings, loft hatches and access openings. There will also be some diffusion through materials such as cracks in masonry walls typically caused by poor perpends in the blockwork or brickwork. Structural leakage is hard to remedy retrospectively therefore good detailing at the design stage is essential.

Services leakage occurs at penetrations from pipes and cables entering the building. These can be sewerage pipes, water pipes and heating pipes. As well as electricity cables there may also be telecommunication cables. Attention, therefore, needs to be paid to sealing all penetrations during construction.

Thermal Bridging:

The scheme will be designed in line with best practise guidance and will target to reduce heat losses through thermal bridging. A detailed thermal bridging analysis will be required at the technical design stage to ensure that the following psi-values can be achieved.

Junctions	Psi-value (W/mK)
Lintels (E1)	0.10
Sill (E3)	0.04
Jambs (E4)	0.05
Ground Floor (E5)	0.10
Intermediate Floor within a Dwelling (E6)	0.05
Eaves - Insulation at Ceiling Level (E10)	0.06
Eaves - Insulation at Rafter Level (E11)	0.04
Gable - Insulation at Rafter Level (E13)	0.04
Flat Roof (E14)	0.13
Flat Roof with parapet (E15)	0.15
Corners (E16)	0.09
Corners - Inverted (E17)	-0.09
Party Wall (E18)	0.06
Eaves - Inverted (E24)	0.10
Staggered Party Wall (E25)	0.12
Party Wall - Ground Floor (P1)	0.22
Party Wall - Roof (insulation at ceiling level) (P4)	0.28
Party Wall - Roof (insulation at rafter level) (P5)	0.28

The default psi-value has been used for the remaining junctions.

Thermal Mass:

Thermal mass of the scheme has been indicatively modelled as 250 kJ/m²K (medium).

Energy Assessment

Haydon Drive, Northwood



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Heating

For the 'Be Lean' scenario, the scheme has been modelled with a gas boiler with an efficiency of 89.5% (as required by the GLA). For the 'Be Green' final scenario, an air source heat pump with a minimum COP of 3 (Worcester Borch CS5800i 5 OR-S or similar) will be proposed as the main heating system. Heat will be provided via radiators and will be controlled via time and temperature zone control by arrangement.

Hot Water

For the 'Be Lean', the hot water will be provided by the main gas heating system (gas boilers with an efficiency of 89.5%). For the 'Be Green' final scenario, hot water will be provided by the air source heat pump, with a minimum COP of 3 (Worcester Borch CS5800i or similar). A hot water cylinder with back up electric immersion heater of 150L with a standing heat loss of 2.09 kWh/day will be specified.

Ventilation

Balanced ventilation with heat recovery has been specified for the houses.

- The houses with three toilets have been modelled with an SFP of 0.53 W/l/s and a heat recovery efficiency of 94%.
- The houses with four toilets have been modelled with an SFP of 0.65 W/l/s and a heat recovery efficiency of 93%.

Cooling

No cooling has been specified for the apartments.

Lighting

High efficiency lighting has been specified for the development with a minimum efficacy of 80 lumens/W. Luminaires of 4W have been assumed for this stage for the following houses:

- Unit A has been modelled with 30 fittings
- Unit B has been modelled with 21 fittings
- Unit C has been modelled with 26 fittings
- Unit D has been modelled with 27 fittings

Energy demand following energy efficiency measures (MWh/year)

	Space Heating	Hot water	Lighting	Auxiliary	Cooling	Unregulated gas	Unregulated electricity
Domestic	19.8	6.3	1.2	1.8	0.0	0.0	11.1

Fabric energy efficiency

	Target Fabric Energy Efficiency (kWh/m2/year)	Design Fabric Energy Efficiency (kWh/m2/year)	Improvement (%)
Domestic	44.13	43.45	1.5%

Primary Energy

	Target Primary Energy Rate (kWh/m2/year)	Dwelling Primary Energy Rate (kWh/m2/year)	Improvement (%)
Domestic	60.60	23.49	61.2%

Energy Assessment

Haydon Drive, Northwood

Cooling and Overheating

Overheating and cooling

The aim of this section is to reduce the impact of the urban heat island effect in London and encourage the design of spaces to avoid overheating and excessive heat generation, and to mitigate overheating due to the impact of climate change.

Where design measures and the use of natural and/or mechanical ventilation are not enough to guarantee the occupant's comfort, in line with the cooling hierarchy the development's cooling strategy must include details of the active cooling plant being proposed, including efficiencies, and the ability to take advantage of free cooling and/or renewable cooling sources.

Where appropriate, the cooling strategy should investigate the opportunities to improve cooling efficiencies through the use of locally available sources such as ground cooling and river/dock water-cooling.

The Cooling Hierarchy in Policy S14

Developments should reduce potential overheating and reliance on air conditioning systems and demonstrate this with the Cooling Hierarchy:

1. Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure
2. Minimise internal heat generation through energy efficient design
3. Manage the heat within the building through exposed internal thermal mass and high ceilings
4. Provide passive ventilation
5. Provide mechanical ventilation
6. Provide active cooling systems

Avoiding overheating: measures taken

The following measures have been taken in accordance with the cooling hierarchy to reduce overheating and the need for cooling:

1. Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure
 - o Orientation of building – the scheme has been orientated East/West to reduce excessive solar gain and openable windows have been specified to facilitate natural ventilation.
 - o Solar control – all methods controlling solar gain to within tolerable limits have been considered. The location, size, design and type of window openings and glazing have been optimised and reduced solar gain factors from low emissivity windows have been specified.
 - o Green roofs – a green roof has been specified for the scheme at the ground and first floor roofs for units B and C. This will act as an insulation barrier and the ecological processes will reduce the amount of solar energy absorbed by the roof membrane, so will reduce temperatures below the surface and cool the building areas directly below.
 - o Insulation levels have been maximised and the resulting U-values are lower than required by Building Regulations. The build-ups therefore prevent the penetration of heat as much as practically possible. See the 'Be Lean' section of this report for target U-values.
 - o A reduced air permeability rate has been targeted to minimise uncontrolled air infiltration. This will require attention to detailing and sealing. See 'Be Lean' section of this report for details of how this will be achieved.

Energy Assessment

Haydon Drive, Northwood

2. Minimise internal heat generation through energy efficient design
 - o Internal heat gains have been minimised where possible. Energy efficient appliances will help reduce internal heat gain and reduce the cooling requirement.
 - o Energy efficient lighting will also be specified as per the 'Be Lean' section.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings
 - o High thermal mass – exposed building fabric materials such as masonry or concrete have been utilised in the form of concrete floors and dense masonry external walls. These materials act as 'thermal batteries'; they absorb heat gains during the day when the building is occupied and 'store' it for an extended period, thereby helping to stabilise daytime temperatures. At night this heat can be dissipated, which 'resets' the heating cycle. Ventilation will also be used at night to purge the stored heat within the structure. A 'ground coupled' system that uses the thermal storage capacity of the ground has not been specified as the passive ventilation option has been selected instead.
 - o Room heights – high ceilings are traditionally used in hot climates to allow thermal stratification so that occupants can inhabit the lower cooler space, and to decrease the transfer of heat gain through the roof. The proposed building has floor to ceiling heights of more than 2.5m. As the roof will be well insulated to below building regulations, there will be minimal penetration of heat through the roof.
4. Provide passive ventilation
 - o Openable windows are specified on all facades of the building.
 - o Shallow floorplates have been specified with dual aspect units to allow for cross ventilation. Cross ventilation will be achieved by opening windows on two facades and ensuring there is a clear path for airflow.
 - o The scheme has been designed to enable 'stack-effect' ventilation in some of the block.
 - o Nighttime cooling will also be utilised. This will work in tandem with high thermal mass materials specified. The larger temperature differential that exists between internal and external temperatures at night will allow effective stack ventilation and purging of heat accumulated within the structure during the day.
5. Provide mechanical ventilation
 - o Mechanical ventilation with summer by-pass will be used to make use of 'free cooling' where the outside air temperature is below that in the building during summer months.
 - o A mixed mode system will be implemented. This will be complimentary to the passive cooling measures taken. During summer months, mechanical ventilation using fans will remove hot air from the building. The building will also adopt a zoned design to allow natural ventilation where possible and mechanical ventilation where there are increased cooling loads such as server/IT rooms and equipment and high-density offices.
 - o The mechanical systems will comply with the Domestic Building Services Compliance Guide as it is demonstrated in the 'Be Lean' section.

Energy Assessment

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Overheating risk

The overheating risk considering all the above-described passive measures have been assessed for the scheme.

According to the GLA guidance on preparing energy assessments (June 2022) Section 8, dynamic modelling in line with CIBSE TM59 should be carried out to assess the risk of overheating. The dynamic overheating analysis carried out by Eight Versa in February 2025, confirms that the scheme meets the CIBSE TM59 requirements and complies with the new Part O.

Active cooling

Air conditioning has not been specified for the scheme, since the overheating analysis demonstrates there is no significant risk of overheating, and the passive design measures are enough to guarantee the occupant's comfort.

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Heating Infrastructure

Heating infrastructure including CHP

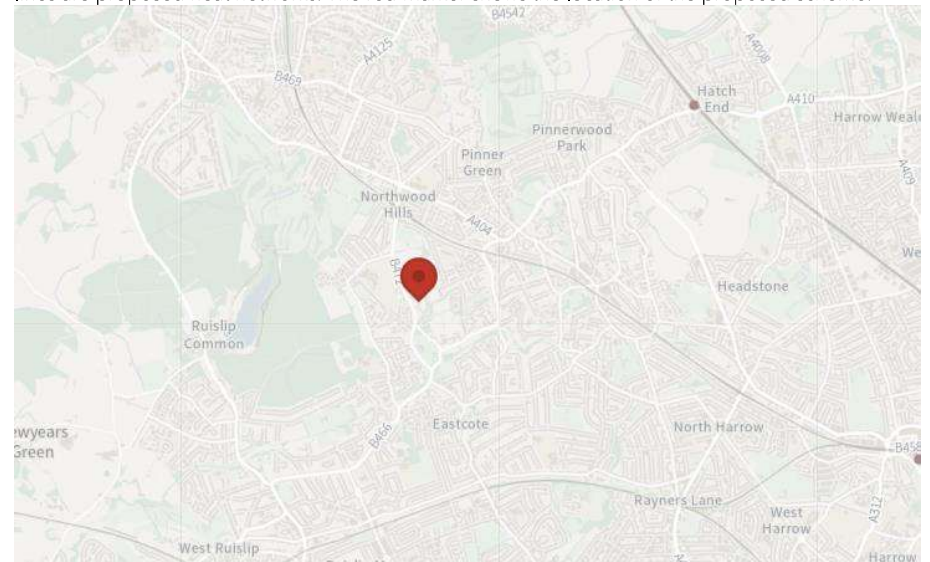
Once demand for energy has been minimised, schemes must demonstrate how their energy systems have been selected in accordance with the order of preference in Policy SI3 of London Plan 2021. This has involved a systematic appraisal of the potential to connect to existing or planned heating networks and on site communal and CHP systems.

To comply with London Plan 2021 Policy SI 3, developments in Heat Network Priority Areas (HNPAs) should have a communal low-temperature heating system and should select a heat source in accordance with the following heating hierarchy:

- connect to local existing or planned heat networks
- use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
- use low-emission combined heat and power (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
- use ultra-low NOx gas boilers

Connect to local existing or planned heat network

The illustration below shows the London heat map. Red lines are existing heat networks and orange lines are proposed heat networks. The red marker shows the location of the proposed scheme.



Energy Assessment

Haydon Drive, Northwood

Use zero-emission and/or local secondary heat sources

According to the GLA and London Plan 2021 Policy SI3, the exploitation of local energy opportunities to maximise the use of locally available energy sources whilst minimising primary energy demand and carbon emissions is encouraged. Secondary heat includes environmental sources such as air, water and ground; and waste sources such as heat from the sewerage system, sewage treatment plants, the tube network, data centres and chiller systems.

There are no local available waste heat sources for the scheme.

Use low-emission combined heat and power (CHP)

In accordance with section 9 of the GLA guidance for Energy Planning where connection to an area wide heat network will not be available in the foreseeable future i.e. 5 years following completion, or the development is of such a scale that it could be the catalyst for an area wide heat network, applicants should evaluate the feasibility of on-site CHP.

GLA guidance stipulates that small, or purely residential developments of less than 350 dwellings will not be expected to include on-site CHP. CHP systems are best utilised where there is a consistent and high demand for heat. Because of the small electricity supplies and demand of this scheme, a CHP installed to meet the base heat load would typically require the export of electricity to the grid. The administrative burden of managing CHP electricity sales at a small scale without an active energy service companies (ESCOs) is prohibitive for smaller operators of residential developments.

The heat demand profile of this residential scheme is not suitable to CHP. The implemented fabric improvements from the 'Be Lean' scenario have also reduced the energy demand from space heating to hot water. For CHP systems to be economically viable they need to run for at least 5,000 hours per year. Therefore, a CHP system would most likely be oversized, and as a result less efficient and economic.

Use ultra-low NOx gas boilers

Where it is clearly demonstrated that the above heating options (District heating, local secondary heat source and CHP) have been fully investigated and ruled out, then a site-wide heating strategy led by ultra-low NOx gas boilers can be considered.

In accordance with section 9 of the GLA guidance for Energy Planning, where it is demonstrable that a site wide network is not feasible then an individual heating strategy can be implemented. A site wide network will not be adopted because the dwellings on site will not have adequate density and local conditions are not favourable to centralised distribution. Therefore, it is considered that distribution losses would be relatively large and the effectiveness and carbon reducing potential would be undermined when compared to an individual servicing strategy. The scheme, therefore, will be serviced by individual systems (ASHP).

Air quality impacts

An air quality assessment is required for all major developments as per the London Plan 2021 policy SI1. To ensure that the air quality assessment is as robust as possible, the total gas and electricity consumption is shown in Appendix A, as it is required by GLA.

Energy Assessment

Haydon Drive, Northwood

Renewable Energy

Renewable Energy Feasibility:

In line with Policy SI2 of the London Plan 2021 the feasibility of renewable energy technologies has been considered. A detailed site-specific analysis and associated carbon saving calculations has also been provided for renewable energy technologies considered feasible.

Each technology has been assessed under 3 broader categories. There are key criteria for each category on which the technology is evaluated. The key criteria have been given a weighting based on a tick-system, a graphical representation of this is shown below:

The weighting of each of the criteria within the categories is shown below:

- Local, site-specific impact: (Maximum score of 5)
 - Local planning criteria = ✓
 - Land used by all components = ✓
 - Noise impact from operation = ✓
 - Interaction on the current building design = ✓
 - Buildability of installation = ✓
- Economic viability: (Maximum score of 5)
 - Capital cost of all components = ✓
 - Grants and funding available = ✓
 - Payback periods (years) 3-5, 5-10, 10-15 = ✓
 - Servicing requirements (low or high) = ✓
 - Maintenance costs (low or high) = ✓

- CO₂ and sustainability: (Maximum score of 10)
 - Carbon saving per year = ✓✓✓✓
 - Impact of future grid decarbonisation (gas vs. electric) = ✓✓
 - Local air quality/pollution = ✓✓
 - Resource use of installation = ✓✓

Key comments on each of the criteria and the corresponding score will be provided in a table for each of the technologies. The score for each of the criteria will be summed and each of the technologies will then be ranked. The assessment of each technology is undertaken on the following pages.

Energy Assessment

Haydon Drive, Northwood

Biomass & Biofuel - Rejected

Biomass is normally considered a carbon 'neutral' fuel, as the carbon dioxide emitted on burning has been recently absorbed from the atmosphere by photosynthesis. Although some form of fossil fuel derived inputs are required in the production and transportation of the fuel.

Wood is seen as a by-product of other industries and the small quantity of energy for drying, sawing, pelleting and delivery are typically discounted. Biomass from coppicing is likely to have external energy inputs from fertiliser, cutting, drying etc. and these may need to be considered. In this toolkit, all biomass fuels are considered to have zero net carbon emissions.

Biomass can be burnt directly to provide heat in buildings. Wood from forests, urban tree pruning, farmed coppices or farm and factory waste, is the most common fuel and is used commercially in the form of wood chips or pellets. Biomass boilers can also be designed to burn smokeless to comply with the Clean Air Acts.

Boilers can be fed automatically by screw drives from fuel hoppers. This typically involves daily addition of bagged fuels.

A biomass boiler could be installed on site for supplementary LTHW heating; however, a major factor influencing the suitability of a biomass boiler is the availability of the biomass fuel. A local and reliable fuel source would be essential for the biomass boiler to be an efficient replacement for a conventional boiler system. Therefore, a very comprehensive feasibility assessment needs to be undertaken to understand the practicalities of such a system.

It is estimated that the heating and hot water demand of the site is too large to meet the required CO₂ emissions reduction if a biomass boiler was a standalone system. Therefore, a biomass boiler would need to be combined with energy demand reduction measures and/or CHP. The likely installed cost would be circa £50,000. The additional cost of providing and storing the bio-fuel also needs to be accounted for. The site is likely to be unsuitable for biomass boilers due to site constraints such as limited transport/access issues, and storage of the biomass fuel. A detailed feasibility study will be required to investigate the suitability.

Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
✓ Local air quality impacts, increased transport usage, increased plant space, slightly increased buildability issues.	✓✓✓ Increased capital costs of installation, typical payback of 8 years, Increased maintenance relative to gas boiler, resource use not significantly increased if well served.	✓✓✓✓✓ Very low carbon intensity of feedstock if properly procured. Decarbonisation impact not applicable, air quality issues.

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Photovoltaic Panels (PV) - Accepted

Photovoltaic systems convert energy from the sun into electricity through semi-conductor cells. Systems consist of semi-conductor cells connected together and mounted into modules. Modules are connected to an inverter to turn the direct current (DC) output into alternating current (AC) electricity for use in buildings.

Photovoltaic panels supply electricity to the building and are attached to electricity grid or to any other electrical load. Excess electricity can be sold to the National Grid when the generated power exceeds the local need. PV systems require only daylight, not sunlight to generate electricity (although more electricity is produced with more sunlight), so energy can still be produced in overcast or cloudy conditions.

The cost of PV cells is heavily dependent on the size of the array. There are significant cost reductions available for larger installations.

The most suitable location for mounting photovoltaic panels is on roofs as they usually have the greatest exposure to the sun. The proposed site has a potential useable roof area of approximately 414 m2 that is orientated towards the south, southeast and southwest.

Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
✓✓✓✓ No local air quality impacts, use of unutilised roof space, no noise issues, good orientation, and slightly increased buildability issues for wiring and metering.	✓✓ Increased capital costs of installation, typical payback of 10-15 years, Feed in Tariff available, limited servicing and maintenance i.e. 1 visit per year, inverter will require replacement.	✓✓✓✓✓ ✓✓✓ High carbon saving from electricity, uses minimal grid electricity, no local air impact, high embodied energy of panels.

Energy Assessment

Haydon Drive, Northwood

Solar Thermal - Rejected

Solar water heating systems use the energy from the sun to heat water for domestic hot water needs. The systems use a heat collector, generally mounted on the roof in which a fluid is heated by the sun. This fluid is used to heat up water that is stored in either a separate hot water cylinder or a twin coil hot water cylinder inside the building. The systems work very successfully in all parts of the UK, as they can work in diffuse light conditions.

Like photovoltaic panels the most suitable location for mounting solar hot water panels is on roofs as they usually have the greatest exposure to the sun. The proposed site has a potential useable roof area of approximately 662.5 m² that is orientated towards the south, southeast and southwest.

It is estimated that the CO₂ emissions reduction that would be produced by solar hot water as a standalone system would not be adequate to achieve the required CO₂ emissions reduction target. Therefore, a solar hot water system would need to be combined with more energy efficiency strategies, a CHP, or additional renewable technologies to achieve the carbon reduction target.

Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
✓✓✓✓	✓✓✓	✓✓✓✓✓
No local air quality impacts, use of unutilised roof space, no noise issues, good orientation, slightly increased buildability issues for piping and cylinders.	Increased capital costs of installation, typical payback of 8-10 years, Heat Incentive available, limited servicing and maintenance i.e. 1 visit per year, heat transfer fluid requires replacing every 10 years.	✓ Lower carbon saving as primarily displacing gas, uses minimal grid electricity, no local air impact, medium embodied energy of panels.

Energy Assessment

Haydon Drive, Northwood



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Wind Energy – Rejected

Wind energy is a cost-effective method of renewable power generation. Wind turbines can produce electricity without carbon dioxide emissions in ranges from watts to megawatt outputs. The most common design is for three blades mounted on a horizontal axis, which is free to rotate into the wind on a tall tower.

The blades drive a generator either directly or via a gearbox to produce electricity. The electricity can either be linked to the grid or charge batteries. An inverter is required to convert the electricity from direct current (DC) to alternating current (AC) for feeding into the grid.

Modern quiet wind turbines are becoming viable in low density areas where ease of maintenance and immediate connection to the grid or direct use of the electricity in a building, may make them cost effective, despite lower wind speeds than open areas.

Wind turbines are generally less suited to dense urban areas as their output will be affected by potentially lower and more disrupted wind speeds, and their use of much more cost-effective machines may be prohibited by their proximity to some building types. Small turbines can be used in inner city areas mounted on buildings, although there are relatively few installations.

A detailed wind resource evaluation would be required for the site to fully understand the generation potential and payback period. Also, it is likely that planning restrictions and resistance from groups within the local community could also affect the viability of wind energy for the project.

Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
✓ No local air quality impacts, use of unutilised roof space, medium noise issues, relatively limited wind speeds in local area, increased buildability issues for wiring and metering.	✓✓✓✓ Medium capital costs of installation, typical payback of 5 years, Feed in Tariff available, limited servicing and maintenance, costs of 2-3% typical.	✓✓✓✓✓ High carbon saving from electricity, output limited from urban installation, consumes little grid electricity, no local air impact, low embodied energy of panels

Energy Assessment

Haydon Drive, Northwood

Ground Source Heat Pump (GSHP) - Rejected

Geo-thermal energy is essentially heat collected from the ground. Heat obtained from the ground may be considered it as a source of heating and cooling within the UK by the use of a geo-thermal heat pump or ground source heat pumps.

A ground source heat pump is a device for converting energy in the form of low-level heat to heat at a usable temperature. The heat pump consists of five main parts: ground collector loop/or boreholes, heat exchanger, compressor, condenser heat exchanger and expansion valve.

At approximately 1.2-1.5 metres down below ground level the temperature is a constant 10 to 12°C. Any boreholes would need to be sunk to an effective depth of 50 – 120m and a ground feasibility report would be required to ascertain if this method of heat source were viable.

From the boreholes pre-insulated pipework is laid in the ground to the heat exchanger device. The system is filled with water and antifreeze. The cooled water is pumped around the loop / borehole gathering energy as it circulates. The water that has been heated to 10-12°C is returned to the ground source heat exchanger where the energy is transferred to the refrigerant gas. For every 1kW of energy used to compress the refrigerant, the process 'gives up' 4 kW of energy for use in the system being used to heat the building.

The installation cost for a Ground Source Heat pump is typically high compared to an ASHP

Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
✓✓ No local air quality impacts, no visual impact, no noise issues, however the constrained site may prohibit its installation. Increased buildability issues for pipework and heating emitters internally.	✓ High capital costs of installation, typical payback >15 years where gas is displaced, Renewable Heat Incentive available, limited servicing and maintenance i.e. 1 visit per year, mechanical parts may require replacement over lifespan.	✓✓✓✓✓ Medium carbon saving from gas displacement, consumes some electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.

Energy Assessment

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Air Source Heat Pump (ASHP) – Accepted

Air source heat pump systems work on the same principle as a ground source heat pump although they use the outside air as the heat source.

The coefficients of performance given by air source heat pump systems are inferior to that of ground source systems due to varying air temperatures. In the depth of winter, the energy efficiency of an air source system will be lower than that of a ground source system, and it is likely that more back-up heat will be required if an air source unit is fitted. This back-up heat often comes from a direct electric heater. They operate over a varying temperatures range of -15°C to +25°C, however, the performance will reduce to below the required 3 to 1 carbon saving ratio in winter, and they also require a defrosting mechanism to melt ice that forms on the air heat exchanger.

ASHPs are cheaper to install than ground source heat pumps but carbon dioxide emission savings will typically be less than that of a ground source heat pump.

The scheme has a space heating and domestic hot water demand which could be met with an air source heat pump system.

Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
✓✓✓✓	✓✓	✓✓✓✓✓
No local air quality impacts, use of unutilised roof space, over visual impact, low noise issues, increased buildability issues for pipework and heating emitters internally.	Medium- high capital costs of installation, typical payback >15 years where gas is displaced, Renewable Heat Incentive available Limited servicing and maintenance i.e. 1 visit per year, mechanical parts may require replacement over lifespan.	✓✓ Medium carbon saving from gas displacement, less efficient in winter, consumes electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.

Energy Assessment

Haydon Drive, Northwood

Summary comparison matrix

An assessment of the feasibility of each of the technologies is shown below.

Renewable Technology	Comments	Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)	Total Score
Biomass Boiler	High air quality impact	✓	✓✓✓	✓✓✓✓✓	9
Photovoltaic	High CO ₂ savings and low visual impact	✓✓✓✓	✓✓	✓✓✓✓✓ ✓✓✓	14
Solar Thermal	Low CO ₂ savings compared to PV panels	✓✓✓✓	✓✓✓	✓✓✓✓✓ ✓	13
Wind Energy	High visual and noise impact	✓	✓✓✓✓	✓✓✓✓✓	10
GSHP	High capital cost	✓✓	✓	✓✓✓✓✓ ✓✓✓	11
ASHP	Low capital cost but low CO ₂ savings compared to GSHP	✓✓✓✓	✓✓	✓✓✓✓✓ ✓✓	13

Photovoltaic panels, solar thermal panels and ASHPs have scored the best.

Due to the limited roof space, photovoltaic panels and ASHPs have been specified as they can provide higher CO₂ savings compared to the solar thermal panels.

Energy Assessment

Haydon Drive, Northwood

Photovoltaic panels (PV) - Performance

A photovoltaic panel system of 56.4 kWp (141 panels of 400W each) has been specified for the whole development, a detailed summary of the lifecycle cost, revenue and payback for the photovoltaic panels is presented in this section.

The following drawing shows that the proposed site has a potential useable roof area of approximately 414 m² that is orientated towards the south, southeast and southwest.



The lifecycle of the proposed high efficiency panels is 25 years. To calculate the lifecycle cost of the panels, the maintenance of the system and replacement cost will be included. The total costs for the proposed system's lifetime is shown in the table below.

Capital cost (£)	£67,680.00
Maintenance cost (£)	8070
Operational cost (£)	900
Total (£)	76,650
Cost of electricity (p/kWh)	17.0
Electricity generation (kWh/yr)	18,716
% of energy used on site	50%
Savings (£)	1,591
Summary	
Cost Performance Criteria	Value
Extra Cost Over Life Cycle (£)	76,650
Predicted Annual Savings (£)	2,094
Payback Period (years)	36.6
Energy and Carbon Performance Criteria	
Predicted Annual Energy Saved (kWh/yr)	18,716
Annual Carbon Emissions Reductions (kg CO ₂ /year) using SAP10.0 carbon factors	2,545
CO ₂ Emissions Reduction (%) with SAP10.2	8.5

The performance and output of the system will be monitored, in line with the 'Be Seen' policy and relevant guidance document

Energy Assessment

Haydon Drive, Northwood

Conclusion

Summary

A sample of houses has been modelled for the purposes of the energy assessment. One of each dwelling type from Blocks A, B, C, and D have been analysed. High energy efficiency performance building services have been used for these units to achieve the required carbon emission targets.

The scheme complies with the 2021 Building Regulations Part L and the minimum energy efficiency targets in the following documents have been followed:

- New build CO₂ emissions – The actual CO₂ Dwelling Emissions Rate (DER) is no greater than the notional building CO₂ Target Emissions Rate (TER).
- New dwelling Fabric efficiency – The Dwelling Fabric Energy Efficiency (DFEE) is not greater than the Target Fabric Energy Efficiency (TFEE).
- New build Primary energy – The Dwelling Primary Energy Rate (DPER) is no greater than the Target Primary Energy Rate (TPER).

In addition, the CO₂ emissions of the scheme have been calculated using the SAP 10.2 carbon emission factors, and the scheme can achieve:

- An on-site CO₂ reduction of 80% beyond Building Regulations through energy efficiency measures and inclusion of renewable technologies (Air Source Heat Pumps and PV panels)
- An improvement of 22% CO₂ improvement through energy efficiency measures, 'Be Lean' stage
- A further improvement of 58% CO₂ has been achieved through renewable technologies 'Be Green' stage (Air Source Heat Pumps and PV panels)
- Zero-carbon target can be achieved through a cash in lieu contribution to the borough's carbon offset fund. The carbon offset payment cost has been calculated as £17,546.

Energy Assessment

Haydon Drive, Northwood



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Appendix A

SAP files

The emission figures and details of the calculations and methodology used to determine the figures provided within the report can be found in the following pages:

- Baseline– TER from the TER SAP worksheet
- Be Lean – DER from the Be Lean scenario DER SAP worksheet
- Proposed – DER from the Proposed scenario DER SAP worksheet

Energy Assessment

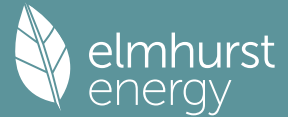
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Baseline – TER from the TER SAP worksheet
Be Lean – DER from the Be Lean scenario DER SAP worksheet

Full SAP Calculation Printout



Property Reference	UNIT A1				Issued on Date	25/02/2025
Assessment Reference	LEAN V2		Prop Type Ref			
Property						
SAP Rating	82 B	DER	11.77	TER	11.47	
Environmental	89 B	% DER < TER				-2.62
CO ₂ Emissions (t/year)	1.32	DFEE	43.78	TFEE	43.16	
Compliance Check	See BREL	% DFEE < TFEE				-1.43
% DPER < TPER	-17.88	DPER	70.81	TPER	60.07	
Assessor Details	Ms. Vanessa Vienna				Assessor ID	T798-0001
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)
Main dwelling			
Ground floor	52.2500 (1b)	x 2.5000 (2b)	= 130.6250 (1b) - (3b)
First floor	43.6200 (1c)	x 2.9000 (2c)	= 126.4980 (1c) - (3c)
Second floor	34.4600 (1d)	x 2.5400 (2d)	= 87.5284 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.6514 (5)

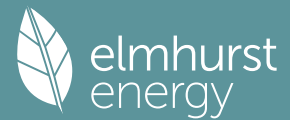
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											3.0000 (17)	
Infiltration rate											0.1500 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1388 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												74.4000 (23c)
Effective ac	0.3049	0.3014	0.2980	0.2806	0.2772	0.2598	0.2598	0.2563	0.2667	0.2772	0.2841	0.2910 (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
Main dwelling							
Opening Type 1			23.0200	1.1450	26.3588		(27)
door			2.7000	1.0000	2.7000		(26)
GROUND FL			52.3500	0.1000	5.2350		(28a)
External Wall	145.2300	25.7200	119.5100	0.1600	19.1216		(29a)
Ext. Roof - flat	43.2000		43.2000	0.1000	4.3200		(30)
Ext. Roof - Pitched	27.9100		27.9100	0.1000	2.7910		(30)
Total net area of external elements Aum (A, m ²)			268.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5264		(33)
Main dwelling							
Party Wall 1			60.5200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							

Full SAP Calculation Printout



K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	14.7400	0.1000	1.4740
E3 Sill	14.7400	0.0400	0.5896
E4 Jamb	40.9000	0.0500	2.0450
E5 Ground floor (normal)	21.5400	0.1000	2.1540
E6 Intermediate floor within a dwelling	20.9700	0.0500	1.0485
E13 Gable (insulation at rafter level)	9.5200	0.0400	0.3808
E14 Flat roof	17.2600	0.1300	2.2438
E15 Flat roof with parapet	7.8800	0.1500	1.1820
E16 Corner (normal)	35.8000	0.0900	3.2220
E17 Corner (inverted - internal area greater than external area)	10.8000	-0.0900	-0.9720
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E24 Eaves (insulation at ceiling level - inverted)	18.6300	0.1000	1.8630
E25 Staggered party wall between dwellings	5.4000	0.1200	0.6480
P1 Party wall - Ground floor	9.4900	0.2200	2.0878
P2 Party wall - Intermediate floor within a dwelling	14.5700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.4000	0.2800	1.7920
P5 Party wall - Roof (insulation at rafter level)	6.3500	0.2800	1.7780
R6 Flat ceiling	10.3300	0.1200	1.2396
R7 Flat ceiling (inverted)	12.7800	0.1200	1.5336
R9 Roof to wall (flat ceiling)	9.1300	0.3200	2.9216
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			27.5553 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	88.0817 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	34.6785	34.2840	33.8895	31.9169	31.5224	29.5498	29.5498	29.1552	30.3388	31.5224	32.3114	33.1004 (38)
Average = Sum(39)m / 12 =	122.7602	122.3657	121.9711	119.9986	119.6040	117.6314	117.6314	117.2369	118.4205	119.6040	120.3931	121.1821 (39)
												119.8999
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9419	0.9389	0.9359	0.9207	0.9177	0.9026	0.9026	0.8995	0.9086	0.9177	0.9238	0.9298 (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													2.8958 (42)
Hot water usage for mixer showers													
72.7736	71.6799	70.0863	67.0371	64.7869	62.2775	60.8511	62.4327	64.1664	66.8608	69.9754	72.4947	(42a)	
Hot water usage for baths													
31.4182	30.9516	30.2945	29.0830	28.1758	27.1699	26.6266	27.2790	27.9895	29.0658	30.3023	31.3120	(42b)	
Hot water usage for other uses													
44.2863	42.6759	41.0655	39.4551	37.8447	36.2342	36.2342	37.8447	39.4551	41.0655	42.6759	44.2863	(42c)	
Average daily hot water use (litres/day)												136.4847 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
148.4781	145.3074	141.4463	135.5752	130.8074	125.6816	123.7119	127.5564	131.6110	136.9921	142.9537	148.0930	(44)	
Energy content (annual)	235.1530	206.9158	217.3977	185.5956	176.0919	154.5402	149.6188	157.9415	162.2895	185.8970	203.6637	231.8779 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2266.9826	
35.2729	31.0374	32.6096	27.8393	26.4138	23.1810	22.4428	23.6912	24.3434	27.8845	30.5496	34.7817	(46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month													
286.1119	252.9432	268.3566	234.9107	227.0508	203.8553	200.5777	208.9004	211.6045	236.8559	252.9788	282.8368	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	286.1119	252.9432	268.3566	234.9107	227.0508	203.8553	200.5777	208.9004	211.6045	236.8559	252.9788	282.8368 (64)	
12Total per year (kWh/year)												2866.9826 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
												0.0000 (64a)	
Heat gains from water heating, kWh/month	90.9281	80.3064	85.0244	74.0393	71.2903	63.7134	62.4880	65.2553	66.2900	74.5505	80.0469	89.8391 (65)	

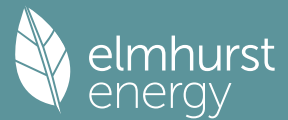
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
151.2834	167.4923	151.2834	156.3261	151.2834	156.3261	151.2834	151.2834	156.3261	151.2834	156.3261	151.2834	151.2834 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
298.1178	301.2114	293.4158	276.8199	255.8705	236.1811	223.0273	219.9338	227.7294	244.3253	265.2747	284.9641	284.9641 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792 (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)												
-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336 (71)
Water heating gains (Table 5)												
122.2152	119.5035	114.2802	102.8324	95.8203	88.4908	83.9892	87.7087	92.0695	100.2022	111.1763	120.7515	120.7515 (72)
Total internal gains	641.0540	657.6448	628.4169	605.4160	572.4117	547.4356	524.7375	525.3635	542.5626	565.2485	602.2147	626.4366 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	6.2100	11.2829	0.4000	0.8000	0.7700	15.5381 (75)
Southeast	3.9000	36.7938	0.4000	0.8000	0.7700	31.8217 (77)
Southwest	12.9100	36.7938	0.4000	0.8000	0.7700	105.3379 (79)

Solar gains	152.6976	265.2616	376.6514	489.6674	569.4417	574.5493	550.0876	489.1620	415.5680	296.8668	183.8364	130.0691 (83)
Total gains	793.7516	922.9064	1005.0683	1095.0834	1141.8534	1121.9849	1074.8251	1014.5255	958.1307	862.1154	786.0511	756.5057 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.7266	73.9643	74.2036	75.4234	75.6722	76.9411	76.9411	77.2000	76.4285	75.6722	75.1762	74.6867	
alpha	5.9151	5.9310	5.9469	6.0282	6.0448	6.1294	6.1294	6.1467	6.0952	6.0448	6.0117	5.9791	
util living area	0.9978	0.9940	0.9847	0.9480	0.8466	0.6507	0.4787	0.5264	0.7825	0.9638	0.9943	0.9983 (86)	
MIT	19.9244	20.0995	20.3334	20.6447	20.8749	20.9804	20.9974	20.9955	20.9421	20.6453	20.2349	19.9027 (87)	
Th 2	20.1320	20.1346	20.1371	20.1499	20.1525	20.1653	20.1653	20.1679	20.1602	20.1525	20.1474	20.1422 (88)	
util rest of house	0.9970	0.9921	0.9796	0.9306	0.8009	0.5743	0.3895	0.4339	0.7119	0.9481	0.9922	0.9978 (89)	
MIT 2	18.8681	19.0934	19.3917	19.7854	20.0462	20.1540	20.1644	20.1662	20.1210	19.7942	19.2767	18.8480 (90)	
Living area fraction	19.0639	19.2799	19.5662	19.9447	20.1999	20.3072	20.3188	20.3199	fLA = Living area / (4) =				0.1854 (91)
MIT	19.0639	19.2799	19.5662	19.9447	20.1999	20.3072	20.3188	20.3199	20.2732	19.9520	19.4543	19.0435 (92)	
Temperature adjustment	18.9139	19.1299	19.4162	19.7947	20.0499	20.1572	20.1688	20.1699	20.1232	19.8020	19.3043	-0.1500	
adjusted MIT	18.9139	19.1299	19.4162	19.7947	20.0499	20.1572	20.1688	20.1699	20.1232	19.8020	19.3043	18.8935 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9955	0.9890	0.9738	0.9216	0.7947	0.5736	0.3898	0.4342	0.7085	0.9397	0.9890	0.9965 (94)
Useful gains	790.1809	912.7344	978.7847	1009.2721	907.4716	643.5311	419.0025	440.4634	678.8647	810.1257	777.4375	753.8939 (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	1794.0079	1741.2551	1575.4067	1307.3508	998.6764	653.6986	419.8078	441.9769	713.2689	1100.5917	1469.3179	1780.5888 (97)
Space heating kWh	746.8473	556.7659	443.8867	214.6167	67.8564	0.0000	0.0000	0.0000	0.0000	216.1067	498.1539	763.8610 (98a)
Space heating requirement - total per year (kWh/year)												3508.0945
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	746.8473	556.7659	443.8867	214.6167	67.8564	0.0000	0.0000	0.0000	0.0000	216.1067	498.1539	763.8610 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3508.0945
Space heating per m2										(98c) / (4) =		26.9170 (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 %)												89.5000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	746.8473	556.7659	443.8867	214.6167	67.8564	0.0000	0.0000	0.0000	0.0000	216.1067	498.1539	763.8610 (98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)	834.4662	622.0848	495.9628	239.7952	75.8172	0.0000	0.0000	0.0000	0.0000	241.4600	556.5965	853.4760 (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	286.1119	252.9432	268.3566	234.9107	227.0508	203.8553	200.5777	208.9004	211.6045	236.8559	252.9788	282.8368 (64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (216)
Fuel for water heating, kWh/month	262.7408	231.1909	242.9024	207.3694	196.7507	172.6706	167.1719	176.4709	181.3290	207.7061	227.5572	259.0815 (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	86.9386	78.5252	86.9386	84.1341	86.9386	84.1341	86.9386	86.9386	84.1341	86.9386	84.1341	86.9386 (231)
Lighting	31.4337	25.2173	22.7054	16.6349	12.8493	10.4980	11.7216	15.2361	19.7902	25.9658	29.3283	32.3073 (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)
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)
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)
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)
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)
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)
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)
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)
Annual totals kWh/year												
Space heating fuel - main system 1												3919.6587 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	89.5000	
Water heating fuel used	2532.9414 (219)	
Space cooling fuel	0.0000 (221)	
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)		
mechanical ventilation fans (SFP = 0.9100)	382.6320 (230a)	
central heating pump	41.0000 (230c)	
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)	
Total electricity for the above, kWh/year	1023.6320 (231)	
Electricity for lighting (calculated in Appendix L)	253.6879 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000 (233)	
Wind generation	0.0000 (234)	
Hydro-electric generation (Appendix N)	0.0000 (235a)	
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)	
Appendix Q - special features		
Energy saved or generated	-0.0000 (236)	
Energy used	0.0000 (237)	
Total delivered energy for all uses	7729.9200 (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	3919.6587	0.2100	823.1283 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2532.9414	0.2100	531.9177 (264)
Space and water heating			1355.0460 (265)
Pumps, fans and electric keep-hot	1023.6320	0.1387	141.9904 (267)
Energy for lighting	253.6879	0.1443	36.6150 (268)
Total CO2, kg/year			1533.6514 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.7700 (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	3919.6587	1.1300	4429.2143 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2532.9414	1.1300	2862.2238 (278)
Space and water heating			7291.4381 (279)
Pumps, fans and electric keep-hot	1023.6320	1.5128	1548.5505 (281)
Energy for lighting	253.6879	1.5338	389.1150 (282)
Total Primary energy kWh/year			9229.1036 (286)
Dwelling Primary energy Rate (DPER)			70.8100 (287)

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

1. Overall dwelling characteristics

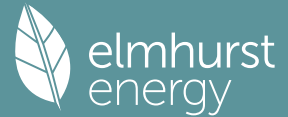
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	52.2500 (1b)	x 2.5000 (2b)	= 130.6250 (1b) - (3b)
First floor	43.6200 (1c)	x 2.9000 (2c)	= 126.4980 (1c) - (3c)
Second floor	34.4600 (1d)	x 2.5400 (2d)	= 87.5284 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.6514 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1161 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3661 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3386 (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)

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Adj infilt rate	0.4317	0.4233	0.4148	0.3725	0.3640	0.3217	0.3217	0.3132	0.3386	0.3640	0.3809	0.3979 (22b)
Effective ac	0.5932	0.5896	0.5860	0.5694	0.5662	0.5517	0.5517	0.5491	0.5573	0.5662	0.5726	0.5791 (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	
Main dwelling								
TER Opaque door			2.7000	1.0000	2.7000			(26)
TER Opening Type			23.0200	1.1450	26.3588			(27)
GROUND FL			52.3500	0.1300	6.8055			(28a)
External Wall	145.2300	25.7200	119.5100	0.1800	21.5118			(29a)
Ext. Roof - flat	43.2000		43.2000	0.1100	4.7520			(30)
Ext. Roof - Pitched	27.9100		27.9100	0.1100	3.0701			(30)
Total net area of external elements Aum(A, m2)			268.6900					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	65.1982		(33)
Main dwelling								
Party Wall 1			60.5200	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	14.7400	0.0500	0.7370
E3 Sill	14.7400	0.0500	0.7370
E4 Jamb	40.9000	0.0500	2.0450
E5 Ground floor (normal)	21.5400	0.1600	3.4464
E6 Intermediate floor within a dwelling	20.9700	0.0000	0.0000
E13 Gable (insulation at rafter level)	9.5200	0.0800	0.7616
E14 Flat roof	17.2600	0.0800	1.3808
E15 Flat roof with parapet	7.8800	0.5600	4.4128
E16 Corner (normal)	35.8000	0.0900	3.2220
E17 Corner (inverted - internal area greater than external area)	10.8000	-0.0900	-0.9720
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E24 Eaves (insulation at ceiling level - inverted)	18.6300	0.2400	4.4712
E25 Staggered party wall between dwellings	5.4000	0.0600	0.3240
P1 Party wall - Ground floor	9.4900	0.0800	0.7592
P2 Party wall - Intermediate floor within a dwelling	14.5700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.4000	0.1200	0.7680
P5 Party wall - Roof (insulation at rafter level)	6.3500	0.0800	0.5080
R6 Flat ceiling	10.3300	0.0600	0.6198
R7 Flat ceiling (inverted)	12.7800	0.0400	0.5112
R9 Roof to wall (flat ceiling)	9.1300	0.0400	0.3652
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			24.4212 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	89.6194 (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	67.4666	67.0550	66.6516	64.7567	64.4022	62.7518	62.7518	62.4462	63.3875	64.4022	65.1194	65.8692 (38)
Average = Sum(39)m / 12 =	157.0860	156.6744	156.2710	154.3761	154.0216	152.3712	152.3712	152.0656	153.0069	154.0216	154.7388	155.4886 (39)
												154.3744
HLP	1.2053	1.2021	1.1990	1.1845	1.1818	1.1691	1.1691	1.1668	1.1740	1.1818	1.1873	1.1930 (40)
HLP (average)												1.1845
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8958 (42)
Hot water usage for mixer showers													
72.7736	71.6799	70.0863	67.0371	64.7869	62.2775	60.8511	62.4327	64.1664	66.8608	69.9754	72.4947	(42a)	
Hot water usage for baths													
31.4182	30.9516	30.2945	29.0830	28.1758	27.1699	26.6266	27.2790	27.9895	29.0658	30.3023	31.3120	(42b)	
Hot water usage for other uses													
44.2863	42.6759	41.0655	39.4551	37.8447	36.2342	36.2342	37.8447	39.4551	41.0655	42.6759	44.2863	(42c)	
Average daily hot water use (litres/day)												136.4847 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.4781	145.3074	141.4463	135.5752	130.8074	125.6816	123.7119	127.5564	131.6110	136.9921	142.9537	148.0930 (44)	
Energy conte	235.1530	206.9158	217.3977	185.5956	176.0919	154.5402	149.6188	157.9415	162.2895	185.8970	203.6637	231.8779 (45)	
Energy content (annual)										Total = Sum(45)m =		2266.9826	
Distribution loss (46)m = 0.15 x (45)m													
35.2729	31.0374	32.6096	27.8393	26.4138	23.1810	22.4428	23.6912	24.3434	27.8845	30.5496	34.7817	(46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month													
286.1119	252.9432	268.3566	234.9107	227.0508	203.8553	200.5777	208.9004	211.6045	236.8559	252.9788	282.8368	(62)	
WWHRS	-33.2690	-29.4234	-30.8105	-25.5123	-23.7766	-20.3458	-19.0709	-20.2800	-21.0505	-24.8162	-28.1138	-32.6529 (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	252.8429	223.5198	237.5461	209.3984	203.2742	183.5095	181.5068	188.6204	190.5540	212.0397	224.8650	250.1839 (64)	
										Total per year (kWh/year) = Sum(64)m =		2557.8606 (64)	
12Total per year (kWh/year)												2558 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)	
Heat gains from water heating, kWh/month	90.9281	80.3064	85.0244	74.0393	71.2903	63.7134	62.4880	65.2553	66.2900	74.5505	80.0469	89.8391 (65)	

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

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.0529	170.5586	154.0529	159.1880	154.0529	159.1880	154.0529	154.0529	159.1880	154.0529	159.1880	154.0529	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.1178	301.2114	293.4158	276.8199	255.8705	236.1811	223.0273	219.9338	227.7294	244.3253	265.2747	284.9641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	(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)	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	(71)
Water heating gains (Table 5)	122.2152	119.5035	114.2802	102.8324	95.8203	88.4908	83.9892	87.7087	92.0695	100.2022	111.1763	120.7515	(72)
Total internal gains	643.8235	660.7111	631.1865	608.2779	575.1813	550.2975	527.5071	528.1330	545.4245	568.0181	605.0766	629.2061	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					6.2100	11.2829		0.6300	0.7000	0.7700		21.4134 (75)	
Southeast					3.9000	36.7938		0.6300	0.7000	0.7700		43.8542 (77)	
Southwest					12.9100	36.7938		0.6300	0.7000	0.7700		145.1687 (79)	
Solar gains	210.4364	365.5636	519.0727	674.8229	784.7619	791.8008	758.0895	674.1264	572.7047	409.1196	253.3496	179.2515	(83)
Total gains	854.2599	1026.2747	1150.2591	1283.1008	1359.9432	1342.0983	1285.5966	1202.2594	1118.1292	977.1377	858.4261	808.4577	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	57.6162	57.7675	57.9167	58.6276	58.7625	59.3990	59.3990	59.5184	59.1522	58.7625	58.4901	58.2081	
alpha	4.8411	4.8512	4.8611	4.9085	4.9175	4.9599	4.9599	4.9679	4.9435	4.9175	4.8993	4.8805	
util living area	0.9970	0.9924	0.9814	0.9444	0.8518	0.6787	0.5114	0.5646	0.8070	0.9637	0.9933	0.9977	(86)
MIT	19.5574	19.7746	20.0731	20.4637	20.7760	20.9473	20.9894	20.9831	20.8744	20.4602	19.9394	19.5265	(87)
Th 2	19.9158	19.9183	19.9208	19.9324	19.9346	19.9448	19.9448	19.9467	19.9409	19.9346	19.9302	19.9256	(88)
util rest of house	0.9960	0.9899	0.9749	0.9244	0.8008	0.5857	0.3940	0.4439	0.7273	0.9466	0.9906	0.9970	(89)
MIT 2	18.2417	18.5203	18.8999	19.3901	19.7464	19.9150	19.9415	19.9408	19.8562	19.3965	18.7404	18.2090	(90)
Living area fraction									fLA = Living area / (4) =			0.1854	(91)
MIT	18.4856	18.7528	19.1174	19.5891	19.9373	20.1064	20.1357	20.1340	20.0450	19.5937	18.9627	18.4533	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4856	18.7528	19.1174	19.5891	19.9373	20.1064	20.1357	20.1340	20.0450	19.5937	18.9627	18.4533	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9940	0.9859	0.9683	0.9164	0.8009	0.6009	0.4158	0.4662	0.7361	0.9394	0.9870	0.9954	(94)
Useful gains	849.1615	1011.7970	1113.8138	1175.8253	1089.1971	806.4301	534.5325	560.5175	823.0954	917.8785	847.2661	804.7056	(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	2228.3568	2170.3862	1971.7304	1650.1443	1268.7205	839.0117	538.7444	567.8132	909.6229	1385.2249	1835.6136	2216.2193	(97)
Space heating kWh	1026.1213	778.5719	638.2899	341.5097	133.5654	0.0000	0.0000	0.0000	0.0000	347.7057	711.6102	1050.1662	(98a)
Space heating requirement - total per year (kWh/year)												5027.5404	
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	1026.1213	778.5719	638.2899	341.5097	133.5654	0.0000	0.0000	0.0000	0.0000	347.7057	711.6102	1050.1662	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5027.5404	
Space heating per m2										(98c) / (4) =		38.5755	(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 %)													92.4000 (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	
	1026.1213	778.5719	638.2899	341.5097	133.5654	0.0000	0.0000	0.0000	0.0000	347.7057	711.6102	1050.1662	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	1110.5209	842.6103	690.7900	369.5993	144.5513	0.0000	0.0000	0.0000	0.0000	376.3049	770.1409	1136.5435	(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	252.8429	223.5198	237.5461	209.3984	203.2742	183.5095	181.5068	188.6204	190.5540	212.0397	224.8650	250.1839	(64)
Efficiency of water heater	87.0568	86.8258	86.3906	85.4226	83.5031	80.3000	80.3000	80.3000	80.3000	85.4339	86.6711	87.1052	(216)
Fuel for water heating, kWh/month													(217)

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	290.4344	257.4347	274.9676	245.1322	243.4331	228.5299	226.0359	234.8946	237.3027	248.1914	259.4462	287.2205	(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	32.0092	25.6789	23.1210	16.9395	13.0845	10.6902	11.9361	15.5150	20.1525	26.4412	29.8653	32.8988	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.9047	-68.9568	-99.1086	-111.3765	-119.9798	-111.8587	-110.3877	-104.2207	-93.3972	-78.7307	-53.7339	-42.2723	(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	-27.5996	-58.0653	-115.4503	-173.4921	-229.5385	-230.7619	-228.1342	-193.1748	-141.5494	-83.1751	-36.8863	-21.8322	(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												5441.0611	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3033.0233	(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)												258.3322	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2582.5872	(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												6235.8294	(238)

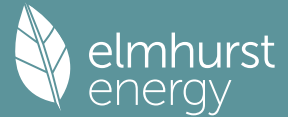
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5441.0611	0.2100	1142.6228 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3033.0233	0.2100	636.9349 (264)
Space and water heating			1779.5577 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	258.3322	0.1443	37.2853 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1042.9274	0.1346	-140.3871
PV Unit electricity exported	-1539.6598	0.1259	-193.7982
Total			-334.1853 (269)
Total CO2, kg/year			1494.5870 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4700 (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	5441.0611	1.1300	6148.3990 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3033.0233	1.1300	3427.3163 (278)
Space and water heating			9575.7153 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	258.3322	1.5338	396.2386 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1042.9274	1.4975	-1561.7761
PV Unit electricity exported	-1539.6598	0.4620	-711.3695
Total			-2273.1456 (283)
Total Primary energy kWh/year			7828.9091 (286)
Target Primary Energy Rate (TPER)			60.0700 (287)

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Property Reference	UNIT A2				Issued on Date	25/02/2025
Assessment Reference	LEAN V2		Prop Type Ref			
Property						
SAP Rating	82 B	DER	11.98	TER	11.74	
Environmental	89 B	% DER < TER				-2.04
CO ₂ Emissions (t/year)	1.35	DFEE	44.73	TFEE	44.37	
Compliance Check	See BREL	% DFEE < TFEE				-0.81
% DPER < TPER	-16.90	DPER	71.95	TPER	61.55	
Assessor Details	Ms. Vanessa Vienna				Assessor ID	T798-0001
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)
Main dwelling			
Ground floor	52.2500 (1b)	x 2.5000 (2b)	= 130.6250 (1b) - (3b)
First floor	43.6200 (1c)	x 2.9000 (2c)	= 126.4980 (1c) - (3c)
Second floor	34.4600 (1d)	x 2.5400 (2d)	= 87.5284 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.6514 (5)

2. Ventilation rate

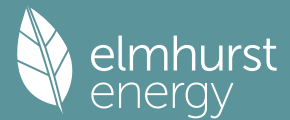
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1388 (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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												74.4000 (23c)
Effective ac	0.3049	0.3014	0.2980	0.2806	0.2772	0.2598	0.2598	0.2563	0.2667	0.2772	0.2841	0.2910 (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
Main dwelling							
Opening Type 1			23.0200	1.1450	26.3588		(27)
door			2.7000	1.0000	2.7000		(26)
GROUND FL			52.3500	0.1000	5.2350		(28a)
External Wall	145.2300	25.7200	119.5100	0.1600	19.1216		(29a)
Ext. Roof - flat	43.2000		43.2000	0.1000	4.3200		(30)
Ext. Roof - Pitched	27.9100		27.9100	0.1000	2.7910		(30)
Total net area of external elements Aum (A, m ²)			268.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5264		(33)
Main dwelling							
Party Wall 1			60.5200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	14.7400	0.1000	1.4740
E3 Sill	14.7400	0.0400	0.5896
E4 Jamb	40.9000	0.0500	2.0450
E5 Ground floor (normal)	21.5400	0.1000	2.1540
E6 Intermediate floor within a dwelling	20.9700	0.0500	1.0485
E13 Gable (insulation at rafter level)	9.5200	0.0400	0.3808
E14 Flat roof	17.2600	0.1300	2.2438
E15 Flat roof with parapet	7.8800	0.1500	1.1820
E16 Corner (normal)	35.8000	0.0900	3.2220
E17 Corner (inverted - internal area greater than external area)	10.8000	-0.0900	-0.9720
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E24 Eaves (insulation at ceiling level - inverted)	18.6300	0.1000	1.8630
E25 Staggered party wall between dwellings	5.4000	0.1200	0.6480
P1 Party wall - Ground floor	9.4900	0.2200	2.0878
P2 Party wall - Intermediate floor within a dwelling	14.5700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.4000	0.2800	1.7920
P5 Party wall - Roof (insulation at rafter level)	6.3500	0.2800	1.7780
R6 Flat ceiling	10.3300	0.1200	1.2396
R7 Flat ceiling (inverted)	12.7800	0.1200	1.5336
R9 Roof to wall (flat ceiling)	9.1300	0.3200	2.9216
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			27.5553 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	88.0817 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	34.6785	34.2840	33.8895	31.9169	31.5224	29.5498	29.5498	29.1552	30.3388	31.5224	32.3114	33.1004 (38)
Average = Sum(39)m / 12 =	122.7602	122.3657	121.9711	119.9986	119.6040	117.6314	117.6314	117.2369	118.4205	119.6040	120.3931	121.1821 (39)
												119.8999
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9419	0.9389	0.9359	0.9207	0.9177	0.9026	0.9026	0.8995	0.9086	0.9177	0.9238	0.9298 (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	2.8958 (42)											
Hot water usage for mixer showers	72.7736	71.6799	70.0863	67.0371	64.7869	62.2775	60.8511	62.4327	64.1664	66.8608	69.9754	72.4947 (42a)
Hot water usage for baths	31.4182	30.9516	30.2945	29.0830	28.1758	27.1699	26.6266	27.2790	27.9895	29.0658	30.3023	31.3120 (42b)
Hot water usage for other uses	44.2863	42.6759	41.0655	39.4551	37.8447	36.2342	36.2342	37.8447	39.4551	41.0655	42.6759	44.2863 (42c)
Average daily hot water use (litres/day)												136.4847 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	148.4781	145.3074	141.4463	135.5752	130.8074	125.6816	123.7119	127.5564	131.6110	136.9921	142.9537	148.0930 (44)
Energy content (annual)	235.1530	206.9158	217.3977	185.5956	176.0919	154.5402	149.6188	157.9415	162.2895	185.8970	203.6637	231.8779 (45)
Distribution loss (46)m = 0.15 x (45)m	35.2729	31.0374	32.6096	27.8393	26.4138	23.1810	22.4428	23.6912	24.3434	27.8845	30.5496	34.7817 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	286.1119	252.9432	268.3566	234.9107	227.0508	203.8553	200.5777	208.9004	211.6045	236.8559	252.9788	282.8368 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	286.1119	252.9432	268.3566	234.9107	227.0508	203.8553	200.5777	208.9004	211.6045	236.8559	252.9788	282.8368 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 2866.9826 (64)											
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	90.9281	80.3064	85.0244	74.0393	71.2903	63.7134	62.4880	65.2553	66.2900	74.5505	80.0469	89.8391 (65)

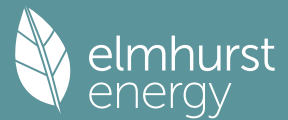
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	151.2834	167.4923	151.2834	156.3261	151.2834	156.3261	151.2834	151.2834	156.3261	151.2834	156.3261	151.2834 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.1178	301.2114	293.4158	276.8199	255.8705	236.1811	223.0273	219.9338	227.7294	244.3253	265.2747	284.9641 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792 (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)	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336 (71)
Water heating gains (Table 5)	122.2152	119.5035	114.2802	102.8324	95.8203	88.4908	83.9892	87.7087	92.0695	100.2022	111.1763	120.7515 (72)
Total internal gains	641.0540	657.6448	628.4169	605.4160	572.4117	547.4356	524.7375	525.3635	542.5626	565.2485	602.2147	626.4366 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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					W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast				3.9000	11.2829		0.4000		0.8000		0.7700		9.7582 (75)
Southeast				12.9100	36.7938		0.4000		0.8000		0.7700		105.3379 (77)
Northwest				6.2100	11.2829		0.4000		0.8000		0.7700		15.5381 (81)

Solar gains	130.6341	230.9207	338.2740	456.5468	545.5155	556.5899	530.3617	461.6909	378.8708	261.2341	157.9997	110.8055	(83)
Total gains	771.6881	888.5654	966.6909	1061.9627	1117.9272	1104.0255	1055.0992	987.0543	921.4334	826.4826	760.2144	737.2420	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.7266	73.9643	74.2036	75.4234	75.6722	76.9411	76.9411	77.2000	76.4285	75.6722	75.1762	74.6867	
alpha	5.9151	5.9310	5.9469	6.0282	6.0448	6.1294	6.1294	6.1467	6.0952	6.0448	6.0117	5.9791	
util living area	0.9981	0.9951	0.9873	0.9542	0.8559	0.6597	0.4874	0.5402	0.8026	0.9700	0.9952	0.9985	(86)
MIT	19.9058	20.0711	20.3032	20.6234	20.8664	20.9789	20.9971	20.9948	20.9333	20.6202	20.2135	19.8863	(87)
Th 2	20.1320	20.1346	20.1371	20.1499	20.1525	20.1653	20.1653	20.1679	20.1602	20.1525	20.1474	20.1422	(88)
util rest of house	0.9974	0.9935	0.9830	0.9384	0.8115	0.5829	0.3967	0.4458	0.7336	0.9565	0.9934	0.9980	(89)
MIT 2	18.8443	19.0574	19.3540	19.7606	20.0381	20.1531	20.1643	20.1660	20.1142	19.7646	19.2495	18.8271	(90)
Living area fraction	19.0411	19.2453	19.5299	19.9206	20.1917	20.3061	20.3187	20.3196	20.2660	19.9232	19.4282	19.0234	(91)
MIT	19.0411	19.2453	19.5299	19.9206	20.1917	20.3061	20.3187	20.3196	20.2660	19.9232	19.4282	19.0234	(92)
Temperature adjustment	18.8911	19.0953	19.3799	19.7706	20.0417	20.1561	20.1687	20.1696	20.1160	19.7732	19.2782	-0.1500	
adjusted MIT	18.8911	19.0953	19.3799	19.7706	20.0417	20.1561	20.1687	20.1696	20.1160	19.7732	19.2782	18.8734	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9907	0.9778	0.9296	0.8049	0.5820	0.3970	0.4460	0.7296	0.9485	0.9906	0.9970	(94)
Useful gains	768.6626	880.3408	945.2419	987.2074	899.8745	642.5907	418.9016	440.1837	672.2636	783.9090	753.0851	735.0043	(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	1791.2056	1737.0158	1570.9802	1304.4513	997.7003	653.5776	419.7928	441.9369	712.4209	1097.1490	1466.1724	1778.1586	(97)
Space heating kWh	760.7720	575.6856	465.5494	228.4156	72.7824	0.0000	0.0000	0.0000	0.0000	233.0506	513.4229	776.1068	(98a)
Space heating requirement - total per year (kWh/year)												3625.7852	
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	760.7720	575.6856	465.5494	228.4156	72.7824	0.0000	0.0000	0.0000	0.0000	233.0506	513.4229	776.1068	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3625.7852	
Space heating per m2										(98c) / (4) =		27.8200	(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 %)													89.5000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	760.7720	575.6856	465.5494	228.4156	72.7824	0.0000	0.0000	0.0000	0.0000	233.0506	513.4229	776.1068	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	850.0246	643.2241	520.1669	255.2130	81.3211	0.0000	0.0000	0.0000	0.0000	260.3917	573.6568	867.1584	(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	286.1119	252.9432	268.3566	234.9107	227.0508	203.8553	200.5777	208.9004	211.6045	236.8559	252.9788	282.8368	(64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	262.7408	231.1909	242.9024	207.3694	196.7507	172.6706	167.1719	176.4709	181.3290	207.7061	227.5572	259.0815	(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	86.9386	78.5252	86.9386	84.1341	86.9386	84.1341	86.9386	86.9386	84.1341	86.9386	84.1341	86.9386	(223)
Lighting	31.4337	25.2173	22.7054	16.6349	12.8493	10.4980	11.7216	15.2361	19.7902	25.9658	29.3283	32.3073	(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)
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)
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)
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)
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)
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)
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)
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)
Annual totals kWh/year													
Space heating fuel - main system 1												4051.1567	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

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Efficiency of water heater	89.5000
Water heating fuel used	2532.9414 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)	
mechanical ventilation fans (SFP = 0.9100)	382.6320 (230a)
central heating pump	41.0000 (230c)
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)
Total electricity for the above, kWh/year	1023.6320 (231)
Electricity for lighting (calculated in Appendix L)	253.6879 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	7861.4180 (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	4051.1567	0.2100	850.7429 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2532.9414	0.2100	531.9177 (264)
Space and water heating			1382.6606 (265)
Pumps, fans and electric keep-hot	1023.6320	0.1387	141.9904 (267)
Energy for lighting	253.6879	0.1443	36.6150 (268)
Total CO2, kg/year			1561.2660 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.9800 (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	4051.1567	1.1300	4577.8070 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2532.9414	1.1300	2862.2238 (278)
Space and water heating			7440.0308 (279)
Pumps, fans and electric keep-hot	1023.6320	1.5128	1548.5505 (281)
Energy for lighting	253.6879	1.5338	389.1150 (282)
Total Primary energy kWh/year			9377.6963 (286)
Dwelling Primary energy Rate (DPER)			71.9500 (287)

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

1. Overall dwelling characteristics

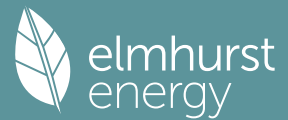
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	52.2500 (1b)	x 2.5000 (2b)	= 130.6250 (1b) - (3b)
First floor	43.6200 (1c)	x 2.9000 (2c)	= 126.4980 (1c) - (3c)
Second floor	34.4600 (1d)	x 2.5400 (2d)	= 87.5284 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.6514 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1161 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3661 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3386 (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)

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Adj infilt rate	0.4317	0.4233	0.4148	0.3725	0.3640	0.3217	0.3217	0.3132	0.3386	0.3640	0.3809	0.3979 (22b)
Effective ac	0.5932	0.5896	0.5860	0.5694	0.5662	0.5517	0.5517	0.5491	0.5573	0.5662	0.5726	0.5791 (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	
Main dwelling								
TER Opaque door			2.7000	1.0000	2.7000			(26)
TER Opening Type			23.0200	1.1450	26.3588			(27)
GROUND FL			52.3500	0.1300	6.8055			(28a)
External Wall	145.2300	25.7200	119.5100	0.1800	21.5118			(29a)
Ext. Roof - flat	43.2000		43.2000	0.1100	4.7520			(30)
Ext. Roof - Pitched	27.9100		27.9100	0.1100	3.0701			(30)
Total net area of external elements Aum(A, m2)			268.6900					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	65.1982		(33)
Main dwelling								
Party Wall 1			60.5200	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	14.7400	0.0500	0.7370
E3 Sill	14.7400	0.0500	0.7370
E4 Jamb	40.9000	0.0500	2.0450
E5 Ground floor (normal)	21.5400	0.1600	3.4464
E6 Intermediate floor within a dwelling	20.9700	0.0000	0.0000
E13 Gable (insulation at rafter level)	9.5200	0.0800	0.7616
E14 Flat roof	17.2600	0.0800	1.3808
E15 Flat roof with parapet	7.8800	0.5600	4.4128
E16 Corner (normal)	35.8000	0.0900	3.2220
E17 Corner (inverted - internal area greater than external area)	10.8000	-0.0900	-0.9720
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E24 Eaves (insulation at ceiling level - inverted)	18.6300	0.2400	4.4712
E25 Staggered party wall between dwellings	5.4000	0.0600	0.3240
P1 Party wall - Ground floor	9.4900	0.0800	0.7592
P2 Party wall - Intermediate floor within a dwelling	14.5700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.4000	0.1200	0.7680
P5 Party wall - Roof (insulation at rafter level)	6.3500	0.0800	0.5080
R6 Flat ceiling	10.3300	0.0600	0.6198
R7 Flat ceiling (inverted)	12.7800	0.0400	0.5112
R9 Roof to wall (flat ceiling)	9.1300	0.0400	0.3652
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			24.4212 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	89.6194 (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	67.4666	67.0550	66.6516	64.7567	64.4022	62.7518	62.7518	62.4462	63.3875	64.4022	65.1194	65.8692 (38)
Average = Sum(39)m / 12 =	157.0860	156.6744	156.2710	154.3761	154.0216	152.3712	152.3712	152.0656	153.0069	154.0216	154.7388	155.4886 (39)
												154.3744
HLP	1.2053	1.2021	1.1990	1.1845	1.1818	1.1691	1.1691	1.1668	1.1740	1.1818	1.1873	1.1930 (40)
HLP (average)												1.1845
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8958 (42)
Hot water usage for mixer showers												
72.7736	71.6799	70.0863	67.0371	64.7869	62.2775	60.8511	62.4327	64.1664	66.8608	69.9754	72.4947 (42a)	
Hot water usage for baths												
31.4182	30.9516	30.2945	29.0830	28.1758	27.1699	26.6266	27.2790	27.9895	29.0658	30.3023	31.3120 (42b)	
Hot water usage for other uses												
44.2863	42.6759	41.0655	39.4551	37.8447	36.2342	36.2342	37.8447	39.4551	41.0655	42.6759	44.2863 (42c)	
Average daily hot water use (litres/day)												136.4847 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.4781	145.3074	141.4463	135.5752	130.8074	125.6816	123.7119	127.5564	131.6110	136.9921	142.9537	148.0930 (44)
Energy conte	235.1530	206.9158	217.3977	185.5956	176.0919	154.5402	149.6188	157.9415	162.2895	185.8970	203.6637	231.8779 (45)
Energy content (annual)										Total = Sum(45)m =		2266.9826
Distribution loss (46)m = 0.15 x (45)m												
35.2729	31.0374	32.6096	27.8393	26.4138	23.1810	22.4428	23.6912	24.3434	27.8845	30.5496	34.7817 (46)	
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
286.1119	252.9432	268.3566	234.9107	227.0508	203.8553	200.5777	208.9004	211.6045	236.8559	252.9788	282.8368 (62)	
WWHRS	-33.2690	-29.4234	-30.8105	-25.5123	-23.7766	-20.3458	-19.0709	-20.2800	-21.0505	-24.8162	-28.1138	-32.6529 (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 (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 (63c)	
FGHRS	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	252.8429	223.5198	237.5461	209.3984	203.2742	183.5095	181.5068	188.6204	190.5540	212.0397	224.8650	250.1839 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2557.8606 (64)
Electric shower(s)												2558 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
90.9281	80.3064	85.0244	74.0393	71.2903	63.7134	62.4880	65.2553	66.2900	74.5505	80.0469	89.8391 (65)	

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

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.0529	170.5586	154.0529	159.1880	154.0529	159.1880	154.0529	154.0529	159.1880	154.0529	159.1880	154.0529	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.1178	301.2114	293.4158	276.8199	255.8705	236.1811	223.0273	219.9338	227.7294	244.3253	265.2747	284.9641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	(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)	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	(71)
Water heating gains (Table 5)	122.2152	119.5035	114.2802	102.8324	95.8203	88.4908	83.9892	87.7087	92.0695	100.2022	111.1763	120.7515	(72)
Total internal gains	643.8235	660.7111	631.1865	608.2779	575.1813	550.2975	527.5071	528.1330	545.4245	568.0181	605.0766	629.2061	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				
Northeast					3.9000	11.2829		0.6300	0.7000	0.7700		13.4480 (75)				
Southeast					12.9100	36.7938		0.6300	0.7000	0.7700		145.1687 (77)				
Northwest					6.2100	11.2829		0.6300	0.7000	0.7700		21.4134 (81)				
Solar gains					180.0302	318.2375	466.1839	629.1785	751.7885	767.0504	730.9047	636.2677	522.1313	360.0133	217.7434	152.7038 (83)
Total gains					823.8537	978.9486	1097.3704	1237.4564	1326.9698	1317.3480	1258.4118	1164.4008	1067.5558	928.0313	822.8200	781.9099 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.6162	57.7675	57.9167	58.6276	58.7625	59.3990	59.3990	59.5184	59.1522	58.7625	58.4901	58.2081	
alpha	4.8411	4.8512	4.8611	4.9085	4.9175	4.9599	4.9599	4.9679	4.9435	4.9175	4.8993	4.8805	
util living area	0.9975	0.9938	0.9846	0.9510	0.8611	0.6884	0.5215	0.5807	0.8271	0.9701	0.9944	0.9981	(86)
MIT	19.5330	19.7374	20.0336	20.4351	20.7631	20.9440	20.9884	20.9809	20.8585	20.4263	19.9113	19.5050	(87)
Th 2	19.9158	19.9183	19.9208	19.9324	19.9346	19.9448	19.9448	19.9467	19.9409	19.9346	19.9302	19.9256	(88)
util rest of house	0.9966	0.9917	0.9791	0.9328	0.8117	0.5952	0.4023	0.4577	0.7503	0.9555	0.9921	0.9974	(89)
MIT 2	18.2105	18.4732	18.8508	19.3568	19.7339	19.9129	19.9412	19.9399	19.8435	19.3564	18.7047	18.1817	(90)
Living area fraction	18.4557	18.7076	19.0700	19.5567	19.9247	20.1040	20.1353	20.1329	20.0317	19.5547	18.9284	18.4270	(91)
MIT	18.4557	18.7076	19.0700	19.5567	19.9247	20.1040	20.1353	20.1329	20.0317	19.5547	18.9284	18.4270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4557	18.7076	19.0700	19.5567	19.9247	20.1040	20.1353	20.1329	20.0317	19.5547	18.9284	18.4270	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9882	0.9731	0.9248	0.8112	0.6102	0.4244	0.4804	0.7579	0.9484	0.9889	0.9960	(94)
Useful gains	819.6016	967.3924	1067.8239	1144.3615	1076.3807	803.8429	534.0677	559.3357	809.1059	880.1787	813.7256	778.7448	(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	2223.6601	2163.2914	1964.3302	1645.1367	1266.7839	838.6517	538.6782	567.6471	907.5835	1379.2208	1830.3121	2212.1341	(97)
Space heating kWh	1044.6196	803.6441	667.0007	360.5581	141.6599	0.0000	0.0000	0.0000	0.0000	371.2873	731.9422	1066.4416	(98a)
Space heating requirement - total per year (kWh/year)												5187.1535	
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	1044.6196	803.6441	667.0007	360.5581	141.6599	0.0000	0.0000	0.0000	0.0000	371.2873	731.9422	1066.4416	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5187.1535	
Space heating per m2										(98c) / (4) =		39.8001	(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 %)													92.4000 (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	
1044.6196	803.6441	667.0007	360.5581	141.6599	0.0000	0.0000	0.0000	0.0000	0.0000	371.2873	731.9422	1066.4416	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	1130.5406	869.7447	721.8622	390.2144	153.3116	0.0000	0.0000	0.0000	0.0000	401.8261	792.1453	1154.1576	(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	252.8429	223.5198	237.5461	209.3984	203.2742	183.5095	181.5068	188.6204	190.5540	212.0397	224.8650	250.1839	(64)
Efficiency of water heater	87.0825	86.8753	86.4680	85.5345	83.6222	80.3000	80.3000	80.3000	80.3000	85.5688	86.7173	87.1269	(216)
Fuel for water heating, kWh/month													(217)

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	290.3486	257.2881	274.7212	244.8117	243.0863	228.5299	226.0359	234.8946	237.3027	247.8003	259.3080	287.1488	(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	32.0092	25.6789	23.1210	16.9395	13.0845	10.6902	11.9361	15.5150	20.1525	26.4412	29.8653	32.8988	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.9047	-68.9568	-99.1086	-111.3765	-119.9798	-111.8587	-110.3877	-104.2207	-93.3972	-78.7307	-53.7339	-42.2723	(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	-27.5996	-58.0653	-115.4503	-173.4921	-229.5385	-230.7619	-228.1342	-193.1748	-141.5494	-83.1751	-36.8863	-21.8322	(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												5613.8025	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3031.2761	(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)												258.3322	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2582.5872	(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												6406.8237	(238)

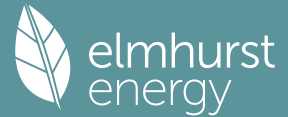
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5613.8025	0.2100	1178.8985 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3031.2761	0.2100	636.5680 (264)
Space and water heating			1815.4665 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	258.3322	0.1443	37.2853 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1042.9274	0.1346	-140.3871
PV Unit electricity exported	-1539.6598	0.1259	-193.7982
Total			-334.1853 (269)
Total CO2, kg/year			1530.4958 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.7400 (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	5613.8025	1.1300	6343.5968 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3031.2761	1.1300	3425.3420 (278)
Space and water heating			9768.9388 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	258.3322	1.5338	396.2386 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1042.9274	1.4975	-1561.7761
PV Unit electricity exported	-1539.6598	0.4620	-711.3695
Total			-2273.1456 (283)
Total Primary energy kWh/year			8022.1326 (286)
Target Primary Energy Rate (TPER)			61.5500 (287)

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Property Reference	UNIT B				Issued on Date	25/02/2025
Assessment Reference	LEAN V2		Prop Type Ref			
Property						
SAP Rating	82 B	DER	12.59	TER	12.51	
Environmental	89 B	% DER < TER				-0.64
CO ₂ Emissions (t/year)	1.19	DFEE	46.48	TFEE	48.90	
Compliance Check	See BREL	% DFEE < TFEE				4.95
% DPER < TPER	-15.36	DPER	75.83	TPER	65.73	
Assessor Details	Ms. Vanessa Vienna				Assessor ID	T798-0001
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)
Main dwelling			
Ground floor	62.5800 (1b)	x 2.5000 (2b)	= 156.4500 (1b) - (3b)
First floor	46.9300 (1c)	x 3.4300 (2c)	= 160.9699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 317.4199 (5)

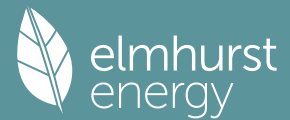
2. Ventilation rate

	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	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.1626 0.1594 0.1562 0.1403 0.1371 0.1211 0.1211 0.1179 0.1275 0.1371 0.1434 0.1498 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.2000 (23c)
Effective ac	0.2866 0.2834 0.2802 0.2642 0.2611 0.2451 0.2451 0.2419 0.2515 0.2611 0.2674 0.2738 (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
Main dwelling							
Opening Type 1			19.6400	1.1450	22.4885		(27)
DOOR			1.8000	1.0000	1.8000		(26)
GROUUND FLOOR			62.5800	0.1000	6.2580		(28a)
External Wall 1	109.5200	21.4400	88.0800	0.1600	14.0928		(29a)
EXT. ROOF - PITCH	50.6300		50.6300	0.1000	5.0630		(30)
EXT. ROOF - FLAT	30.1300		30.1300	0.1000	3.0130		(30)
Total net area of external elements Aum(A, m ²)			252.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.7153		(33)
Main dwelling							
Party Wall 1			66.9700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E1 Steel lintel with perforated steel base plate	13.1000	0.1000	1.3100
E3 Sill	12.1000	0.0400	0.4840
E4 Jamb	33.0000	0.0500	1.6500
E5 Ground floor (normal)	20.4000	0.1000	2.0400
E6 Intermediate floor within a dwelling	6.0100	0.0500	0.3005
E10 Eaves (insulation at ceiling level)	5.0900	0.0600	0.3054
E11 Eaves (insulation at rafter level)	5.0900	0.0400	0.2036
E13 Gable (insulation at rafter level)	12.5200	0.0400	0.5008
E14 Flat roof	5.6800	0.1300	0.7384
E15 Flat roof with parapet	14.3900	0.1500	2.1585
E16 Corner (normal)	20.4000	0.0900	1.8360
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180
E18 Party wall between dwellings	5.0000	0.0600	0.3000
E24 Eaves (insulation at ceiling level - inverted)	11.1300	0.1000	1.1130
E25 Staggered party wall between dwellings	12.8000	0.1200	1.5360
P1 Party wall - Ground floor	15.2600	0.2200	3.3572
P2 Party wall - Intermediate floor within a dwelling	12.7200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6300	0.2800	2.1364
P5 Party wall - Roof (insulation at rafter level)	5.9900	0.2800	1.6772
R4 Ridge (vaulted ceiling)	8.0900	0.1200	0.9708
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			21.6998 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	74.4151 (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	30.0170	29.6831	29.3492	27.6798	27.3459	25.6765	25.6765	25.3426	26.3443	27.3459	28.0137	28.6815 (38)
Average = Sum(39)m / 12 =	104.4322	104.0983	103.7644	102.0950	101.7611	100.0916	100.0916	99.7578	100.7594	101.7611	102.4288	103.0966 (39)
												102.0115
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9536	0.9506	0.9475	0.9323	0.9292	0.9140	0.9140	0.9109	0.9201	0.9292	0.9353	0.9414 (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													2.8119 (42)
Hot water usage for mixer showers													
Hot water usage for baths	71.3653	70.2928	68.7300	65.7399	63.5332	61.0723	59.6736	61.2246	62.9247	65.5670	68.6214	71.0919 (42a)	
Hot water usage for other uses	30.8126	30.3550	29.7106	28.5224	27.6327	26.6462	26.1133	26.7532	27.4500	28.5056	29.7183	30.7085 (42b)	
Average daily hot water use (litres/day)	43.4262	41.8470	40.2679	38.6888	37.1096	35.5305	35.5305	37.1096	38.6888	40.2679	41.8470	43.4262 (42c)	
												133.8430 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	145.6042	142.4949	138.7086	132.9511	128.2756	123.2491	121.3174	125.0875	129.0635	134.3405	140.1867	145.2266 (44)	
Distribution loss (46)m = 0.15 x (45)m	230.6014	202.9109	213.1899	182.0034	172.6836	151.5491	146.7229	154.8844	159.1482	182.2988	199.7216	227.3897 (45)	
Water storage loss:										Total = Sum(45)m =		2223.1040	
Total storage loss	34.5902	30.4366	31.9785	27.3005	25.9025	22.7324	22.0084	23.2327	23.8722	27.3448	29.9582	34.1085 (46)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
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 (57)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (59)	
Total heat required for water heating calculated for each month	281.5603	248.9383	264.1488	231.3185	223.6425	200.8642	197.6818	205.8433	208.4633	233.2577	249.0367	278.3486 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	281.5603	248.9383	264.1488	231.3185	223.6425	200.8642	197.6818	205.8433	208.4633	233.2577	249.0367	278.3486 (64)	
12Total per year (kWh/year)												2823.1040 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
												0.0000 (64a)	
Heat gains from water heating, kWh/month	89.4147	78.9747	83.6254	72.8449	70.1570	62.7188	61.5251	64.2388	65.2456	73.3541	78.7362	88.3468 (65)	

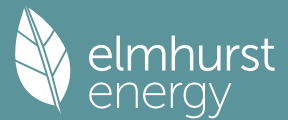
5. Internal gains (see Table 5 and 5a)

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	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	137.2509	151.9563	137.2509	141.8259	137.2509	137.2509	137.2509	137.2509	141.8259	137.2509	141.8259	137.2509 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	270.8501	273.6607	266.5782	251.5002	232.4670	214.5785	202.6279	199.8173	206.8999	221.9778	241.0110	258.8995 (68)
Pumps, fans	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741 (71)
Total internal gains	120.1810	117.5219	112.3997	101.1735	94.2971	87.1095	82.6950	86.3425	90.6188	98.5942	109.3558	118.7457 (72)
	596.4598	611.3167	584.4065	562.6774	532.1928	508.6917	487.7516	488.5884	504.5224	526.0006	560.3705	583.0739 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	

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East	8.2200	19.6403	0.4000	0.8000	0.7700	35.8016 (76)
South	3.9600	46.7521	0.4000	0.8000	0.7700	41.0562 (78)
West	7.4600	19.6403	0.4000	0.8000	0.7700	32.4915 (80)

Solar gains	109.3493	200.8353	305.6644	417.6805	494.1219	499.6366	478.1033	421.3217	345.3572	231.0467	133.8191	91.6373 (83)
Total gains	705.8091	812.1520	890.0709	980.3579	1026.3146	1008.3282	965.8549	909.9102	849.8796	757.0474	694.1896	674.7111 (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	72.8211	73.0546	73.2897	74.4881	74.7325	75.9790	75.9790	76.2333	75.4754	74.7325	74.2453	73.7644
alpha	5.8547	5.8703	5.8860	5.9659	5.9822	6.0653	6.0653	6.0822	6.0317	5.9822	5.9497	5.9176
util living area	0.9970	0.9926	0.9809	0.9351	0.8198	0.6199	0.4538	0.5004	0.7594	0.9575	0.9928	0.9977 (86)
MIT	19.9439	20.1165	20.3582	20.6752	20.8929	20.9841	20.9979	20.9964	20.9491	20.6600	20.2517	19.9226 (87)
Th 2	20.1222	20.1247	20.1273	20.1401	20.1427	20.1556	20.1556	20.1582	20.1505	20.1427	20.1376	20.1324 (88)
util rest of house	0.9961	0.9903	0.9747	0.9145	0.7709	0.5447	0.3679	0.4109	0.6871	0.9397	0.9901	0.9969 (89)
MIT 2	18.8855	19.1072	19.4145	19.8118	20.0538	20.1466	20.1549	20.1569	20.1167	19.8029	19.2904	18.8660 (90)
Living area fraction	FLA = Living area / (4) =											0.4106 (91)
MIT	19.3200	19.5216	19.8019	20.1663	20.3983	20.4905	20.5010	20.5015	20.4585	20.1548	19.6850	19.2998 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1700	19.3716	19.6519	20.0163	20.2483	20.3405	20.3510	20.3515	20.3085	20.0048	19.5350	19.1498 (93)

8. Space heating requirement

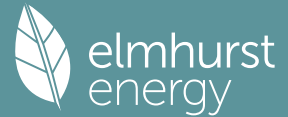
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9946	0.9876	0.9703	0.9111	0.7774	0.5616	0.3879	0.4317	0.7015	0.9362	0.9875	0.9958 (94)
Useful gains	701.9859	802.0508	863.6625	893.1642	797.8926	566.2592	374.6999	392.8135	596.1489	708.7216	685.5273	671.8439 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1552.9086	1506.4666	1364.7034	1134.9170	869.8856	574.5720	375.4452	394.1961	625.5625	957.0376	1273.7077	1541.2719 (97)
Space heating kWh	633.0865	473.3675	372.7744	174.0620	53.5627	0.0000	0.0000	0.0000	0.0000	184.7471	423.4899	646.8544 (98a)
Space heating requirement - total per year (kWh/year)												2961.9444
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	633.0865	473.3675	372.7744	174.0620	53.5627	0.0000	0.0000	0.0000	0.0000	184.7471	423.4899	646.8544 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2961.9444
Space heating per m2										(98c) / (4) =		27.0473 (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 %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	633.0865	473.3675	372.7744	174.0620	53.5627	0.0000	0.0000	0.0000	0.0000	184.7471	423.4899	646.8544 (98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)	707.3592	528.9022	416.5077	194.4827	59.8466	0.0000	0.0000	0.0000	0.0000	206.4213	473.1730	722.7424 (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	281.5603	248.9383	264.1488	231.3185	223.6425	200.8642	197.6818	205.8433	208.4633	233.2577	249.0367	278.3486 (64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (216)
Fuel for water heating, kWh/month	257.6552	226.7161	238.2010	203.3557	192.9426	169.3286	163.9362	173.0552	177.8192	203.6858	223.1526	254.0667 (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	78.8454	71.2152	78.8454	76.3020	78.8454	76.3020	78.8454	78.8454	76.3020	78.8454	76.3020	78.8454 (231)
Lighting	28.5180	22.8782	20.5993	15.0919	11.6574	9.5242	10.6343	13.8229	17.9545	23.5573	26.6080	29.3106 (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												3309.4351 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												89.5000

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Water heating fuel used	2483.9150 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)	
mechanical ventilation fans (SFP = 0.7420)	287.3412 (230a)
central heating pump	41.0000 (230c)
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)
Total electricity for the above, kWh/year	928.3412 (231)
Electricity for lighting (calculated in Appendix L)	230.1567 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	6951.8481 (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	3309.4351	0.2100	694.9814 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2483.9150	0.2100	521.6222 (264)
Space and water heating			1216.6035 (265)
Pumps, fans and electric keep-hot	928.3412	0.1387	128.7724 (267)
Energy for lighting	230.1567	0.1443	33.2187 (268)
Total CO2, kg/year			1378.5946 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.5900 (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	3309.4351	1.1300	3739.6617 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2483.9150	1.1300	2806.8240 (278)
Space and water heating			6546.4857 (279)
Pumps, fans and electric keep-hot	928.3412	1.5128	1404.3946 (281)
Energy for lighting	230.1567	1.5338	353.0221 (282)
Total Primary energy kWh/year			8303.9023 (286)
Dwelling Primary energy Rate (DPER)			75.8300 (287)

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

1. Overall dwelling characteristics

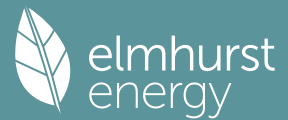
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	62.5800 (1b)	x 2.5000 (2b)	= 156.4500 (1b) - (3b)
First floor	46.9300 (1c)	x 3.4300 (2c)	= 160.9699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	317.4199 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1260 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3760 (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) = 0.3196 (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	0.4075	0.3995	0.3915	0.3516	0.3436	0.3036	0.3036	0.2956	0.3196	0.3436	0.3596	0.3755 (22b)

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Effective ac 0.5830 0.5798 0.5766 0.5618 0.5590 0.5461 0.5461 0.5437 0.5511 0.5590 0.5646 0.5705 (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	
Main dwelling								
TER Opaque door			1.8000	1.0000	1.8000			(26)
TER Opening Type			19.6400	1.1450	22.4885			(27)
GROUUND FLOOR			62.5800	0.1300	8.1354			(28a)
External Wall 1	109.5200	21.4400	88.0800	0.1800	15.8544			(29a)
EXT. ROOF - PITCH	50.6300		50.6300	0.1100	5.5693			(30)
EXT. ROOF - FLAT	30.1300		30.1300	0.1100	3.3143			(30)
Total net area of external elements Aum(A, m2)			252.8600					(31)
Fabric heat loss, W/K = Sum (A x U)					57.1619			(33)
Main dwelling								
Party Wall 1			66.9700	0.0000	0.0000			(32)

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

250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	13.1000	0.0500	0.6550	
E3 Sill	12.1000	0.0500	0.6050	
E4 Jamb	33.0000	0.0500	1.6500	
E5 Ground floor (normal)	20.4000	0.1600	3.2640	
E6 Intermediate floor within a dwelling	6.0100	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	5.0900	0.0600	0.3054	
E11 Eaves (insulation at rafter level)	5.0900	0.0400	0.2036	
E13 Gable (insulation at rafter level)	12.5200	0.0800	1.0016	
E14 Flat roof	5.6800	0.0800	0.4544	
E15 Flat roof with parapet	14.3900	0.5600	8.0584	
E16 Corner (normal)	20.4000	0.0900	1.8360	
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180	
E18 Party wall between dwellings	5.0000	0.0600	0.3000	
E24 Eaves (insulation at ceiling level - inverted)	11.1300	0.2400	2.6712	
E25 Staggered party wall between dwellings	12.8000	0.0600	0.7680	
P1 Party wall - Ground floor	15.2600	0.0800	1.2208	
P2 Party wall - Intermediate floor within a dwelling	12.7200	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	7.6300	0.1200	0.9156	
P5 Party wall - Roof (insulation at rafter level)	5.9900	0.0800	0.4792	
R4 Ridge (vaulted ceiling)	8.0900	0.0800	0.6472	

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

24.1174 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.2793 (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	61.0717	60.7339	60.4029	58.8480	58.5571	57.2028	57.2028	56.9520	57.7245	58.5571	59.1456	59.7609	(38)
Average = Sum(39)m / 12 =	142.3510	142.0133	141.6823	140.1274	139.8364	138.4822	138.4822	138.2314	139.0038	139.8364	140.4250	141.0402	(39)

140.1260

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2999	1.2968	1.2938	1.2796	1.2769	1.2646	1.2646	1.2623	1.2693	1.2769	1.2823	1.2879	(40)
HLP (average)												1.2796	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8119 (42)
Hot water usage for mixer showers													
71.3653	70.2928	68.7300	65.7399	63.5332	61.0723	59.6736	61.2246	62.9247	65.5670	68.6214	71.0919	71.0919	(42a)
Hot water usage for baths													
30.8126	30.3550	29.7106	28.5224	27.6327	26.6462	26.1133	26.7532	27.4500	28.5056	29.7183	30.7085	30.7085	(42b)
Hot water usage for other uses													
43.4262	41.8470	40.2679	38.6888	37.1096	35.5305	35.5305	37.1096	38.6888	40.2679	41.8470	43.4262	43.4262	(42c)
Average daily hot water use (litres/day)													133.8430 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.6042	142.4949	138.7086	132.9511	128.2756	123.2491	121.3174	125.0875	129.0635	134.3405	140.1867	145.2266	(44)
Energy conte	230.6014	202.9109	213.1899	182.0034	172.6836	151.5491	146.7229	154.8844	159.1482	182.2988	199.7216	227.3897	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													2223.1040

34.5902	30.4366	31.9785	27.3005	25.9025	22.7324	22.0084	23.2327	23.8722	27.3448	29.9582	34.1085	(46)
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Water storage loss:

Total storage loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)

If cylinder contains dedicated solar storage

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Combi loss 50.9589 46.0274 50.9589 49.3151 50.9589 49.3151 50.9589 50.9589 49.3151 50.9589 49.3151 50.9589 (61)

Total heat required for water heating calculated for each month

281.5603 248.9383 264.1488 231.3185 223.6425 200.8642 197.6818 205.8433 208.4633 233.2577 249.0367 278.3486 (62)

WWHRS -32.6252 -28.8540 -30.2143 -25.0186 -23.3165 -19.9521 -18.7019 -19.8876 -20.6432 -24.3360 -27.5698 -32.0211 (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 248.9351 220.0842 233.9345 206.2998 200.3260 180.9121 178.9800 185.9558 187.8201 208.9217 221.4669 246.3275 (64)

Total per year (kWh/year) = Sum(64)m = 2519.9638 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

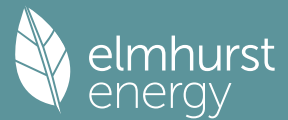
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 89.4147 78.9747 83.6254 72.8449 70.1570 62.7188 61.5251 64.2388 65.2456 73.3541 78.7362 88.3468 (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	
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(66)m	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.6120	154.5704	139.6120	144.2657	139.6120	144.2657	139.6120	139.6120	144.2657	139.6120	144.2657	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8501	273.6607	266.5782	251.5002	232.4670	214.5785	202.6279	199.8173	206.8999	221.9778	241.0110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	(71)
Water heating gains (Table 5)	120.1810	117.5219	112.3997	101.1735	94.2971	87.1095	82.6950	86.3425	90.6188	98.5942	109.3558	(72)
Total internal gains	598.8210	613.9308	586.7676	565.1172	534.5539	511.1315	490.1127	490.9495	506.9622	528.3618	562.8103	(73)

6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East	8.2200				19.6403		0.6300		0.7000		0.7700		49.3391 (76)
South	3.9600				46.7521		0.6300		0.7000		0.7700		56.5806 (78)
West	7.4600				19.6403		0.6300		0.7000		0.7700		44.7773 (80)
Solar gains	150.6970	276.7761	421.2437	575.6160	680.9617	688.5616	658.8861	580.6340	475.9454	318.4113	184.4194	126.2876	(83)
Total gains	749.5180	890.7069	1008.0113	1140.7332	1215.5156	1199.6931	1148.9988	1071.5836	982.9076	846.7730	747.2297	711.7226	(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	53.4233	53.5503	53.6755	54.2711	54.3840	54.9158	54.9158	55.0154	54.7097	54.3840	54.1560	53.9198
alpha	4.5616	4.5700	4.5784	4.6181	4.6256	4.6611	4.6611	4.6677	4.6473	4.6256	4.6104	4.5947
util living area	0.9965	0.9917	0.9801	0.9412	0.8488	0.6814	0.5170	0.5711	0.8127	0.9641	0.9926	0.9972 (86)
MIT	19.4464	19.6623	19.9827	20.4053	20.7429	20.9340	20.9853	20.9771	20.8464	20.3896	19.8432	19.4151 (87)
Th 2	19.8409	19.8433	19.8457	19.8569	19.8590	19.8687	19.8687	19.8705	19.8649	19.8590	19.8547	19.8503 (88)
util rest of house	0.9952	0.9889	0.9730	0.9197	0.7952	0.5832	0.3908	0.4418	0.7301	0.9466	0.9896	0.9963 (89)
MIT 2	18.0481	18.3248	18.7318	19.2602	19.6450	19.8319	19.8643	19.8628	19.7620	19.2534	18.5648	18.0145 (90)
Living area fraction	18.6222	18.8739	19.2453	19.7303	20.0957	20.2843	20.3245	20.3203	20.2072	19.7199	19.0897	18.5895 (92)
MIT	18.6222	18.8739	19.2453	19.7303	20.0957	20.2843	20.3245	20.3203	20.2072	19.7199	19.0897	18.5895 (93)
Temperature adjustment	18.6222	18.8739	19.2453	19.7303	20.0957	20.2843	20.3245	20.3203	20.2072	19.7199	19.0897	18.5895 (93)
adjusted MIT	18.6222	18.8739	19.2453	19.7303	20.0957	20.2843	20.3245	20.3203	20.2072	19.7199	19.0897	18.5895 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9934	0.9857	0.9682	0.9168	0.8077	0.6213	0.4429	0.4951	0.7578	0.9438	0.9867	0.9947 (94)
Useful gains	744.5632	877.9399	975.9068	1045.8453	981.7384	745.3550	508.9105	530.5537	744.8844	799.2175	737.3052	707.9636 (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	2038.7761	1984.4813	1805.7876	1517.6219	1174.0316	787.1789	515.7815	541.9037	848.9267	1275.2946	1683.6521	2029.5020 (97)
Space heating kWh	962.8944	743.5958	617.4313	339.6791	143.0661	0.0000	0.0000	0.0000	0.0000	354.2014	681.3698	983.2245 (98a)
Space heating requirement - total per year (kWh/year)												4825.4625
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	962.8944	743.5958	617.4313	339.6791	143.0661	0.0000	0.0000	0.0000	0.0000	354.2014	681.3698	983.2245 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4825.4625
Space heating per m2										(98c) / (4) =		44.0641 (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 %)												92.4000 (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	962.8944	743.5958	617.4313	339.6791	143.0661	0.0000	0.0000	0.0000	0.0000	354.2014	681.3698	983.2245 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	1042.0935	804.7574	668.2157	367.6181	154.8334	0.0000	0.0000	0.0000	0.0000	383.3348	737.4132	1064.0958 (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	248.9351	220.0842	233.9345	206.2998	200.3260	180.9121	178.9800	185.9558	187.8201	208.9217	221.4669	246.3275 (64)
Efficiency of water heater (217)m	86.9863	86.7775	86.3586	85.4424	83.6723	80.3000	80.3000	80.3000	80.3000	85.5026	86.6243	87.0326 (217)
Fuel for water heating, kWh/month	286.1774	253.6190	270.8872	241.4491	239.4174	225.2953	222.8891	231.5763	233.8980	244.3453	255.6638	283.0289 (219)
Space cooling fuel requirement												

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(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	29.0086	23.2718	20.9537	15.3516	11.8580	9.6881	10.8172	14.0607	18.2634	23.9626	27.0657	29.8149	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-54.8154	-75.4427	-105.8791	-116.1140	-122.7479	-113.6409	-112.1538	-107.0117	-97.6676	-84.7854	-59.5729	-47.6027	(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	-36.8141	-76.6921	-151.0988	-225.0741	-295.8713	-296.7170	-293.2950	-249.1799	-183.7286	-109.1297	-48.9631	-29.1755	(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												5222.3620	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2988.2470	(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)												234.1161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3093.1733	(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												5437.5518	(238)

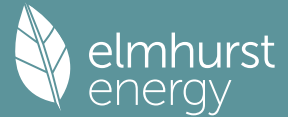
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5222.3620	0.2100	1096.6960 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2988.2470	0.2100	627.5319 (264)
Space and water heating			1724.2279 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	234.1161	0.1443	33.7902 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1097.4340	0.1351	-148.2846
PV Unit electricity exported	-1995.7393	0.1261	-251.7343
Total			-400.0189 (269)
Total CO2, kg/year			1369.9284 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5100 (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	5222.3620	1.1300	5901.2691 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2988.2470	1.1300	3376.7191 (278)
Space and water heating			9277.9882 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	234.1161	1.5338	359.0951 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1097.4340	1.4994	-1645.5012
PV Unit electricity exported	-1995.7393	0.4630	-924.0591
Total			-2569.5603 (283)
Total Primary energy kWh/year			7197.6238 (286)
Target Primary Energy Rate (TPER)			65.7300 (287)

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Property Reference	UNIT C				Issued on Date	25/02/2025
Assessment Reference	LEAN V2		Prop Type Ref			
Property						
SAP Rating	82 B	DER	12.83	TER	13.14	
Environmental	88 B	% DER < TER				2.36
CO ₂ Emissions (t/year)	1.25	DFEE	47.85	TFEE	52.55	
Compliance Check	See BREL	% DFEE < TFEE				8.95
% DPER < TPER	-11.31	DPER	77.02	TPER	69.19	
Assessor Details	Ms. Vanessa Vienna				Assessor ID	T798-0001
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)
Main dwelling			
Ground floor	65.4400 (1b)	x 2.5000 (2b)	= 163.6000 (1b) - (3b)
First floor	46.9300 (1c)	x 3.4300 (2c)	= 160.9699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 324.5699 (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	3.0000 (17)											
Infiltration rate	0.1500 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)											
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												75.2000 (23c)
Effective ac	0.2866	0.2834	0.2802	0.2642	0.2611	0.2451	0.2451	0.2419	0.2515	0.2611	0.2674	0.2738 (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
Main dwelling							
Opening Type 1			18.6800	1.1450	21.3893		(27)
Door			1.8000	1.0000	1.8000		(26)
ground floor			65.4400	0.1000	6.5440		(28a)
External Wall	150.0700	20.4800	129.5900	0.1600	20.7344		(29a)
Ext. Roof - Pitch	50.6300		50.6300	0.1000	5.0630		(30)
Ext. Roof - Flat	32.9900		32.9900	0.1000	3.2990		(30)
Total net area of external elements Aum(A, m ²)			299.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.8297		(33)
Main dwelling							
Party Wall 1			30.6700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E1 Steel lintel with perforated steel base plate	12.8200	0.1000	1.2820
E3 Sill	11.8200	0.0400	0.4728
E4 Jamb	32.4400	0.0500	1.6220
E5 Ground floor (normal)	30.3900	0.1000	3.0390
E6 Intermediate floor within a dwelling	13.6400	0.0500	0.6820
E10 Eaves (insulation at ceiling level)	5.0900	0.0600	0.3054
E11 Eaves (insulation at rafter level)	11.0900	0.0400	0.4436
E13 Gable (insulation at rafter level)	12.5200	0.0400	0.5008
E14 Flat roof	5.8800	0.1300	0.7644
E15 Flat roof with parapet	16.5400	0.1500	2.4810
E16 Corner (normal)	22.9000	0.0900	2.0610
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180
E18 Party wall between dwellings	2.5000	0.0600	0.1500
E24 Eaves (insulation at ceiling level - inverted)	11.1300	0.1000	1.1130
E25 Staggered party wall between dwellings	7.7000	0.1200	0.9240
P1 Party wall - Ground floor	6.9700	0.2200	1.5334
P2 Party wall - Intermediate floor within a dwelling	5.0900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.9700	0.2800	1.9516
R4 Ridge (vaulted ceiling)	8.0900	0.1200	0.9708
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.3788 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	78.2085 (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	30.6932	30.3517	30.0103	28.3033	27.9619	26.2549	26.2549	25.9135	26.9377	27.9619	28.6447	29.3275	(38)
Heat transfer coeff	108.9017	108.5603	108.2189	106.5118	106.1704	104.4634	104.4634	104.1220	105.1462	106.1704	106.8532	107.5360	(39)
Average = Sum(39)m / 12 =												106.4265	
HLP	0.9691	0.9661	0.9631	0.9479	0.9448	0.9296	0.9296	0.9266	0.9357	0.9448	0.9509	0.9570	(40)
HLP (average)												0.9471	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8283 (42)
Hot water usage for mixer showers	71.6416	70.5649	68.9961	65.9943	63.7791	61.3087	59.9046	61.4616	63.1683	65.8208	68.8870	71.3671	(42a)
Hot water usage for baths	30.9314	30.4721	29.8252	28.6324	27.7393	26.7489	26.2140	26.8564	27.5558	28.6155	29.8328	30.8269	(42b)
Hot water usage for other uses	43.5949	42.0096	40.4244	38.8391	37.2538	35.6686	35.6686	37.2538	38.8391	40.4244	42.0096	43.5949	(42c)
Average daily hot water use (litres/day)													134.3612 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	146.1679	143.0466	139.2456	133.4658	128.7722	123.7263	121.7872	125.5718	129.5632	134.8606	140.7295	145.7889	(44)
Energy content (annual)	231.4943	203.6965	214.0153	182.7081	173.3522	152.1359	147.2910	155.4841	159.7644	183.0046	200.4949	228.2701	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2231.7114	
	34.7241	30.5545	32.1023	27.4062	26.0028	22.8204	22.0937	23.3226	23.9647	27.4507	30.0742	34.2405	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	282.4532	249.7239	264.9742	232.0231	224.3111	201.4509	198.2499	206.4430	209.0795	233.9635	249.8100	279.2290	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	282.4532	249.7239	264.9742	232.0231	224.3111	201.4509	198.2499	206.4430	209.0795	233.9635	249.8100	279.2290	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2831.7114	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month	89.7116	79.2359	83.8998	73.0792	70.3793	62.9139	61.7140	64.4382	65.4504	73.5888	78.9933	88.6395	(65)

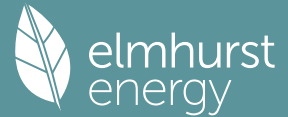
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	140.5032	155.5571	140.5032	145.1866	140.5032	145.1866	140.5032	140.5032	145.1866	140.5032	145.1866	140.5032	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.9180	277.7708	270.5819	255.2775	235.9584	217.8012	205.6711	202.8183	210.0073	225.3117	244.6307	262.7879	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	(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)	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	(71)
Water heating gains (Table 5)	120.5801	117.9106	112.7686	101.4989	94.5959	87.3805	82.9489	86.6105	90.9034	98.9096	109.7129	119.1392	(72)
Total internal gains	604.4262	619.6635	592.2786	570.3879	539.4824	515.7933	494.5482	495.3569	511.5222	533.1494	567.9552	590.8552	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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East	8.2200	19.6403	0.4000	0.8000	0.7700	35.8016 (76)
South	3.4000	46.7521	0.4000	0.8000	0.7700	35.2503 (78)
West	7.0600	19.6403	0.4000	0.8000	0.7700	30.7493 (80)

Solar gains	101.8012	187.9186	287.9395	395.8054	469.8248	475.6388	454.9130	399.8972	326.1768	216.7468	124.7648	85.1877 (83)
Total gains	706.2274	807.5820	880.2181	966.1933	1009.3072	991.4321	949.4611	895.2541	837.6990	749.8963	692.7200	676.0429 (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	71.6561	71.8815	72.1083	73.2639	73.4995	74.7006	74.7006	74.9455	74.2155	73.4995	73.0298	72.5661
alpha	5.7771	5.7921	5.8072	5.8843	5.9000	5.9800	5.9800	5.9964	5.9477	5.9000	5.8687	5.8377
util living area	0.9974	0.9938	0.9844	0.9467	0.8455	0.6521	0.4808	0.5291	0.7880	0.9648	0.9939	0.9980 (86)
MIT	19.9008	20.0670	20.3060	20.6295	20.8672	20.9781	20.9969	20.9947	20.9351	20.6228	20.2113	19.8808 (87)
Th 2	20.1091	20.1117	20.1142	20.1270	20.1296	20.1424	20.1424	20.1449	20.1372	20.1296	20.1244	20.1193 (88)
util rest of house	0.9966	0.9918	0.9792	0.9288	0.7991	0.5740	0.3889	0.4339	0.7165	0.9494	0.9916	0.9973 (89)
MIT 2	18.8207	19.0346	19.3394	19.7478	20.0171	20.1298	20.1414	20.1430	20.0932	19.7483	19.2292	18.8028 (90)
Living area fraction	19.2127	19.4093	19.6902	20.0678	20.3256	20.4376	20.4518	20.4521	20.3987	20.0657	19.5856	19.1940 (92)
MIT	19.2127	19.4093	19.6902	20.0678	20.3256	20.4376	20.4518	20.4521	20.3987	20.0657	19.5856	19.1940 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0627	19.2593	19.5402	19.9178	20.1756	20.2876	20.3018	20.3021	20.2487	19.9157	19.4356	19.0440 (93)

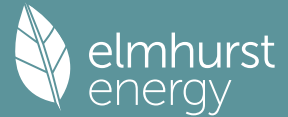
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9951	0.9892	0.9747	0.9237	0.8018	0.5877	0.4062	0.4517	0.7266	0.9446	0.9890	0.9962 (94)
Useful gains	702.7962	798.8549	857.9618	892.4790	809.2382	582.6858	385.6393	404.3434	608.6495	708.3251	685.0927	673.4503 (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	1607.6837	1558.8481	1411.1934	1173.5241	899.8563	594.1494	386.7065	406.2956	646.5156	989.0469	1318.0995	1596.2700 (97)
Space heating kWh	673.2363	510.7154	411.6044	202.3524	67.4199	0.0000	0.0000	0.0000	0.0000	208.8570	455.7649	686.5779 (98a)
Space heating requirement - total per year (kWh/year)												3216.5281
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	673.2363	510.7154	411.6044	202.3524	67.4199	0.0000	0.0000	0.0000	0.0000	208.8570	455.7649	686.5779 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3216.5281
Space heating per m2										(98c) / (4) =		28.6244 (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 %)												89.5000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	673.2363	510.7154	411.6044	202.3524	67.4199	0.0000	0.0000	0.0000	0.0000	208.8570	455.7649	686.5779 (98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)	752.2193	570.6317	459.8932	226.0921	75.3295	0.0000	0.0000	0.0000	0.0000	233.3598	509.2345	767.1261 (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	282.4532	249.7239	264.9742	232.0231	224.3111	201.4509	198.2499	206.4430	209.0795	233.9635	249.8100	279.2290 (64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (216)
Fuel for water heating, kWh/month	258.6528	227.5939	239.1233	204.1431	193.6896	169.9842	164.5710	173.7253	178.5077	204.4744	224.0167	255.0504 (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	79.3951	71.7117	79.3951	76.8340	79.3951	76.8340	79.3951	79.3951	76.8340	79.3951	76.8340	79.3951 (231)
Lighting	29.1938	23.4203	21.0874	15.4495	11.9337	9.7499	10.8863	14.1504	18.3800	24.1156	27.2385	30.0052 (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												3593.8862 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												89.5000
Water heating fuel used												2493.5323 (219)

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Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)		
mechanical ventilation fans (SFP = 0.7420)	293.8137	(230a)
central heating pump	41.0000	(230c)
maintaining electric keep-hot facility for gas combi boiler	600.0000	(230f)
Total electricity for the above, kWh/year	934.8137	(231)
Electricity for lighting (calculated in Appendix L)	235.6106	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7257.8428	(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	3593.8862	0.2100	754.7161	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2493.5323	0.2100	523.6418	(264)
Space and water heating			1278.3579	(265)
Pumps, fans and electric keep-hot	934.8137	0.1387	129.6702	(267)
Energy for lighting	235.6106	0.1443	34.0059	(268)
Total CO2, kg/year			1442.0340	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.8300	(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	3593.8862	1.1300	4061.0914	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2493.5323	1.1300	2817.6915	(278)
Space and water heating			6878.7829	(279)
Pumps, fans and electric keep-hot	934.8137	1.5128	1414.1861	(281)
Energy for lighting	235.6106	1.5338	361.3874	(282)
Total Primary energy kWh/year			8654.3564	(286)
Dwelling Primary energy Rate (DPER)			77.0200	(287)

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

1. Overall dwelling characteristics

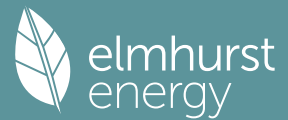
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	65.4400 (1b)	x 2.5000 (2b)	= 163.6000 (1b) - (3b)	
First floor	46.9300 (1c)	x 3.4300 (2c)	= 160.9699 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3700		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	324.5699 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1232 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3732	(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) =	0.3173 (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	0.4045	0.3966	0.3886	0.3490	0.3410	0.3014	0.3014	0.2935	0.3173	0.3410	0.3569	0.3728 (22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8000	1.0000	1.8000			(26)
TER Opening Type			18.6800	1.1450	21.3893			(27)
ground floor			65.4400	0.1300	8.5072			(28a)
External Wall	150.0700	20.4800	129.5900	0.1800	23.3262			(29a)
Ext. Roof - Pitch	50.6300		50.6300	0.1100	5.5693			(30)
Ext. Roof - Flat	32.9900		32.9900	0.1100	3.6289			(30)
Total net area of external elements Aum(A, m2)			299.1300					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	64.2209		(33)
Main dwelling								
Party Wall 1			30.6700	0.0000	0.0000			(32)

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

250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	12.8200	0.0500	0.6410	
E3 Sill	11.8200	0.0500	0.5910	
E4 Jamb	32.4400	0.0500	1.6220	
E5 Ground floor (normal)	30.3900	0.1600	4.8624	
E6 Intermediate floor within a dwelling	13.6400	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	5.0900	0.0600	0.3054	
E11 Eaves (insulation at rafter level)	11.0900	0.0400	0.4436	
E13 Gable (insulation at rafter level)	12.5200	0.0800	1.0016	
E14 Flat roof	5.8800	0.0800	0.4704	
E15 Flat roof with parapet	16.5400	0.5600	9.2624	
E16 Corner (normal)	22.9000	0.0900	2.0610	
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180	
E18 Party wall between dwellings	2.5000	0.0600	0.1500	
E24 Eaves (insulation at ceiling level - inverted)	11.1300	0.2400	2.6712	
E25 Staggered party wall between dwellings	7.7000	0.0600	0.4620	
P1 Party wall - Ground floor	6.9700	0.0800	0.5576	
P2 Party wall - Intermediate floor within a dwelling	5.0900	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	6.9700	0.1200	0.8364	
R4 Ridge (vaulted ceiling)	8.0900	0.0800	0.6472	

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

25.6672 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 89.8881 (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	62.3165	61.9763	61.6427	60.0762	59.7831	58.4187	58.4187	58.1660	58.9443	59.7831	60.3760	60.9959	(38)
Average = Sum(39)m / 12 =	152.2046	151.8644	151.5308	149.9643	149.6712	148.3068	148.3068	148.0542	148.8324	149.6712	150.2641	150.8840	(39)
													149.9629

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3545	1.3515	1.3485	1.3346	1.3319	1.3198	1.3198	1.3176	1.3245	1.3319	1.3372	1.3427	(40)
HLP (average)												1.3345	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

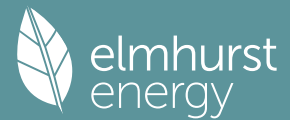
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8283 (42)
Hot water usage for mixer showers													
71.6416	70.5649	68.9961	65.9943	63.7791	61.3087	59.9046	61.4616	63.1683	65.8208	68.8870	71.3671	71.3671	(42a)
Hot water usage for baths													
30.9314	30.4721	29.8252	28.6324	27.7393	26.7489	26.2140	26.8564	27.5558	28.6155	29.8328	30.8269	30.8269	(42b)
Hot water usage for other uses													
43.5949	42.0096	40.4244	38.8391	37.2538	35.6686	35.6686	37.2538	38.8391	40.4244	42.0096	43.5949	43.5949	(42c)
Average daily hot water use (litres/day)													134.3612 (43)
Daily hot water use													
146.1679	143.0466	139.2456	133.4658	128.7722	123.7263	121.7872	125.5718	129.5632	134.8606	140.7295	145.7889	145.7889	(44)
Energy conte	231.4943	203.6965	214.0153	182.7081	173.3522	152.1359	147.2910	155.4841	159.7644	183.0046	200.4949	228.2701	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
34.7241	30.5545	32.1023	27.4062	26.0028	22.8204	22.0937	23.3226	23.9647	27.4507	30.0742	34.2405	34.2405	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
282.4532	249.7239	264.9742	232.0231	224.3111	201.4509	198.2499	206.4430	209.0795	233.9635	249.8100	279.2290	279.2290	(62)
WWHRS	-32.7515	-28.9657	-30.3312	-25.1155	-23.4067	-20.0293	-18.7743	-19.9645	-20.7231	-24.4302	-27.6765	-32.1450	(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													
249.7016	220.7582	234.6430	206.9077	200.9044	181.4216	179.4756	186.4785	188.3564	209.5333	222.1335	247.0840	247.0840	(64)
12Total per year (kWh/year)													
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													
89.7116	79.2359	83.8998	73.0792	70.3793	62.9139	61.7140	64.4382	65.4504	73.5888	78.9933	88.6395	88.6395	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	143.6047	158.9909	143.6047	148.3915	143.6047	148.3915	143.6047	148.3915	143.6047	148.3915	143.6047	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	274.9180	277.7708	270.5819	255.2775	235.9584	217.8012	205.6711	202.8183	210.0073	225.3117	244.6307	(68)
Pumps, fans	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	(71)
Total internal gains	120.5801	117.9106	112.7686	101.4989	94.5959	87.3805	82.9489	86.6105	90.9034	98.9096	109.7129	(72)
	607.5277	623.0973	595.3801	573.5928	542.5839	518.9982	497.6497	498.4585	514.7271	536.2509	571.1601	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					8.2200	19.6403		0.6300	0.7000	0.7700		49.3391 (76)	
South					3.4000	46.7521		0.6300	0.7000	0.7700		48.5793 (78)	
West					7.0600	19.6403		0.6300	0.7000	0.7700		42.3764 (80)	
Solar gains	140.2948	258.9753	396.8166	545.4693	647.4773	655.4897	626.9270	551.1083	449.5124	298.7042	171.9415	117.3993 (83)	
Total gains	747.8225	882.0726	992.1967	1119.0621	1190.0612	1174.4879	1124.5766	1049.5668	964.2396	834.9552	743.1016	711.3561 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.2696	51.3845	51.4976	52.0355	52.1374	52.6171	52.6171	52.7069	52.4313	52.1374	51.9317	51.7183
alpha	4.4180	4.4256	4.4332	4.4690	4.4758	4.5078	4.5078	4.5138	4.4954	4.4758	4.4621	4.4479
util living area	0.9968	0.9930	0.9836	0.9524	0.8751	0.7222	0.5582	0.6133	0.8428	0.9705	0.9936	0.9975 (86)
MIT	19.3479	19.5561	19.8756	20.3089	20.6764	20.9066	20.9771	20.9654	20.8019	20.3109	19.7543	19.3178 (87)
Th 2	19.7984	19.8007	19.8030	19.8139	19.8159	19.8253	19.8253	19.8271	19.8217	19.8159	19.8118	19.8075 (88)
util rest of house	0.9957	0.9905	0.9776	0.9339	0.8257	0.6215	0.4201	0.4739	0.7639	0.9554	0.9909	0.9966 (89)
MIT 2	17.8933	18.1604	18.5675	19.1132	19.5409	19.7719	19.8184	19.8152	19.6852	19.1268	18.4223	17.8610 (90)
Living area fraction	18.4211	18.6669	19.0422	19.5472	19.9529	20.1837	20.2389	20.2326	20.0905	19.5565	18.9057	18.3897 (92)
MIT	18.4211	18.6669	19.0422	19.5472	19.9529	20.1837	20.2389	20.2326	20.0905	19.5565	18.9057	18.3897 (93)
Temperature adjustment												0.0000
adjusted MIT	18.4211	18.6669	19.0422	19.5472	19.9529	20.1837	20.2389	20.2326	20.0905	19.5565	18.9057	18.3897 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9938	0.9872	0.9724	0.9287	0.8323	0.6547	0.4706	0.5246	0.7846	0.9510	0.9879	0.9950 (94)
Ext temp.	743.2106	870.7780	964.8135	1039.2736	990.4489	768.9208	529.2324	550.6315	756.5443	794.0610	734.1306	707.8134 (95)
Heat loss rate W	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)
Space heating kWh	2149.3041	2090.7015	1900.5315	1596.6957	1235.2279	828.0994	539.6685	567.4324	891.5771	1340.5302	1773.9745	2140.9923 (97)
Space heating requirement - total per year (kWh/year)	1046.1335	819.7886	696.1742	401.3439	182.1156	0.0000	0.0000	0.0000	0.0000	406.5731	748.6876	1066.2851 (98a)
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)	1046.1335	819.7886	696.1742	401.3439	182.1156	0.0000	0.0000	0.0000	0.0000	406.5731	748.6876	1066.2851 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (99)
Space heating per m2	(98c) / (4) = 47.7628 (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 %)	92.4000 (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
1046.1335	819.7886	696.1742	401.3439	182.1156	0.0000	0.0000	0.0000	0.0000	0.0000	406.5731	748.6876	1066.2851 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	1132.1791	887.2171	753.4353	434.3549	197.0948	0.0000	0.0000	0.0000	0.0000	440.0142	810.2680	1153.9882 (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	249.7016	220.7582	234.6430	206.9077	200.9044	181.4216	179.4756	186.4785	188.3564	209.5333	222.1335	247.0840 (64)
Water heating requirement	87.1024	86.9249	86.5630	85.7751	84.1716	80.3000	80.3000	80.3000	80.3000	85.7758	86.7736	87.1442 (217)
Fuel for water heating, kWh/month	286.6758	253.9642	271.0661	241.2212	238.6843	225.9298	223.5064	232.2272	234.5659	244.2803	255.9920	283.5347 (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	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)

Full SAP Calculation Printout



Lighting	29.8382	23.9373	21.5529	15.7906	12.1971	9.9651	11.1266	14.4628	18.7857	24.6479	27.8397	30.6675	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.8727	-78.0468	-109.2137	-119.4032	-125.9158	-116.4587	-114.9331	-109.8175	-100.4693	-87.5399	-61.7270	-49.4167	(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	-38.9444	-81.0408	-159.5085	-237.3777	-311.8349	-312.6531	-309.0454	-262.6526	-193.7872	-115.2375	-51.7693	-30.8704	(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												5808.5516	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2991.6481	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												240.8116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3234.5360	(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												5892.4753	(238)

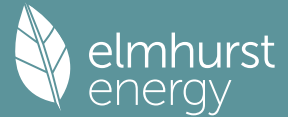
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5808.5516	0.2100	1219.7958 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2991.6481	0.2100	628.2461 (264)
Space and water heating			1848.0419 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	240.8116	0.1443	34.7566 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1129.8142	0.1352	-152.7335
PV Unit electricity exported	-2104.7217	0.1262	-265.5403
Total			-418.2738 (269)
Total CO2, kg/year			1476.4540 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1400 (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	5808.5516	1.1300	6563.6633 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2991.6481	1.1300	3380.5624 (278)
Space and water heating			9944.2257 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	240.8116	1.5338	369.3648 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1129.8142	1.4997	-1694.3290
PV Unit electricity exported	-2104.7217	0.4631	-974.7400
Total			-2669.0690 (283)
Total Primary energy kWh/year			7774.6223 (286)
Target Primary Energy Rate (TPER)			69.1900 (287)

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Property Reference	Unit D				Issued on Date	25/02/2025	
Assessment Reference	LEAN V3			Prop Type Ref			
Property							
SAP Rating	84 B		DER	9.83		TER	9.95
Environmental	90 B		% DER < TER				1.21
CO ₂ Emissions (t/year)	1.23		DFEE	37.10		TFEE	37.31
Compliance Check	See BREL		% DFEE < TFEE				0.57
% DPER < TPER	-15.15		DPER	59.93		TPER	52.04
Assessor Details	Ms. Vanessa Vienna					Assessor ID	T798-0001
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)
Main dwelling			
Ground floor	54.4000 (1b)	x 2.5000 (2b)	= 136.0000 (1b) - (3b)
First floor	45.6100 (1c)	x 2.9000 (2c)	= 132.2690 (1c) - (3c)
Second floor	45.6100 (1d)	x 2.5000 (2d)	= 114.0250 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	382.2940 (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		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												74.4000 (23c)
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778 (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
Main dwelling							
Opening Type 1			18.8900	1.1450	21.6298		(27)
Door			2.0000	1.0000	2.0000		(26)
Rooflight			2.0800	1.1450	2.3817		(27a)
Ground Floor			54.4000	0.1000	5.4400		(28a)
External Wall 1	97.0900	20.8900	76.2000	0.1600	12.1920		(29a)
Ext. Roof - Pitch	68.5900	2.0800	66.5100	0.1000	6.6510		(30)
Ext. Roof - Flat	8.7900		8.7900	0.1000	0.8790		(30)
Total net area of external elements Aum(A, m ²)			228.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1735		(33)
Main dwelling							
Party Wall 1			107.7000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	15.5500	0.1000	1.5550
E6 Intermediate floor within a dwelling	17.9000	0.0500	0.8950
E13 Gable (insulation at rafter level)	16.2300	0.0400	0.6492
E15 Flat roof with parapet	8.4500	0.1500	1.2675
E16 Corner (normal)	5.0000	0.0900	0.4500
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	23.0000	0.0600	1.3800
E24 Eaves (insulation at ceiling level - inverted)	3.7000	0.1000	0.3700
E25 Staggered party wall between dwellings	2.5000	0.1200	0.3000
P1 Party wall - Ground floor	16.9000	0.2200	3.7180
P2 Party wall - Intermediate floor within a dwelling	33.7900	0.0000	0.0000
R4 Ridge (vaulted ceiling)	8.4500	0.1200	1.0140
P5 Party wall - Roof (insulation at rafter level)	16.9000	0.2800	4.7320
E1 Steel lintel with perforated steel base plate	13.5600	0.1000	1.3560
E3 Sill	12.5600	0.0400	0.5024
E4 Jamb	40.9000	0.0500	2.0450
R11 Upstands or kerbs of rooflights	8.4000	0.2400	2.0160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			22.0251 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	73.1986 (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	36.6565	36.2544	35.8522	33.8416	33.4395	31.4289	31.4289	31.0267	32.2331	33.4395	34.2437	35.0480	(38)
Heat transfer coeff	109.8550	109.4529	109.0508	107.0402	106.6380	104.6274	104.6274	104.2253	105.4317	106.6380	107.4423	108.2465	(39)
Average = Sum(39)m / 12 =												106.9396	
HLP	0.7544	0.7516	0.7489	0.7351	0.7323	0.7185	0.7185	0.7157	0.7240	0.7323	0.7378	0.7433	(40)
HLP (average)												0.7344	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9271 (42)
Hot water usage for mixer showers													
73.2978	72.1963	70.5912	67.5200	65.2536	62.7261	61.2895	62.8825	64.6287	67.3424	70.4795	73.0170	73.0170	(42a)
Hot water usage for baths													
33.3091	32.8144	32.1178	30.8334	29.8716	28.8051	28.2291	28.9208	29.6740	30.8152	32.1261	33.1965	33.1965	(42b)
Hot water usage for other uses													
46.9542	45.2468	43.5394	41.8319	40.1245	38.4171	38.4171	40.1245	41.8319	43.5394	45.2468	46.9542	46.9542	(42c)
Average daily hot water use (litres/day)												141.1466	(43)
Daily hot water use													
153.5612	150.2575	146.2483	140.1853	135.2497	129.9483	127.9356	131.9278	136.1346	141.6970	147.8524	153.1677	153.1677	(44)
Energy conte	243.2034	213.9647	224.7783	191.9067	182.0721	159.7866	154.7271	163.3542	167.8676	192.2815	210.6429	239.8237	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
36.4805	32.0947	33.7167	28.7860	27.3108	23.9680	23.2091	24.5031	25.1801	28.8422	31.5964	35.9735	35.9735	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
294.1623	259.9921	275.7372	241.2218	233.0310	209.1017	205.6860	214.3131	217.1827	243.2404	259.9579	290.7826	290.7826	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
294.1623	259.9921	275.7372	241.2218	233.0310	209.1017	205.6860	214.3131	217.1827	243.2404	259.9579	290.7826	290.7826	(64)
Total per year (kWh/year)													
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													
93.6048	82.6501	87.4785	76.1378	73.2787	65.4578	64.1865	67.0550	68.1448	76.6733	82.3675	92.4811	92.4811	(65)

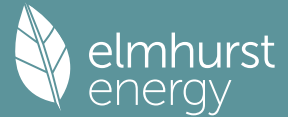
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
164.6070	182.2435	164.6070	170.0939	164.6070	170.0939	164.6070	164.6070	170.0939	164.6070	170.0939	164.6070	164.6070	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
315.7163	318.9925	310.7367	293.1611	270.9751	250.1233	236.1931	232.9170	241.1727	258.7483	280.9344	301.7861	301.7861	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	(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)													
-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	(71)
Water heating gains (Table 5)													
125.8130	122.9913	117.5786	105.7469	98.4929	90.9136	86.2722	90.1277	94.6455	103.0555	114.3993	124.3025	124.3025	(72)
Total internal gains	676.0430	694.1339	662.8290	638.9085	603.9816	578.0375	553.9789	554.5583	572.8188	596.3175	635.3343	660.6023	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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Northeast			12.6400		11.2829		0.4000		0.8000		0.7700		31.6266 (75)
Southeast			1.0400		36.7938		0.4000		0.8000		0.7700		8.4858 (77)
Southwest			5.2100		36.7938		0.4000		0.8000		0.7700		42.5105 (79)
Southeast			2.0800		26.0000		0.4000		0.8000		1.0000		15.5750 (82)

Solar gains	98.1979	183.5905	292.3476	427.6042	536.0116	556.5373	526.4578	442.3112	338.9140	214.2151	120.6445	82.0499	(83)
Total gains	774.2409	877.7244	955.1766	1066.5128	1139.9932	1134.5749	1080.4367	996.8694	911.7328	810.5327	755.9788	742.6522	(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	92.0531	92.3913	92.7320	94.4739	94.8301	96.6525	96.6525	97.0254	95.9152	94.8301	94.1203	93.4210
alpha	7.1369	7.1594	7.1821	7.2983	7.3220	7.4435	7.4435	7.4684	7.3943	7.3220	7.2747	7.2281
util living area	0.9988	0.9966	0.9892	0.9466	0.8105	0.5854	0.4257	0.4799	0.7622	0.9708	0.9965	0.9991 (86)
MIT	20.1581	20.2956	20.4946	20.7725	20.9460	20.9956	20.9996	20.9992	20.9740	20.7433	20.4109	20.1441 (87)
Th 2	20.2930	20.2954	20.2979	20.3100	20.3124	20.3245	20.3245	20.3270	20.3197	20.3124	20.3075	20.3027 (88)
util rest of house	0.9984	0.9955	0.9857	0.9302	0.7671	0.5257	0.3606	0.4103	0.7004	0.9585	0.9952	0.9988 (89)
MIT 2	19.2914	19.4691	19.7240	20.0757	20.2675	20.3220	20.3244	20.3266	20.3021	20.0478	19.6266	19.2812 (90)
Living area fraction	FLA = Living area / (4) = 0.1747 (91)											
MIT	19.4428	19.6135	19.8586	20.1974	20.3860	20.4397	20.4424	20.4441	20.4195	20.1693	19.7637	19.4319 (92)
Temperature adjustment	-0.1500											
adjusted MIT	19.2928	19.4635	19.7086	20.0474	20.2360	20.2897	20.2924	20.2941	20.2695	20.0193	19.6137	19.2819 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9976	0.9937	0.9817	0.9228	0.7619	0.5226	0.3575	0.4068	0.6955	0.9518	0.9933	0.9982 (94)
Useful gains	772.3600	872.1775	937.7354	984.1561	868.5433	592.9612	386.2045	405.5732	634.1496	771.4384	750.9160	741.2866 (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	1647.0392	1594.0176	1440.4084	1193.2232	910.2620	595.2983	386.3220	405.8663	650.4564	1004.4525	1344.4967	1632.5688 (97)
Space heating kWh	650.7613	485.0765	373.9887	150.5283	31.0387	0.0000	0.0000	0.0000	0.0000	173.3625	427.3782	663.1139 (98a)
Space heating requirement - total per year (kWh/year)	2955.2482											
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	650.7613	485.0765	373.9887	150.5283	31.0387	0.0000	0.0000	0.0000	0.0000	173.3625	427.3782	663.1139 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2955.2482											
Space heating per m2	(98c) / (4) = 20.2942 (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 %)	89.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	650.7613	485.0765	373.9887	150.5283	31.0387	0.0000	0.0000	0.0000	0.0000	173.3625	427.3782	663.1139 (98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)	727.1076	541.9849	417.8645	168.1881	34.6802	0.0000	0.0000	0.0000	0.0000	193.7011	477.5175	740.9094 (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	294.1623	259.9921	275.7372	241.2218	233.0310	209.1017	205.6860	214.3131	217.1827	243.2404	259.9579	290.7826 (64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (216)
Fuel for water heating, kWh/month	271.7356	239.0667	251.1489	214.4209	203.4325	178.5325	172.8794	182.5186	187.5616	214.8396	235.3552	267.9594 (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	90.4880	81.7311	90.4880	87.5690	90.4880	87.5690	90.4880	90.4880	87.5690	90.4880	87.5690	90.4880 (231)
Lighting	34.2021	27.4382	24.7050	18.1000	13.9809	11.4225	12.7539	16.5780	21.5332	28.2527	31.9113	35.1527 (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	3301.9533 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	89.5000											

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Water heating fuel used	2619.4510 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)	
mechanical ventilation fans (SFP = 0.9100)	424.4228 (230a)
central heating pump	41.0000 (230c)
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)
Total electricity for the above, kWh/year	1065.4228 (231)
Electricity for lighting (calculated in Appendix L)	276.0305 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	7262.8576 (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	3301.9533	0.2100	693.4102 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	2619.4510	0.2100	550.0847 (264)	
Space and water heating			1243.4949 (265)	
Pumps, fans and electric keep-hot	1065.4228	0.1387	147.7873 (267)	
Energy for lighting	276.0305	0.1443	39.8397 (268)	
Total CO2, kg/year			1431.1219 (272)	
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.8300 (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	3301.9533	1.1300	3731.2073 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	2619.4510	1.1300	2959.9797 (278)	
Space and water heating			6691.1869 (279)	
Pumps, fans and electric keep-hot	1065.4228	1.5128	1611.7716 (281)	
Energy for lighting	276.0305	1.5338	423.3847 (282)	
Total Primary energy kWh/year			8726.3433 (286)	
Dwelling Primary energy Rate (DPER)			59.9300 (287)	

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

1. Overall dwelling characteristics

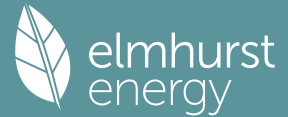
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	54.4000 (1b)	x 2.5000 (2b)	= 136.0000 (1b) - (3b)	
First floor	45.6100 (1c)	x 2.9000 (2c)	= 132.2690 (1c) - (3c)	
Second floor	45.6100 (1d)	x 2.5000 (2d)	= 114.0250 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.6200		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 382.2940 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000 (6a)	
Number of open flues	0 * 20 = 0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)	
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)	
Number of blocked chimneys	0 * 20 = 0.0000 (6f)	
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)	
Number of passive vents	0 * 10 = 0.0000 (7b)	
Number of flueless gas fires	0 * 40 = 0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1046 (8)	
Pressure Test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3546 (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) = 0.3014 (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												

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Effective ac	0.3843	0.3768	0.3693	0.3316	0.3240	0.2864	0.2864	0.2788	0.3014	0.3240	0.3391	0.3542 (22b)
	0.5739	0.5710	0.5682	0.5550	0.5525	0.5410	0.5410	0.5389	0.5454	0.5525	0.5575	0.5627 (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
Main dwelling							
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Opening Type			18.8900	1.1450	21.6298		(27)
TER Roof Light			2.0800	1.5918	4.2059		(27a)
Ground Floor			54.4000	0.1300	7.0720		(28a)
External Wall 1	97.0900	20.8900	76.2000	0.1800	13.7160		(29a)
Ext. Roof - Pitch	68.5900	2.0800	66.5100	0.1100	7.3161		(30)
Ext. Roof - Flat	8.7900		8.7900	0.1100	0.9669		(30)
Total net area of external elements Aum(A, m2)			228.8700				(31)
Fabric heat loss, W/K = Sum (A x U)					56.9067		(33)
Main dwelling							
Party Wall 1			107.7000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	15.5500	0.1600	2.4880
E6 Intermediate floor within a dwelling	17.9000	0.0000	0.0000
E13 Gable (insulation at rafter level)	16.2300	0.0800	1.2984
E15 Flat roof with parapet	8.4500	0.5600	4.7320
E16 Corner (normal)	5.0000	0.0900	0.4500
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	23.0000	0.0600	1.3800
E24 Eaves (insulation at ceiling level - inverted)	3.7000	0.2400	0.8880
E25 Staggered party wall between dwellings	2.5000	0.0600	0.1500
P1 Party wall - Ground floor	16.9000	0.0800	1.3520
P2 Party wall - Intermediate floor within a dwelling	33.7900	0.0000	0.0000
R4 Ridge (vaulted ceiling)	8.4500	0.0800	0.6760
P5 Party wall - Roof (insulation at rafter level)	16.9000	0.0800	1.3520
E1 Steel lintel with perforated steel base plate	13.5600	0.0500	0.6780
E3 Sill	12.5600	0.0500	0.6280
E4 Jamb	40.9000	0.0500	2.0450
R11 Upstands or kerbs of rooflights	8.4000	0.0800	0.6720
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.5644 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	75.4711 (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	72.3959	72.0341	71.6795	70.0137	69.7021	68.2513	68.2513	67.9826	68.8101	69.7021	70.3325	70.9917 (38)
Heat transfer coeff	147.8670	147.5051	147.1505	145.4848	145.1731	143.7223	143.7223	143.4536	144.2811	145.1731	145.8036	146.4627 (39)
Average = Sum(39)m / 12 =												145.4833
HLP	1.0154	1.0129	1.0105	0.9991	0.9969	0.9870	0.9870	0.9851	0.9908	0.9969	1.0013	1.0058 (40)
HLP (average)												0.9991
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

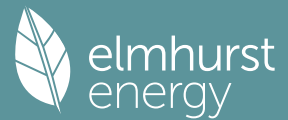
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9271 (42)
Hot water usage for mixer showers													
73.2978	72.1963	70.5912	67.5200	65.2536	62.7261	61.2895	62.8825	64.6287	67.3424	70.4795	73.0170	(42a)	
Hot water usage for baths													
31.6437	31.1737	30.5119	29.2917	28.3780	27.3649	26.8176	27.4748	28.1903	29.2744	30.5198	31.5367	(42b)	
Hot water usage for other uses													
44.6065	42.9845	41.3624	39.7403	38.1183	36.4962	36.4962	38.1183	39.7403	41.3624	42.9845	44.6065	(42c)	
Average daily hot water use (litres/day)												137.4682 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
149.5480	146.3545	142.4655	136.5521	131.7499	126.5872	124.6033	128.4755	132.5593	137.9793	143.9838	149.1602	(44)	
Energy content (annual)	236.8475	208.4068	218.9641	186.9330	177.3607	155.6537	150.6969	159.0796	163.4589	187.2365	205.1313	233.5488 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =	2283.3179		
35.5271	31.2610	32.8446	28.0399	26.6041	23.3481	22.6045	23.8619	24.5188	28.0855	30.7697	35.0323	(46)	
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month													
287.8064	254.4342	269.9231	236.2480	228.3196	204.9688	201.6558	210.0385	212.7740	238.1954	254.4463	284.5077	(62)	
WWHRS	-33.5087	-29.6354	-31.0324	-25.6961	-23.9478	-20.4923	-19.2083	-20.4261	-21.2022	-24.9950	-28.3163	-32.8882 (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													
254.2977	224.7988	238.8906	210.5519	204.3718	184.4765	182.4475	189.6124	191.5718	213.2004	226.1300	251.6196	(64)	
12Total per year (kWh/year)													
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	(64a)	
												0.0000 (64a)	
Heat gains from water heating, kWh/month													
91.4915	80.8021	85.5453	74.4840	71.7122	64.0836	62.8465	65.6337	66.6789	74.9959	80.5349	90.3947	(65)	

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

Metabolic gains (Table 5), Watts												
(66)m	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554 (66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	169.0709	187.1857	169.0709	174.7066	169.0709	174.7066	169.0709	169.0709	174.7066	169.0709	174.7066	169.0709 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	315.7163	318.9925	310.7367	293.1611	270.9751	250.1233	236.1931	232.9170	241.1727	258.7483	280.9344	301.7861 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355 (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)	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843 (71)
Water heating gains (Table 5)	122.9725	120.2412	114.9802	103.4500	96.3873	89.0051	84.4710	88.2173	92.6095	100.8009	111.8540	121.4983 (72)
Total internal gains	677.6664	696.3260	664.6945	641.2243	606.3400	580.7417	556.6417	557.1118	575.3955	598.5268	637.4017	662.2619 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					12.6400	11.2829	0.6300	0.7000			0.7700			43.5854 (75)
Southeast					1.0400	36.7938	0.6300	0.7000			0.7700			11.6945 (77)
Southwest					5.2100	36.7938	0.6300	0.7000			0.7700			58.5847 (79)
Southeast					2.0800	26.0000	0.6300	0.7000			1.0000			21.4644 (82)
Solar gains	135.3290	253.0107	402.8916	589.2921	738.6910	766.9780	725.5246	609.5601	467.0658	295.2153	166.2632			113.0750 (83)
Total gains	812.9954	949.3367	1067.5861	1230.5164	1345.0309	1347.7196	1282.1663	1166.6719	1042.4613	893.7421	803.6649			775.3369 (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)													
tau	68.3892	68.5569	68.7222	69.5090	69.6582	70.3614	70.3614	70.4932	70.0889	69.6582	69.3570	69.0449	
alpha	5.5593	5.5705	5.5815	5.6339	5.6439	5.6908	5.6908	5.6995	5.6726	5.6439	5.6238	5.6030	
util living area	0.9986	0.9964	0.9894	0.9559	0.8511	0.6558	0.4887	0.5559	0.8299	0.9782	0.9967	0.9989 (86)	
MIT	19.7492	19.9212	20.1862	20.5578	20.8445	20.9727	20.9956	20.9914	20.9011	20.5187	20.0726	19.7253 (87)	
Th 2	20.0705	20.0726	20.0746	20.0841	20.0859	20.0942	20.0942	20.0957	20.0910	20.0859	20.0823	20.0785 (88)	
util rest of house	0.9981	0.9951	0.9857	0.9401	0.8041	0.5740	0.3905	0.4516	0.7606	0.9676	0.9953	0.9986 (89)	
MIT 2	18.5982	18.8196	19.1584	19.6273	19.9539	20.0786	20.0928	20.0926	20.0214	19.5881	19.0211	18.5735 (90)	
Living area fraction									fLA = Living area / (4) =			0.1747 (91)	
MIT	18.7993	19.0121	19.3380	19.7899	20.1095	20.2348	20.2505	20.2496	20.1751	19.7506	19.2048	18.7748 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7993	19.0121	19.3380	19.7899	20.1095	20.2348	20.2505	20.2496	20.1751	19.7506	19.2048	18.7748 (93)	

8. Space heating requirement

Utilisation	0.9972	0.9931	0.9816	0.9339	0.8055	0.5872	0.4077	0.4698	0.7678	0.9624	0.9934	0.9978 (94)	
Useful gains	810.6906	942.7892	1047.9237	1149.1242	1083.3639	791.4219	522.7346	548.1167	800.4044	860.0929	798.3904	773.6402 (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	2143.9608	2081.6001	1889.1172	1584.3092	1220.8279	809.8433	524.6578	552.2399	876.5243	1328.4270	1764.9261	2134.6597 (97)	
Space heating kWh	991.9530	765.2809	625.8480	313.3332	102.2732	0.0000	0.0000	0.0000	0.0000	348.4406	695.9057	1012.5985 (98a)	
Space heating requirement - total per year (kWh/year)												4855.6330	
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	991.9530	765.2809	625.8480	313.3332	102.2732	0.0000	0.0000	0.0000	0.0000	348.4406	695.9057	1012.5985 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												4855.6330	
Space heating per m2										(98c) / (4) =		33.3445 (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 %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	991.9530	765.2809	625.8480	313.3332	102.2732	0.0000	0.0000	0.0000	0.0000	348.4406	695.9057	1012.5985 (98)	
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)	
Space heating fuel (main heating system)	1073.5422	828.2261	677.3246	339.1052	110.6853	0.0000	0.0000	0.0000	0.0000	377.1002	753.1447	1095.8858 (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	254.2977	224.7988	238.8906	210.5519	204.3718	184.4765	182.4475	189.6124	191.5718	213.2004	226.1300	251.6196 (64)	
Efficiency of water heater (217)m	86.9988	86.7896	86.3453	85.2314	82.9772	80.3000	80.3000	80.3000	80.3000	85.4270	86.6247	80.3000 (216)	
Fuel for water heating, kWh/month	292.3003	259.0160	276.6688	247.0358	246.2987	229.7341	227.2074	236.1300	238.5702	249.5704	261.0456	289.0698 (219)	
Space cooling fuel requirement													

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(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	35.1296	28.1823	25.3750	18.5908	14.3601	11.7323	13.0997	17.0276	22.1171	29.0188	32.7767	36.1060	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-51.1085	-72.1556	-103.8216	-116.7897	-125.8892	-117.3794	-115.8340	-109.3343	-97.9261	-82.4455	-56.1881	-44.1664	(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	-28.5438	-60.0932	-119.5660	-179.8007	-238.0111	-239.3395	-236.6175	-200.2986	-146.6881	-86.1225	-38.1609	-22.5759	(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												5255.0141	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3052.6470	(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)												283.5160	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2688.8563	(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												5988.3208	(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	5255.0141	0.2100	1103.5530 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3052.6470	0.2100	641.0559 (264)
Space and water heating			1744.6088 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	283.5160	0.1443	40.9201 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1093.0385	0.1346	-147.1102
PV Unit electricity exported	-1595.8178	0.1258	-200.8331
Total			-347.9433 (269)
Total CO2, kg/year			1449.5149 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9500 (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	5255.0141	1.1300	5938.1659 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3052.6470	1.1300	3449.4912 (278)
Space and water heating			9387.6571 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	283.5160	1.5338	434.8663 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1093.0385	1.4974	-1636.7335
PV Unit electricity exported	-1595.8178	0.4620	-737.1906
Total			-2373.9241 (283)
Total Primary energy kWh/year			7578.7001 (286)
Target Primary Energy Rate (TPER)			52.0400 (287)

Energy Assessment

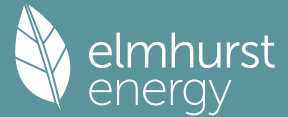
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Proposed – DER from the Be Green scenario DER SAP worksheet

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Property Reference	UNIT A1				Issued on Date	25/02/2025	
Assessment Reference	GREEN V2			Prop Type Ref			
Property							
SAP Rating	88 B	DER	2.53	TER	11.31		
Environmental	98 A	% DER < TER				77.63	
CO ₂ Emissions (t/year)	0.28	DFEE	43.78	TFEE	43.16		
Compliance Check	See BREL	% DFEE < TFEE				-1.43	
% DPER < TPER	55.88	DPER	26.13	TPER	59.21		
Assessor Details	Ms. Vanessa Vienna				Assessor ID	T798-0001	
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)
Main dwelling			
Ground floor	52.2500 (1b)	x 2.5000 (2b)	= 130.6250 (1b) - (3b)
First floor	43.6200 (1c)	x 2.9000 (2c)	= 126.4980 (1c) - (3c)
Second floor	34.4600 (1d)	x 2.5400 (2d)	= 87.5284 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 344.6514 (5)

2. Ventilation rate

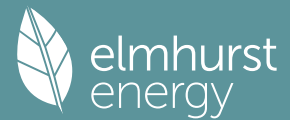
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1388 (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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												74.4000 (23c)
Effective ac	0.3049	0.3014	0.2980	0.2806	0.2772	0.2598	0.2598	0.2563	0.2667	0.2772	0.2841	0.2910 (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
Main dwelling							
Opening Type 1			23.0200	1.1450	26.3588		(27)
door			2.7000	1.0000	2.7000		(26)
GROUND FL			52.3500	0.1000	5.2350		(28a)
External Wall	145.2300	25.7200	119.5100	0.1600	19.1216		(29a)
Ext. Roof - flat	43.2000		43.2000	0.1000	4.3200		(30)
Ext. Roof - Pitched	27.9100		27.9100	0.1000	2.7910		(30)
Total net area of external elements Aum (A, m ²)			268.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5264		(33)
Main dwelling							
Party Wall 1			60.5200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	14.7400	0.1000	1.4740
E3 Sill	14.7400	0.0400	0.5896
E4 Jamb	40.9000	0.0500	2.0450
E5 Ground floor (normal)	21.5400	0.1000	2.1540
E6 Intermediate floor within a dwelling	20.9700	0.0500	1.0485
E13 Gable (insulation at rafter level)	9.5200	0.0400	0.3808
E14 Flat roof	17.2600	0.1300	2.2438
E15 Flat roof with parapet	7.8800	0.1500	1.1820
E16 Corner (normal)	35.8000	0.0900	3.2220
E17 Corner (inverted - internal area greater than external area)	10.8000	-0.0900	-0.9720
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E24 Eaves (insulation at ceiling level - inverted)	18.6300	0.1000	1.8630
E25 Staggered party wall between dwellings	5.4000	0.1200	0.6480
P1 Party wall - Ground floor	9.4900	0.2200	2.0878
P2 Party wall - Intermediate floor within a dwelling	14.5700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.4000	0.2800	1.7920
P5 Party wall - Roof (insulation at rafter level)	6.3500	0.2800	1.7780
R6 Flat ceiling	10.3300	0.1200	1.2396
R7 Flat ceiling (inverted)	12.7800	0.1200	1.5336
R9 Roof to wall (flat ceiling)	9.1300	0.3200	2.9216
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			27.5553 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss		(33) + (36) + (36a) =	88.0817 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	34.6785	34.2840	33.8895	31.9169	31.5224	29.5498	29.5498	29.1552	30.3388	31.5224	32.3114	33.1004	(38)
Average = Sum(39)m / 12 =	122.7602	122.3657	121.9711	119.9986	119.6040	117.6314	117.6314	117.2369	118.4205	119.6040	120.3931	121.1821	(39)
												119.8999	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9419	0.9389	0.9359	0.9207	0.9177	0.9026	0.9026	0.8995	0.9086	0.9177	0.9238	0.9298	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

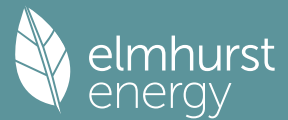
Assumed occupancy													2.8958 (42)
Hot water usage for mixer showers													
72.7736	71.6799	70.0863	67.0371	64.7869	62.2775	60.8511	62.4327	64.1664	66.8608	69.9754	72.4947	(42a)	
Hot water usage for baths													
31.4182	30.9516	30.2945	29.0830	28.1758	27.1699	26.6266	27.2790	27.9895	29.0658	30.3023	31.3120	(42b)	
Hot water usage for other uses													
44.2863	42.6759	41.0655	39.4551	37.8447	36.2342	36.2342	37.8447	39.4551	41.0655	42.6759	44.2863	(42c)	
Average daily hot water use (litres/day)													136.4847 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.4781	145.3074	141.4463	135.5752	130.8074	125.6816	123.7119	127.5564	131.6110	136.9921	142.9537	148.0930	(44)
Energy content (annual)	235.1530	206.9158	217.3977	185.5956	176.0919	154.5402	149.6188	157.9415	162.2895	185.8970	203.6637	231.8779	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.2729	31.0374	32.6096	27.8393	26.4138	23.1810	22.4428	23.6912	24.3434	27.8845	30.5496	34.7817	(46)	
Water storage loss:													
Store volume													255.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6560 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8942 (55)
Total storage loss													
27.7214	25.0387	27.7214	26.8272	27.7214	26.8272	27.7214	27.7214	26.8272	27.7214	26.8272	27.7214	(56)	
If cylinder contains dedicated solar storage													
27.7214	25.0387	27.7214	26.8272	27.7214	26.8272	27.7214	27.7214	26.8272	27.7214	26.8272	27.7214	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	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	(61)	
Total heat required for water heating calculated for each month													
286.1368	252.9658	268.3815	234.9348	227.0757	203.8794	200.6027	208.9253	211.6287	236.8808	253.0029	282.8618	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(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	(63c)	
FGHRS	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	286.1368	252.9658	268.3815	234.9348	227.0757	203.8794	200.6027	208.9253	211.6287	236.8808	253.0029	282.8618	(64)
12Total per year (kWh/year)													2867.2762 (64)
Electric shower(s)													2867 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
118.9754	105.6395	113.0718	101.1819	99.3376	90.8560	90.5353	93.3026	93.4326	102.5978	107.1895	117.8865	(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	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	151.2834	167.4923	151.2834	156.3261	151.2834	156.3261	151.2834	151.2834	156.3261	151.2834	156.3261	151.2834	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	298.1178	301.2114	293.4158	276.8199	255.8705	236.1811	223.0273	219.9338	227.7294	244.3253	265.2747	284.9641	(68)
Pumps, fans	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	(69)
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	(70)
Water heating gains (Table 5)	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	(71)
Total internal gains	159.9132	157.2016	151.9782	140.5304	133.5183	126.1889	121.6873	125.4067	129.7675	137.9003	148.8744	158.4496	(72)
	675.7520	692.3428	663.1149	640.1140	607.1098	585.1337	562.4356	563.0615	580.2607	599.9466	636.9127	661.1346	(73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast	6.2100				11.2829		0.4000	0.8000	0.7700	15.5391 (75)		
Southeast	3.9000				36.7938		0.4000	0.8000	0.7700	31.8217 (77)		
Southwest	12.9100				36.7938		0.4000	0.8000	0.7700	105.3379 (79)		
Solar gains	152.6976	265.2616	376.6514	489.6674	569.4417	574.5493	550.0876	489.1620	415.5680	296.8668	183.8364	130.0691 (83)
Total gains	828.4496	957.6044	1039.7663	1129.7815	1176.5515	1159.6830	1112.5232	1052.2235	995.8287	896.8134	820.7492	791.2037 (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)												
tau	73.7266	73.9643	74.2036	75.4234	75.6722	76.9411	76.9411	77.2000	76.4285	75.6722	75.1762	74.6867
alpha	5.9151	5.9310	5.9469	6.0282	6.0448	6.1294	6.1294	6.1467	6.0952	6.0448	6.0117	5.9791
util living area	0.9972	0.9928	0.9820	0.9410	0.8329	0.6323	0.4629	0.5084	0.7621	0.9571	0.9929	0.9978 (86)
Living	19.9536	20.1281	20.3602	20.6662	20.8863	20.9831	20.9978	20.9962	20.9499	20.6689	20.2635	19.9320
Non living	18.9054	19.1295	19.4251	19.8102	20.0570	20.1557	20.1646	20.1665	20.1269	19.8216	19.3129	18.8855
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4647	20.1281	20.3602	20.6662	20.8863	20.9831	20.9978	20.9962	20.9499	20.6689	20.2635	20.0814 (87)
Th 2	20.1320	20.1346	20.1371	20.1499	20.1525	20.1653	20.1653	20.1679	20.1602	20.1525	20.1474	20.1422 (88)
util rest of house	0.9963	0.9906	0.9762	0.9219	0.7856	0.5570	0.3764	0.4186	0.6904	0.9392	0.9903	0.9972 (89)
MIT 2	19.6430	19.1295	19.4251	19.8102	20.0570	20.1557	20.1646	20.1665	20.1269	19.8216	19.3129	19.1120 (90)
Living area fraction										FLA = Living area / (4) =		0.1854 (91)
MIT	19.7953	19.3146	19.5984	19.9689	20.2107	20.3091	20.3190	20.3203	20.2794	19.9787	19.4891	19.2917 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7953	19.3146	19.5984	19.9689	20.2107	20.3091	20.3190	20.3203	20.2794	19.9787	19.4891	19.2917 (93)
8. Space heating requirement												
Utilisation	0.9959	0.9876	0.9714	0.9171	0.7892	0.5704	0.3924	0.4353	0.7013	0.9347	0.9874	0.9962 (94)
Useful gains	825.0141	945.7415	1010.0359	1036.1093	928.4964	661.4274	436.6058	458.0114	698.3487	838.2090	810.4174	788.1999 (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	1902.2090	1763.8571	1597.6283	1328.2503	1017.9181	671.5664	437.4767	459.6078	731.7725	1121.7271	1491.5633	1828.8432 (97)
Space heating kWh	801.4330	549.7736	437.1687	210.3415	66.5298	0.0000	0.0000	0.0000	0.0000	210.9374	490.4250	774.2387 (98a)
Space heating requirement - total per year (kWh/year)												3540.8478
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	801.4330	549.7736	437.1687	210.3415	66.5298	0.0000	0.0000	0.0000	0.0000	210.9374	490.4250	774.2387 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3540.8478
Space heating per m2										(98c) / (4) =		27.1683 (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 %)												309.3397 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	801.4330	549.7736	437.1687	210.3415	66.5298	0.0000	0.0000	0.0000	0.0000	210.9374	490.4250	774.2387 (98)
Space heating efficiency (main heating system 1)	309.3397	309.3397	309.3397	309.3397	309.3397	0.0000	0.0000	0.0000	0.0000	309.3397	309.3397	309.3397 (210)
Space heating fuel (main heating system)	259.0787	177.7249	141.3232	67.9969	21.5070	0.0000	0.0000	0.0000	0.0000	68.1896	158.5393	250.2875 (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	286.1368	252.9658	268.3815	234.9348	227.0757	203.8794	200.6027	208.9253	211.6287	236.8808	253.0029	282.8618 (64)
Efficiency of water heater	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178 (216)
Fuel for water heating, kWh/month	101.5326	89.7622	95.2323	83.3641	80.5753	72.3444	71.1817	74.1349	75.0941	84.0546	89.7753	100.3704 (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)
Pumps and Fa	32.4975	29.3526	32.4975	31.4492	32.4975	31.4492	32.4975	32.4975	31.4492	32.4975	31.4492	32.4975 (231)
Lighting	31.4337	25.2173	22.7054	16.6349	12.8493	10.4980	11.7216	15.2361	19.7902	25.9658	29.3283	32.3073 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-22.0272	-34.7739	-55.9799	-69.0331	-78.7439	-74.5926	-73.5439	-66.5421	-54.8548	-41.6584	-25.2265	-18.5433 (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)
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)
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)
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)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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												1144.6472	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												281.8178	
Water heating fuel used												1017.4218	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)													
mechanical ventilation fans (SFP = 0.9100)												382.6320	(230a)
Total electricity for the above, kWh/year												382.6320	(231)
Electricity for lighting (calculated in Appendix L)												253.6879	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-615.5196	(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												2182.8693	(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	1144.6472	0.1563	178.8608	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1017.4218	0.1410	143.4343	(264)
Space and water heating			322.2951	(265)
Pumps, fans and electric keep-hot	382.6320	0.1387	53.0758	(267)
Energy for lighting	253.6879	0.1443	36.6150	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-615.5196	0.1328	-81.7419	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-81.7419	(269)
Total CO2, kg/year			330.2440	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.5300	(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	1144.6472	1.5785	1806.7934	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1017.4218	1.5213	1547.7937	(278)
Space and water heating			3354.5871	(279)
Pumps, fans and electric keep-hot	382.6320	1.5128	578.8457	(281)
Energy for lighting	253.6879	1.5338	389.1150	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-615.5196	1.4907	-917.5658	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-917.5658	(283)
Total Primary energy kWh/year			3404.9820	(286)
Dwelling Primary energy Rate (DPER)			26.1300	(287)

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

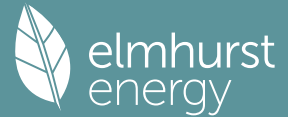
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	52.2500 (1b)	x 2.5000 (2b)	= 130.6250 (1b) - (3b)	
First floor	43.6200 (1c)	x 2.9000 (2c)	= 126.4980 (1c) - (3c)	
Second floor	34.4600 (1d)	x 2.5400 (2d)	= 87.5284 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.3300			
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	344.6514 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)

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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) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
40.0000 / (5) = 0.1161 (8)
Yes
Blower Door
5.0000 (17)
0.3661 (18)
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3386 (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	0.4317	0.4233	0.4148	0.3725	0.3640	0.3217	0.3217	0.3132	0.3386	0.3640	0.3809	0.3979 (22b)
Effective ac	0.5932	0.5896	0.5860	0.5694	0.5662	0.5517	0.5517	0.5491	0.5573	0.5662	0.5726	0.5791 (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
Main dwelling							
TER Opaque door			2.7000	1.0000	2.7000		(26)
TER Opening Type			23.0200	1.1450	26.3588		(27)
GROUND FL			52.3500	0.1300	6.8055		(28a)
External Wall	145.2300	25.7200	119.5100	0.1800	21.5118		(29a)
Ext. Roof - flat	43.2000		43.2000	0.1100	4.7520		(30)
Ext. Roof - Pitched	27.9100		27.9100	0.1100	3.0701		(30)
Total net area of external elements Aum(A, m2)			268.6900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 65.1982		(33)
Main dwelling							
Party Wall 1			60.5200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	14.7400	0.0500	0.7370
E1 Steel lintel with perforated steel base plate	14.7400	0.0500	0.7370
E3 Sill	40.9000	0.0500	2.0450
E4 Jamb	21.5400	0.1600	3.4464
E5 Ground floor (normal)	20.9700	0.0000	0.0000
E6 Intermediate floor within a dwelling	9.5200	0.0800	0.7616
E13 Gable (insulation at rafter level)	17.2600	0.0800	1.3808
E14 Flat roof	7.8800	0.5600	4.4128
E15 Flat roof with parapet	35.8000	0.0900	3.2220
E16 Corner (normal)	10.8000	-0.0900	-0.9720
E17 Corner (inverted - internal area greater than external area)	5.4000	0.0600	0.3240
E18 Party wall between dwellings	18.6300	0.2400	4.4712
E24 Eaves (insulation at ceiling level - inverted)	5.4000	0.0600	0.3240
E25 Staggered party wall between dwellings	9.4900	0.0800	0.7592
P1 Party wall - Ground floor	14.5700	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	6.4000	0.1200	0.7680
P4 Party wall - Roof (insulation at ceiling level)	6.3500	0.0800	0.5080
P5 Party wall - Roof (insulation at rafter level)	10.3300	0.0600	0.6198
R6 Flat ceiling	12.7800	0.0400	0.5112
R7 Flat ceiling (inverted)	9.1300	0.0400	0.3652
R9 Roof to wall (flat ceiling)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.4212 (36)
Point Thermal bridges 0.0000
Total fabric heat loss (33) + (36) + (36a) = 89.6194 (37)

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

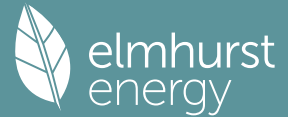
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	67.4666	67.0550	66.6516	64.7567	64.4022	62.7518	62.7518	62.4462	63.3875	64.4022	65.1194	65.8692 (38)
Heat transfer coeff	157.0860	156.6744	156.2710	154.3761	154.0216	152.3712	152.3712	152.0656	153.0069	154.0216	154.7388	155.4886 (39)
Average = Sum(39)m / 12 =												154.3744

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2053	1.2021	1.1990	1.1845	1.1818	1.1691	1.1691	1.1668	1.1740	1.1818	1.1873	1.1930 (40)
HLP (average)												1.1845
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8958 (42)
Hot water usage for mixer showers													
72.7736	71.6799	70.0863	67.0371	64.7869	62.2775	60.8511	62.4327	64.1664	66.8608	69.9754	72.4947	(42a)	
Hot water usage for baths													
31.4182	30.9516	30.2945	29.0830	28.1758	27.1699	26.6266	27.2790	27.9895	29.0658	30.3023	31.3120	(42b)	
Hot water usage for other uses													
44.2863	42.6759	41.0655	39.4551	37.8447	36.2342	36.2342	37.8447	39.4551	41.0655	42.6759	44.2863	(42c)	
Average daily hot water use (litres/day)													136.4847 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.4781	145.3074	141.4463	135.5752	130.8074	125.6816	123.7119	127.5564	131.6110	136.9921	142.9537	148.0930	(44)
Energy content (annual)	235.1530	206.9158	217.3977	185.5956	176.0919	154.5402	149.6188	157.9415	162.2895	185.8970	203.6637	231.8779	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =			2266.9826
35.2729	31.0374	32.6096	27.8393	26.4138	23.1810	22.4428	23.6912	24.3434	27.8845	30.5496	34.7817	(46)	
Water storage loss:													
Store volume													255.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9132 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0331 (55)
Total storage loss													
32.0271	28.9277	32.0271	30.9940	32.0271	30.9940	32.0271	32.0271	30.9940	32.0271	30.9940	32.0271	(56)	
If cylinder contains dedicated solar storage													
32.0271	28.9277	32.0271	30.9940	32.0271	30.9940	32.0271	32.0271	30.9940	32.0271	30.9940	32.0271	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	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	(61)	

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Total heat required for water heating calculated for each month												
WWHRS	290.4425	256.8547	272.6872	239.1016	231.3814	208.0462	204.9083	213.2310	215.7955	241.1865	257.1697	287.1674 (62)
PV diverter	-33.2690	-29.4234	-30.8105	-25.5123	-23.7766	-20.3458	-19.0709	-20.2800	-21.0505	-24.8162	-28.1138	-32.6529 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

12Total per year (kWh/year)	257.1735	227.4313	241.8767	213.5893	207.6048	187.7004	185.8374	192.9510	194.7449	216.3703	229.0559	254.5145 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	122.4200	108.7506	116.5163	104.5153	102.7821	94.1894	93.9799	96.7471	96.7660	106.0423	110.5230	121.3310 (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	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	298.1178	301.2114	293.4158	276.8199	255.8705	236.1811	223.0273	219.9338	227.7294	244.3253	265.2747	284.9641 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792 (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)	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336 (71)
Water heating gains (Table 5)	164.5430	161.8313	156.6080	145.1602	138.1480	130.8186	126.3170	130.0365	134.3973	142.5300	153.5041	163.0793 (72)
Total internal gains	686.1513	703.0389	673.5143	650.6057	617.5091	592.6253	569.8349	570.4608	587.7523	610.3459	647.4044	671.5339 (73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W

Northeast				6.2100	11.2829		0.6300		0.7000		0.7700		21.4134 (75)
Southeast				3.9000	36.7938		0.6300		0.7000		0.7700		43.8542 (77)
Southwest				12.9100	36.7938		0.6300		0.7000		0.7700		145.1687 (79)

Solar gains	210.4364	365.5636	519.0727	674.8229	784.7619	791.8008	758.0895	674.1264	572.7047	409.1196	253.3496	179.2515	(83)
Total gains	896.5877	1068.6025	1192.5869	1325.4286	1402.2710	1384.4261	1327.9244	1244.5872	1160.4570	1019.4655	900.7539	850.7855	(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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	57.6162	57.7675	57.9167	58.6276	58.7625	59.3990	59.3990	59.5184	59.1522	58.7625	58.4901	58.2081
util living area	4.8411	4.8512	4.8611	4.9085	4.9175	4.9599	4.9599	4.9679	4.9435	4.9175	4.8993	4.8805
MIT	0.9964	0.9910	0.9786	0.9379	0.8397	0.6626	0.4963	0.5475	0.7901	0.9577	0.9918	0.9972 (86)
Th 2	19.5912	19.8076	20.1042	20.4893	20.7916	20.9526	20.9907	20.9852	20.8863	20.4885	19.9727	19.5605 (87)
util rest of house	19.9158	19.9183	19.9208	19.9324	19.9346	19.9448	19.9448	19.9467	19.9409	19.9346	19.9302	19.9256 (88)
MIT 2	0.9951	0.9880	0.9712	0.9162	0.7867	0.5701	0.3817	0.4295	0.7084	0.9383	0.9885	0.9962 (89)
Living area fraction	18.2849	18.5621	18.9385	19.4197	19.7614	19.9183	19.9419	19.9416	19.8656	19.4297	18.7824	18.2526 (90)
MIT	18.5271	18.7930	19.1546	19.6180	19.9524	20.1100	20.1363	20.1350	20.0548	19.6259	19.0030	0.1854 (91)
Temperature adjustment	18.5271	18.7930	19.1546	19.6180	19.9524	20.1100	20.1363	20.1350	20.0548	19.6259	19.0030	0.0000 (92)
adjusted MIT	18.5271	18.7930	19.1546	19.6180	19.9524	20.1100	20.1363	20.1350	20.0548	19.6259	19.0030	18.4950 (93)

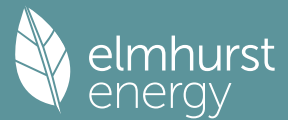
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9928	0.9836	0.9642	0.9083	0.7877	0.5854	0.4030	0.4513	0.7182	0.9310	0.9844	0.9943 (94)
Ext temp.	890.1054	1051.0838	1149.8752	1203.8993	1104.6324	810.4393	535.1660	561.6458	833.4711	949.0865	886.7117	845.9291 (95)
Heat loss rate W	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)
Space heating kWh	2234.8705	2176.6748	1977.5411	1654.6029	1271.0403	839.5680	538.8348	567.9719	911.1238	1390.1904	1841.8601	2222.7135 (97)
Space heating requirement - total per year (kWh/year)	1000.5052	756.3972	615.7834	324.5066	123.8075	0.0000	0.0000	0.0000	0.0000	328.1813	687.7068	1024.3276 (98a)
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)	1000.5052	756.3972	615.7834	324.5066	123.8075	0.0000	0.0000	0.0000	0.0000	328.1813	687.7068	1024.3276 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Efficiency of main space heating system 1 (in %)	1.0000 (202)
Efficiency of main space heating system 2 (in %)	92.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (207)
	0.0000 (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1000.5052	756.3972	615.7834	324.5066	123.8075	0.0000	0.0000	0.0000	0.0000	328.1813	687.7068	1024.3276	(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)	1083.9710	819.4986	667.1543	351.5781	134.1359	0.0000	0.0000	0.0000	0.0000	355.5594	745.0778	1109.7807	(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	257.1735	227.4313	241.8767	213.5893	207.6048	187.7004	185.8374	192.9510	194.7449	216.3703	229.0559	254.5145	(64)
Efficiency of water heater (217)m	86.7983	86.5437	86.0626	84.9950	82.9403	79.8000	79.8000	79.8000	79.8000	84.9913	86.3663	86.8506	(216)
Fuel for water heating, kWh/month	296.2887	262.7938	281.0473	251.2963	250.3063	235.2136	232.8790	241.7932	244.0413	254.5792	265.2144	293.0487	(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	32.0092	25.6789	23.1210	16.9395	13.0845	10.6902	11.9361	15.5150	20.1525	26.4412	29.8653	32.8988	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-48.9047	-68.9568	-99.1086	-111.3765	-119.9798	-111.8587	-110.3877	-104.2207	-93.3972	-78.7307	-53.7339	-42.2723	(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	-27.5996	-58.0653	-115.4503	-173.4921	-229.5385	-230.7619	-228.1342	-193.1748	-141.5494	-83.1751	-36.8863	-21.8322	(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												5266.7558	(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												3108.5017	(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)												258.3322	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2582.5872	(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												6137.0026	(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	5266.7558	0.2100	1106.0187 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3108.5017	0.2100	652.7853 (264)
Space and water heating			1758.8041 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	258.3322	0.1443	37.2853 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1042.9274	0.1346	-140.3871 (236)
PV Unit electricity exported	-1539.6598	0.1259	-193.7982 (237)
Total			-334.1853 (269)
Total CO2, kg/year			1473.8333 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.3100 (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	5266.7558	1.1300	5951.4341 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3108.5017	1.1300	3512.6069 (278)
Space and water heating			9464.0410 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	258.3322	1.5338	396.2386 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1042.9274	1.4975	-1561.7761 (283)
PV Unit electricity exported	-1539.6598	0.4620	-711.3695 (286)
Total			-2273.1456 (287)
Total Primary energy kWh/year			7717.2347 (286)
Target Primary Energy Rate (TPER)			59.2100 (287)

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Property Reference	UNIT A2				Issued on Date	25/02/2025	
Assessment Reference	GREEN V2			Prop Type Ref			
Property							
SAP Rating	88 B		DER	2.59		TER	11.49
Environmental	98 A		% DER < TER				77.46
CO ₂ Emissions (t/year)	0.29		DFEE	44.73		TFEE	44.37
Compliance Check	See BREL		% DFEE < TFEE				-0.81
% DPER < TPER	55.64		DPER	26.70		TPER	60.19
Assessor Details	Ms. Vanessa Vienna					Assessor ID	T798-0001
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)
Main dwelling			
Ground floor	52.2500 (1b)	x 2.5000 (2b)	= 130.6250 (1b) - (3b)
First floor	43.6200 (1c)	x 2.9000 (2c)	= 126.4980 (1c) - (3c)
Second floor	34.4600 (1d)	x 2.5400 (2d)	= 87.5284 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.6514 (5)

2. Ventilation rate

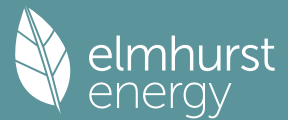
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1388 (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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												74.4000 (23c)
Effective ac	0.3049	0.3014	0.2980	0.2806	0.2772	0.2598	0.2598	0.2563	0.2667	0.2772	0.2841	0.2910 (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
Main dwelling							
Opening Type 1			23.0200	1.1450	26.3588		(27)
door			2.7000	1.0000	2.7000		(26)
GROUND FL			52.3500	0.1000	5.2350		(28a)
External Wall	145.2300	25.7200	119.5100	0.1600	19.1216		(29a)
Ext. Roof - flat	43.2000		43.2000	0.1000	4.3200		(30)
Ext. Roof - Pitched	27.9100		27.9100	0.1000	2.7910		(30)
Total net area of external elements Aum (A, m ²)			268.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5264		(33)
Main dwelling							
Party Wall 1			60.5200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	14.7400	0.1000	1.4740
E3 Sill	14.7400	0.0400	0.5896
E4 Jamb	40.9000	0.0500	2.0450
E5 Ground floor (normal)	21.5400	0.1000	2.1540
E6 Intermediate floor within a dwelling	20.9700	0.0500	1.0485
E13 Gable (insulation at rafter level)	9.5200	0.0400	0.3808
E14 Flat roof	17.2600	0.1300	2.2438
E15 Flat roof with parapet	7.8800	0.1500	1.1820
E16 Corner (normal)	35.8000	0.0900	3.2220
E17 Corner (inverted - internal area greater than external area)	10.8000	-0.0900	-0.9720
E18 Party wall between dwellings	5.4000	0.0600	0.3240
E24 Eaves (insulation at ceiling level - inverted)	18.6300	0.1000	1.8630
E25 Staggered party wall between dwellings	5.4000	0.1200	0.6480
P1 Party wall - Ground floor	9.4900	0.2200	2.0878
P2 Party wall - Intermediate floor within a dwelling	14.5700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.4000	0.2800	1.7920
P5 Party wall - Roof (insulation at rafter level)	6.3500	0.2800	1.7780
R6 Flat ceiling	10.3300	0.1200	1.2396
R7 Flat ceiling (inverted)	12.7800	0.1200	1.5336
R9 Roof to wall (flat ceiling)	9.1300	0.3200	2.9216
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			27.5553 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss		(33) + (36) + (36a) =	88.0817 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	34.6785	34.2840	33.8895	31.9169	31.5224	29.5498	29.5498	29.1552	30.3388	31.5224	32.3114	33.1004	(38)
Average = Sum(39)m / 12 =	122.7602	122.3657	121.9711	119.9986	119.6040	117.6314	117.6314	117.2369	118.4205	119.6040	120.3931	121.1821	(39)
												119.8999	
HLP	0.9419	0.9389	0.9359	0.9207	0.9177	0.9026	0.9026	0.8995	0.9086	0.9177	0.9238	0.9298	(40)
HLP (average)												0.9200	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

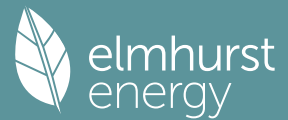
4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.8958 (42)
Hot water usage for mixer showers												
	72.7736	71.6799	70.0863	67.0371	64.7869	62.2775	60.8511	62.4327	64.1664	66.8608	69.9754	72.4947 (42a)
Hot water usage for baths												
	31.4182	30.9516	30.2945	29.0830	28.1758	27.1699	26.6266	27.2790	27.9895	29.0658	30.3023	31.3120 (42b)
Hot water usage for other uses												
	44.2863	42.6759	41.0655	39.4551	37.8447	36.2342	36.2342	37.8447	39.4551	41.0655	42.6759	44.2863 (42c)
Average daily hot water use (litres/day)												136.4847 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	148.4781	145.3074	141.4463	135.5752	130.8074	125.6816	123.7119	127.5564	131.6110	136.9921	142.9537	148.0930 (44)
Energy content												
	235.1530	206.9158	217.3977	185.5956	176.0919	154.5402	149.6188	157.9415	162.2895	185.8970	203.6637	231.8779 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2266.9826
	35.2729	31.0374	32.6096	27.8393	26.4138	23.1810	22.4428	23.6912	24.3434	27.8845	30.5496	34.7817 (46)
Water storage loss:												
Store volume												185.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0260 (55)
Total storage loss												
	31.8060	28.7280	31.8060	30.7800	31.8060	30.7800	31.8060	31.8060	30.7800	31.8060	30.7800	31.8060 (56)
If cylinder contains dedicated solar storage												
	31.8060	28.7280	31.8060	30.7800	31.8060	30.7800	31.8060	31.8060	30.7800	31.8060	30.7800	31.8060 (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												
	290.2214	256.6550	272.4661	238.8876	231.1603	207.8322	204.6872	213.0099	215.5815	240.9654	256.9557	286.9463 (62)
WWHRS												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter												
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	290.2214	256.6550	272.4661	238.8876	231.1603	207.8322	204.6872	213.0099	215.5815	240.9654	256.9557	286.9463 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2915.3686 (64)
Electric shower(s)												2915 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	122.2431	108.5909	116.3394	104.3441	102.6053	94.0182	93.8030	96.5703	96.5949	105.8655	110.3518	121.1541 (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	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	151.2834	167.4923	151.2834	156.3261	151.2834	156.3261	151.2834	151.2834	156.3261	151.2834	156.3261	151.2834 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	298.1178	301.2114	293.4158	276.8199	255.8705	236.1811	223.0273	219.9338	227.7294	244.3253	265.2747	284.9641 (68)
Pumps, fans	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792 (69)
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 (70)
Water heating gains (Table 5)	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336 (71)
Total internal gains	164.3052	161.5936	156.3702	144.9224	137.9103	130.5809	126.0793	129.7987	134.1595	142.2923	153.2664	162.8416 (72)
	680.1440	696.7348	667.5069	644.5060	611.5018	589.5257	566.8276	567.4535	584.6527	604.3386	641.3047	665.5266 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		FF	Access factor Table 6d		Gains W
Northeast	3.9000				11.2829	0.4000		0.8000			0.7700		9.7582 (75)
Southeast	12.9100				36.7938	0.4000		0.8000			0.7700		105.3379 (77)
Northwest	6.2100				11.2829	0.4000		0.8000			0.7700		15.5381 (81)
Solar gains	130.6341	230.9207	338.2740	456.5468	545.5155	556.5899	530.3617	461.6909	378.8708	261.2341	157.9997	110.8055	(83)
Total gains	810.7782	927.6555	1005.7810	1101.0528	1157.0173	1146.1156	1097.1893	1029.1444	963.5234	865.5727	799.3045	776.3321	(84)
7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.7266	73.9643	74.2036	75.4234	75.6722	76.9411	76.9411	77.2000	76.4285	75.6722	75.1762	74.6867	
alpha	5.9151	5.9310	5.9469	6.0282	6.0448	6.1294	6.1294	6.1467	6.0952	6.0448	6.0117	5.9791	
util living area	0.9975	0.9939	0.9847	0.9468	0.8406	0.6388	0.4692	0.5193	0.7796	0.9632	0.9938	0.9981	(86)
Living	19.9388	20.1035	20.3339	20.6485	20.8800	20.9822	20.9976	20.9958	20.9433	20.6477	20.2459	19.9195	
Non living	18.8864	19.0984	19.3923	19.7898	20.0511	20.1551	20.1645	20.1663	20.1219	19.7970	19.2906	18.8695	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4571	20.1035	20.3339	20.6485	20.8800	20.9822	20.9976	20.9958	20.9433	20.6477	20.2459	20.0706	(87)
Th 2	20.1320	20.1346	20.1371	20.1499	20.1525	20.1653	20.1653	20.1679	20.1602	20.1525	20.1474	20.1422	(88)
util rest of house	0.9967	0.9919	0.9795	0.9291	0.7942	0.5631	0.3816	0.4279	0.7088	0.9473	0.9915	0.9974	(89)
MIT 2	19.6354	19.0984	19.3923	19.7898	20.0511	20.1551	20.1645	20.1663	20.1219	19.7970	19.2906	19.0988	(90)
Living area fraction									fLA =	Living area / (4) =		0.1854	(91)
MIT	19.7878	19.2847	19.5669	19.9490	20.2047	20.3084	20.3190	20.3201	20.2741	19.9547	19.4677	19.2790	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7878	19.2847	19.5669	19.9490	20.2047	20.3084	20.3190	20.3201	20.2741	19.9547	19.4677	19.2790	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9893	0.9751	0.9241	0.7974	0.5765	0.3979	0.4448	0.7192	0.9426	0.9889	0.9965	(94)
Useful gains	807.7635	917.7117	980.7416	1017.5018	922.5800	660.7583	436.5278	457.7834	692.9655	815.9041	790.3959	773.6521	(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	1901.2800	1760.1935	1593.7838	1325.8596	1017.2018	671.4906	437.4675	459.5813	731.1456	1118.8578	1488.9813	1827.2995	(97)
Space heating kWh	813.5763	566.1478	456.1034	222.0176	70.3986	0.0000	0.0000	0.0000	0.0000	225.3975	502.9815	783.9136	(98a)
Space heating requirement - total per year (kWh/year)												3640.5363	
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	813.5763	566.1478	456.1034	222.0176	70.3986	0.0000	0.0000	0.0000	0.0000	225.3975	502.9815	783.9136	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3640.5363	
Space heating per m2										(98c) / (4) =		27.9332	(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 %)													309.3397 (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	813.5763	566.1478	456.1034	222.0176	70.3986	0.0000	0.0000	0.0000	0.0000	225.3975	502.9815	783.9136	(98)
Space heating efficiency (main heating system 1)	309.3397	309.3397	309.3397	309.3397	309.3397	0.0000	0.0000	0.0000	0.0000	309.3397	309.3397	309.3397	(210)
Space heating fuel (main heating system)	263.0042	183.0182	147.4442	71.7715	22.7577	0.0000	0.0000	0.0000	0.0000	72.8641	162.5984	253.4152	(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	290.2214	256.6550	272.4661	238.8876	231.1603	207.8322	204.6872	213.0099	215.5815	240.9654	256.9557	286.9463	(64)
Efficiency of water heater (217)m	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	281.8178	(216)
Fuel for water heating, kWh/month	102.9819	91.0713	96.6816	84.7667	82.0247	73.7470	72.6310	75.5842	76.4967	85.5040	91.1779	101.8198	(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	32.4975	29.3526	32.4975	31.4492	32.4975	31.4492	32.4975	32.4975	31.4492	32.4975	31.4492	32.4975	(231)
Lighting	31.4337	25.2173	22.7054	16.6349	12.8493	10.4980	11.7216	15.2361	19.7902	25.9658	29.3283	32.3073	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-22.0414	-34.8222	-56.1001	-69.1977	-78.8789	-74.6760	-73.6297	-66.6133	-54.9035	-41.7472	-25.2523	-18.5530	(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)
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)
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)
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)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

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(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												1176.8734	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												281.8178	
Water heating fuel used												1034.4869	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)													
mechanical ventilation fans (SFP = 0.9100)												382.6320	(230a)
Total electricity for the above, kWh/year												382.6320	(231)
Electricity for lighting (calculated in Appendix L)												253.6879	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-616.4153	(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												2231.2649	(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	1176.8734	0.1561	183.7474	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1034.4869	0.1409	145.8014	(264)
Space and water heating			329.5488	(265)
Pumps, fans and electric keep-hot	382.6320	0.1387	53.0758	(267)
Energy for lighting	253.6879	0.1443	36.6150	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-616.4153	0.1328	-81.8627	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-81.8627	(269)
Total CO2, kg/year			337.3769	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.5900	(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	1176.8734	1.5780	1857.1181	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1034.4869	1.5211	1573.6097	(278)
Space and water heating			3430.7278	(279)
Pumps, fans and electric keep-hot	382.6320	1.5128	578.8457	(281)
Energy for lighting	253.6879	1.5338	389.1150	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-616.4153	1.4907	-918.9080	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-918.9080	(283)
Total Primary energy kWh/year			3479.7804	(286)
Dwelling Primary energy Rate (DPER)			26.7000	(287)

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

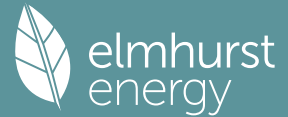
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	52.2500 (1b)	x 2.5000 (2b)	= 130.6250 (1b) - (3b)	
First floor	43.6200 (1c)	x 2.9000 (2c)	= 126.4980 (1c) - (3c)	
Second floor	34.4600 (1d)	x 2.5400 (2d)	= 87.5284 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.3300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	344.6514 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)

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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) =
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
40.0000 / (5) = 0.1161 (8)
Yes
Blower Door
5.0000 (17)
0.3661 (18)
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3386 (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	0.4317	0.4233	0.4148	0.3725	0.3640	0.3217	0.3217	0.3132	0.3386	0.3640	0.3809	0.3979 (22b)
Effective ac	0.5932	0.5896	0.5860	0.5694	0.5662	0.5517	0.5517	0.5491	0.5573	0.5662	0.5726	0.5791 (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
Main dwelling							
TER Opaque door			2.7000	1.0000	2.7000		(26)
TER Opening Type			23.0200	1.1450	26.3588		(27)
GROUND FL			52.3500	0.1300	6.8055		(28a)
External Wall	145.2300	25.7200	119.5100	0.1800	21.5118		(29a)
Ext. Roof - flat	43.2000		43.2000	0.1100	4.7520		(30)
Ext. Roof - Pitched	27.9100		27.9100	0.1100	3.0701		(30)
Total net area of external elements Aum(A, m2)			268.6900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 65.1982		(33)
Main dwelling							
Party Wall 1			60.5200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	14.7400	0.0500	0.7370
E1 Steel lintel with perforated steel base plate	14.7400	0.0500	0.7370
E3 Sill	40.9000	0.0500	2.0450
E4 Jamb	21.5400	0.1600	3.4464
E5 Ground floor (normal)	20.9700	0.0000	0.0000
E6 Intermediate floor within a dwelling	9.5200	0.0800	0.7616
E13 Gable (insulation at rafter level)	17.2600	0.0800	1.3808
E14 Flat roof	7.8800	0.5600	4.4128
E15 Flat roof with parapet	35.8000	0.0900	3.2220
E16 Corner (normal)	10.8000	-0.0900	-0.9720
E17 Corner (inverted - internal area greater than external area)	5.4000	0.0600	0.3240
E18 Party wall between dwellings	18.6300	0.2400	4.4712
E24 Eaves (insulation at ceiling level - inverted)	5.4000	0.0600	0.3240
E25 Staggered party wall between dwellings	9.4900	0.0800	0.7592
P1 Party wall - Ground floor	14.5700	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	6.4000	0.1200	0.7680
P4 Party wall - Roof (insulation at ceiling level)	6.3500	0.0800	0.5080
P5 Party wall - Roof (insulation at rafter level)	10.3300	0.0600	0.6198
R6 Flat ceiling	12.7800	0.0400	0.5112
R7 Flat ceiling (inverted)	9.1300	0.0400	0.3652
R9 Roof to wall (flat ceiling)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 24.4212 (36)
Point Thermal bridges 0.0000
Total fabric heat loss (33) + (36) + (36a) = 89.6194 (37)

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

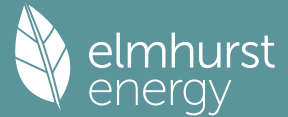
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	67.4666	67.0550	66.6516	64.7567	64.4022	62.7518	62.7518	62.4462	63.3875	64.4022	65.1194	65.8692 (38)
Heat transfer coeff	157.0860	156.6744	156.2710	154.3761	154.0216	152.3712	152.3712	152.0656	153.0069	154.0216	154.7388	155.4886 (39)
Average = Sum(39)m / 12 =												154.3744

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2053	1.2021	1.1990	1.1845	1.1818	1.1691	1.1691	1.1668	1.1740	1.1818	1.1873	1.1930 (40)
HLP (average)												1.1845
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8958 (42)
Hot water usage for mixer showers													
72.7736	71.6799	70.0863	67.0371	64.7869	62.2775	60.8511	62.4327	64.1664	66.8608	69.9754	72.4947	(42a)	
Hot water usage for baths													
31.4182	30.9516	30.2945	29.0830	28.1758	27.1699	26.6266	27.2790	27.9895	29.0658	30.3023	31.3120	(42b)	
Hot water usage for other uses													
44.2863	42.6759	41.0655	39.4551	37.8447	36.2342	36.2342	37.8447	39.4551	41.0655	42.6759	44.2863	(42c)	
Average daily hot water use (litres/day)												136.4847 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
148.4781	145.3074	141.4463	135.5752	130.8074	125.6816	123.7119	127.5564	131.6110	136.9921	142.9537	148.0930	(44)	
Energy content (annual)	235.1530	206.9158	217.3977	185.5956	176.0919	154.5402	149.6188	157.9415	162.2895	185.8970	203.6637	231.8779 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2266.9826	
35.2729	31.0374	32.6096	27.8393	26.4138	23.1810	22.4428	23.6912	24.3434	27.8845	30.5496	34.7817	(46)	
Water storage loss:													
Store volume												185.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.5775 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.8518 (55)	
Total storage loss													
26.4067	23.8512	26.4067	25.5549	26.4067	25.5549	26.4067	26.4067	25.5549	26.4067	25.5549	26.4067	(56)	
If cylinder contains dedicated solar storage													
26.4067	23.8512	26.4067	25.5549	26.4067	25.5549	26.4067	26.4067	25.5549	26.4067	25.5549	26.4067	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	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	(61)	

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Total heat required for water heating calculated for each month												
WWHRS	284.8221	251.7783	267.0668	233.6625	225.7610	202.6071	199.2880	207.6106	210.3564	235.5661	251.7306	281.5470 (62)
PV diverter	-33.2690	-29.4234	-30.8105	-25.5123	-23.7766	-20.3458	-19.0709	-20.2800	-21.0505	-24.8162	-28.1138	-32.6529 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	251.5531	222.3549	236.2563	208.1502	201.9844	182.2613	180.2171	187.3306	189.3059	210.7499	223.6168	248.8941 (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	2542.6746 (64a)
Heat gains from water heating, kWh/month	117.9237	104.6895	112.0200	100.1641	98.2858	89.8381	89.4836	92.2508	92.4148	101.5460	106.1717	116.8347 (65)
Total per year (kWh/year) = Sum(64a)m =												2543 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

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	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920	144.7920 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	154.0529	170.5586	154.0529	159.1880	154.0529	159.1880	154.0529	154.0529	159.1880	154.0529	159.1880	154.0529 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	298.1178	301.2114	293.4158	276.8199	255.8705	236.1811	223.0273	219.9338	227.7294	244.3253	265.2747	284.9641 (68)
Pumps, fans	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792	37.4792 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336	-115.8336 (71)
Total internal gains	158.4996	155.7879	150.5646	139.1168	132.1046	124.7752	120.2736	123.9931	128.3538	136.4866	147.4607	157.0359 (72)
680.1079	696.9955	667.4708	644.5622	611.4657	586.5819	563.7915	564.4174	581.7089	604.3025	641.3610	665.4905	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	3.9000	11.2829	0.6300	0.7000	0.7700	13.4480 (75)
Southeast	12.9100	36.7938	0.6300	0.7000	0.7700	145.1687 (77)
Northwest	6.2100	11.2829	0.6300	0.7000	0.7700	21.4134 (81)
Solar gains	180.0302	318.2375	466.1839	629.1785	751.7885	1363.2542
Total gains	860.1381	1015.2330	1133.6547	1273.7408	1353.6324	1294.6962

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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	57.6162	57.7675	57.9167	58.6276	58.7625	59.3990	59.3990	59.5184	59.1522	58.7625	58.4901	58.2081
util living area	4.8411	4.8512	4.8611	4.9085	4.9175	4.9599	4.9599	4.9679	4.9435	4.9175	4.8993	4.8805
MIT	0.9970	0.9927	0.9825	0.9458	0.8509	0.6743	0.5081	0.5653	0.8127	0.9655	0.9933	0.9976 (86)
Th 2	19.5621	19.7660	20.0607	20.4579	20.7772	20.9488	20.9897	20.9830	20.8701	20.4514	19.9400	19.5343 (87)
util rest of house	19.9158	19.9183	19.9208	19.9324	19.9346	19.9448	19.9448	19.9467	19.9409	19.9346	19.9302	19.9256 (88)
MIT 2	0.9959	0.9903	0.9763	0.9262	0.7997	0.5814	0.3913	0.4445	0.7337	0.9490	0.9906	0.9968 (89)
Living area fraction	18.2477	18.5094	18.8846	19.3834	19.7477	19.9159	19.9416	19.9408	19.8528	19.3862	18.7411	18.2191 (90)
MIT	18.4914	18.7423	19.1026	19.5826	19.9385	20.1074	20.1359	20.1340	20.0414	19.5837	18.9633	18.4629 (91)
Temperature adjustment	18.4914	18.7423	19.1026	19.5826	19.9385	20.1074	20.1359	20.1340	20.0414	19.5837	18.9633	18.4629 (92)
adjusted MIT	18.4914	18.7423	19.1026	19.5826	19.9385	20.1074	20.1359	20.1340	20.0414	19.5837	18.9633	18.4629 (93)

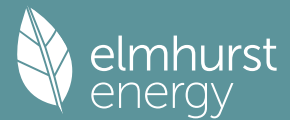
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9939	0.9865	0.9699	0.9181	0.7999	0.5966	0.4130	0.4668	0.7423	0.9418	0.9870	0.9951 (94)
Ext temp.	854.8624	1001.4805	1099.4841	1169.4735	1090.4451	807.5726	534.6775	560.4718	819.3259	908.1876	847.9019	814.2073 (95)
Heat loss rate W	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)
Space heating kWh	2229.2632	2168.7366	1969.4233	1649.1342	1268.9086	839.1704	538.7651	567.8068	909.0751	1383.6820	1835.7142	2217.7154 (97)
Space heating requirement - total per year (kWh/year)	1022.5542	784.3961	647.2348	345.3557	132.7768	0.0000	0.0000	0.0000	0.0000	353.7678	711.2248	1044.2100 (98a)
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)	1022.5542	784.3961	647.2348	345.3557	132.7768	0.0000	0.0000	0.0000	0.0000	353.7678	711.2248	1044.2100 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1022.5542	784.3961	647.2348	345.3557	132.7768	0.0000	0.0000	0.0000	0.0000	353.7678	711.2248	1044.2100 (98c)
Space heating per m2	5041.5203	5041.5203	5041.5203	5041.5203	5041.5203	5041.5203	5041.5203	5041.5203	5041.5203	5041.5203	5041.5203	5041.5203 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Efficiency of main space heating system 1 (in %)	1.0000 (202)
Efficiency of main space heating system 2 (in %)	92.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (207)
	0.0000 (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1022.5542	784.3961	647.2348	345.3557	132.7768	0.0000	0.0000	0.0000	0.0000	353.7678	711.2248	1044.2100	(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)	1107.8594	849.8333	701.2294	374.1666	143.8536	0.0000	0.0000	0.0000	0.0000	383.2804	770.5578	1131.3218	(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	251.5531	222.3549	236.2563	208.1502	201.9844	182.2613	180.2171	187.3306	189.3059	210.7499	223.6168	248.8941	(64)
Efficiency of water heater (217)m	86.8658	86.6418	86.2003	85.1870	83.1422	79.8000	79.8000	79.8000	79.8000	85.2122	86.4673	86.9133	(216)
Fuel for water heating, kWh/month	289.5883	256.6369	274.0784	244.3450	242.9384	228.3977	225.8359	234.7501	237.2254	247.3237	258.6143	286.3706	(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	32.0092	25.6789	23.1210	16.9395	13.0845	10.6902	11.9361	15.5150	20.1525	26.4412	29.8653	32.8988	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-48.9047	-68.9568	-99.1086	-111.3765	-119.9798	-111.8587	-110.3877	-104.2207	-93.3972	-78.7307	-53.7339	-42.2723	(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	-27.5996	-58.0653	-115.4503	-173.4921	-229.5385	-230.7619	-228.1342	-193.1748	-141.5494	-83.1751	-36.8863	-21.8322	(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												5462.1022	(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												3026.1048	(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)												258.3322	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2582.5872	(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												6249.9520	(238)

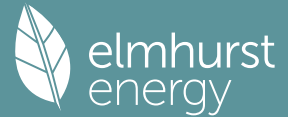
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5462.1022	0.2100	1147.0415 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3026.1048	0.2100	635.4820 (264)
Space and water heating			1782.5235 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	258.3322	0.1443	37.2853 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1042.9274	0.1346	-140.3871 (236)
PV Unit electricity exported	-1539.6598	0.1259	-193.7982 (237)
Total			-334.1853 (269)
Total CO2, kg/year			1497.5527 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4900 (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	5462.1022	1.1300	6172.1755 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3026.1048	1.1300	3419.4984 (278)
Space and water heating			9591.6739 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	258.3322	1.5338	396.2386 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1042.9274	1.4975	-1561.7761 (283)
PV Unit electricity exported	-1539.6598	0.4620	-711.3695 (286)
Total			-2273.1456 (283)
Total Primary energy kWh/year			7844.8676 (286)
Target Primary Energy Rate (TPER)			60.1900 (287)

Full SAP Calculation Printout



Property Reference	UNIT B				Issued on Date	25/02/2025
Assessment Reference	GREEN V3	Prop Type Ref				
Property						
SAP Rating	91 B	DER	2.25	TER	12.15	
Environmental	98 A	% DER < TER				81.48
CO ₂ Emissions (t/year)	0.2	DFEE	46.48	TFEE	48.90	
Compliance Check	See BREL	% DFEE < TFEE				4.95
% DPER < TPER	64.16	DPER	22.87	TPER	63.81	
Assessor Details	Ms. Vanessa Vienna				Assessor ID	T798-0001
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)
Main dwelling			
Ground floor	62.5800 (1b)	x 2.5000 (2b)	= 156.4500 (1b) - (3b)
First floor	46.9300 (1c)	x 3.4300 (2c)	= 160.9699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 317.4199 (5)

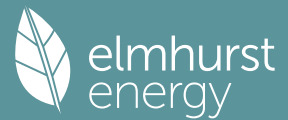
2. Ventilation rate

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	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000	(22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750	(22a)
Adj infilt rate	0.1626 0.1594 0.1562 0.1403 0.1371 0.1211 0.1211 0.1179 0.1275 0.1371 0.1434 0.1498	(22b)
Balanced mechanical ventilation with heat recovery		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		75.2000 (23c)
Effective ac	0.2866 0.2834 0.2802 0.2642 0.2611 0.2451 0.2451 0.2419 0.2515 0.2611 0.2674 0.2738	(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
Main dwelling							
Opening Type 1			19.6400	1.1450	22.4885		(27)
DOOR			1.8000	1.0000	1.8000		(26)
GROUUND FLOOR			62.5800	0.1000	6.2580		(28a)
External Wall 1	109.5200	21.4400	88.0800	0.1600	14.0928		(29a)
EXT. ROOF - PITCH	50.6300		50.6300	0.1000	5.0630		(30)
EXT. ROOF - FLAT	30.1300		30.1300	0.1000	3.0130		(30)
Total net area of external elements Aum(A, m ²)			252.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.7153		(33)
Main dwelling							
Party Wall 1			66.9700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E1 Steel lintel with perforated steel base plate	13.1000	0.1000	1.3100
E3 Sill	12.1000	0.0400	0.4840
E4 Jamb	33.0000	0.0500	1.6500
E5 Ground floor (normal)	20.4000	0.1000	2.0400
E6 Intermediate floor within a dwelling	6.0100	0.0500	0.3005
E10 Eaves (insulation at ceiling level)	5.0900	0.0600	0.3054
E11 Eaves (insulation at rafter level)	5.0900	0.0400	0.2036
E13 Gable (insulation at rafter level)	12.5200	0.0400	0.5008
E14 Flat roof	5.6800	0.1300	0.7384
E15 Flat roof with parapet	14.3900	0.1500	2.1585
E16 Corner (normal)	20.4000	0.0900	1.8360
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180
E18 Party wall between dwellings	5.0000	0.0600	0.3000
E24 Eaves (insulation at ceiling level - inverted)	11.1300	0.1000	1.1130
E25 Staggered party wall between dwellings	12.8000	0.1200	1.5360
P1 Party wall - Ground floor	15.2600	0.2200	3.3572
P2 Party wall - Intermediate floor within a dwelling	12.7200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6300	0.2800	2.1364
P5 Party wall - Roof (insulation at rafter level)	5.9900	0.2800	1.6772
R4 Ridge (vaulted ceiling)	8.0900	0.1200	0.9708
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			21.6998 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	74.4151 (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	30.0170	29.6831	29.3492	27.6798	27.3459	25.6765	25.6765	25.3426	26.3443	27.3459	28.0137	28.6815 (38)
Average = Sum(39)m / 12 =	104.4322	104.0983	103.7644	102.0950	101.7611	100.0916	100.0916	99.7578	100.7594	101.7611	102.4288	103.0966 (39)
												102.0115
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9536	0.9506	0.9475	0.9323	0.9292	0.9140	0.9140	0.9109	0.9201	0.9292	0.9353	0.9414 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

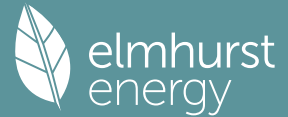
Assumed occupancy												2.8119 (42)
Hot water usage for mixer showers	71.3653	70.2928	68.7300	65.7399	63.5332	61.0723	59.6736	61.2246	62.9247	65.5670	68.6214	71.0919 (42a)
Hot water usage for baths	30.8126	30.3550	29.7106	28.5224	27.6327	26.6462	26.1133	26.7532	27.4500	28.5056	29.7183	30.7085 (42b)
Hot water usage for other uses	43.4262	41.8470	40.2679	38.6888	37.1096	35.5305	35.5305	37.1096	38.6888	40.2679	41.8470	43.4262 (42c)
Average daily hot water use (litres/day)												133.8430 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	145.6042	142.4949	138.7086	132.9511	128.2756	123.2491	121.3174	125.0875	129.0635	134.3405	140.1867	145.2266 (44)
Energy content (annual)	230.6014	202.9109	213.1899	182.0034	172.6836	151.5491	146.7229	154.8844	159.1482	182.2988	199.7216	227.3897 (45)
Distribution loss (46)m = 0.15 x (45)m	34.5902	30.4366	31.9785	27.3005	25.9025	22.7324	22.0084	23.2327	23.8722	27.3448	29.9582	34.1085 (46)
Water storage loss:												150.0000 (47)
Store volume												2.0900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												1.6302 (55)
Enter (49) or (54) in (55)												
Total storage loss	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362 (56)
If cylinder contains dedicated solar storage	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	335.9952	298.1053	318.5837	283.9974	278.0774	222.9671	220.5215	228.6830	230.5662	287.6926	301.7156	332.7835 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	335.9952	298.1053	318.5837	283.9974	278.0774	222.9671	220.5215	228.6830	230.5662	287.6926	301.7156	332.7835 (64)
12Total per year (kWh/year)												3339.6886 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	120.5610	107.1069	114.7717	102.9865	101.3034	68.3997	67.3953	70.1090	70.9264	104.5004	108.8778	119.4932 (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	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.2509	151.9563	137.2509	141.8259	137.2509	141.8259	137.2509	137.2509	141.8259	137.2509	141.8259	137.2509 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8501	273.6607	266.5782	251.5002	232.4670	214.5785	202.6279	199.8173	206.8999	221.9778	241.0110	258.8995 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741 (71)
Water heating gains (Table 5)	162.0444	159.3853	154.2631	143.0368	136.1605	94.9996	90.5851	94.2325	98.5089	140.4576	151.2192	160.6091 (72)
Total internal gains	635.3232	650.1801	623.2699	601.5407	571.0561	516.5817	495.6416	496.4785	512.4124	564.8640	599.2339	621.9372 (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			8.2200	19.6403	0.4000	0.8000	0.7700	35.8016 (76)
South			3.9600	46.7521	0.4000	0.8000	0.7700	41.0562 (78)
West			7.4600	19.6403	0.4000	0.8000	0.7700	32.4915 (80)

Solar gains	109.3493	200.8353	305.6644	417.6805	494.1219	499.6366	478.1033	421.3217	345.3572	231.0467	133.8191	91.6373 (83)
Total gains	744.6725	851.0154	928.9342	1019.2213	1065.1780	1016.2183	973.7449	917.8002	857.7696	795.9107	733.0530	713.5745 (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	72.8211	73.0546	73.2897	74.4881	74.7325	75.9790	75.9790	76.2333	75.4754	74.7325	74.2453	73.7644
alpha	5.8547	5.8703	5.8860	5.9659	5.9822	6.0653	6.0653	6.0822	6.0317	5.9822	5.9497	5.9176
util living area	0.9961	0.9907	0.9768	0.9247	0.8016	0.6156	0.4503	0.4963	0.7545	0.9478	0.9906	0.9969 (86)
Living	19.9825	20.1540	20.3930	20.7015	20.9056	20.9847	20.9980	20.9965	20.9509	20.6900	20.2893	19.9614
Non living	18.9347	19.1547	19.4575	19.8416	20.0654	20.1470	20.1550	20.1569	20.1180	19.8373	19.3378	18.9156
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4795	20.1540	20.3930	20.7015	20.9056	20.9847	20.9980	20.9965	20.9509	20.6900	20.2893	20.1067 (87)
Th 2	20.1222	20.1247	20.1273	20.1401	20.1427	20.1556	20.1556	20.1582	20.1505	20.1427	20.1376	20.1324 (88)
util rest of house	0.9948	0.9878	0.9694	0.9020	0.7511	0.5407	0.3650	0.4074	0.6819	0.9269	0.9871	0.9959 (89)
MIT 2	19.6488	19.1547	19.4575	19.8416	20.0654	20.1470	20.1550	20.1569	20.1180	19.8373	19.3378	19.1349 (90)
Living area fraction									fLA = Living area / (4) =			0.4106 (91)
MIT	19.9898	19.5649	19.8416	20.1946	20.4103	20.4909	20.5011	20.5016	20.4600	20.1874	19.7284	19.5339 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9898	19.5649	19.8416	20.1946	20.4103	20.4909	20.5011	20.5016	20.4600	20.1874	19.7284	19.5339 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9946	0.9854	0.9664	0.9036	0.7678	0.5711	0.4001	0.4440	0.7097	0.9282	0.9849	0.9950 (94)
Useful gains	740.6401	838.5990	897.7405	920.9649	817.8013	580.3157	389.5469	407.4984	608.7822	738.7377	722.0129	710.0248 (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	1638.5220	1526.5948	1384.3826	1153.1260	886.3720	589.6289	390.4644	409.1698	640.8267	975.6228	1293.5162	1580.8715 (97)
Space heating kWh	668.0241	462.3332	362.0618	167.1561	51.0166	0.0000	0.0000	0.0000	0.0000	176.2426	411.4824	647.9100 (98a)
Space heating requirement - total per year (kWh/year)												2946.2267
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	668.0241	462.3332	362.0618	167.1561	51.0166	0.0000	0.0000	0.0000	0.0000	176.2426	411.4824	647.9100 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2946.2267
Space heating per m2										(98c) / (4) =		26.9037 (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 %)

306.1412 (206)

Efficiency of main space heating system 2 (in %)

0.0000 (207)

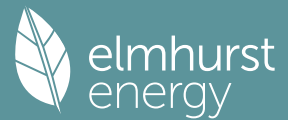
Efficiency of secondary/supplementary heating system, %

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	668.0241	462.3332	362.0618	167.1561	51.0166	0.0000	0.0000	0.0000	0.0000	176.2426	411.4824	647.9100 (98)
Space heating efficiency (main heating system 1)	306.1412	306.1412	306.1412	306.1412	306.1412	0.0000	0.0000	0.0000	0.0000	306.1412	306.1412	306.1412 (210)
Space heating fuel (main heating system)	218.2078	151.0196	118.2662	54.6010	16.6644	0.0000	0.0000	0.0000	0.0000	57.5690	134.4093	211.6376 (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	335.9952	298.1053	318.5837	283.9974	278.0774	222.9671	220.5215	228.6830	230.5662	287.6926	301.7156	332.7835 (64)
Efficiency of water heater	281.8194	281.8194	281.8194	281.8194	281.8194	281.8194	281.8194	281.8194	281.8194	281.8194	281.8194	281.8194 (216)
Fuel for water heating, kWh/month	119.2236	105.7788	113.0453	100.7728	98.6722	79.1170	78.2492	81.1452	81.8135	102.0840	107.0599	118.0840 (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)
Pumps and Fa	24.4043	22.0426	24.4043	23.6171	24.4043	23.6171	24.4043	24.4043	23.6171	24.4043	23.6171	24.4043 (223)
Lighting	28.5180	22.8782	20.5993	15.0919	11.6574	9.5242	10.6343	13.8229	17.9545	23.5573	26.6080	29.3106 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-47.4608	-69.7173	-103.7510	-118.2022	-127.7700	-117.0820	-115.6588	-107.8974	-93.9030	-79.2904	-52.6604	-40.6034 (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)
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)
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)
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)
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)

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Full SAP Calculation Printout



Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											Air changes per hour	40.0000 / (5) =	0.1260 (8)
Pressure test												Yes		
Pressure Test Method												Blower Door		
Measured/design AP50												5.0000 (17)		
Infiltration rate												0.3760 (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) =											0.3196 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	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)		
Adj infilt rate	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)		
Effective ac	0.4075	0.3995	0.3915	0.3516	0.3436	0.3036	0.3036	0.2956	0.3196	0.3436	0.3596	0.3755 (22b)		
	0.5830	0.5798	0.5766	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5646	0.5705 (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
Main dwelling							
TER Opaque door			1.8000	1.0000	1.8000		(26)
TER Opening Type			19.6400	1.1450	22.4885		(27)
GROUUND FLOOR			62.5800	0.1300	8.1354		(28a)
External Wall 1	109.5200	21.4400	88.0800	0.1800	15.8544		(29a)
EXT. ROOF - PITCH	50.6300		50.6300	0.1100	5.5693		(30)
EXT. ROOF - FLAT	30.1300		30.1300	0.1100	3.3143		(30)
Total net area of external elements Aum(A, m2)			252.8600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	57.1619	(33)
Main dwelling							
Party Wall 1			66.9700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.1000	0.0500	0.6550
E1 Steel lintel with perforated steel base plate	12.1000	0.0500	0.6050
E3 Sill	33.0000	0.0500	1.6500
E4 Jamb	20.4000	0.1600	3.2640
E5 Ground floor (normal)	6.0100	0.0000	0.0000
E6 Intermediate floor within a dwelling	5.0900	0.0600	0.3054
E10 Eaves (insulation at ceiling level)	5.0900	0.0400	0.2036
E11 Eaves (insulation at rafter level)	12.5200	0.0800	1.0016
E13 Gable (insulation at rafter level)	5.6800	0.0800	0.4544
E14 Flat roof	14.3900	0.5600	8.0584
E15 Flat roof with parapet	20.4000	0.0900	1.8360
E16 Corner (normal)	10.2000	-0.0900	-0.9180
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0600	0.3000
E18 Party wall between dwellings	11.1300	0.2400	2.6712
E24 Eaves (insulation at ceiling level - inverted)	12.8000	0.0600	0.7680
E25 Staggered party wall between dwellings	15.2600	0.0800	1.2208
P1 Party wall - Ground floor	12.7200	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	7.6300	0.1200	0.9156
P4 Party wall - Roof (insulation at ceiling level)	5.9900	0.0800	0.4792
P5 Party wall - Roof (insulation at rafter level)	8.0900	0.0800	0.6472
R4 Ridge (vaulted ceiling)			

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

Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	81.2793 (37)

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

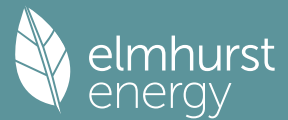
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	61.0717	60.7339	60.4029	58.8480	58.5571	57.2028	57.2028	56.9520	57.7245	58.5571	59.1456	59.7609 (38)
Heat transfer coeff	142.3510	142.0133	141.6823	140.1274	139.8364	138.4822	138.4822	138.2314	139.0038	139.8364	140.4250	141.0402 (39)
Average = Sum(39)m / 12 =												140.1260

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2999	1.2968	1.2938	1.2796	1.2769	1.2646	1.2646	1.2623	1.2693	1.2769	1.2823	1.2879 (40)
HLP (average)												1.2796
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8119 (42)
Hot water usage for mixer showers	71.3653	70.2928	68.7300	65.7399	63.5332	61.0723	59.6736	61.2246	62.9247	65.5670	68.6214	71.0919 (42a)
Hot water usage for baths	30.8126	30.3550	29.7106	28.5224	27.6327	26.6462	26.1133	26.7532	27.4500	28.5056	29.7183	30.7085 (42b)
Hot water usage for other uses	43.4262	41.8470	40.2679	38.6888	37.1096	35.5305	35.5305	37.1096	38.6888	40.2679	41.8470	43.4262 (42c)
Average daily hot water use (litres/day)												133.8430 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	145.6042	142.4949	138.7086	132.9511	128.2756	123.2491	121.3174	125.0875	129.0635	134.3405	140.1867	145.2266 (44)
Energy content (annual)	230.6014	202.9109	213.1899	182.0034	172.6836	151.5491	146.7229	154.8844	159.1482	182.2988	199.7216	227.3897 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2223.1040
	34.5902	30.4366	31.9785	27.3005	25.9025	22.7324	22.0084	23.2327	23.8722	27.3448	29.9582	34.1085 (46)
Water storage loss:												
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	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	277.1963	244.9966	259.7848	227.0952	219.2785	196.6410	193.3178	201.4793	204.2401	228.8937	244.8134	273.9846 (62)

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WVHRS	-32.6252	-28.8540	-30.2143	-25.0186	-23.3165	-19.9521	-18.7019	-19.8876	-20.6432	-24.3360	-27.5698	-32.0211 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	244.5711	216.1426	229.5705	202.0766	195.9620	176.6889	174.6160	181.5918	183.5969	204.5577	217.2437	241.9635 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2468.5812 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	113.9509	101.1364	108.1616	96.5896	94.6932	86.4636	86.0613	88.7750	88.9903	97.8903	102.4809	112.8830 (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	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	140.5926	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.6120	154.5704	139.6120	144.2657	139.6120	144.2657	139.6120	139.6120	144.2657	139.6120	144.2657	139.6120	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8501	273.6607	266.5782	251.5002	232.4670	214.5785	202.6279	199.8173	206.8999	221.9778	241.0110	258.8995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	37.0593	(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)	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	-112.4741	(71)
Water heating gains (Table 5)	153.1598	150.5007	145.3784	134.1522	127.2758	120.0883	115.6738	119.3212	123.5976	131.5729	142.3346	151.7245	(72)
Total internal gains	631.7997	646.9096	619.7464	598.0959	567.5326	544.1103	523.0914	523.9283	539.9410	561.3405	595.7891	618.4137	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					8.2200	19.6403		0.6300	0.7000	0.7700		49.3391 (76)	
South					3.9600	46.7521		0.6300	0.7000	0.7700		56.5806 (78)	
West					7.4600	19.6403		0.6300	0.7000	0.7700		44.7773 (80)	
Solar gains	150.6970	276.7761	421.2437	575.6160	680.9617	688.5616	658.8861	580.6340	475.9454	318.4113	184.4194	126.2876	(83)
Total gains	782.4967	923.6857	1040.9901	1173.7119	1248.4944	1232.6719	1181.9776	1104.5623	1015.8864	879.7518	780.2085	744.7014	(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	53.4233	53.5503	53.6755	54.2711	54.3840	54.9158	54.9158	55.0154	54.7097	54.3840	54.1560	53.9198
alpha	4.5616	4.5700	4.5784	4.6181	4.6256	4.6611	4.6611	4.6677	4.6473	4.6256	4.6104	4.5947
util living area	0.9958	0.9905	0.9775	0.9355	0.8386	0.6676	0.5039	0.5563	0.7985	0.9589	0.9912	0.9966 (86)
MIT	19.4773	19.6924	20.0110	20.4286	20.7575	20.9393	20.9868	20.9794	20.8582	20.4157	19.8735	19.4461 (87)
Th 2	19.8409	19.8433	19.8457	19.8569	19.8590	19.8687	19.8687	19.8705	19.8649	19.8590	19.8547	19.8503 (88)
util rest of house	0.9943	0.9873	0.9697	0.9125	0.7833	0.5698	0.3803	0.4293	0.7139	0.9395	0.9876	0.9955 (89)
MIT 2	18.0873	18.3628	18.7668	19.2871	19.6589	19.8352	19.8648	19.8636	19.7713	19.2841	18.6030	18.0540 (90)
Living area fraction	18.6580	18.9087	19.2776	19.7557	20.1099	20.2885	20.3254	20.3217	20.2176	19.7487	19.1246	18.6256 (92)
MIT	18.6580	18.9087	19.2776	19.7557	20.1099	20.2885	20.3254	20.3217	20.2176	19.7487	19.1246	18.6256 (93)
Temperature adjustment	18.6580	18.9087	19.2776	19.7557	20.1099	20.2885	20.3254	20.3217	20.2176	19.7487	19.1246	18.6256 (93)
adjusted MIT	18.6580	18.9087	19.2776	19.7557	20.1099	20.2885	20.3254	20.3217	20.2176	19.7487	19.1246	18.6256 (93)

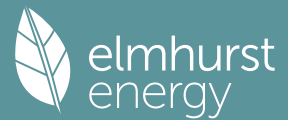
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9922	0.9837	0.9646	0.9101	0.7968	0.6080	0.4313	0.4816	0.7429	0.9371	0.9845	0.9937 (94)
Useful gains	776.4164	908.6265	1004.1908	1068.1775	994.7999	749.4433	509.7476	531.9694	754.7004	824.4039	768.1080	740.0230 (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	2043.8710	1989.4156	1810.3637	1521.1867	1176.0115	787.7541	515.9038	542.1069	850.3659	1279.3206	1688.5569	2034.5852 (97)
Space heating kWh	942.9862	726.2903	599.7927	326.1666	134.8214	0.0000	0.0000	0.0000	0.0000	338.4581	662.7232	963.1543 (98a)
Space heating requirement - total per year (kWh/year)												4694.3928
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	942.9862	726.2903	599.7927	326.1666	134.8214	0.0000	0.0000	0.0000	0.0000	338.4581	662.7232	963.1543 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4694.3928
Space heating per m2												(98c) / (4) = 42.8673 (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	

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Space heating requirement	942.9862	726.2903	599.7927	326.1666	134.8214	0.0000	0.0000	0.0000	0.0000	338.4581	662.7232	963.1543 (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)	1021.6536	786.8800	649.8295	353.3766	146.0687	0.0000	0.0000	0.0000	0.0000	366.6935	718.0100	1043.5041 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	244.5711	216.1426	229.5705	202.0766	195.9620	176.6889	174.6160	181.5918	183.5969	204.5577	217.2437	241.9635 (64)
Efficiency of water heater	86.7843	86.5610	86.1117	85.1273	83.2385	79.8000	79.8000	79.8000	79.8000	85.1810	86.3945	79.8000 (216)
Fuel for water heating, kWh/month	281.8149	249.6997	266.5961	237.3818	235.4224	221.4147	218.8170	227.5586	230.0713	240.1446	251.4555	86.8337 (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	278.6516 (219)
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	29.8149 (232)
Lighting	29.0086	23.2718	20.9537	15.3516	11.8580	9.6881	10.8172	14.0607	18.2634	23.9626	27.0657	
Electricity generated by PVs (Appendix M) (negative quantity)	-54.8154	-75.4427	-105.8791	-116.1140	-122.7479	-113.6409	-112.1538	-107.0117	-97.6676	-84.7854	-59.5729	-47.6027 (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)
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)
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)
Electricity generated by PVs (Appendix M) (negative quantity)	-36.8141	-76.6921	-151.0988	-225.0741	-295.8713	-296.7170	-293.2950	-249.1799	-183.7286	-109.1297	-48.9631	-29.1755 (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)
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)
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)
Annual totals kWh/year												
Space heating fuel - main system 1												5086.0161 (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												2939.0282 (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)												234.1161 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-3093.1733 (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												5251.9871 (238)

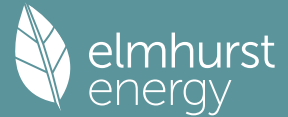
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5086.0161	0.2100	1068.0634 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2939.0282	0.2100	617.1959 (264)
Space and water heating			1685.2593 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	234.1161	0.1443	33.7902 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1097.4340	0.1351	-148.2846
PV Unit electricity exported	-1995.7393	0.1261	-251.7343
Total			-400.0189 (269)
Total CO2, kg/year			1330.9598 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1500 (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	5086.0161	1.1300	5747.1982 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2939.0282	1.1300	3321.1018 (278)
Space and water heating			9068.3000 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	234.1161	1.5338	359.0951 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1097.4340	1.4994	-1645.5012
PV Unit electricity exported	-1995.7393	0.4630	-924.0591
Total			-2569.5603 (283)
Total Primary energy kWh/year			6987.9356 (286)
Target Primary Energy Rate (TPER)			63.8100 (287)

Full SAP Calculation Printout



Property Reference	UNIT C				Issued on Date	25/02/2025	
Assessment Reference	Green V3			Prop Type Ref			
Property							
SAP Rating	91 B	DER	2.13	TER	12.79		
Environmental	98 A	% DER < TER				83.35	
CO ₂ Emissions (t/year)	0.19	DFEE	47.85	TFEE	52.55		
Compliance Check	See BREL	% DFEE < TFEE				8.95	
% DPER < TPER	68.16	DPER	21.43	TPER	67.30		
Assessor Details	Ms. Vanessa Vienna				Assessor ID	T798-0001	
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)
Main dwelling			
Ground floor	65.4400 (1b)	x 2.5000 (2b)	= 163.6000 (1b) - (3b)
First floor	46.9300 (1c)	x 3.4300 (2c)	= 160.9699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 324.5699 (5)

2. Ventilation rate

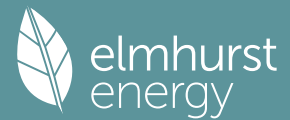
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												75.2000 (23c)
Effective ac	0.2866	0.2834	0.2802	0.2642	0.2611	0.2451	0.2451	0.2419	0.2515	0.2611	0.2674	0.2738 (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
Main dwelling							
Opening Type 1			18.6800	1.1450	21.3893		(27)
Door			1.8000	1.0000	1.8000		(26)
ground floor			65.4400	0.1000	6.5440		(28a)
External Wall	150.0700	20.4800	129.5900	0.1600	20.7344		(29a)
Ext. Roof - Pitch	50.6300		50.6300	0.1000	5.0630		(30)
Ext. Roof - Flat	32.9900		32.9900	0.1000	3.2990		(30)
Total net area of external elements Aum(A, m ²)			299.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.8297		(33)
Main dwelling							
Party Wall 1			30.6700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E1 Steel lintel with perforated steel base plate	12.8200	0.1000	1.2820
E3 Sill	11.8200	0.0400	0.4728
E4 Jamb	32.4400	0.0500	1.6220
E5 Ground floor (normal)	30.3900	0.1000	3.0390
E6 Intermediate floor within a dwelling	13.6400	0.0500	0.6820
E10 Eaves (insulation at ceiling level)	5.0900	0.0600	0.3054
E11 Eaves (insulation at rafter level)	11.0900	0.0400	0.4436
E13 Gable (insulation at rafter level)	12.5200	0.0400	0.5008
E14 Flat roof	5.8800	0.1300	0.7644
E15 Flat roof with parapet	16.5400	0.1500	2.4810
E16 Corner (normal)	22.9000	0.0900	2.0610
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180
E18 Party wall between dwellings	2.5000	0.0600	0.1500
E24 Eaves (insulation at ceiling level - inverted)	11.1300	0.1000	1.1130
E25 Staggered party wall between dwellings	7.7000	0.1200	0.9240
P1 Party wall - Ground floor	6.9700	0.2200	1.5334
P2 Party wall - Intermediate floor within a dwelling	5.0900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.9700	0.2800	1.9516
R4 Ridge (vaulted ceiling)	8.0900	0.1200	0.9708
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.3788 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	78.2085 (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	30.6932	30.3517	30.0103	28.3033	27.9619	26.2549	26.2549	25.9135	26.9377	27.9619	28.6447	29.3275	(38)
Average = Sum(39)m / 12 =	108.9017	108.5603	108.2189	106.5118	106.1704	104.4634	104.4634	104.1220	105.1462	106.1704	106.8532	107.5360	(39)
												106.4265	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9691	0.9661	0.9631	0.9479	0.9448	0.9296	0.9296	0.9266	0.9357	0.9448	0.9509	0.9570	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

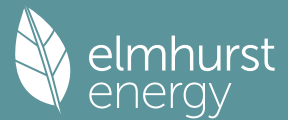
Assumed occupancy													2.8283 (42)
Hot water usage for mixer showers													
Hot water usage for baths	71.6416	70.5649	68.9961	65.9943	63.7791	61.3087	59.9046	61.4616	63.1683	65.8208	68.8870	71.3671	(42a)
Hot water usage for other uses	30.9314	30.4721	29.8252	28.6324	27.7393	26.7489	26.2140	26.8564	27.5558	28.6155	29.8328	30.8269	(42b)
Average daily hot water use (litres/day)	43.5949	42.0096	40.4244	38.8391	37.2538	35.6686	35.6686	37.2538	38.8391	40.4244	42.0096	43.5949	(42c)
												134.3612	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	146.1679	143.0466	139.2456	133.4658	128.7722	123.7263	121.7872	125.5718	129.5632	134.8606	140.7295	145.7889	(44)
Energy content (annual)	231.4943	203.6965	214.0153	182.7081	173.3522	152.1359	147.2910	155.4841	159.7644	183.0046	200.4949	228.2701	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	34.7241	30.5545	32.1023	27.4062	26.0028	22.8204	22.0937	23.3226	23.9647	27.4507	30.0742	34.2405	(46)
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0900 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.6302 (55)
Total storage loss	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362	(56)
If cylinder contains dedicated solar storage	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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	336.8881	298.8909	319.4091	284.7021	278.7460	223.5539	221.0896	229.2827	231.1824	288.3984	302.4889	333.6639	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	336.8881	298.8909	319.4091	284.7021	278.7460	223.5539	221.0896	229.2827	231.1824	288.3984	302.4889	333.6639	(64)
12Total per year (kWh/year)													3348.2960 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month	120.8579	107.3681	115.0462	103.2208	101.5257	68.5948	67.5842	70.3084	71.1313	104.7351	109.1350	119.7859	(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	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	140.5032	155.5571	140.5032	145.1866	140.5032	145.1866	140.5032	140.5032	145.1866	140.5032	145.1866	140.5032	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	274.9180	277.7708	270.5819	255.2775	235.9584	217.8012	205.6711	202.8183	210.0073	225.3117	244.6307	262.7879	(68)
Pumps, fans	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	(69)
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	(70)
Water heating gains (Table 5)	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	(71)
Total internal gains	162.4434	159.7740	154.6320	143.3623	136.4592	95.2705	90.8390	94.5005	98.7934	140.7730	151.5763	161.0026	(72)
	643.2896	658.5268	631.1419	609.2513	578.3458	523.6833	502.4382	503.2470	519.4123	572.0128	606.8186	629.7186	(73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b		g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	8.2200				19.6403	0.4000			0.8000		0.7700	35.8016 (76)
South	3.4000				46.7521	0.4000			0.8000		0.7700	35.2503 (78)
West	7.0600				19.6403	0.4000			0.8000		0.7700	30.7493 (80)
Solar gains	101.8012	187.9186	287.9395	395.8054	469.8248	475.6388	454.9130	399.8972	326.1768	216.7468	124.7648	85.1877 (83)
Total gains	745.0908	846.4454	919.0814	1005.0567	1048.1706	999.3221	957.3512	903.1442	845.5891	788.7596	731.5834	714.9063 (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	71.6561	71.8815	72.1083	73.2639	73.4995	74.7006	74.7006	74.9455	74.2155	73.4995	73.0298	72.5661
alpha	5.7771	5.7921	5.8072	5.8843	5.9000	5.9800	5.9800	5.9964	5.9477	5.9000	5.8687	5.8377
util living area	0.9966	0.9922	0.9810	0.9378	0.8283	0.6477	0.4770	0.5247	0.7832	0.9565	0.9920	0.9973 (86)
Living	19.9385	20.1038	20.3407	20.6571	20.8819	20.9788	20.9970	20.9950	20.9372	20.6534	20.2482	19.9187
Non living	18.8688	19.0812	19.3824	19.7795	20.0309	20.1302	20.1414	20.1431	20.0948	19.7840	19.2757	18.8512
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4570	20.1038	20.3407	20.6571	20.8819	20.9788	20.9970	20.9950	20.9372	20.6534	20.2482	20.0700 (87)
Th 2	20.1091	20.1117	20.1142	20.1270	20.1296	20.1424	20.1424	20.1449	20.1372	20.1296	20.1244	20.1193 (88)
util rest of house	0.9955	0.9897	0.9747	0.9178	0.7798	0.5698	0.3857	0.4302	0.7113	0.9382	0.9890	0.9964 (89)
MIT 2	19.6146	19.0812	19.3824	19.7795	20.0309	20.1302	20.1414	20.1431	20.0948	19.7840	19.2757	19.0797 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.9203	19.4523	19.7302	20.0980	20.3398	20.4382	20.4519	20.4522	20.4005	20.0995	19.6286	19.4391 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.9203	19.4523	19.7302	20.0980	20.3398	20.4382	20.4519	20.4522	20.4005	20.0995	19.6286	19.4391 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9952	0.9873	0.9713	0.9170	0.7924	0.5975	0.4189	0.4646	0.7348	0.9374	0.9867	0.9955 (94)
Useful gains	741.5231	835.7069	892.7098	921.6360	830.6153	597.0685	401.0722	419.5729	621.3263	739.3986	721.8634	711.7169 (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	1701.0790	1579.8022	1431.7542	1192.7195	917.2869	609.8784	402.3838	421.9281	662.4777	1008.5661	1338.7251	1638.7502 (97)
Space heating kWh	713.9096	500.0320	401.0490	195.1801	64.4837	0.0000	0.0000	0.0000	0.0000	200.2606	444.1404	689.7127 (98a)
Space heating requirement - total per year (kWh/year)	3208.7682											
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	713.9096	500.0320	401.0490	195.1801	64.4837	0.0000	0.0000	0.0000	0.0000	200.2606	444.1404	689.7127 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3208.7682											
Space heating per m2	(98c) / (4) = 28.5554 (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	713.9096	500.0320	401.0490	195.1801	64.4837	0.0000	0.0000	0.0000	0.0000	200.2606	444.1404	689.7127 (98)
Space heating efficiency (main heating system 1)	305.9461	305.9461	305.9461	305.9461	305.9461	0.0000	0.0000	0.0000	0.0000	305.9461	305.9461	305.9461 (210)
Space heating fuel (main heating system)	233.3449	163.4380	131.0849	63.7956	21.0768	0.0000	0.0000	0.0000	0.0000	65.4562	145.1695	225.4360 (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	336.8881	298.8909	319.4091	284.7021	278.7460	223.5539	221.0896	229.2827	231.1824	288.3984	302.4889	333.6639 (64)
Efficiency of water heater	281.7307	281.7307	281.7307	281.7307	281.7307	281.7307	281.7307	281.7307	281.7307	281.7307	281.7307	281.7307 (216)
Fuel for water heating, kWh/month	119.5781	106.0910	113.3739	101.0547	98.9406	79.3502	78.4755	81.3837	82.0580	102.3667	107.3681	118.4337 (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	24.9540	22.5391	24.9540	24.1491	24.9540	24.1491	24.9540	24.9540	24.1491	24.9540	24.1491	24.9540 (231)
Lighting	29.1938	23.4203	21.0874	15.4495	11.9337	9.7499	10.8863	14.1504	18.3800	24.1156	27.2385	30.0052 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-57.4995	-83.3562	-122.3735	-137.0159	-145.5132	-131.6730	-130.0890	-122.2679	-107.6985	-93.5827	-63.3377	-49.2948 (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)												

Full SAP Calculation Printout



(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												1048.8018	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												281.7307	
Water heating fuel used												1188.4741	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												293.8137	(230a)
Total electricity for the above, kWh/year												293.8137	(231)
Electricity for lighting (calculated in Appendix L)												235.6106	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1243.7020	(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												1522.9982	(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	1048.8018	0.1561	163.7149 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1188.4741	0.1415	168.1210 (264)
Space and water heating			331.8359 (265)
Pumps, fans and electric keep-hot	293.8137	0.1387	40.7556 (267)
Energy for lighting	235.6106	0.1443	34.0059 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1243.7020	0.1348	-167.6337
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-167.6337 (269)
Total CO2, kg/year			238.9636 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.1300 (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	1048.8018	1.5779	1654.8843 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1188.4741	1.5231	1810.1735 (278)
Space and water heating			3465.0578 (279)
Pumps, fans and electric keep-hot	293.8137	1.5128	444.4813 (281)
Energy for lighting	235.6106	1.5338	361.3874 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1243.7020	1.4982	-1863.2781
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1863.2781 (283)
Total Primary energy kWh/year			2407.6484 (286)
Dwelling Primary energy Rate (DPER)			21.4300 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

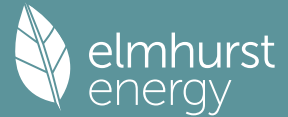
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	65.4400 (1b)	x 2.5000 (2b)	= 163.6000 (1b) - (3b)
First floor	46.9300 (1c)	x 3.4300 (2c)	= 160.9699 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 324.5699 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1232 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3732 (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) = 0.3173 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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													
	0.4045	0.3966	0.3886	0.3490	0.3410	0.3014	0.3014	0.2935	0.3173	0.3410	0.3569	0.3728	(22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695	(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	
Main dwelling								
TER Opaque door			1.8000	1.0000	1.8000			(26)
TER Opening Type			18.6800	1.1450	21.3893			(27)
ground floor			65.4400	0.1300	8.5072			(28a)
External Wall	150.0700	20.4800	129.5900	0.1800	23.3262			(29a)
Ext. Roof - Pitch	50.6300		50.6300	0.1100	5.5693			(30)
Ext. Roof - Flat	32.9900		32.9900	0.1100	3.6289			(30)
Total net area of external elements Aum(A, m2)			299.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.2209			(33)
Main dwelling								
Party Wall 1			30.6700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	12.8200	0.0500	0.6410	
E3 Sill	11.8200	0.0500	0.5910	
E4 Jamb	32.4400	0.0500	1.6220	
E5 Ground floor (normal)	30.3900	0.1600	4.8624	
E6 Intermediate floor within a dwelling	13.6400	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	5.0900	0.0600	0.3054	
E11 Eaves (insulation at rafter level)	11.0900	0.0400	0.4436	
E13 Gable (insulation at rafter level)	12.5200	0.0800	1.0016	
E14 Flat roof	5.8800	0.0800	0.4704	
E15 Flat roof with parapet	16.5400	0.5600	9.2624	
E16 Corner (normal)	22.9000	0.0900	2.0610	
E17 Corner (inverted - internal area greater than external area)	10.2000	-0.0900	-0.9180	
E18 Party wall between dwellings	2.5000	0.0600	0.1500	
E24 Eaves (insulation at ceiling level - inverted)	11.1300	0.2400	2.6712	
E25 Staggered party wall between dwellings	7.7000	0.0600	0.4620	
P1 Party wall - Ground floor	6.9700	0.0800	0.5576	
P2 Party wall - Intermediate floor within a dwelling	5.0900	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	6.9700	0.1200	0.8364	
R4 Ridge (vaulted ceiling)	8.0900	0.0800	0.6472	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.6672 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 89.8881 (37)

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

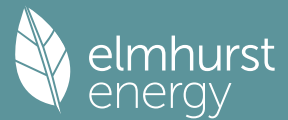
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	62.3165	61.9763	61.6427	60.0762	59.7831	58.4187	58.4187	58.1660	58.9443	59.7831	60.3760	60.9959	(38)
Heat transfer coeff	152.2046	151.8644	151.5308	149.9643	149.6712	148.3068	148.3068	148.0542	148.8324	149.6712	150.2641	150.8840	(39)
Average = Sum(39)m / 12 =												149.9629	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.3545	1.3515	1.3485	1.3346	1.3319	1.3198	1.3198	1.3176	1.3245	1.3319	1.3372	1.3427	(40)
HLP (average)												1.3345	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8283 (42)
Hot water usage for mixer showers													
	71.6416	70.5649	68.9961	65.9943	63.7791	61.3087	59.9046	61.4616	63.1683	65.8208	68.8870	71.3671	(42a)
Hot water usage for baths													
	30.9314	30.4721	29.8252	28.6324	27.7393	26.7489	26.2140	26.8564	27.5558	28.6155	29.8328	30.8269	(42b)
Hot water usage for other uses													
	43.5949	42.0096	40.4244	38.8391	37.2538	35.6686	35.6686	37.2538	38.8391	40.4244	42.0096	43.5949	(42c)
Average daily hot water use (litres/day)												134.3612	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	146.1679	143.0466	139.2456	133.4658	128.7722	123.7263	121.7872	125.5718	129.5632	134.8606	140.7295	145.7889	(44)
Energy conte	231.4943	203.6965	214.0153	182.7081	173.3522	152.1359	147.2910	155.4841	159.7644	183.0046	200.4949	228.2701	(45)
Energy content (annual)										Total = Sum(45)m =		2231.7114	
Distribution loss (46)m = 0.15 x (45)m													
	34.7241	30.5545	32.1023	27.4062	26.0028	22.8204	22.0937	23.3226	23.9647	27.4507	30.0742	34.2405	(46)
Water storage loss:													
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													
	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													
	278.0892	245.7822	260.6102	227.7999	219.9471	197.2277	193.8859	202.0790	204.8563	229.5995	245.5867	274.8650	(62)
WWHRS	-32.7515	-28.9657	-30.3312	-25.1155	-23.4067	-20.0293	-18.7743	-19.9645	-20.7231	-24.4302	-27.6765	-32.1450	(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)

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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	245.3376	216.8165	230.2790	202.6844	196.5404	177.1984	175.1116	182.1145	184.1332	205.1693	217.9103	242.7200 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2476.0152 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	114.2478	101.3977	108.4360	96.8239	94.9155	86.6586	86.2502	88.9744	89.1951	98.1250	102.7380	113.1757 (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	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	141.4164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.6047	158.9909	143.6047	148.3915	143.6047	148.3915	143.6047	143.6047	148.3915	143.6047	148.3915	143.6047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.9180	277.7708	270.5819	255.2775	235.9584	217.8012	205.6711	202.8183	210.0073	225.3117	244.6307	262.7879	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	37.1416	(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)	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	-113.1331	(71)
Water heating gains (Table 5)	153.5588	150.8894	145.7473	134.4776	127.5746	120.3592	115.9277	119.5892	123.8821	131.8884	142.6917	152.1179	(72)
Total internal gains	640.5065	656.0761	628.3588	606.5716	575.5627	551.9769	530.6284	531.4372	547.7059	569.2297	604.1389	626.9355	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					8.2200	19.6403		0.6300	0.7000	0.7700		49.3391 (76)	
South					3.4000	46.7521		0.6300	0.7000	0.7700		48.5793 (78)	
West					7.0600	19.6403		0.6300	0.7000	0.7700		42.3764 (80)	
Solar gains	140.2948	258.9753	396.8166	545.4693	647.4773	655.4897	626.9270	551.1083	449.5124	298.7042	171.9415	117.3993	(83)
Total gains	780.8013	915.0514	1025.1755	1152.0409	1223.0400	1207.4667	1157.5554	1082.5456	997.2183	867.9340	776.0804	744.3348	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.2696	51.3845	51.4976	52.0355	52.1374	52.6171	52.6171	52.7069	52.4313	52.1374	51.9317	51.7183
alpha	4.4180	4.4256	4.4332	4.4690	4.4758	4.5078	4.5078	4.5138	4.4954	4.4758	4.4621	4.4479
util living area	0.9962	0.9919	0.9815	0.9477	0.8660	0.7087	0.5443	0.5979	0.8298	0.9662	0.9924	0.9970 (86)
MIT	19.3777	19.5853	19.9035	20.3329	20.6927	20.9136	20.9792	20.9687	20.8156	20.3371	19.7837	19.3478 (87)
Th 2	19.7984	19.8007	19.8030	19.8139	19.8159	19.8253	19.8253	19.8271	19.8217	19.8159	19.8118	19.8075 (88)
util rest of house	0.9949	0.9891	0.9748	0.9278	0.8146	0.6077	0.4087	0.4604	0.7482	0.9494	0.9893	0.9959 (89)
MIT 2	17.9313	18.1974	18.6022	19.1413	19.5571	19.7765	19.8191	19.8165	19.6966	19.1579	18.4595	17.8992 (90)
Living area fraction	18.4562	18.7011	19.0745	19.5738	19.9692	20.1891	20.2401	20.2346	20.1027	FLA = Living area / (4) =		0.3629 (91)
MIT	18.4562	18.7011	19.0745	19.5738	19.9692	20.1891	20.2401	20.2346	20.1027	19.5858	18.9400	18.4249 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4562	18.7011	19.0745	19.5738	19.9692	20.1891	20.2401	20.2346	20.1027	19.5858	18.9400	18.4249 (93)

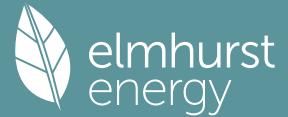
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9928	0.9855	0.9693	0.9228	0.8222	0.6413	0.4583	0.5105	0.7704	0.9451	0.9859	0.9941	(94)
Ext temp.	775.1611	901.7393	993.7510	1063.0607	1005.5862	774.3552	530.4618	552.6430	768.2678	820.2548	765.1656	739.9447	(95)
Heat loss rate W	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)
Space heating kWh	2154.6373	2095.8955	1905.4192	1600.6847	1237.6609	828.9038	539.8545	567.7321	893.3970	1344.9171	1779.1346	2146.3121	(97)
Space heating requirement - total per year (kWh/year)	1026.3302	802.4730	678.2812	387.0892	172.6635	0.0000	0.0000	0.0000	0.0000	390.3488	730.0577	1046.3374	(98a)
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)	1026.3302	802.4730	678.2812	387.0892	172.6635	0.0000	0.0000	0.0000	0.0000	390.3488	730.0577	1046.3374	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	1026.3302	802.4730	678.2812	387.0892	172.6635	0.0000	0.0000	0.0000	0.0000	390.3488	730.0577	1046.3374	(98)

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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)	1111.9504	869.4182	734.8659	419.3816	187.0677	0.0000	0.0000	0.0000	0.0000	422.9131	790.9617	1133.6266	(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	245.3376	216.8165	230.2790	202.6844	196.5404	177.1984	175.1116	182.1145	184.1332	205.1693	217.9103	242.7200	(64)
Efficiency of water heater	86.9090	86.7196	86.3322	85.4866	83.7706	79.8000	79.8000	79.8000	79.8000	85.4786	86.5560	86.9535	(216)
Fuel for water heating, kWh/month	282.2926	250.0203	266.7360	237.0950	234.6174	222.0531	219.4382	228.2136	230.7434	240.0240	251.7564	279.1379	(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)
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	29.8382	23.9373	21.5529	15.7906	12.1971	9.9651	11.1266	14.4628	18.7857	24.6479	27.8397	30.6675	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-56.8727	-78.0468	-109.2137	-119.4032	-125.9158	-116.4587	-114.9331	-109.8175	-100.4693	-87.5399	-61.7270	-49.4167	(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)
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)
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)
Electricity generated by PVs (Appendix M) (negative quantity)	-38.9444	-81.0408	-159.5085	-237.3777	-311.8349	-312.6531	-309.0454	-262.6526	-193.7872	-115.2375	-51.7693	-30.8704	(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)
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)
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)
Annual totals kWh/year													
Space heating fuel - main system 1												5670.1853	(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												2942.1277	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												240.8116	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3234.5360	(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												5704.5886	(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	5670.1853	0.2100	1190.7389 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2942.1277	0.2100	617.8468 (264)
Space and water heating			1808.5857 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	240.8116	0.1443	34.7566 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1129.8142	0.1352	-152.7335
PV Unit electricity exported	-2104.7217	0.1262	-265.5403
Total			-418.2738 (269)
Total CO2, kg/year			1436.9978 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.7900 (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	5670.1853	1.1300	6407.3093 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2942.1277	1.1300	3324.6043 (278)
Space and water heating			9731.9136 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	240.8116	1.5338	369.3648 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1129.8142	1.4997	-1694.3290
PV Unit electricity exported	-2104.7217	0.4631	-974.7400
Total			-2669.0690 (283)
Total Primary energy kWh/year			7562.3102 (286)
Target Primary Energy Rate (TPER)			67.3000 (287)

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Property Reference	Unit D			Issued on Date	25/02/2025
Assessment Reference	GREENV3	Prop Type Ref			
Property					
SAP Rating	92 A	DER	1.76	TER	9.68
Environmental	98 A	% DER < TER			81.82
CO ₂ Emissions (t/year)	0.21	DFEE	37.10	TFEE	37.31
Compliance Check	See BREL	% DFEE < TFEE			0.57
% DPER < TPER	64.85	DPER	17.77	TPER	50.56
Assessor Details	Ms. Vanessa Vienna			Assessor ID	T798-0001
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)
Main dwelling			
Ground floor	54.4000 (1b)	x 2.5000 (2b)	= 136.0000 (1b) - (3b)
First floor	45.6100 (1c)	x 2.9000 (2c)	= 132.2690 (1c) - (3c)
Second floor	45.6100 (1d)	x 2.5000 (2d)	= 114.0250 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	382.2940 (5)

2. Ventilation rate

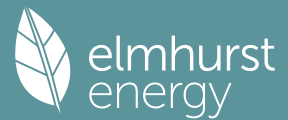
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												74.4000 (23c)
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778 (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
Main dwelling							
Opening Type 1			18.8900	1.1450	21.6298		(27)
Door			2.0000	1.0000	2.0000		(26)
Rooflight			2.0800	1.1450	2.3817		(27a)
Ground Floor			54.4000	0.1000	5.4400		(28a)
External Wall 1	97.0900	20.8900	76.2000	0.1600	12.1920		(29a)
Ext. Roof - Pitch	68.5900	2.0800	66.5100	0.1000	6.6510		(30)
Ext. Roof - Flat	8.7900		8.7900	0.1000	0.8790		(30)
Total net area of external elements Aum(A, m ²)			228.8700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.1735		(33)
Main dwelling							
Party Wall 1			107.7000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)

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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
Northeast	12.6400	11.2829	0.4000	0.8000	0.7700	31.6266 (75)
Southeast	1.0400	36.7938	0.4000	0.8000	0.7700	8.4858 (77)
Southwest	5.2100	36.7938	0.4000	0.8000	0.7700	42.5105 (79)
Southeast	2.0800	26.0000	0.4000	0.8000	1.0000	15.5750 (82)

Solar gains	98.1979	183.5905	292.3476	427.6042	536.0116	556.5373	526.4578	442.3112	338.9140	214.2151	120.6445	82.0499 (83)
Total gains	813.1042	916.5878	994.0400	1105.3761	1178.8566	1142.4649	1088.3267	1004.7595	919.6228	849.3960	794.8422	781.5156 (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	92.0531	92.3913	92.7320	94.4739	94.8301	96.6525	96.6525	97.0254	95.9152	94.8301	94.1203	93.4210
alpha	7.1369	7.1594	7.1821	7.2983	7.3220	7.4435	7.4435	7.4684	7.3943	7.3220	7.2747	7.2281
util living area	0.9983	0.9955	0.9865	0.9370	0.7919	0.5815	0.4226	0.4762	0.7571	0.9627	0.9952	0.9987 (86)
Living	20.1886	20.3256	20.5230	20.7934	20.9536	20.9958	20.9996	20.9992	20.9751	20.7679	20.4410	20.1747
Non living	19.3304	19.5073	19.7594	20.0995	20.2743	20.3221	20.3244	20.3267	20.3029	20.0766	19.6647	19.3204
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5849	20.3256	20.5230	20.7934	20.9536	20.9958	20.9996	20.9992	20.9751	20.7679	20.4410	20.2902 (87)
Th 2	20.2930	20.2954	20.2979	20.3100	20.3124	20.3245	20.3245	20.3270	20.3197	20.3124	20.3075	20.3027 (88)
util rest of house	0.9978	0.9941	0.9821	0.9186	0.7474	0.5222	0.3580	0.4071	0.6952	0.9479	0.9935	0.9983 (89)
MIT 2	19.9093	19.5073	19.7594	20.0995	20.2743	20.3221	20.3244	20.3267	20.3029	20.0766	19.6647	19.4974 (90)
Living area fraction	20.0273	19.6502	19.8928	20.2207	20.3930	20.4398	20.4424	20.4441	20.4203	20.1974	19.8003	19.6359 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0273	19.6502	19.8928	20.2207	20.3930	20.4398	20.4424	20.4441	20.4203	20.1974	19.8003	19.6359 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9976	0.9924	0.9789	0.9159	0.7529	0.5324	0.3692	0.4191	0.7048	0.9449	0.9917	0.9978 (94)
Useful gains	811.1147	909.6364	973.1150	1012.3591	887.5871	608.2964	401.8640	421.1296	648.1938	802.5768	788.2581	779.7993 (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	1727.7250	1614.4537	1460.4938	1211.7725	926.9992	611.0051	402.0170	421.5023	666.3609	1023.4490	1364.5543	1670.8854 (97)
Space heating kWh	681.9581	473.6372	362.6099	143.5777	29.3227	0.0000	0.0000	0.0000	0.0000	164.3289	414.9333	662.9681 (98a)
Space heating requirement - total per year (kWh/year)												2933.3358
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	681.9581	473.6372	362.6099	143.5777	29.3227	0.0000	0.0000	0.0000	0.0000	164.3289	414.9333	662.9681 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2933.3358
Space heating per m2										(98c) / (4) =		20.1438 (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 %)

305.9245 (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	681.9581	473.6372	362.6099	143.5777	29.3227	0.0000	0.0000	0.0000	0.0000	164.3289	414.9333	662.9681 (98)
Space heating efficiency (main heating system 1)	305.9245	305.9245	305.9245	305.9245	305.9245	0.0000	0.0000	0.0000	0.0000	305.9245	305.9245	305.9245 (210)
Space heating fuel (main heating system)	222.9171	154.8216	118.5292	46.9324	9.5849	0.0000	0.0000	0.0000	0.0000	53.7155	135.6326	216.7097 (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	348.5972	309.1591	330.1721	293.9007	287.4659	231.2046	228.5257	237.1528	239.2856	297.6753	312.6369	345.2175 (64)
Efficiency of water heater	281.7208	281.7208	281.7208	281.7208	281.7208	281.7208	281.7208	281.7208	281.7208	281.7208	281.7208	281.7208 (216)
Fuel for water heating, kWh/month	123.7385	109.7395	117.1983	104.3234	102.0393	82.0687	81.1178	84.1801	84.9371	105.6632	110.9740	122.5388 (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)
Pumps and Fa	36.0469	32.5585	36.0469	34.8841	36.0469	34.8841	36.0469	36.0469	34.8841	36.0469	34.8841	36.0469 (231)
Lighting	34.2021	27.4382	24.7050	18.1000	13.9809	11.4225	12.7539	16.5780	21.5332	28.2527	31.9113	35.1527 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-52.2705	-78.5699	-119.7388	-138.1203	-150.3151	-139.2783	-137.4811	-127.7657	-109.9889	-90.2724	-58.4469	-44.4134 (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)
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)
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)
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)
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)

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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													958.8431	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													281.7208	
Water heating fuel used													1228.5187	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)														
mechanical ventilation fans (SFP = 0.9100)													424.4228	(230a)
Total electricity for the above, kWh/year													424.4228	(231)
Electricity for lighting (calculated in Appendix L)													276.0305	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1246.6612	(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													1641.1540	(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	958.8431	0.1568	150.3280 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1228.5187	0.1415	173.7904 (264)
Space and water heating			324.1184 (265)
Pumps, fans and electric keep-hot	424.4228	0.1387	58.8727 (267)
Energy for lighting	276.0305	0.1443	39.8397 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1246.6612	0.1340	-167.0482
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-167.0482 (269)
Total CO2, kg/year			255.7826 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	958.8431	1.5804	1515.3634 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1228.5187	1.5231	1871.1829 (278)
Space and water heating			3386.5463 (279)
Pumps, fans and electric keep-hot	424.4228	1.5128	642.0668 (281)
Energy for lighting	276.0305	1.5338	423.3847 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1246.6612	1.4952	-1864.0163
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1864.0163 (283)
Total Primary energy kWh/year			2587.9816 (286)
Dwelling Primary energy Rate (DPER)			17.7700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

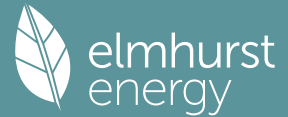
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	54.4000 (1b)	x 2.5000 (2b)	= 136.0000 (1b) - (3b)
First floor	45.6100 (1c)	x 2.9000 (2c)	= 132.2690 (1c) - (3c)
Second floor	45.6100 (1d)	x 2.5000 (2d)	= 114.0250 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 382.2940 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1046 (8)
Pressure Test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3546 (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) = 0.3014 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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													
	0.3843	0.3768	0.3693	0.3316	0.3240	0.2864	0.2864	0.2788	0.3014	0.3240	0.3391	0.3542	(22b)
Effective ac	0.5739	0.5710	0.5682	0.5550	0.5525	0.5410	0.5410	0.5389	0.5454	0.5525	0.5575	0.5627	(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	
Main dwelling								
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type			18.8900	1.1450	21.6298			(27)
TER Roof Light			2.0800	1.5918	4.2059			(27a)
Ground Floor			54.4000	0.1300	7.0720			(28a)
External Wall 1	97.0900	20.8900	76.2000	0.1800	13.7160			(29a)
Ext. Roof - Pitch	68.5900	2.0800	66.5100	0.1100	7.3161			(30)
Ext. Roof - Flat	8.7900		8.7900	0.1100	0.9669			(30)
Total net area of external elements Aum(A, m2)			228.8700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.9067			(33)
Main dwelling								
Party Wall 1			107.7000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)

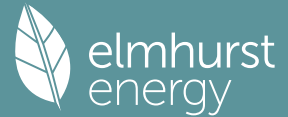
List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	15.5500	0.1600	2.4880	
E5 Ground floor (normal)	17.9000	0.0000	0.0000	
E6 Intermediate floor within a dwelling	16.2300	0.0800	1.2984	
E13 Gable (insulation at rafter level)	8.4500	0.5600	4.7320	
E15 Flat roof with parapet	5.0000	0.0900	0.4500	
E16 Corner (normal)	2.5000	-0.0900	-0.2250	
E17 Corner (inverted - internal area greater than external area)	23.0000	0.0600	1.3800	
E18 Party wall between dwellings	3.7000	0.2400	0.8880	
E24 Eaves (insulation at ceiling level - inverted)	2.5000	0.0600	0.1500	
E25 Staggered party wall between dwellings	16.9000	0.0800	1.3520	
P1 Party wall - Ground floor	33.7900	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	8.4500	0.0800	0.6760	
R4 Ridge (vaulted ceiling)	16.9000	0.0800	1.3520	
P5 Party wall - Roof (insulation at rafter level)	13.5600	0.0500	0.6780	
E1 Steel lintel with perforated steel base plate	12.5600	0.0500	0.6280	
E3 Sill	40.9000	0.0500	2.0450	
E4 Jamb	8.4000	0.0800	0.6720	
R11 Upstands or kerbs of rooflights				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.5644	(36)
Point Thermal bridges			(36a) = 0.0000	
Total fabric heat loss			(33) + (36) + (36a) = 75.4711	(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	72.3959	72.0341	71.6795	70.0137	69.7021	68.2513	68.2513	67.9826	68.8101	69.7021	70.3325	70.9917	(38)
Average = Sum(39)m / 12 =	147.8670	147.5051	147.1505	145.4848	145.1731	143.7223	143.7223	143.4536	144.2811	145.1731	145.8036	146.4627	(39)
												145.4833	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0154	1.0129	1.0105	0.9991	0.9969	0.9870	0.9870	0.9851	0.9908	0.9969	1.0013	1.0058	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9271	(42)
Hot water usage for mixer showers														
	73.2978	72.1963	70.5912	67.5200	65.2536	62.7261	61.2895	62.8825	64.6287	67.3424	70.4795	73.0170	(42a)	
Hot water usage for baths														
	31.6437	31.1737	30.5119	29.2917	28.3780	27.3649	26.8176	27.4748	28.1903	29.2744	30.5198	31.5367	(42b)	
Hot water usage for other uses														
	44.6065	42.9845	41.3624	39.7403	38.1183	36.4962	36.4962	38.1183	39.7403	41.3624	42.9845	44.6065	(42c)	
Average daily hot water use (litres/day)													137.4682	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	149.5480	146.3545	142.4655	136.5521	131.7499	126.5872	124.6033	128.4755	132.5593	137.9793	143.9838	149.1602	(44)	
Energy conte	236.8475	208.4068	218.9641	186.9330	177.3607	155.6537	150.6969	159.0796	163.4589	187.2365	205.1313	233.5488	(45)	
Energy content (annual)										Total = Sum(45)m =	2283.3179			
Distribution loss (46)m = 0.15 x (45)m														
	35.5271	31.2610	32.8446	28.0399	26.6041	23.3481	22.6045	23.8619	24.5188	28.0855	30.7697	35.0323	(46)	
Water storage loss:														
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														
	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														
	283.4424	250.4925	265.5591	232.0248	223.9556	200.7456	197.2918	205.6745	208.5508	233.8314	250.2231	280.1437	(62)	
WWHRS	-33.5087	-29.6354	-31.0324	-25.6961	-23.9478	-20.4923	-19.2083	-20.4261	-21.2022	-24.9950	-28.3163	-32.8882	(63a)	

Full SAP Calculation Printout



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	249.9337	220.8572	234.5266	206.3287	200.0078	180.2533	178.0835	185.2484	187.3486	208.8364	221.9068	247.2555	(64)	
Total per year (kWh/year) = Sum(64)m =												2520.5865	(64)	
12Total per year (kWh/year)													2521	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)	
Heat gains from water heating, kWh/month	116.0277	102.9638	110.0815	98.2287	96.2484	87.8283	87.3827	90.1699	90.4236	99.5321	104.2796	114.9309	(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	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	146.3554	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	169.0709	187.1857	169.0709	174.7066	169.0709	174.7066	169.0709	169.0709	174.7066	169.0709	174.7066	169.0709	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	315.7163	318.9925	310.7367	293.1611	270.9751	250.1233	236.1931	232.9170	241.1727	258.7483	280.9344	301.7861	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	37.6355	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	-117.0843	(71)
Water heating gains (Table 5)	155.9512	153.2200	147.9590	136.4287	129.3661	121.9838	117.4498	121.1961	125.5883	133.7797	144.8328	154.4770	(72)
Total internal gains	710.6451	729.3048	697.6733	674.2031	639.3187	613.7204	589.6205	590.0906	608.3743	631.5056	670.3804	695.2407	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast					12.6400	11.2829	0.6300	0.7000	0.7700	43.5854 (75)			
Southeast					1.0400	36.7938	0.6300	0.7000	0.7700	11.6945 (77)			
Southwest					5.2100	36.7938	0.6300	0.7000	0.7700	58.5847 (79)			
Southeast					2.0800	26.0000	0.6300	0.7000	1.0000	21.4644 (82)			
Solar gains	135.3290	253.0107	402.8916	589.2921	738.6910	766.9780	725.5246	609.5601	467.0658	295.2153	166.2632	113.0750	(83)
Total gains	845.9741	982.3155	1100.5649	1263.4952	1378.0097	1380.6984	1315.1451	1199.6506	1075.4401	926.7208	836.6437	808.3157	(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	68.3892	68.5569	68.7222	69.5090	69.6582	70.3614	70.3614	70.4932	70.0889	69.6582	69.3570	69.0449	
alpha	5.5593	5.5705	5.5815	5.6339	5.6439	5.6908	5.6908	5.6995	5.6726	5.6439	5.6238	5.6030	
util living area	0.9983	0.9957	0.9878	0.9510	0.8407	0.6426	0.4769	0.5417	0.8154	0.9744	0.9959	0.9987	(86)
MIT	19.7738	19.9455	20.2095	20.5770	20.8549	20.9753	20.9961	20.9924	20.9101	20.5405	20.0970	19.7501	(87)
Th 2	20.0705	20.0726	20.0746	20.0841	20.0859	20.0942	20.0942	20.0957	20.0910	20.0859	20.0823	20.0785	(88)
util rest of house	0.9977	0.9943	0.9836	0.9339	0.7923	0.5615	0.3809	0.4396	0.7442	0.9623	0.9943	0.9982	(89)
MIT 2	18.6297	18.8506	19.1877	19.6498	19.9638	20.0802	20.0929	20.0930	20.0287	19.6143	19.0522	18.6052	(90)
Living area fraction	18.8296	19.0419	19.3662	19.8118	20.1195	20.2366	20.2507	20.2501	20.1827	19.7761	19.2347	18.8052	(91)
MIT	18.8296	19.0419	19.3662	19.8118	20.1195	20.2366	20.2507	20.2501	20.1827	19.7761	19.2347	18.8052	(92)
Temperature adjustment	18.8296	19.0419	19.3662	19.8118	20.1195	20.2366	20.2507	20.2501	20.1827	19.7761	19.2347	18.8052	(93)
adjusted MIT	18.8296	19.0419	19.3662	19.8118	20.1195	20.2366	20.2507	20.2501	20.1827	19.7761	19.2347	18.8052	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9966	0.9920	0.9791	0.9277	0.7942	0.5747	0.3977	0.4574	0.7522	0.9569	0.9921	0.9973	(94)
Useful gains	843.0851	974.4272	1077.6068	1172.1393	1094.4554	793.5245	522.9978	548.7107	808.9785	886.7570	830.0621	806.1578	(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	2148.4464	2085.9959	1893.2693	1587.4997	1222.2781	810.0994	524.6910	552.3137	877.6179	1332.1274	1769.2836	2139.1229	(97)
Space heating kWh	971.1888	746.9742	606.8529	299.0595	95.1001	0.0000	0.0000	0.0000	0.0000	331.3556	676.2395	991.7260	(98a)
Space heating requirement - total per year (kWh/year)												4718.4966	
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	971.1888	746.9742	606.8529	299.0595	95.1001	0.0000	0.0000	0.0000	0.0000	331.3556	676.2395	991.7260	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4718.4966	
Space heating per m2												(98c) / (4) =	32.4028 (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	

Full SAP Calculation Printout



Space heating requirement	971.1888	746.9742	606.8529	299.0595	95.1001	0.0000	0.0000	0.0000	0.0000	331.3556	676.2395	991.7260 (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)	1052.2089	809.2895	657.4788	324.0081	103.0337	0.0000	0.0000	0.0000	0.0000	358.9984	732.6538	1074.4594 (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	249.9337	220.8572	234.5266	206.3287	200.0078	180.2533	178.0835	185.2484	187.3486	208.8364	221.9068	247.2555 (64)
Efficiency of water heater (217)m	86.7964	86.5719	86.0935	84.8913	82.4943	79.8000	79.8000	79.8000	79.8000	85.0900	86.3926	79.8000 (216)
Fuel for water heating, kWh/month	287.9539	255.1141	272.4092	243.0506	242.4502	225.8813	223.1623	232.1408	234.7727	245.4301	256.8584	86.8454 (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	284.7079 (219)
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	0.0000 (221)
Lighting	35.1296	28.1823	25.3750	18.5908	14.3601	11.7323	13.0997	17.0276	22.1171	29.0188	32.7767	7.3041 (231)
Electricity generated by PVs (Appendix M) (negative quantity)												36.1060 (232)
(233a)m	-51.1085	-72.1556	-103.8216	-116.7897	-125.8892	-117.3794	-115.8340	-109.3343	-97.9261	-82.4455	-56.1881	-44.1664 (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	-28.5438	-60.0932	-119.5660	-179.8007	-238.0111	-239.3395	-236.6175	-200.2986	-146.6881	-86.1225	-38.1609	-22.5759 (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												5112.1307 (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												3003.9316 (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)												283.5160 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2688.8563 (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												5796.7219 (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	5112.1307	0.2100	1073.5474 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3003.9316	0.2100	630.8256 (264)
Space and water heating			1704.3731 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	283.5160	0.1443	40.9201 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1093.0385	0.1346	-147.1102
PV Unit electricity exported	-1595.8178	0.1258	-200.8331
Total			-347.9433 (269)
Total CO2, kg/year			1409.2791 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.6800 (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	5112.1307	1.1300	5776.7077 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3003.9316	1.1300	3394.4427 (278)
Space and water heating			9171.1503 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	283.5160	1.5338	434.8663 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1093.0385	1.4974	-1636.7335
PV Unit electricity exported	-1595.8178	0.4620	-737.1906
Total			-2373.9241 (283)
Total Primary energy kWh/year			7362.1933 (286)
Target Primary Energy Rate (TPER)			50.5600 (287)