

Sustainability & Energy Statement

Land at Muntham Drive and Chapel Road, Barns Green

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Executive Summary

This Sustainability and Energy Statement has been prepared in support of a detailed planning application for the erection of 31 dwellings with associated parking, landscaping and open space on land at Muntham Drive and Chapel Road, Barns Green, Horsham.

The Statement includes an energy demand assessment showing which selected energy efficiency, low-carbon and renewable energy measures have been considered and those, which will be incorporated into the development.

SAP calculations have been prepared for representative units, the results from which have been aggregated across similar unit types to provide an accurate assessment of the total emissions from the site.

The calculations have allowed the testing of different construction specifications and technologies and the Statement demonstrates how the homes will exceed the requirements of the Building Regulations Part L (2021) and the objectives of the planning policy.

It is proposed to install air source heat pumps into the houses and exhaust air heat pumps into the maisonette apartments.

All space heating and hot water will therefore be provided to the homes from renewable technologies.

All systems are fuelled by mains electricity and therefore as the National Grid decarbonises so the homes will become zero carbon. The homes are zero carbon ready.

The TER and DER Worksheets for the modelled homes are attached as Appendix 1.

The total reduction in site carbon dioxide emissions from energy efficiency measures and low-carbon and renewable technologies can be summarised as follows;

	Total Emissions	% Reduction
	kg CO ₂ per year	
Baseline (Building Regulations TER)	34,368	
Be Green - after energy efficiency and heat pumps (DER)	12,863	62.57%

The water efficiency measures incorporated within the homes will ensure the water use is less than 110 litres per person per day and achieves the enhanced standard required by the Building Regulations (includes 5 l/p/d for external water use) and the planning policy.

The proposal meets the requirements of the adopted policy.

1.0 Introduction

This report has been commissioned by Shanly Homes and provides a Sustainability and Energy Statement in support of a detailed planning application for the erection of 31 dwellings with associated parking, landscaping and open space on land at Muntham Drive and Chapel Road, Barns Green, Horsham.

The Statement describes the methodology used in assessing the dwellings and the initiatives proposed.

The homes have been designed and will be constructed to reduce energy demand and carbon dioxide emissions.

The objective has been to reduce the energy demand to an economic minimum by making investments in the parts of the buildings that have the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric.

Once cost-effective structures have been designed, low-carbon and renewable technologies have been considered to provide heat and/or electricity.

The following hierarchy has been followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.

2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled “A better quality of life: A strategy for sustainable development in the UK”. This sets out four main objectives for sustainable development in the UK:

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:

- National Planning Policy Framework – December 2024 (updated in February 2025)

Paragraph 161 states;

‘The planning system should support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.’

Local Policy

The local planning policy is provided by the **Horsham District Planning Framework**, which was adopted in November 2015.

The following policies are relevant to this Statement and may have been edited for clarity and specific relevance.

Policy 35 Strategic Policy: Climate Change

Development will be supported where it makes a clear contribution to mitigating and adapting to the impacts of climate change and to meeting the district's carbon reduction targets as set out in the Council's Acting Together on Climate Change Strategy, 2009.

Measures, which should be used to mitigate the effects of climate change include;

- 1. Reduced energy use in construction;*
- 2. Improved energy efficiency in new developments, including influencing the behaviour of occupants to reduce energy use;*
- 3. The use of decentralised, renewable and low carbon energy supply systems;*
- 4. The use of patterns of development which reduce the need to travel, encourage walking and cycling and include good accessibility to public transport and other forms of sustainable transport; and*
- 5. Measures, which reduce the amount of biodegradable waste sent to landfill.*

Development must be designed so that it can adapt to the impacts of climate change, reducing vulnerability, particularly in terms of flood risk, water supply and changes to the district's landscape. Developments should adapt to climate change using the following measures:

- 1. Provision of appropriate flood storage capacity in new building development;*
- 2. Use of green infrastructure and dual use SuDS to help absorb heat, reduce surface water runoff, provide flood storage capacity and assist habitat migration;*
- 3. Use of measures, which promote the conservation of water and/or grey water recycling;*
- 4. Use of site layout, design measures and construction techniques that provide resilience to climate change (opportunities for natural ventilation and solar gain).*

If it is not possible to incorporate the adaption and mitigation measures proposed, an explanation should be provided as to why this is the case.

Policy 36 Strategic Policy: Appropriate Energy Use

Energy hierarchy

All development will be required to contribute to clean, efficient energy in Horsham based on the following hierarchy:

- 1. Lean – use less energy – e.g. through demand reduction*

2. *Clean – supply energy efficiently – e.g. through heat networks*
3. *Green – use renewable energy sources*

Energy Statements

All applications for residential or commercial development must include an Energy Statement demonstrating and quantifying how the development will comply with the Energy Hierarchy.

Policy 37 Sustainable Construction

Proposals must seek to improve the sustainability of development. To deliver sustainable design, development should incorporate the following measures where appropriate according to the type of development and location:

1. *Maximise energy efficiency and integrate the use of decentralised, renewable and low carbon energy;*
2. *Limit water use to 110 litres/person/day;*
3. *Use design measures to minimise vulnerability to flooding and heatwave events;*
4. *Be designed to encourage the use of natural lighting and ventilation;*
5. *Be designed to encourage walking, cycling, cycle storage and accessibility to sustainable forms of transport;*
6. *Minimise construction and demolition waste and utilise recycled and low-impact materials;*
7. *Be flexible to allow future modification of use or layout, facilitating future adaptation, refurbishment and retrofitting;*
8. *Incorporate measures, which enhance the biodiversity value of development.*

All new development will be required to provide satisfactory arrangements for the storage of refuse and recyclable materials as an integral part of design.

Note: The Deregulation Act of 2015 withdrew the Code for Sustainable Homes and compliance with the scheme is no longer applicable.

The Council are in the process of preparing their new Local Plan and have published the **Horsham District Local Plan 2023-2040 Regulation 19** (January 2024).

The emerging policies include:

Strategic Policy 6: Climate Change - Carbon Reduction

1. *Development proposals will only be supported where they include measures which contribute to achieving net zero carbon emissions across the District by 2050 at the latest. The Council will be supportive of a range of measures to achieve this target, including but not limited to:*

- a) *Design which incorporates high standards of energy efficiency including optimal levels of thermal insulation, ventilation and cooling and passive solar design;*
- b) *The use of renewable and low carbon energy supply systems and connection to renewable and low carbon heat networks;*
- c) *The efficient use of natural resources used in new buildings to reduce the environmental impacts of construction;*
- d) *Design that influences the behaviour of occupants to reduce energy use;*
- e) *Using patterns of development and providing sustainable transport infrastructure which reduce the need to travel, encourage walking and cycling and include good accessibility to public transport and other forms of sustainable transport and ensure residents have access to services and facilities that are within walking distance;*
- f) *Reduce whole life carbon emissions by retaining and reusing existing buildings, components or materials, including on-site where possible.*

Climate Change Adaptation

- 2. *Development will only be supported if it includes site and building level measures to adapt to the future impacts of climate change and reduce vulnerability, particularly in terms of the comfort, health and wellbeing of current and future occupiers. Flood risk, water supply, overheating and changes to the District's landscape should also be considered. Measures should include but are not limited to:*
 - a) *Use of site and interior building layout: new buildings should be orientated to maximise the opportunities for both natural heating and ventilation and to reduce the exposure to wind and other elements, and the potential for overheating;*
 - b) *The conservation of water supplies to minimise the risk and impact of drought and flooding;*
 - c) *The use of green/blue infrastructure and dual use Sustainable Drainage Systems (SuDS) to provide multifunctional benefits such as helping to absorb heat, reduce surface water runoff, provide flood storage capacity and assist habitat migration; and*
 - d) *Moderating external temperatures through the use of green walls and roofs, tree planting or other nature-based solutions and landscaping for shade and drainage design.*
- 3. *Development will be supported providing it avoids responses to climate impacts which lead to increases in energy use and carbon dioxide emissions. In considering the likely impact of climate change over the lifetime of the development reference should be made to the most recent climate change projections.*

Sustainability Statement

- 4. *Development will be supported provided a Sustainability Statement is submitted which demonstrates how the development has taken measures to mitigate and adapt to the effects of climate change.*

Strategic Policy 7: Appropriate Energy Use

Energy Hierarchy

1. *Development will be supported provided that it contributes to clean, efficient energy in Horsham based on the following cascade:*
 - a) **Be Lean** – use less energy – for example, by minimising energy demand through energy efficiency measures such as fabric performance and passive design;
 - b) **Be Clean** – supply energy efficiently and exploit local energy resources such as secondary heat and district energy networks where available. Preference must be given to technologies with greater efficiencies and fuels with lower carbon emissions to achieve the highest total lifecycle carbon emission savings, in accordance with Part 2 of this policy;
 - c) **Be Green** – maximise the use of renewable energy sources.
 - d) **Be Seen** – monitor, verify and report on energy performance.

Zero and Low Carbon Heating

2. *Development proposals must demonstrate how they will provide zero and low carbon heating in accordance with the following hierarchy. Evidence must be provided that opportunities to meet each level of the hierarchy have been exhausted before cascading to the next level:*
 - a) *Connect to local existing or planned heat networks*, in combination with on-site renewable energy generation;*
 - b) *Maximise use of on-site renewable energy generation;*
 - c) *Use of the optimum means of low or zero-carbon heat supply is demonstrated, based on the in order of preference below:*
 - i. *Use of waste heat sources;*
 - ii. *Electrically-driven ground, water or air source heat pumps;***
 - iii. *Direct Electric Heating. ***

Energy Statements

3. *Residential or commercial development will be supported provided that it includes an Energy Statement, (which may be incorporated into the Sustainability Statement), demonstrating how compliance with this policy has been achieved.*

Renewable Energy Schemes

4. *Stand-alone renewable energy schemes will be supported where they do not conflict with other policies in this Plan. Renewable and low carbon energy generation developments that are led by, or meet the needs of, local communities will carry significant weight.*

**Where a local heat network is planned but not yet in existence or connection is not currently viable, but may become viable in the future, the development should be designed to allow for the cost-effective connection and supply at a later date. In this case the heat should be supplied according to steps 2b and 2c of the above hierarchy.*

***Electric heat pumps and direct electric heating are assumed to become zero-carbon when the national grid decarbonises.*

Strategic Policy 8: Sustainable Design and Construction

1. *Development will be supported where it is demonstrated that sustainable design, including its construction and operation, is integrated into the development from the design stage onwards. To deliver sustainable design, development will only be supported where it meets all of the following requirements that are relevant:*
 - a) *New-build homes to deliver, as a minimum, carbon emissions reduction as set out in the 2021 Edition (or any future update) of the 2010 Building Regulations (Part L);*
 - b) *New non-domestic buildings to achieve a BREEAM rating of 'Excellent', unless it can be demonstrated that this would make the scheme unviable;*
 - c) *Incorporate a Fabric First Approach, maximising the performance of the components and materials that form the building fabric itself, before consideration of the use of mechanical or electrical building service systems;*
 - d) *Minimise construction and demolition waste, utilise recycled and low-impact materials and incorporate measures that reduce the amount of biodegradable waste sent to landfill;*
 - e) *Be designed flexibly to enable future modification of use or layout, facilitating future adaption, refurbishment and retrofitting;*
 - f) *Include the provision of gigabit capable broadband access and enable provision of future communication technologies.*
2. *Where permission is required to retrofit energy efficiency measures into existing development, schemes will be supported in principle.*
3. *Development that involves the retrofitting of an existing historic building (heritage asset) will be supported provided that the following criteria are met:*
 - a) *It does not result in detriment to the significance of the asset or damage to its fabric;*
 - b) *A whole building approach to improving energy efficiency is taken as advocated by Historic England;*
 - c) *Micro-renewable technologies do not result in harm to the heritage asset or their setting;*
 - d) *Where the proposal involves major development, it is demonstrated that opportunities for the retention and retrofitting of existing historic buildings within the site boundary have been included within the scheme.*
4. *In order to demonstrate compliance, proposals should be accompanied by a Sustainability Statement to demonstrate how these measures will be incorporated into development design.*

3.0 Assessment Methodology

The energy strategy uses SAP calculations, which have been prepared for representative units. The results have been aggregated across similar unit types to provide an accurate assessment of the total site emissions and allow different specification options, low-carbon and renewable technologies to be tested.

Emission Factors

The CO₂ emission factors, where applicable, used throughout this report have been taken from the Building Regulation Approved Document L - 2021.

	kg CO ₂ /kWh
Natural gas	0.210
Grid supplied and displaced electricity	0.136

4.0 Proposal

The proposal is for the construction of 31 dwellings.

The accommodation schedule can be expressed as follows:

Unit Type	Number	Area	Area
		m ²	m ²
1-Bedroom Maisonette apartments	3	52.0	156.0
1-Bedroom Maisonette apartments	1	61.3	61.3
2-Bedroom Maisonette apartments	2	63.9	127.8
2-Bedroom Maisonette apartments	2	70.0	140.0
2-Bedroom Semi-detached houses	4	80.8	323.2
2-Bedroom Detached houses	2	80.8	161.6
3-Bedroom Semi-detached houses	2	97.8	195.6
3-Bedroom Detached house	1	97.8	97.8
3-Bedroom Detached houses	5	110.9	554.5
3-Bedroom Detached house	1	124.0	124.0
4-Bedroom Detached house	1	182.6	182.6
4-Bedroom 1½-storey Detached houses	2	187.1	374.2
4-Bedroom Detached houses	2	190.5	381.0
5-Bedroom 1½-storey Detached houses	3	214.0	642.0
Total	31		3,521.6

5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean and Be Clean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical.

Passive Design Measures

The passive design measures proposed include;

(i) Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The Site Layout sets out all homes in the context of the shape of the site and the surrounding development but generally locates all with either an orientation towards, (i) southeast-northwest or (ii) southwest-northeast. The design provides all homes with access to direct sunlight throughout the day.

(ii) Natural Daylighting

The design of the site seeks to maximise the standard of natural daylighting to all units. This will create a high-quality internal environment, which will reduce the need for artificial lighting.

(iii) Efficient Building Fabric

a. Building Envelope

U-values of the building envelope must meet Building Regulations Part L (2021) standards and further improvements to U-values will reduce the building's heating requirements.

It is assumed that the buildings are built with traditional load bearing brick and block construction using 350mm thick cavity walls, with 102mm brickwork external skin, 150mm fully filled cavity and 100mm medium density blockwork internally.

The ground floors will be insulated with at least 150mm of PIR insulation.

Cold roofs will be insulated with 450mm of mineral wool and sloping ceilings; low-level walls and dormer windows will be insulated with 100mm PIR between joists and studs and 50mm below.

Windows are proposed as double glazed with Low 'e' soft coat and argon filled.

It is proposed to set maximum limits for the elemental U-values as follows:

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m ² K	W/m ² K	
Ground Floors	0.18	0.13	28%
External Walls	0.26	0.18	31%
Roofs (cold)	0.16	0.10	38%
Flat Roofs	0.16	0.11	31%
Sloping Roofs	0.16	0.15	6%
Windows and Glazed Doors	1.60	1.20	25%
Entrance Doors	1.60	1.00	38%
'g' Value for Glazing			0.50

b. Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building.

The Building Regulations set a minimum standard for air permeability of 8 m³ of air per hour per m² of envelope area, at 50Pa. The SAP modelling has been based on achieving a 38% improvement over Building Regulations and will target a permeability of 5.0 m³/hr/m² for the homes.

c. Thermal Bridging

The significance of Thermal Bridging, as a potentially major source of fabric heat losses, is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO₂ reduction targets set out in this strategy.

The thermal details for the buildings will be modelled at the detailed working drawing stage but for the purposes of this assessment the thermal details formulated by the Recognised Construction Details have been used. Any details not available on the RCD website will be modelled.

These will enable the buildings to achieve the higher energy efficiency requirements of the Building Regulations.

The following table provides the values currently used within the modelled SAP calculations.

Reference	Location	PSI Value
		W/mK
E2	Other Lintels (including other steel lintels)	0.028
E3	Sill	0.024
E4	Jamb	0.019
E5	Ground Floor (Normal)	0.046
E6	Intermediate Floor	0.000
E7	Party Floor	0.036
E10	Eaves (Ceiling)	0.051
E11	Eaves (Rafter)	0.018
E12	Gable (Ceiling)	0.029
E13	Gable (Rafter)	0.034
E14	Flat Roof	0.041
E16	Corner (normal)	0.037
E17	Corner (inverted)	-0.079
E18	Party Walls	0.041

d. Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2021 to address the possibility of overheating and poor air quality. The ventilation to the En-Suites and Bathrooms includes the installation of a System 1 mechanical extract ventilation system (intermittent point of use extract).

Active Design Measures will include;

(i) Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

Part L of the Building Regulations requires all light fittings to have lamps with a minimum luminous efficacy of 80 light source lumens per circuit-watt. It is assumed all fittings will achieve this standard.

(ii) Space Heating and Hot Water

The SAP modelling has been based upon the installation of air source heat pumps to the houses and exhaust air heat pumps to the maisonette apartments.

5.2 Low-Carbon and Renewable Technologies (Be Clean and Be Green)

The carbon dioxide emissions established above have been used to test the viability of various renewable and low-carbon technologies as follows.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Muntham Drive and Chapel Road to be 4.7 m/s at 10m above ground level and 5.5 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. The use of wind turbines will also have a detrimental aesthetic impact on the appearance of the development.

The use of wind turbines is not proposed.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.

CHP units are generally gas fuelled and generate electricity with heat being a by-product. The heat is usually used to meet the hot water load, which is fairly consistent throughout the year.

Historically CO₂ savings have been achieved because gas has been used to generate electricity and gas has had a lower emissions factor than electricity. However, with the de-carbonisation of the electricity grid the benefit of CHP is negated.

CHP is not proposed.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

The houses have insufficient ground area to sustain a horizontal collection system and the installations would require a bore hole to each, which would be cost prohibitive. The installation of GSHPs into the maisonette apartments is not practical.

The use of ground source heat pumps is not proposed.

Solar

(i) Solar Water Heating

Solar hot water panels use the sun's energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees.

The installation of air source and exhaust air heat pumps reduces the emissions significantly and the installation of solar hot water heating panels would only increase the emissions reduction by a further 5-7%.

Solar hot water panels could be used to reduce emissions but the incremental increase in reductions does not represent good value when compared with other technologies.

Solar hot water heating panels are not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels. The panels typically have an electrical warranty of 20-25 years and an expected system lifespan of 25-40 years.

The installation of air source heat pumps reduces the emissions significantly and whilst photovoltaic panels could be installed to some homes without detrimentally impacting the aesthetics of the development, they are not proposed at this stage.

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however, the initial heat energy is extracted from the external air rather than the ground.

The system works by transferring heat absorbed from the outside air to an indoor space using a wet central heating system to heat radiators or underfloor heating and provide domestic hot water. Heat pumps work similarly to a refrigerator in that they absorb heat and transfer it to another medium.

ASHPs use electricity and through a condenser/ evaporator system put out somewhere between 3.0 and 3.3 times as much energy as they require to run. ASHPs work well with low temperature systems.

The SAP modelling has been based on the installation of air source heat pumps to the houses and exhaust air heat pumps to the maisonette apartments.

5.3 Establishing Carbon Dioxide Emissions

SAP calculations have been prepared for representative units, the results from which can be aggregated across similar units to provide an accurate assessment of the total site emissions.

There are three no. 1-bedroom maisonette apartments with floor areas of 52.0 m², a single unit at 61.3 m² and two no. 2-bedroom maisonette apartments at 63.9 m² and two no. at 70.0 m². SAP calculations have been prepared for a unit at 61.0 m², which are proposed as representative of these eight units.

There are four no. 2-bedroom semi-detached houses with floor areas of 80.8 m² and two no. 3-bedroom semi-detached houses with floor areas of 97.8 m² and SAP calculations have been prepared for a unit at 80.8 m², which are proposed as representative of these six units.

There are nine no. detached houses with floor areas of 80.8 m² (2 no.), 97.8 m² (1 no.), 110.9 m² (5 no.) and 124.0 m² (1 no.) and SAP calculations have therefore been prepared for a unit at 110.9 m², which are proposed as representative of these nine units.

There are three no. 2-storey detached houses with floor areas of 182.6 m² (1 no.) and 190.5 m² (2 no.) and SAP calculations have been prepared for a unit at 182.6 m², which are proposed as representative of all three.

There are five no. 1½-storey detached houses with floor areas of 187.1 m² (2 no.) and 214.0 m² (3 no.) and SAP calculations have been prepared for a unit at 214.0 m², which are proposed as representative of all five.

The TER & DER Worksheets for the modelled units are attached as Appendix 1 but the emissions can be summarised as follows;

Unit Type	TER Emissions	DER Emissions
	kg CO ₂ /yr	kg CO ₂ /yr
1-Bedroom Maisonette apartment – 61.0 m ²	10.93	3.59
2-Bedroom Semi-detached house – 80.8 m ²	10.68	4.23
3-Bedroom Detached house – 110.9 m ²	11.09	4.19
4-Bedroom Detached house – 182.6 m ²	8.43	3.31
5-Bedroom 1½-storey Detached house – 214.0 m ²	8.24	3.08

Summary

The emissions can be aggregated across the 31 units to provide an accurate assessment of the total site emissions as follows;

	Area	CO ₂ TER	CO ₂ DER
	m ²	kg/yr	kg/yr
1 & 2-Bedroom Maisonette apartments	485.1	5,302	1,742
2 & 3-Bedroom Semi-detached houses	518.8	5,541	2,195
2 & 3-Bedroom Detached houses	937.9	10,401	3,930
4-Bedroom Detached houses	563.6	4,751	1,866
4 & 5-Bedroom 1½-storey Detached houses	1,016.2	8,373	3,130
Totals	3,521.6	34,368	12,863

The total emissions allowable through the Building Regulations (TER) are calculated as:

- **34,368 kg CO₂ per year**

With total actual site emissions (DER) assessed as:

- **12,863 kg CO₂ per year**

The site carbon dioxide emissions are reduced by 21,505 kg CO₂ per year as a result of the energy efficiency measures and renewable technologies, which equates to a reduction of 62.57% of the TER emissions.

5.4 Summary of Calculations and Proposals for Low-carbon and Renewable Technologies

The application seeks detailed consent for the construction of 31 no. 2, 3, 4 and 5-bedroom semi-detached and detached 1½-storey and 2-storey houses.

SAP calculations have been prepared for representative units built to the specification set out above including the installation of air source heat pumps to the houses and exhaust air heat pumps to the maisonette apartments. The results from the calculations have been aggregated across similar unit types to provide an assessment of the total site emissions.

Various technologies have been considered and whilst wind turbines, combined heat and power, ground source heat pumps and solar hot water heating panels are not considered appropriate the use of photovoltaic panels and air source heat pumps are considered feasible, although the installation of photovoltaic panels are not considered at this stage.

Be Lean

The construction standards for the fabric of the buildings proposes U-values, which demonstrate good practice and improve upon those required by the Building Regulations. Air tightness standards are targeted at a 38% improvement upon the minimum required by the Building Regulations.

In addition, it is proposed to install energy efficiency mechanical and electrical services.

Be Clean and Be Green

As a result of the energy efficiency measures incorporated into the fabric specification of the homes and the installation of heat pumps to the homes the total emissions from the site based upon the maximum permissible by the Building Regulations (TER) are calculated as **34,368 kg CO₂ per year**, with actual (DER) emissions after energy efficiency measures and the installation of renewable technologies of **12,863 kg CO₂ per year**.

The emissions are reduced by a total of **21,505 kg CO₂ per year**, which equates to a reduction of **62.57%**.

All space heating and hot water will be provided to the homes from renewable technologies.

All systems to the homes are fuelled by mains electricity and therefore as the National Grid decarbonises so the homes will become zero carbon. The homes are zero carbon ready.

There will be no mains gas connection to the site and therefore there will be no on-site NO_x or CO₂ emissions.

The proposal meets the requirements of the adopted policy.

6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The site lies within Flood Zone 1 and the risk of flooding is regarded as low.

Further details of the flood risk and the proposals for the disposal of surface water are set out within the Flood Risk Assessment and Drainage Strategy, which accompanies the application.

Surface Water Management

Consideration has been given to the use of grey water recycling. However, customer's resistance to the appearance of the recycled water and the cost of the systems does not currently make them a viable option. They have therefore not been included in the proposals.

Water efficiency measures

In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WCs and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included will ensure that the water use target of less than 110 litres per person per day is achieved.

Water efficient devices have been evaluated and will be installed. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.

The following devices will be incorporated within the maisonette apartments and houses:

- water efficient taps;
- water efficient toilets;
- low output showers;
- flow restrictors to manage water pressures to achieve optimum levels and
- water meters.

Below is a typical specification, which would achieve the 110 Litres per person per day target (including five litres per person per day allowance for external water use).

Schedule of Appliance Water Consumption		
Appliance	Flow rate or capacity	Total Litres
WC	6/3 litres dual flush	17.64
Basin	2.0 litres/min.	4.74
Shower	9.0 litres/min	39.33
Bath	175 litres	19.25
Sink	5.0 litres/min	12.56
Washing Machine	6.75 litres/kg	14.18
Dishwasher	1.25 litres/places	4.50
		112.20
	Normalisation Factor	0.91
Total Internal Water Consumption		102.10
External Water Use		5.00
Total Water Consumption		107.10

7.0 Materials and Waste

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.

Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy. A full evaluation of these suppliers will be undertaken at the next stage of design.

In addition, timber would be sourced, where practical, certified by PEFC or an equivalent approved certification body and all site timber used within the construction process would be recycled.

All insulation materials to will have a zero ozone depleting potential

Construction waste

Targets will be set to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials.

Appendix 1 – TER & DER Worksheets for the Modelled Units

Full SAP Calculation Printout



Plot Reference	Barns Green 2BF GND MAIS 61			Issued on Date	21/05/2026	
Assessment Reference	Barns Green 2BF GND MAIS 61		Plot Type Ref	Barns Green 2BF GND MAIS 61		
Plot Address	Land at, Muntham Drive and, Chapel Road, Barns Green, West Sussex			SAP Version	10.2	
SAP Rating	87 B	DER	3.59	TER	10.93	
Environmental	97 A	% DER < TER			67.15	
CO ₂ Emissions (t/year)	0.2	DFEE	26.38	TFEE	27.93	
Compliance Check	See BREL	% DFEE < TFEE			5.52	
% DPER < TPER	33.81	DPER	37.73	TPER	57.00	
Assessor Details	Mr. Ivan Ball			Assessor ID	DE88-0001	
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	61.4000 (1b)	2.4000 (2b)	147.3600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	147.3600 (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	1 * 10 = 10.0000 (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) =	10.0000 / (5) = 0.0679 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3179 (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) = 0.2702 (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	0.3445	0.3377	0.3310	0.2972	0.2904	0.2567	0.2567	0.2499	0.2702	0.2904	0.3040	0.3175 (22b)
Effective ac	0.5593	0.5570	0.5548	0.5442	0.5422	0.5329	0.5329	0.5312	0.5365	0.5422	0.5462	0.5504 (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							
Windows & Glazed Doors			10.4600	1.1450	11.9771		(27)
Ground Floor			61.4000	0.1300	7.9820		(28a)
External Wall	50.7600	10.4600	40.3000	0.1800	7.2540		(29a)
Total net area of external elements Aum(A, m ²)			112.1600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.2131		(33)
Main dwelling							
Party Wall			30.8600	0.0000	0.0000		(32)
Party Ceiling			61.4000				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				6.0500	0.0280	0.1694	
E3 Sill				3.0000	0.0240	0.0720	
E4 Jamb				16.5000	0.0190	0.3135	
E5 Ground floor (normal)				21.1500	0.0460	0.9729	
E18 Party wall between dwellings				9.6000	0.0410	0.3936	
E16 Corner (normal)				2.4000	0.0370	0.0888	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.0102 (36)
Point Thermal bridges							(36a) = 0.0000

Full SAP Calculation Printout



Total fabric heat loss (33) + (36) + (36a) = 29.2233 (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	27.1997	27.0877	26.9779	26.4620	26.3655	25.9163	25.9163	25.8331	26.0893	26.3655	26.5608	26.7649 (38)
Average = Sum(39)m / 12 =	56.4230	56.3110	56.2012	55.6853	55.5888	55.1396	55.1396	55.0564	55.3126	55.5888	55.7841	55.9882 (39)
												55.6849
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9189	0.9171	0.9153	0.9069	0.9054	0.8980	0.8980	0.8967	0.9009	0.9054	0.9085	0.9119 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.9069
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Hot water usage for mixer showers												2.0209 (42)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for other uses	66.9634	65.9689	64.5684	61.9862	60.0527	57.9087	56.7506	58.1413	59.6555	61.9496	64.5850	66.7370 (42b)
Average daily hot water use (litres/day)	35.3263	34.0417	32.7571	31.4725	30.1880	28.9034	28.9034	30.1880	31.4725	32.7571	34.0417	35.3263 (42c)
												94.2004 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.2897	100.0106	97.3255	93.4587	90.2406	86.8121	85.6540	88.3293	91.1280	94.7068	98.6267	102.0633 (44)
Energy content (annual)	162.0019	142.4138	149.5857	127.9404	121.4812	106.7456	103.5911	109.3701	112.3700	128.5162	140.5119	159.8065 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3003	21.3621	22.4379	19.1911	18.2222	16.0118	15.5387	16.4055	16.8555	19.2774	21.0768	23.9710 (46)
Water storage loss (or HIU loss):												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8424 (55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	188.1163	166.0010	175.7001	153.2124	147.5956	132.0176	129.7055	135.4845	137.6420	154.6306	165.7839	185.9209 (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	188.1163	166.0010	175.7001	153.2124	147.5956	132.0176	129.7055	135.4845	137.6420	154.6306	165.7839	185.9209 (64)
12Total per year (kWh/year)												1871.8101 (64)
Electric shower(s)												1872 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	53.8656	47.3526	49.7373	42.5402	40.3925	35.4929	34.4440	36.3655	37.3630	42.7316	46.7202	53.1357 (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	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	91.7625	101.5942	91.7625	94.8212	91.7625	94.8212	91.7625	91.7625	94.8212	91.7625	94.8212	91.7625 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	176.4635	178.2946	173.6802	163.8567	151.4562	139.8015	132.0155	130.1844	134.7988	144.6223	157.0227	168.6774 (68)
Pumps, fans	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046 (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)	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371 (71)
Total internal gains	72.4000	70.4651	66.8512	59.0836	54.2910	49.2957	46.2957	48.8784	51.8931	57.4350	64.8892	71.4189 (72)
	393.9399	403.6678	385.6077	371.0754	350.8236	337.2324	323.3877	324.1392	334.8270	347.1337	370.0471	385.1727 (73)

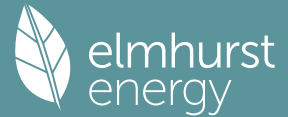
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.6400	10.6334		0.5000		0.7000		0.7700		11.9672 (74)
South				5.8200	46.7521		0.5000		0.7000		0.7700		65.9971 (78)
Solar gains	77.9643	130.9562	176.5442	218.0329	246.2442	246.0719	236.5175	214.7511	190.5500	143.8048	92.9921	67.0040	(83)
Total gains	471.9042	534.6240	562.1520	589.1083	597.0678	583.3043	559.9051	538.8903	525.3770	490.9385	463.0392	452.1767	(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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	75.5700	75.7204	75.8683	76.5711	76.7041	77.3290	77.3290	77.4459	77.0871	76.7041	76.4356	76.1569
	6.0380	6.0480	6.0579	6.1047	6.1136	6.1553	6.1553	6.1631	6.1391	6.1136	6.0957	6.0771

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util living area	0.9923	0.9828	0.9647	0.9100	0.7908	0.5938	0.4319	0.4676	0.6953	0.9192	0.9822	0.9939 (86)
Living	20.1361	20.3050	20.5028	20.7484	20.9181	20.9881	20.9985	20.9976	20.9701	20.7682	20.4145	20.1036
Non living	19.1523	19.3665	19.6141	19.9132	20.0962	20.1625	20.1687	20.1695	20.1479	19.9424	19.5121	19.1157
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.1514	20.1530	20.1545	20.1616	20.1630	20.1692	20.1692	20.1703	20.1668	20.1630	20.1603	20.1574 (88)
util rest of house	0.9899	0.9777	0.9543	0.8846	0.7403	0.5216	0.3511	0.3845	0.6234	0.8912	0.9760	0.9921 (89)
MIT 2	20.1514	20.1530	20.1545	20.1616	20.1630	20.1692	20.1692	20.1703	20.1668	20.1630	20.1603	20.1574 (90)
Living area fraction									FLA = Living area / (4) =			0.3769 (91)
MIT	20.4712	20.4722	20.4731	20.4776	20.4784	20.4823	20.4823	20.4830	20.4808	20.4784	20.4767	20.4750 (92)
Temperature adjustment												0.0000
adjusted MIT	20.4712	20.4722	20.4731	20.4776	20.4784	20.4823	20.4823	20.4830	20.4808	20.4784	20.4767	20.4750 (93)

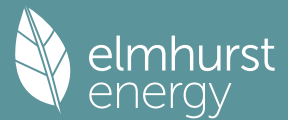
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9798	0.9586	0.8949	0.7602	0.5493	0.3817	0.4160	0.6514	0.9027	0.9786	0.9928	(94)
Useful gains	467.6100	523.8280	538.8711	527.1856	453.8969	320.4019	213.7114	224.1956	342.2396	443.1824	453.1202	448.9313	(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	912.4300	876.8858	785.3068	644.7015	487.9816	324.3466	214.0675	224.7953	352.9383	549.1293	746.2084	911.2061	(97)
Space heating kWh	330.9461	237.2549	183.3482	84.6114	25.3590	0.0000	0.0000	0.0000	0.0000	78.8245	211.0235	343.9325	(98a)
Space heating requirement - total per year (kWh/year)												1495.3001	
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	330.9461	237.2549	183.3482	84.6114	25.3590	0.0000	0.0000	0.0000	0.0000	78.8245	211.0235	343.9325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1495.3001	
Space heating per m2										(98c) / (4) =		24.3534	(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 %)													299.0307 (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	330.9461	237.2549	183.3482	84.6114	25.3590	0.0000	0.0000	0.0000	0.0000	78.8245	211.0235	343.9325	(98)
Space heating efficiency (main heating system 1)	299.0307	299.0307	299.0307	299.0307	299.0307	0.0000	0.0000	0.0000	0.0000	299.0307	299.0307	299.0307	(210)
Space heating fuel (main heating system)	110.6730	79.3413	61.3142	28.2952	8.4804	0.0000	0.0000	0.0000	0.0000	26.3600	70.5692	115.0158	(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	188.1163	166.0010	175.7001	153.2124	147.5956	132.0176	129.7055	135.4845	137.6420	154.6306	165.7839	185.9209	(64)
Efficiency of water heater (217)m	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	220.6850	(216)
Fuel for water heating, kWh/month	85.2420	75.2208	79.6158	69.4258	66.8807	59.8217	58.7740	61.3927	62.3703	70.0685	75.1224	84.2472	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	19.0664	15.2958	13.7722	10.0901	7.7939	6.3677	7.1098	9.2416	12.0040	15.7498	17.7894	19.5963	(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												500.0490	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												220.6850	
Water heating fuel used												848.1819	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												153.8770	(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)

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Energy used
Total delivered energy for all uses

0.0000 (237)
1502.1079 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	500.0490	0.1565	78.2695 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	848.1819	0.1411	119.6599 (264)
Space and water heating			197.9294 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	153.8770	0.1443	22.2092 (268)
Total CO ₂ , kg/year			220.1386 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5900 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	500.0490	1.5795	789.8090 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	848.1819	1.5217	1290.6481 (278)
Space and water heating			2080.4571 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	153.8770	1.5338	236.0217 (282)
Total Primary energy kWh/year			2316.4788 (286)
Dwelling Primary energy Rate (DPER)			37.7300 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	61.4000 (1b)	x 2.4000 (2b)	= 147.3600 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	147.3600 (5)

2. Ventilation rate

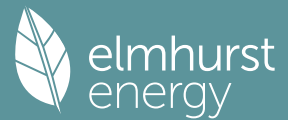
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1357 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3857 (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) = 0.3279 (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	0.4180	0.4098	0.4016	0.3607	0.3525	0.3115	0.3115	0.3033	0.3279	0.3525	0.3688	0.3852 (22b)
Effective ac	0.5874	0.5840	0.5807	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	0.5742 (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							
TER Opening Type			10.4600	1.1450	11.9771		(27)
Ground Floor			61.4000	0.1300	7.9820		(28a)
External Wall	50.7600	10.4600	40.3000	0.1800	7.2540		(29a)
Total net area of external elements A _{um} (A, m ²)			112.1600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.2131		(33)
Main dwelling							
Party Wall			30.8600	0.0000	0.0000		(32)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							250.0000 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	6.0500	0.0500	0.3025
E3 Sill	3.0000	0.0500	0.1500
E4 Jamb	16.5000	0.0500	0.8250
E5 Ground floor (normal)	21.1500	0.1600	3.3840
E18 Party wall between dwellings	9.6000	0.0600	0.5760
E16 Corner (normal)	2.4000	0.0900	0.2160

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

Point Thermal bridges		(36a) =	5.4535 (36)
Total fabric heat loss	(33) + (36) + (36a) =		32.6666 (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	28.5632	28.3983	28.2365	27.4769	27.3348	26.6732	26.6732	26.5507	26.9281	27.3348	27.6223	27.9229 (38)
Heat transfer coeff	61.2298	61.0649	60.9031	60.1435	60.0014	59.3398	59.3398	59.2173	59.5947	60.0014	60.2889	60.5895 (39)
Average = Sum(39)m / 12 =												60.1429

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9972	0.9945	0.9919	0.9795	0.9772	0.9664	0.9664	0.9645	0.9706	0.9772	0.9819	0.9868 (40)
HLP (average)												0.9795
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0209 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
66.9634	65.9689	64.5684	61.9862	60.0527	57.9087	56.7506	58.1413	59.6555	61.9496	64.5850	66.7370	66.7370 (42b)
Hot water usage for other uses												
35.3263	34.0417	32.7571	31.4725	30.1880	28.9034	28.9034	30.1880	31.4725	32.7571	34.0417	35.3263	35.3263 (42c)
Average daily hot water use (litres/day)												94.2004 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.2897	100.0106	97.3255	93.4587	90.2406	86.8121	85.6540	88.3293	91.1280	94.7068	98.6267	102.0633 (44)
Energy conte	162.0019	142.4138	149.5857	127.9404	121.4812	106.7456	103.5911	109.3701	112.3700	128.5162	140.5119	159.8065 (45)
Energy content (annual)										Total = Sum(45)m =		1564.3341
Distribution loss (46)m = 0.15 x (45)m												
24.3003	21.3621	22.4379	19.1911	18.2222	16.0118	15.5387	16.4055	16.8555	19.2774	21.0768	23.9710	23.9710 (46)
Water storage loss (or HIU 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	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	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												
208.5968	184.4995	196.1806	173.0322	168.0761	151.8374	150.1860	155.9650	157.4618	175.1111	185.6037	206.4014	206.4014 (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	208.5968	184.4995	196.1806	173.0322	168.0761	151.8374	150.1860	155.9650	157.4618	175.1111	185.6037	206.4014 (64)
12Total per year (kWh/year)												2112.9515 (64)
Electric shower(s)												2113 (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	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												
91.1415	81.0212	87.0132	78.6136	77.6684	71.5664	71.7200	73.6415	73.4365	80.0075	82.7937	90.4116	90.4116 (65)

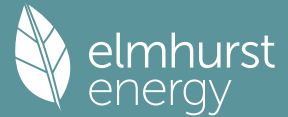
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464	101.0464 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
91.7625	101.5942	91.7625	94.8212	91.7625	94.8212	91.7625	91.7625	91.7625	94.8212	91.7625	94.8212	91.7625 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
176.4635	178.2946	173.6802	163.8567	151.4562	139.8015	132.0155	130.1844	134.7988	144.6223	157.0227	168.6774	168.6774 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046	33.1046 (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)												
-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371	-80.8371 (71)
Water heating gains (Table 5)												
122.5021	120.5672	116.9532	109.1856	104.3931	99.3977	96.3978	98.9805	101.9951	107.5370	114.9912	121.5209	121.5209 (72)
Total internal gains	447.0419	456.7699	438.7098	424.1774	403.9257	387.3344	373.4897	374.2412	384.9291	400.2357	423.1491	438.2748 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North												4.6400	10.6334	0.6300	0.7000	0.7700	15.0786
South												5.8200	46.7521	0.6300	0.7000	0.7700	83.1564 (74)
Solar gains	98.2350	165.0048	222.4457	274.7215	310.2677	310.0506	298.0120	270.5864	240.0930	181.1940	117.1701	84.4251 (83)					
Total gains	545.2769	621.7746	661.1555	698.8989	714.1933	697.3850	671.5017	644.8277	625.0220	581.4298	540.3192	522.6998 (84)					

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7. Mean internal temperature (heating season)

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

21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	69.6374	69.8256	70.0110	70.8952	71.0631	71.8554	71.8554	72.0041	71.5482	71.0631	70.7243	70.3734
alpha	5.6425	5.6550	5.6674	5.7263	5.7375	5.7904	5.7904	5.8003	5.7699	5.7375	5.7150	5.6916
util living area	0.9864	0.9711	0.9430	0.8680	0.7301	0.5371	0.3878	0.4208	0.6366	0.8799	0.9695	0.9889 (86)
MIT	20.1295	20.3184	20.5333	20.7818	20.9341	20.9906	20.9988	20.9981	20.9759	20.7974	20.4341	20.0985 (87)
Th 2	20.0856	20.0879	20.0901	20.1004	20.1024	20.1114	20.1114	20.1131	20.1079	20.1024	20.0984	20.0943 (88)
util rest of house	0.9824	0.9631	0.9274	0.8352	0.6748	0.4658	0.3101	0.3405	0.5628	0.8431	0.9596	0.9856 (89)
MIT 2	19.0927	19.3302	19.5953	19.8926	20.0509	20.1063	20.1110	20.1124	20.0933	19.9174	19.4856	19.0603 (90)
Living area fraction									fLA = Living area / (4) =			0.3769 (91)
MIT	19.4835	19.7026	19.9488	20.2277	20.3838	20.4396	20.4456	20.4462	20.4260	20.2491	19.8431	19.4516 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4835	19.7026	19.9488	20.2277	20.3838	20.4396	20.4456	20.4462	20.4260	20.2491	19.8431	19.4516 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9790	0.9590	0.9247	0.8403	0.6928	0.4925	0.3394	0.3708	0.5898	0.8498	0.9562	0.9827 (94)
Useful gains	533.8391	596.2691	611.3485	587.2512	494.8278	343.4557	227.9053	239.1211	368.6278	494.0745	516.6441	513.6349 (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	929.6805	903.9200	819.0745	681.2871	521.0395	346.5204	228.1965	239.6046	376.9936	578.9580	768.2662	924.0867 (97)
Space heating kWh	294.5060	206.7414	154.5481	67.7058	19.5015	0.0000	0.0000	0.0000	0.0000	63.1533	181.1679	305.3761 (98a)
Space heating requirement - total per year (kWh/year)												1292.7003
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	294.5060	206.7414	154.5481	67.7058	19.5015	0.0000	0.0000	0.0000	0.0000	63.1533	181.1679	305.3761 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1292.7003
Space heating per m2										(98c) / (4) =		21.0538 (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	294.5060	206.7414	154.5481	67.7058	19.5015	0.0000	0.0000	0.0000	0.0000	63.1533	181.1679	305.3761 (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)	319.0748	223.9885	167.4411	73.3541	21.1284	0.0000	0.0000	0.0000	0.0000	68.4218	196.2816	330.8517 (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	208.5968	184.4995	196.1806	173.0322	168.0761	151.8374	150.1860	155.9650	157.4618	175.1111	185.6037	206.4014 (64)
Efficiency of water heater (217)m	84.8331	84.3157	83.5305	82.1414	80.6498	79.8000	79.8000	79.8000	79.8000	82.0029	84.0056	79.8000 (216)
Fuel for water heating, kWh/month	245.8909	218.8200	234.8611	210.6517	208.4024	190.2724	188.2030	195.4448	197.3206	213.5425	220.9422	243.0063 (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	19.0664	15.2958	13.7722	10.0901	7.7939	6.3677	7.1098	9.2416	12.0040	15.7498	17.7894	19.5963 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-29.0225	-41.0713	-59.2714	-66.9399	-72.4648	-67.7742	-66.9681	-63.0985	-56.2871	-47.1296	-31.9739	-25.0761 (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	-15.9283	-33.5618	-66.7948	-100.4374	-132.8981	-133.5359	-131.9338	-111.6391	-81.7581	-47.9998	-21.2709	-12.5891 (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												1400.5420 (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												2567.3578 (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)

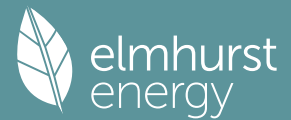
153.8770 (232)

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

PV generation

-1517.4244 (233)

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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	2690.3524 (238)

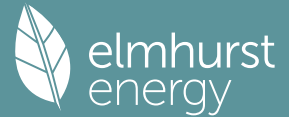
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1400.5420	0.2100	294.1138 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2567.3578	0.2100	539.1451 (264)
Space and water heating			833.2590 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	153.8770	0.1443	22.2092 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-627.0774	0.1345	-84.3339
PV Unit electricity exported	-890.3470	0.1259	-112.0659
Total			-196.3998 (269)
Total CO2, kg/year			670.9977 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.9300 (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	1400.5420	1.1300	1582.6124 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2567.3578	1.1300	2901.1144 (278)
Space and water heating			4483.7268 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	153.8770	1.5338	236.0217 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-627.0774	1.4970	-938.7576
PV Unit electricity exported	-890.3470	0.4620	-411.3582
Total			-1350.1158 (283)
Total Primary energy kWh/year			3499.7335 (286)
Target Primary Energy Rate (TPER)			57.0000 (287)

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Plot Reference	Barns Green 2BH SEMI 81				Issued on Date	21/05/2026
Assessment Reference	Barns Green 2BH SEMI 81	Plot Type Ref		Barns Green 2BH SEMI 81		
Plot Address	Land at, Muntham Drive and, Chapel Road, Barns Green, West Sussex				SAP Version	10.2
SAP Rating	83 B	DER	4.23	TER	10.68	
Environmental	96 A	% DER < TER				60.39
CO ₂ Emissions (t/year)	0.31	DFEE	31.09	TFEE	32.65	
Compliance Check	See BREL	% DFEE < TFEE				4.78
% DPER < TPER	19.83	DPER	44.62	TPER	55.66	
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001
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	40.2500 (1b)	x 2.4000 (2b)	= 96.6000 (1b) - (3b)
First floor	40.2500 (1c)	x 2.4000 (2c)	= 96.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 193.2000 (5)

2. Ventilation rate

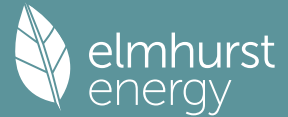
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1035 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3535 (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) = 0.3005 (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	0.3831	0.3756	0.3681	0.3305	0.3230	0.2855	0.2855	0.2780	0.3005	0.3230	0.3381	0.3531 (22b)
Effective ac	0.5734	0.5705	0.5677	0.5546	0.5522	0.5407	0.5407	0.5386	0.5451	0.5522	0.5571	0.5623 (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							
Windows & Glazed Doors			12.8900	1.1450	14.7595		(27)
Entrance Door			2.1000	1.0000	2.1000		(26)
Ground Floor			40.2500	0.1300	5.2325		(28a)
External Wall	86.1600	14.9900	71.1700	0.1800	12.8106		(29a)
Roof	40.2500		40.2500	0.1000	4.0250		(30)
Total net area of external elements Aum(A, m ²)			166.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.9276		(33)
Main dwelling							
Party Wall			45.2200	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
E2 Other lintels (including other steel lintels)				8.4400	0.0280		0.2363
E3 Sill				4.0600	0.0240		0.0974
E4 Jamb				23.7000	0.0190		0.4503
E5 Ground floor (normal)				17.9500	0.0460		0.8257
E18 Party wall between dwellings				9.6000	0.0410		0.3936
E16 Corner (normal)				9.6000	0.0370		0.3552

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E6 Intermediate floor within a dwelling	17.9500	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	8.5300	0.0510	0.4350
E12 Gable (insulation at ceiling level)	9.4200	0.0290	0.2732
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.0668 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	41.9944 (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	
36.5573	36.3756	36.1974	35.3609	35.2044	34.4758	34.4758	34.3409	34.7564	35.2044	35.5210	35.8520	(38)
Heat transfer coeff	78.5517	78.3700	78.1919	77.3553	77.1988	76.4702	76.4702	76.3353	76.7508	77.1988	77.5154	(39)
Average = Sum(39)m / 12 =												77.3546
HLP	0.9758	0.9735	0.9713	0.9609	0.9590	0.9499	0.9499	0.9483	0.9534	0.9590	0.9629	(40)
HLP (average)												0.9609
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

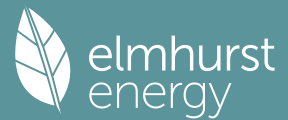
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.4723 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	75.7252	74.6006	73.0169	70.0968	67.9103	65.4858	64.1762	65.7488	67.4611	70.0554	73.0356	(42b)
Hot water usage for other uses	39.9486	38.4959	37.0433	35.5906	34.1379	32.6852	32.6852	34.1379	35.5906	37.0433	38.4959	(42c)
Average daily hot water use (litres/day)												106.5261 (43)
Daily hot water use	115.6738	113.0965	110.0601	105.6874	102.0482	98.1710	96.8614	99.8867	103.0517	107.0987	111.5316	(44)
Energy conte	183.1991	161.0479	169.1583	144.6807	137.3765	120.7127	117.1455	123.6806	127.0731	145.3319	158.8972	(45)
Energy content (annual)										Total = Sum(45)m =	1769.0199	
Distribution loss (46)m = 0.15 x (45)m	27.4799	24.1572	25.3737	21.7021	20.6065	18.1069	17.5718	18.5521	19.0610	21.7998	23.8346	(46)
Water storage loss (or HIU loss):												170.0000 (47)
Store volume												1.5600 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8424 (55)
Enter (49) or (54) in (55)												
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	(57)
Primary loss	37.2980	33.6885	37.2980	36.0948	37.2980	36.0948	37.2980	36.0948	37.2980	36.0948	37.2980	(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	246.6114	218.3236	232.5707	206.0475	200.7888	182.0795	180.5579	187.0930	188.4399	208.7443	220.2640	(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	246.6114	218.3236	232.5707	206.0475	200.7888	182.0795	180.5579	187.0930	188.4399	208.7443	220.2640	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =	2515.6493	(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	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000	(64a)
Heat gains from water heating, kWh/month	111.6436	99.3690	106.9750	97.1998	96.4076	89.2304	89.6808	91.8537	91.3452	99.0527	101.9267	(65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	123.6140	123.6140	123.6140	123.6140	123.6140	123.6140	123.6140	123.6140	123.6140	123.6140	123.6140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.0033	128.4323	116.0033	119.8701	116.0033	119.8701	116.0033	116.0033	119.8701	116.0033	119.8701	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.4824	222.7703	217.0048	204.7308	189.2370	174.6751	164.9468	162.6589	168.4244	180.6984	196.1922	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	(71)
Water heating gains (Table 5)	150.0586	147.8705	143.7836	134.9997	129.5801	123.9311	120.5387	123.4593	126.8684	133.1354	141.5649	(72)
Total internal gains	546.6285	559.1573	536.8760	519.6848	494.9046	478.5606	461.5730	462.2057	475.2471	489.9214	517.7114	(73)

6. Solar gains												
[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
North			6.4400	10.6334	0.5000	0.7000	0.7700	16.6096	(74)			
East			0.7100	19.6403	0.5000	0.7000	0.7700	3.3823	(76)			
South			5.7400	46.7521	0.5000	0.7000	0.7700	65.0900	(78)			
Solar gains	85.0818	144.9588	200.6236	256.0008	296.1111	298.7846	286.0054	254.8863	219.3716	160.6141	101.8611	(83)
Total gains	631.7103	704.1160	737.4995	775.6856	791.0158	777.3451	747.5784	717.0920	694.6187	650.5355	619.5726	(84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.1669	71.3319	71.4944	72.2675	72.4140	73.1040	73.1040	73.2332	72.8367	72.4140	72.1183	71.8116	
alpha	5.7445	5.7555	5.7663	5.8178	5.8276	5.8736	5.8736	5.8822	5.8558	5.8276	5.8079	5.7874	
util living area	0.9922	0.9843	0.9690	0.9205	0.8092	0.6135	0.4478	0.4859	0.7186	0.9270	0.9825	0.9936 (86)	
Living	20.0579	20.2176	20.4231	20.6939	20.8925	20.9827	20.9976	20.9963	20.9580	20.7243	20.3538	20.0315	
Non living	19.0162	19.2194	19.4779	19.8114	20.0293	20.1156	20.1245	20.1253	20.0954	19.8535	19.3999	18.9883	
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	20.5180	20.2176	20.4231	20.6939	20.8925	20.9827	20.9976	20.9963	20.9580	20.7243	20.3538	20.1670 (87)	
Th 2	20.1036	20.1054	20.1073	20.1160	20.1176	20.1253	20.1253	20.1267	20.1223	20.1176	20.1143	20.1109 (88)	
util rest of house	0.9898	0.9796	0.9595	0.8966	0.7584	0.5365	0.3600	0.3957	0.6436	0.9001	0.9764	0.9916 (89)	
MIT 2	19.6701	19.2194	19.4779	19.8114	20.0293	20.1156	20.1245	20.1253	20.0954	19.8535	19.3999	19.1906 (90)	
Living area fraction									fLA = Living area / (4) =				0.2106 (91)
MIT	19.8486	19.4295	19.6770	19.9972	20.2110	20.2982	20.3083	20.3087	20.2771	20.0369	19.6008	19.3962 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.8486	19.4295	19.6770	19.9972	20.2110	20.2982	20.3083	20.3087	20.2771	20.0369	19.6008	19.3962 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9889	0.9750	0.9539	0.8929	0.7642	0.5522	0.3785	0.4147	0.6576	0.8972	0.9718	0.9895 (94)
Useful gains	624.7185	686.5358	703.4753	692.5903	604.5068	429.2272	282.9842	297.3685	456.7530	583.6684	602.1050	602.2781 (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	1221.3692	1138.6799	1030.3312	858.4260	657.0418	435.7404	283.5776	298.3734	474.0943	728.5147	969.0020	1182.9702 (97)
Space heating kWh	443.9081	303.8408	243.1808	119.4017	39.0860	0.0000	0.0000	0.0000	0.0000	107.7657	264.1658	432.0349 (98a)
Space heating requirement - total per year (kWh/year)												1953.3838
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	443.9081	303.8408	243.1808	119.4017	39.0860	0.0000	0.0000	0.0000	0.0000	107.7657	264.1658	432.0349 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1953.3838
Space heating per m2										(98c) / (4) =		24.2656 (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 %)													257.8918 (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	443.9081	303.8408	243.1808	119.4017	39.0860	0.0000	0.0000	0.0000	0.0000	107.7657	264.1658	432.0349 (98)	
Space heating efficiency (main heating system 1)	257.8918	257.8918	257.8918	257.8918	257.8918	0.0000	0.0000	0.0000	0.0000	257.8918	257.8918	257.8918 (210)	
Space heating fuel (main heating system)	172.1296	117.8171	94.2957	46.2991	15.1560	0.0000	0.0000	0.0000	0.0000	41.7872	102.4328	167.5256 (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	246.6114	218.3236	232.5707	206.0475	200.7888	182.0795	180.5579	187.0930	188.4399	208.7443	220.2640	244.1288 (64)	
Efficiency of water heater	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800 (216)	
Fuel for water heating, kWh/month	135.2926	119.7738	127.5898	113.0390	110.1541	99.8900	99.0552	102.6404	103.3793	114.5185	120.8383	133.9306 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	24.1032	19.3365	17.4104	12.7556	9.8528	8.0498	8.9880	11.6830	15.1750	19.9105	22.4888	24.7731 (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													757.4430 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													182.2800
Water heating fuel used													1380.1017 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													194.5267 (232)

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

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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	2332.0714 (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	757.4430	0.1563	118.4135 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1380.1017	0.1407	194.1844 (264)
Space and water heating			312.5979 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	194.5267	0.1443	28.0762 (268)
Total CO2, kg/year			340.6741 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.2300 (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	757.4430	1.5788	1195.8137 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1380.1017	1.5203	2098.1115 (278)
Space and water heating			3293.9253 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	194.5267	1.5338	298.3715 (282)
Total Primary energy kWh/year			3592.2968 (286)
Dwelling Primary energy Rate (DPER)			44.6200 (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	40.2500 (1b)	x 2.4000 (2b)	= 96.6000 (1b) - (3b)
First floor	40.2500 (1c)	x 2.4000 (2c)	= 96.6000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	193.2000 (5)

2. Ventilation rate

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

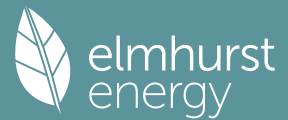
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1553 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4053	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3445 (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	0.4392	0.4306	0.4220	0.3789	0.3703	0.3273	0.3273	0.3187	0.3445	0.3703	0.3875	0.4048 (22b)
Effective ac	0.5965	0.5927	0.5890	0.5718	0.5686	0.5536	0.5536	0.5508	0.5593	0.5686	0.5751	0.5819 (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			2.1000	1.0000	2.1000		(26)
TER Opening Type			12.8900	1.1450	14.7595		(27)

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Ground Floor				40.2500	0.1300	5.2325	(28a)
External Wall	86.1600	14.9900		71.1700	0.1800	12.8106	(29a)
Roof	40.2500			40.2500	0.1100	4.4275	(30)
Total net area of external elements Aum(A, m2)				166.6600			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		39.3301	(33)
Main dwelling							
Party Wall			45.2200	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	
E2 Other lintels (including other steel lintels)				8.4400	0.0500	0.4220	
E3 Sill				4.0600	0.0500	0.2030	
E4 Jamb				23.7000	0.0500	1.1850	
E5 Ground floor (normal)				17.9500	0.1600	2.8720	
E18 Party wall between dwellings				9.6000	0.0600	0.5760	
E16 Corner (normal)				9.6000	0.0900	0.8640	
E6 Intermediate floor within a dwelling				17.9500	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)				8.5300	0.0600	0.5118	
E12 Gable (insulation at ceiling level)				9.4200	0.0600	0.5652	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.1990 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.5291 (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	38.0278	37.7890	37.5549	36.4554	36.2497	35.2922	35.2922	35.1148	35.6610	36.2497	36.6659	37.1009
Average = Sum(39)m / 12 =	84.5569	84.3181	84.0840	82.9846	82.7789	81.8213	81.8213	81.6440	82.1902	82.7789	83.1950	83.6301
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0504	1.0474	1.0445	1.0309	1.0283	1.0164	1.0164	1.0142	1.0210	1.0283	1.0335	1.0389
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

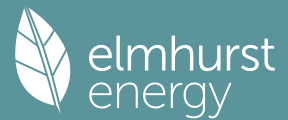
Assumed occupancy													2.4723 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	75.7252	74.6006	73.0169	70.0968	67.9103	65.4858	64.1762	65.7488	67.4611	70.0554	73.0356	75.4692	(42b)
Hot water usage for other uses	39.9486	38.4959	37.0433	35.5906	34.1379	32.6852	32.6852	34.1379	35.5906	37.0433	38.4959	39.9486	(42c)
Average daily hot water use (litres/day)													106.5261 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	115.6738	113.0965	110.0601	105.6874	102.0482	98.1710	96.8614	99.8867	103.0517	107.0987	111.5316	115.4178	(44)
Energy content (annual)	183.1991	161.0479	169.1583	144.6807	137.3765	120.7127	117.1455	123.6806	127.0731	145.3319	158.8972	180.7164	(45)
Distribution loss (46)m = 0.15 x (45)m	27.4799	24.1572	25.3737	21.7021	20.6065	18.1069	17.5718	18.5521	19.0610	21.7998	23.8346	27.1075	(46)
Water storage loss (or HIU loss):													170.0000 (47)
Store volume													1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.8102 (55)
Enter (49) or (54) in (55)													
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(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	231.5768	204.7439	217.5360	191.4979	185.7542	167.5298	165.5232	172.0583	173.8902	193.7096	205.7143	229.0941	(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	231.5768	204.7439	217.5360	191.4979	185.7542	167.5298	165.5232	172.0583	173.8902	193.7096	205.7143	229.0941	(64)
12Total per year (kWh/year)													2338.6284 (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	99.6158	88.5052	94.9473	85.5601	84.3798	77.5907	77.6530	79.8260	79.7055	87.0250	90.2870	98.7904	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.0033	128.4323	116.0033	119.8701	116.0033	119.8701	116.0033	116.0033	119.8701	116.0033	119.8701	116.0033	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.4824	222.7703	217.0048	204.7308	189.2370	174.6751	164.9468	162.6589	168.4244	180.6984	196.1922	210.7541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	35.3614	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	-98.8912	(71)
Water heating gains (Table 5)	133.8923	131.7042	127.6173	118.8334	113.4138	107.7648	104.3724	107.2930	110.7021	116.9691	125.3986	132.7828	(72)
Total internal gains	533.4622	545.9910	523.7097	506.5185	481.7383	462.3943	445.4067	446.0394	459.0808	476.7551	504.5451	522.6244	(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		
North	6.4400				10.6334	0.6300		0.7000	0.7700	20.9281 (74)		
East	0.7100				19.6403	0.6300		0.7000	0.7700	4.2616 (76)		
South	5.7400				46.7521	0.6300		0.7000	0.7700	82.0133 (78)		
Solar gains	107.2031	182.6481	252.7857	322.5609	373.1000	376.4685	360.3668	321.1568	276.4082	202.3738	128.3450	91.8183 (83)
Total gains	640.6652	728.6390	776.4954	829.0795	854.8383	838.8628	805.7735	767.1962	735.4890	679.1288	632.8902	614.4427 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.1126	66.2999	66.4844	67.3653	67.5326	68.3230	68.3230	68.4714	68.0164	67.5326	67.1949	66.8453
alpha	5.4075	5.4200	5.4323	5.4910	5.5022	5.5549	5.5549	5.5648	5.5344	5.5022	5.4797	5.4564
util living area	0.9923	0.9838	0.9669	0.9144	0.7987	0.6063	0.4440	0.4848	0.7198	0.9272	0.9830	0.9938 (86)
MIT	19.9471	20.1306	20.3640	20.6652	20.8814	20.9795	20.9969	20.9950	20.9486	20.6851	20.2731	19.9204 (87)
Th 2	20.0415	20.0440	20.0464	20.0577	20.0598	20.0697	20.0697	20.0715	20.0659	20.0598	20.0555	20.0511 (88)
util rest of house	0.9900	0.9789	0.9566	0.8886	0.7450	0.5258	0.3516	0.3894	0.6413	0.8996	0.9769	0.9919 (89)
MIT 2	18.8289	19.0625	19.3561	19.7272	19.9634	20.0583	20.0687	20.0698	20.0332	19.7590	19.2533	18.8020 (90)
Living area fraction	fLA = Living area / (4) =											0.2106 (91)
MIT	19.0643	19.2874	19.5683	19.9247	20.1567	20.2523	20.2641	20.2646	20.2260	19.9540	19.4680	19.0375 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0643	19.2874	19.5683	19.9247	20.1567	20.2523	20.2641	20.2646	20.2260	19.9540	19.4680	19.0375 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9866	0.9738	0.9502	0.8844	0.7510	0.5421	0.3711	0.4095	0.6556	0.8959	0.9720	0.9890 (94)
Useful gains	632.0877	709.5525	737.8058	733.2126	641.9622	454.7263	299.0276	314.1950	482.2055	608.4312	615.1420	607.6696 (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	1248.4245	1213.1203	1098.8343	914.8814	700.0344	462.4780	299.8044	315.5221	503.4950	774.3145	1028.9569	1240.8599 (97)
Space heating kWh	458.5546	338.3976	268.6052	130.8015	43.2057	0.0000	0.0000	0.0000	0.0000	123.4171	297.9467	471.0936 (98a)
Space heating requirement - total per year (kWh/year)												2132.0219
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	458.5546	338.3976	268.6052	130.8015	43.2057	0.0000	0.0000	0.0000	0.0000	123.4171	297.9467	471.0936 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2132.0219
Space heating per m2	(98c) / (4) =											26.4847 (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	458.5546	338.3976	268.6052	130.8015	43.2057	0.0000	0.0000	0.0000	0.0000	123.4171	297.9467	471.0936 (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)	496.8088	366.6279	291.0133	141.7134	46.8101	0.0000	0.0000	0.0000	0.0000	133.7130	322.8025	510.3939 (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	231.5768	204.7439	217.5360	191.4979	185.7542	167.5298	165.5232	172.0583	173.8902	193.7096	205.7143	229.0941 (64)
Efficiency of water heater (217)m	85.5620	85.1787	84.5338	83.2232	81.3560	79.8000	79.8000	79.8000	79.8000	83.0768	84.8896	79.8000 (216)
Fuel for water heating, kWh/month	270.6539	240.3700	257.3361	230.1017	228.3227	209.9371	207.4225	215.6119	217.9075	233.1693	242.3315	267.5089 (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	24.1032	19.3365	17.4104	12.7556	9.8528	8.0498	8.9880	11.6830	15.1750	19.9105	22.4888	24.7731 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-37.5044	-52.7929	-75.7691	-85.0571	-91.6024	-85.4553	-84.3940	-79.7269	-71.4743	-60.3002	-41.2011	-32.4338 (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	-21.4296	-45.0566	-89.5131	-134.3871	-177.6437	-178.4773	-176.3812	-149.3672	-109.5132	-64.4216	-28.6068	-16.9481 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	2309.8829 (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	2820.6733 (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)	194.5267 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1989.4571 (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	3421.6257 (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	2309.8829	0.2100	485.0754 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2820.6733	0.2100	592.3414 (264)
Space and water heating			1077.4168 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	194.5267	0.1443	28.0762 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-797.7116	0.1346	-107.3880
PV Unit electricity exported	-1191.7455	0.1259	-150.0498
Total			-257.4378 (269)
Total CO2, kg/year			859.9845 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.6800 (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	2309.8829	1.1300	2610.1677 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2820.6733	1.1300	3187.3608 (278)
Space and water heating			5797.5285 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	194.5267	1.5338	298.3715 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-797.7116	1.4975	-1194.6010
PV Unit electricity exported	-1191.7455	0.4622	-550.7865
Total			-1745.3874 (283)
Total Primary energy kWh/year			4480.6133 (286)
Target Primary Energy Rate (TPER)			55.6600 (287)

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Plot Reference	Barns Green 3BH DET 111			Issued on Date	21/05/2026	
Assessment Reference	Barns Green 3BH DET 111		Plot Type Ref	Barns Green 3BH DET 111		
Plot Address	Land at, Muntham Drive and, Chapel Road, Barns Green, West Sussex			SAP Version	10.2	
SAP Rating	81 B	DER	4.19	TER	11.09	
Environmental	96 A	% DER < TER			62.22	
CO ₂ Emissions (t/year)	0.42	DFEE	38.58	TFEE	41.09	
Compliance Check	See BREL	% DFEE < TFEE			6.11	
% DPER < TPER	24.35	DPER	43.91	TPER	58.04	
Assessor Details	Mr. Ivan Ball			Assessor ID	DE88-0001	
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	55.5000 (1b)	x 2.4000 (2b)	= 133.2000 (1b) - (3b)
First floor	55.5000 (1c)	x 2.4000 (2c)	= 133.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 266.4000 (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	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1126 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3626 (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) = 0.3082 (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	0.3930	0.3853	0.3776	0.3390	0.3313	0.2928	0.2928	0.2851	0.3082	0.3313	0.3467	0.3622 (22b)
Effective ac	0.5772	0.5742	0.5713	0.5575	0.5549	0.5429	0.5429	0.5406	0.5475	0.5549	0.5601	0.5656 (25)

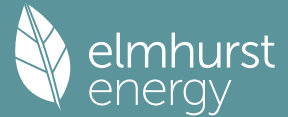
3. Heat losses and heat loss parameter

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							
Windows & Glazed Doors			14.4500	1.1450	16.5458		(27)
External Doors			5.0400	1.0000	5.0400		(26)
Ground Floor			60.2500	0.1300	7.8325		(28a)
External Wall	160.1800	19.4900	140.6900	0.1800	25.3242		(29a)
External Roof	60.2500		60.2500	0.1000	6.0250		(30)
Total net area of external elements Aum(A, m ²)			280.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.7675		(33)

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

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.5000	0.0190	0.2565
E3 Sill	11.1000	0.0160	0.1776
E4 Jamb	34.2000	0.0170	0.5814
E5 Ground floor (normal)	31.8900	0.0460	1.4669
E16 Corner (normal)	24.0000	0.0370	0.8880
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0790	-0.3792
E6 Intermediate floor within a dwelling	30.2700	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	19.3000	0.0480	0.9264

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E12 Gable (insulation at ceiling level) 11.0000 0.0290 0.3190
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.2366 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 65.0041 (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
 50.7443 50.4807 50.2223 49.0087 48.7817 47.7247 47.7247 47.5289 48.1318 48.7817 49.2410 49.7212 (38)
 Heat transfer coeff 115.7485 115.4849 115.2265 114.0129 113.7858 112.7288 112.7288 112.5331 113.1360 113.7858 114.2452 114.7254 (39)
 Average = Sum(39)m / 12 = 114.0118

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 HLP (average) 1.0428 1.0404 1.0381 1.0271 1.0251 1.0156 1.0156 1.0138 1.0192 1.0251 1.0292 1.0336 (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 2.8207 (42)
 Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
 Hot water usage for baths 82.4889 81.2638 79.5386 76.3577 73.9759 71.3349 69.9083 71.6214 73.4866 76.3127 79.5591 82.2100 (42b)
 Hot water usage for other uses 43.5168 41.9343 40.3519 38.7695 37.1870 35.6046 35.6046 37.1870 38.7695 40.3519 41.9343 43.5168 (42c)
 Average daily hot water use (litres/day) 116.0409 (43)
 Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 126.0056 123.1981 119.8905 115.1272 111.1630 106.9395 105.5129 108.8084 112.2561 116.6646 121.4934 125.7267 (44)
 Energy conte 199.5621 175.4325 184.2673 157.6034 149.6467 131.4946 127.6087 134.7276 138.4230 158.3127 173.0896 196.8577 (45)
 Energy content (annual) Total = Sum(45)m = 1927.0258
 Distribution loss (46)m = 0.15 x (45)m 29.9343 26.3149 27.6401 23.6405 22.4470 19.7242 19.1413 20.2091 20.7635 23.7469 25.9634 29.5287 (46)
 Water storage loss (or HIU loss): 200.0000 (47)
 Store volume 1.6800 (48)
 a) If manufacturer declared loss factor is known (kWh/day): 0.5400 (49)
 Temperature factor from Table 2b 0.9072 (55)
 Enter (49) or (54) in (55)
 Total storage loss 28.1232 25.4016 28.1232 27.2160 28.1232 27.2160 28.1232 28.1232 27.2160 28.1232 27.2160 28.1232 (56)
 If cylinder contains dedicated solar storage 28.1232 25.4016 28.1232 27.2160 28.1232 27.2160 28.1232 28.1232 27.2160 28.1232 27.2160 28.1232 (57)
 Primary loss 37.2980 33.6885 37.2980 36.0948 37.2980 36.0948 37.2980 37.2980 36.0948 37.2980 36.0948 37.2980 (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 264.9832 234.5225 249.6884 220.9142 215.0679 194.8054 193.0299 200.1487 201.7338 223.7339 236.4004 262.2789 (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 264.9832 234.5225 249.6884 220.9142 215.0679 194.8054 193.0299 200.1487 201.7338 223.7339 236.4004 262.2789 (64)
 Total per year (kWh/year) = Sum(64)m = 2697.3072 (64)
 12Total per year (kWh/year) 2697 (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 118.6913 105.6034 113.6058 103.0518 102.0945 94.3706 94.7668 97.1338 96.6743 104.9759 108.2009 117.7921 (65)

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

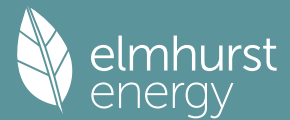
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 (66)m 141.0348 141.0348 141.0348 141.0348 141.0348 141.0348 141.0348 141.0348 141.0348 141.0348 141.0348 141.0348 (66)
 Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 150.0960 166.1777 150.0960 155.0992 150.0960 155.0992 150.0960 155.0992 150.0960 155.0992 150.0960 155.0992 (67)
 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 272.9850 275.8177 268.6793 253.4825 234.2993 216.2698 204.2250 201.3923 208.5307 223.7274 242.9106 260.9402 (68)
 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.1035 37.1035 37.1035 37.1035 37.1035 37.1035 37.1035 37.1035 37.1035 37.1035 37.1035 37.1035 (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) -112.8279 -112.8279 -112.8279 -112.8279 -112.8279 -112.8279 -112.8279 -112.8279 -112.8279 -112.8279 -112.8279 -112.8279 (71)
 Water heating gains (Table 5) 159.5313 157.1479 152.6960 143.1275 137.2237 131.0703 127.3748 130.5562 134.2698 141.0966 150.2791 158.3227 (72)
 Total internal gains 647.9228 664.4537 636.7817 617.0196 586.9295 567.7497 547.0062 547.3549 563.2101 580.2305 613.5993 634.6693 (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 0.6100 11.2829 0.5000 0.7000 0.7700 1.6694 (75)
 Southeast 6.1200 36.7938 0.5000 0.7000 0.7700 54.6170 (77)
 Southwest 1.8700 36.7938 0.5000 0.7000 0.7700 16.6885 (79)
 Northwest 5.8500 11.2829 0.5000 0.7000 0.7700 16.0096 (81)
 Solar gains 88.9844 157.4457 231.0217 312.3912 373.7673 381.5610 363.4973 316.1033 258.9476 178.2165 107.6522 75.4602 (83)
 Total gains 736.9072 821.8994 867.8034 929.4108 960.6968 949.3107 910.5035 863.4582 822.1577 758.4470 721.2516 710.1295 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.5956	66.7476	66.8972	67.6093	67.7442	68.3794	68.3794	68.4984	68.1334	67.7442	67.4719	67.1894
alpha	5.4397	5.4498	5.4598	5.5073	5.5163	5.5586	5.5586	5.5666	5.5422	5.5163	5.4981	5.4793
util living area												
	0.9967	0.9934	0.9864	0.9599	0.8843	0.7125	0.5361	0.5851	0.8244	0.9673	0.9928	0.9973 (86)
Living	19.8195	19.9724	20.1967	20.5185	20.7938	20.9553	20.9922	20.9877	20.8982	20.5556	20.1390	19.7971
Non living	18.6714	18.8677	19.1540	19.5612	19.8822	20.0439	20.0678	20.0673	19.9963	19.6131	19.0879	18.6483
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	20.3961	19.9724	20.1967	20.5185	20.7938	20.9553	20.9922	20.9877	20.8982	20.5556	20.1390	19.9654 (87)
Th 2	20.0478	20.0498	20.0517	20.0608	20.0625	20.0704	20.0704	20.0718	20.0673	20.0625	20.0590	20.0555 (88)
util rest of house												
	0.9957	0.9913	0.9816	0.9451	0.8425	0.6276	0.4274	0.4744	0.7531	0.9524	0.9901	0.9965 (89)
MIT 2	19.4991	18.8677	19.1540	19.5612	19.8822	20.0439	20.0678	20.0673	19.9963	19.6131	19.0879	18.9019 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.7140	19.1325	19.4039	19.7906	20.1006	20.2623	20.2893	20.2878	20.2125	19.8390	19.3398	19.1568 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7140	19.1325	19.4039	19.7906	20.1006	20.2623	20.2893	20.2878	20.2125	19.8390	19.3398	19.1568 (93)

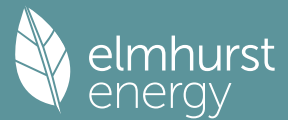
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9952	0.9884	0.9773	0.9399	0.8444	0.6462	0.4536	0.5010	0.7655	0.9478	0.9871	0.9953 (94)
Useful gains	733.3709	812.3842	848.0921	873.5087	811.2120	613.4376	412.9745	432.5494	629.3848	718.8398	711.9579	706.8080 (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	1784.1517	1643.6347	1486.8667	1241.6728	955.8730	638.3025	415.8913	437.5107	691.5400	1051.2618	1398.3383	1715.9194 (97)
Space heating kWh	781.7809	558.6004	475.2483	265.0782	107.6278	0.0000	0.0000	0.0000	0.0000	247.3220	494.1939	750.7789 (98a)
Space heating requirement - total per year (kWh/year)												3680.6303
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	781.7809	558.6004	475.2483	265.0782	107.6278	0.0000	0.0000	0.0000	0.0000	247.3220	494.1939	750.7789 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3680.6303
Space heating per m2										(98c) / (4) =		33.1588 (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 %)												274.4610 (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	781.7809	558.6004	475.2483	265.0782	107.6278	0.0000	0.0000	0.0000	0.0000	247.3220	494.1939	750.7789 (98)
Space heating efficiency (main heating system 1)	274.4610	274.4610	274.4610	274.4610	274.4610	0.0000	0.0000	0.0000	0.0000	274.4610	274.4610	274.4610 (210)
Space heating fuel (main heating system)	284.8423	203.5263	173.1570	96.5814	39.2143	0.0000	0.0000	0.0000	0.0000	90.1119	180.0598	273.5467 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	264.9832	234.5225	249.6884	220.9142	215.0679	194.8054	193.0299	200.1487	201.7338	223.7339	236.4004	262.2789 (64)
Efficiency of water heater (217)m	172.7062	172.7062	172.7062	172.7062	172.7062	172.7062	172.7062	172.7062	172.7062	172.7062	172.7062	172.7062 (216)
Fuel for water heating, kWh/month	153.4301	135.7928	144.5741	127.9133	124.5282	112.7958	111.7678	115.8898	116.8075	129.5460	136.8801	151.8642 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.1870	25.0194	22.5272	16.5044	12.7484	10.4156	11.6296	15.1165	19.6349	25.7620	29.0982	32.0538 (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												1341.0396 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												172.7062
Water heating fuel used												1561.7898 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												251.6968 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)

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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	3154.5262 (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	1341.0396	0.1555	208.5063 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1561.7898	0.1407	219.7980 (264)
Space and water heating			428.3043 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	251.6968	0.1443	36.3276 (268)
Total CO2, kg/year			464.6320 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1900 (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	1341.0396	1.5756	2112.9563 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1561.7898	1.5204	2374.5104 (278)
Space and water heating			4487.4667 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	251.6968	1.5338	386.0609 (282)
Total Primary energy kWh/year			4873.5276 (286)
Dwelling Primary energy Rate (DPER)			43.9100 (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	55.5000 (1b)	x 2.4000 (2b)	= 133.2000 (1b) - (3b)
First floor	55.5000 (1c)	x 2.4000 (2c)	= 133.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 266.4000 (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)

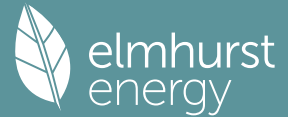
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1502 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4002	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3401 (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	0.4337	0.4252	0.4167	0.3741	0.3656	0.3231	0.3231	0.3146	0.3401	0.3656	0.3826	0.3996 (22b)
Effective ac	0.5940	0.5904	0.5868	0.5700	0.5668	0.5522	0.5522	0.5495	0.5578	0.5668	0.5732	0.5799 (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			5.0400	1.0000	5.0400		(26)
TER Opening Type			14.4500	1.1450	16.5458		(27)
Ground Floor			60.2500	0.1300	7.8325		(28a)

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External Wall	160.1800	19.4900	140.6900	0.1800	25.3242	(29a)
External Roof	60.2500		60.2500	0.1100	6.6275	(30)
Total net area of external elements Aum(A, m2)			280.6800			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.3700	(33)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.5000	0.0500	0.6750
E3 Sill	11.1000	0.0500	0.5550
E4 Jamb	34.2000	0.0500	1.7100
E5 Ground floor (normal)	31.8900	0.1600	5.1024
E16 Corner (normal)	24.0000	0.0900	2.1600
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
E6 Intermediate floor within a dwelling	30.2700	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	19.3000	0.0600	1.1580
E12 Gable (insulation at ceiling level)	11.0000	0.0600	0.6600
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.5884 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			(33) + (36) + (36a) = 72.9584 (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	52.2225	51.9015	51.5869	50.1090	49.8325	48.5453	48.5453	48.3070	49.0411	49.8325	50.3919	50.9767 (38)
Average = Sum(39)m / 12 =	125.1809	124.8599	124.5453	123.0674	122.7909	121.5037	121.5037	121.2654	121.9995	122.7909	123.3503	123.9351 (39)
												123.0661
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1278	1.1249	1.1220	1.1087	1.1062	1.0946	1.0946	1.0925	1.0991	1.1062	1.1113	1.1165 (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													2.8207 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	82.4889	81.2638	79.5386	76.3577	73.9759	71.3349	69.9083	71.6214	73.4866	76.3127	79.5591	82.2100	(42b)
Hot water usage for other uses	43.5168	41.9343	40.3519	38.7695	37.1870	35.6046	35.6046	37.1870	38.7695	40.3519	41.9343	43.5168	(42c)
Average daily hot water use (litres/day)													116.0409 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	126.0056	123.1981	119.8905	115.1272	111.1630	106.9395	105.5129	108.8084	112.2561	116.6646	121.4934	125.7267	(44)
Distribution loss (46)m = 0.15 x (45)m	199.5621	175.4325	184.2673	157.6034	149.6467	131.4946	127.6087	134.7276	138.4230	158.3127	173.0896	196.8577	(45)
Water storage loss (or HIU loss):	29.9343	26.3149	27.6401	23.6405	22.4470	19.7242	19.1413	20.2091	20.7635	23.7469	25.9634	29.5287	(46)
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8924 (55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.4882	221.4302	235.1933	206.8867	200.5728	180.7779	178.5348	185.6536	187.7063	209.2388	222.3729	247.7838	(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	250.4882	221.4302	235.1933	206.8867	200.5728	180.7779	178.5348	185.6536	187.7063	209.2388	222.3729	247.7838	(64)
12Total per year (kWh/year)													2526.6392 (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	2527 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	107.0953	95.1295	102.0097	91.8298	90.4984	83.1486	83.1708	85.5378	85.4523	93.3798	96.9789	106.1960	(65)

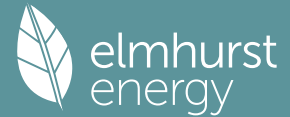
5. Internal gains (see Table 5 and 5a)

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	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	150.0960	166.1777	150.0960	155.0992	150.0960	155.0992	150.0960	150.0960	155.0992	150.0960	155.0992	150.0960 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	272.9850	275.8177	268.6793	253.4825	234.2993	216.2698	204.2250	201.3923	208.5307	223.7274	242.9106	260.9402 (68)
Pumps, fans	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035 (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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279 (71)
Total internal gains	143.9452	141.5617	137.1098	127.5413	121.6376	115.4841	111.7887	114.9701	118.6837	125.5105	134.6930	142.7366 (72)
	635.3366	651.8676	624.1956	604.4335	574.3434	552.1636	531.4201	531.7688	547.6240	567.6444	601.0132	622.0832 (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					0.6100	11.2829	0.6300		0.7000		0.7700		2.1034 (75)						
Southeast					6.1200	36.7938	0.6300		0.7000		0.7700		68.8174 (77)						
Southwest					1.8700	36.7938	0.6300		0.7000		0.7700		21.0275 (79)						
Northwest					5.8500	11.2829	0.6300		0.7000		0.7700		20.1720 (81)						
Solar gains	112.1204	198.3815	291.0874	393.6129	470.9468	480.7669	458.0066	398.2901	326.2739	224.5528	135.6418	95.0798 (83)							
Total gains	747.4570	850.2491	915.2829	998.0464	1045.2902	1032.9305	989.4267	930.0589	873.8979	792.1972	736.6551	717.1630 (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	61.5775	61.7359	61.8918	62.6351	62.7761	63.4411	63.4411	63.5658	63.1833	62.7761	62.4914	62.1966							
alpha	5.1052	5.1157	5.1261	5.1757	5.1851	5.2294	5.2294	5.2377	5.2122	5.1851	5.1661	5.1464							
util living area	0.9966	0.9929	0.9846	0.9546	0.8730	0.7020	0.5302	0.5826	0.8229	0.9663	0.9927	0.9973 (86)							
MIT	19.6952	19.8687	20.1218	20.4781	20.7767	20.9488	20.9902	20.9844	20.8804	20.5020	20.0437	19.6718 (87)							
Th 2	19.9782	19.9806	19.9829	19.9937	19.9958	20.0052	20.0052	20.0070	20.0016	19.9958	19.9916	19.9874 (88)							
util rest of house	0.9955	0.9905	0.9792	0.9379	0.8273	0.6128	0.4156	0.4655	0.7483	0.9505	0.9898	0.9964 (89)							
MIT 2	18.4621	18.6849	19.0076	19.4578	19.8035	19.9754	20.0021	20.0013	19.9190	19.4952	18.9171	18.4387 (90)							
Living area fraction	fLA = Living area / (4) = 0.2396 (91)																		
MIT	18.7576	18.9686	19.2746	19.7023	20.0367	20.2087	20.2389	20.2369	20.1494	19.7365	19.1870	18.7342 (92)							
Temperature adjustment	0.0000																		
adjusted MIT	18.7576	18.9686	19.2746	19.7023	20.0367	20.2087	20.2389	20.2369	20.1494	19.7365	19.1870	18.7342 (93)							
8. Space heating requirement																			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec							
Utilisation	0.9935	0.9872	0.9742	0.9319	0.8294	0.6322	0.4432	0.4935	0.7608	0.9453	0.9866	0.9947 (94)							
Useful gains	742.6313	839.4041	891.6398	930.0580	867.0016	652.9933	438.4878	459.0224	664.8576	748.8343	726.7659	713.3767 (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	1809.8137	1756.6049	1591.0220	1329.4092	1023.6758	681.4735	442.1342	465.2857	738.0249	1121.8781	1490.9397	1801.3022 (97)							
Space heating kWh	793.9837	616.3589	520.3403	287.5329	116.5656	0.0000	0.0000	0.0000	0.0000	277.5446	550.2051	809.4166 (98a)							
Space heating requirement - total per year (kWh/year)													3971.9479						
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	793.9837	616.3589	520.3403	287.5329	116.5656	0.0000	0.0000	0.0000	0.0000	277.5446	550.2051	809.4166 (98c)							
Space heating requirement after solar contribution - total per year (kWh/year)													3971.9479						
Space heating per m2	(98c) / (4) =												35.7833 (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	793.9837	616.3589	520.3403	287.5329	116.5656	0.0000	0.0000	0.0000	0.0000	277.5446	550.2051	809.4166 (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)	860.2207	667.7778	563.7490	311.5199	126.2899	0.0000	0.0000	0.0000	0.0000	300.6984	596.1052	876.9411 (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	250.4882	221.4302	235.1933	206.8867	200.5728	180.7779	178.5348	185.6536	187.7063	209.2388	222.3729	247.7838 (64)							
Efficiency of water heater	86.4614	86.2296	85.7881	84.7981	82.8877	79.8000	79.8000	79.8000	79.8000	84.6942	86.0080	79.8000 (216)							
(217)m	86.4614	86.2296	85.7881	84.7981	82.8877	79.8000	79.8000	79.8000	79.8000	84.6942	86.0080	86.5132 (217)							
Fuel for water heating, kWh/month	289.7109	256.7914	274.1561	243.9755	241.9812	226.5387	223.7278	232.6487	235.2209	247.0521	258.5491	286.4117 (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	31.1870	25.0194	22.5272	16.5044	12.7484	10.4156	11.6296	15.1165	19.6349	25.7620	29.0982	32.0538 (232)							
Electricity generated by PVs (Appendix M) (negative quantity)																			
(233a)m	-50.2809	-70.0450	-99.4687	-110.4009	-117.7903	-109.4332	-108.0283	-102.5783	-92.8001	-79.3839	-54.9594	-43.5659 (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 FVs (Appendix M) (negative quantity)																			
(233b)m	-30.9820	-64.8780	-128.4360	-192.1868	-253.4683	-254.4987	-251.5499	-213.3155	-156.7603	-92.5926	-41.2974	-24.5260 (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													4303.3021 (211)						
Space heating fuel - main system 2													0.0000 (213)						

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	3016.7641 (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)	251.6968 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2743.2266 (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	4914.5365 (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	4303.3021	0.2100	903.6934 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3016.7641	0.2100	633.5205 (264)
Space and water heating			1537.2139 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	251.6968	0.1443	36.3276 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1038.7351	0.1349	-140.0872
PV Unit electricity exported	-1704.4915	0.1260	-214.7677
Total			-354.8549 (269)
Total CO2, kg/year			1230.6159 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.0900 (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	4303.3021	1.1300	4862.7314 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3016.7641	1.1300	3408.9435 (278)
Space and water heating			8271.6749 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	251.6968	1.5338	386.0609 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1038.7351	1.4984	-1556.4898
PV Unit electricity exported	-1704.4915	0.4625	-788.3524
Total			-2344.8422 (283)
Total Primary energy kWh/year			6442.9944 (286)
Target Primary Energy Rate (TPER)			58.0400 (287)

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Plot Reference	Barns Green 4BH DET 178				Issued on Date	21/05/2026	
Assessment Reference	Barns Green 4BH DET 178			Plot Type Ref	Barns Green 4BH DET 178		
Plot Address	Land at, Muntham Drive and, Chapel Road, Barns Green, West Sussex				SAP Version	10.2	
SAP Rating	83 B	DER	3.31	TER	8.43		
Environmental	97 A	% DER < TER				60.74	
CO ₂ Emissions (t/year)	0.53	DFEE	37.91	TFEE	39.23		
Compliance Check	See BREL	% DFEE < TFEE				3.36	
% DPER < TPER	22.18	DPER	34.50	TPER	44.33		
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001	
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	95.9700 (1b)	x 2.4000 (2b)	= 230.3280 (1b) - (3b)
First floor	81.8200 (1c)	x 2.4000 (2c)	= 196.3680 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.7900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 426.6960 (5)

2. Ventilation rate

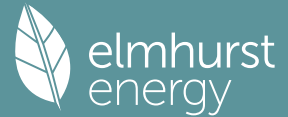
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.0937 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3437 (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) = 0.2922 (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	0.3725	0.3652	0.3579	0.3214	0.3141	0.2776	0.2776	0.2703	0.2922	0.3141	0.3287	0.3433 (22b)
Effective ac	0.5694	0.5667	0.5641	0.5516	0.5493	0.5385	0.5385	0.5365	0.5427	0.5493	0.5540	0.5589 (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							
Windows & Glazed Doors			34.2400	1.1450	39.2061		(27)
External Doors			2.2100	1.0000	2.2100		(26a)
Ground Floor			95.9700	0.1300	12.4761		(28a)
External Wall	193.1500	36.4500	156.7000	0.1800	28.2060		(29a)
External Roof	95.9700		95.9700	0.1000	9.5970		(30)
Total net area of external elements Aum(A, m ²)			385.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.6952		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				25.1700	0.0280		0.7048
E3 Sill				19.6200	0.0240		0.4709
E4 Jamb				44.1000	0.0190		0.8379
E5 Ground floor (normal)				42.5000	0.0460		1.9550
E16 Corner (normal)				36.0000	0.0370		1.3320
E17 Corner (inverted - internal area greater than external area)				16.8000	-0.0790		-1.3272
E6 Intermediate floor within a dwelling				37.9800	0.0000		0.0000
E10 Eaves (insulation at ceiling level)				42.9100	0.0510		2.1884

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E12 Gable (insulation at ceiling level) 5.8300 0.0290 0.1691
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3308 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 98.0260 (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	80.1756	79.7962	79.4243	77.6775	77.3507	75.8293	75.8293	75.5476	76.4153	77.3507	78.0119	78.7031
Average = Sum(39)m / 12 =	178.2017	177.8222	177.4504	175.7036	175.3767	173.8553	173.8553	173.5736	174.4414	175.3767	176.0379	176.7291
												175.7020
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0023	1.0002	0.9981	0.9883	0.9864	0.9779	0.9779	0.9763	0.9812	0.9864	0.9901	0.9940
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9729 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	85.4436	84.1747	82.3877	79.0929	76.6258	73.8901	72.4124	74.1869	76.1190	79.0462	82.4089	85.1548 (42b)
Hot water usage for other uses	45.0755	43.4364	41.7973	40.1582	38.5191	36.8800	36.8800	38.5191	40.1582	41.7973	43.4364	45.0755 (42c)
Average daily hot water use (litres/day)												120.1975 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	130.5192	127.6111	124.1850	119.2511	115.1449	110.7701	109.2924	112.7060	116.2772	120.8435	125.8453	130.2303 (44)
Energy content (annual)	206.7105	181.7165	190.8678	163.2488	155.0071	136.2048	132.1797	139.5536	143.3814	163.9835	179.2897	203.9092 (45)
Distribution loss (46)m = 0.15 x (45)m	31.0066	27.2575	28.6302	24.4873	23.2511	20.4307	19.8270	20.9330	21.5072	24.5975	26.8935	30.5864 (46)
Water storage loss (or HIU loss):												250.0000 (47)
Store volume												1.6800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.9072 (55)
Enter (49) or (54) in (55)												
Total storage loss	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232 (56)
If cylinder contains dedicated solar storage	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232 (57)
Primary loss	37.2980	33.6885	37.2980	36.0948	37.2980	36.0948	37.2980	37.2980	36.0948	37.2980	36.0948	37.2980 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	272.1316	240.8066	256.2890	226.5596	220.4283	199.5156	197.6009	204.9747	206.6922	229.4047	242.6005	269.3304 (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	272.1316	240.8066	256.2890	226.5596	220.4283	199.5156	197.6009	204.9747	206.6922	229.4047	242.6005	269.3304 (64)
12Total per year (kWh/year)												2766.3341 (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	121.0682	107.6928	115.8005	104.9289	103.8768	95.9367	96.2867	98.7385	98.3230	106.8615	110.2625	120.1367 (65)

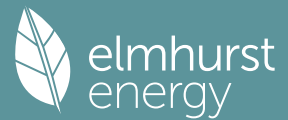
5. Internal gains (see Table 5 and 5a)

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	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.2588	197.3580	178.2588	184.2008	178.2588	184.2008	178.2588	178.2588	184.2008	178.2588	184.2008	178.2588 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	349.4134	353.0392	343.9022	324.4508	299.8968	276.8195	261.4024	257.7766	266.9136	286.3650	310.9190	333.9963 (68)
Pumps, fans	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645 (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)	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163 (71)
Total internal gains	162.7260	160.2572	155.6458	145.7345	139.6193	133.2454	129.4176	132.7130	136.5597	143.6310	153.1423	161.4741 (72)
	757.9918	778.2479	745.4004	721.9797	685.3685	661.8593	636.6725	636.3421	655.2676	675.8484	715.8557	741.3229 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	1.3700	10.6334	0.5000	0.7700	0.7700	3.5334 (74)
Northeast	14.5800	11.2829	0.5000	0.7000	0.7700	39.9008 (75)
East	1.3700	19.6403	0.5000	0.7000	0.7700	6.5263 (76)
Southeast	0.6300	36.7938	0.5000	0.7000	0.7700	5.6223 (77)
Southwest	14.9400	36.7938	0.5000	0.7000	0.7700	133.3297 (79)
Northwest	1.3500	11.2829	0.5000	0.7000	0.7700	3.6945 (81)
Solar gains	192.6070	344.9456	516.2248	712.9236	864.7965	887.5190
Total gains	950.5989	1123.1935	1261.6252	1434.9033	1550.1651	1549.3783
						1480.2895
						1362.3379
						1238.9889
						1069.0713
						233.7831
						949.6389
						162.8286 (83)
						904.1515 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	69.2840	69.4319	69.5774	70.2691	70.4000	71.0161	71.0161	71.1314	70.7775	70.4000	70.1356	69.8613
alpha	5.6189	5.6288	5.6385	5.6846	5.6933	5.7344	5.7344	5.7421	5.7185	5.6933	5.6757	5.6574
util living area	0.9989	0.9969	0.9908	0.9625	0.8713	0.6842	0.5110	0.5745	0.8386	0.9797	0.9972	0.9992 (86)
Living	19.7444	19.9194	20.1796	20.5372	20.8258	20.9672	20.9947	20.9902	20.8976	20.5174	20.0685	19.7181
Non living	18.6001	18.8253	19.1580	19.6105	19.9439	20.0827	20.1001	20.0995	20.0262	19.5935	19.0228	18.5715
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	20.3577	19.9194	20.1796	20.5372	20.8258	20.9672	20.9947	20.9902	20.8976	20.5174	20.0685	19.8974 (87)
Th 2	20.0814	20.0832	20.0849	20.0931	20.0947	20.1018	20.1018	20.1031	20.0991	20.0947	20.0916	20.0883 (88)
util rest of house	0.9985	0.9958	0.9875	0.9487	0.8278	0.6019	0.4098	0.4685	0.7710	0.9697	0.9960	0.9989 (89)
MIT 2	19.4909	18.8253	19.1580	19.6105	19.9439	20.0827	20.1001	20.0995	20.0262	19.5935	19.0228	18.8448 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.5981	18.9607	19.2845	19.7252	20.0531	20.1921	20.2108	20.2097	20.1340	19.7078	19.1522	18.9751 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.5981	18.9607	19.2845	19.7252	20.0531	20.1921	20.2108	20.2097	20.1340	19.7078	19.1522	18.9751 (93)

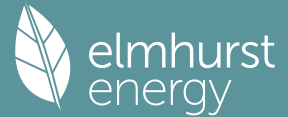
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9982	0.9939	0.9834	0.9416	0.8255	0.6106	0.4223	0.4814	0.7740	0.9639	0.9942	0.9984 (94)
Useful gains	948.9346	1116.3169	1240.7194	1351.1739	1279.6961	946.0674	625.1015	655.8599	958.9371	1030.5018	944.1386	902.6852 (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	2726.1513	2500.3065	2268.6053	1902.0293	1464.9340	972.2222	627.7506	661.2635	1052.5859	1597.3019	2121.6420	2611.1882 (97)
Space heating kWh	1322.2492	930.0410	764.7471	396.6159	137.8170	0.0000	0.0000	0.0000	0.0000	421.6992	847.8024	1271.1263 (98a)
Space heating requirement - total per year (kWh/year)	6092.0982											
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	1322.2492	930.0410	764.7471	396.6159	137.8170	0.0000	0.0000	0.0000	0.0000	421.6992	847.8024	1271.1263 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	6092.0982											
Space heating per m2	(98c) / (4) = 34.2657 (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 %)	294.4753 (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	1322.2492	930.0410	764.7471	396.6159	137.8170	0.0000	0.0000	0.0000	0.0000	421.6992	847.8024	1271.1263 (98)
Space heating efficiency (main heating system 1)	294.4753	294.4753	294.4753	294.4753	294.4753	0.0000	0.0000	0.0000	0.0000	294.4753	294.4753	294.4753 (210)
Space heating fuel (main heating system)	449.0187	315.8299	259.6982	134.6856	46.8009	0.0000	0.0000	0.0000	0.0000	143.2036	287.9027	431.6580 (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	272.1316	240.8066	256.2890	226.5596	220.4283	199.5156	197.6009	204.9747	206.6922	229.4047	242.6005	269.3304 (64)
Efficiency of water heater	174.2881	174.2881	174.2881	174.2881	174.2881	174.2881	174.2881	174.2881	174.2881	174.2881	174.2881	174.2881 (216)
Fuel for water heating, kWh/month	156.1390	138.1658	147.0490	129.9914	126.4735	114.4746	113.3760	117.6068	118.5922	131.6238	139.1951	154.5317 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.0387	29.7138	26.7540	19.6011	15.1405	12.3699	13.8116	17.9529	23.3190	30.5958	34.5579	38.0681 (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	2068.7975 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	174.2881											
Water heating fuel used	1587.2190 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												
Total electricity for the above, kWh/year	0.0000 (231)											
Electricity for lighting (calculated in Appendix L)	298.9232 (232)											

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

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3954.9397 (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	2068.7975	0.1557	322.2037 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1587.2190	0.1408	223.4088 (264)
Space and water heating			545.6125 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	298.9232	0.1443	43.1439 (268)
Total CO2, kg/year			588.7563 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.3100 (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	2068.7975	1.5766	3261.6236 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1587.2190	1.5205	2413.2923 (278)
Space and water heating			5674.9159 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	298.9232	1.5338	458.4984 (282)
Total Primary energy kWh/year			6133.4143 (286)
Dwelling Primary energy Rate (DPER)			34.5000 (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	95.9700 (1b)	x 2.4000 (2b)	= 230.3280 (1b) - (3b)
First floor	81.8200 (1c)	x 2.4000 (2c)	= 196.3680 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	177.7900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 426.6960 (5)

2. Ventilation rate

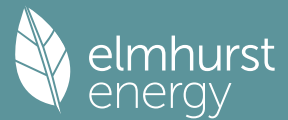
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.0937 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3437 (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) = 0.2922 (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	0.3725	0.3652	0.3579	0.3214	0.3141	0.2776	0.2776	0.2703	0.2922	0.3141	0.3287	0.3433 (22b)
Effective ac	0.5694	0.5667	0.5641	0.5516	0.5493	0.5385	0.5385	0.5365	0.5427	0.5493	0.5540	0.5589 (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 Semi-glazed door			2.2100	1.0000	2.2100		(26a)

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TER Opening Type			34.2400	1.1450	39.2061	(27)
Ground Floor			95.9700	0.1300	12.4761	(28a)
External Wall	193.1500	36.4500	156.7000	0.1800	28.2060	(29a)
External Roof	95.9700		95.9700	0.1100	10.5567	(30)
Total net area of external elements Aum(A, m2)			385.0900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	92.6549		(33)

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

250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	25.1700	0.0500	1.2585
E3 Sill	19.6200	0.0500	0.9810
E4 Jamb	44.1000	0.0500	2.2050
E5 Ground floor (normal)	42.5000	0.1600	6.8000
E16 Corner (normal)	36.0000	0.0900	3.2400
E17 Corner (inverted - internal area greater than external area)	16.8000	-0.0900	-1.5120
E6 Intermediate floor within a dwelling	37.9800	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	42.9100	0.0600	2.5746
E12 Gable (insulation at ceiling level)	5.8300	0.0600	0.3498

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

15.8969 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 108.5518 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	80.1756	79.7962	79.4243	77.6775	77.3507	75.8293	75.8293	75.5476	76.4153	77.3507	78.0119	78.7031	(38)
Heat transfer coeff	188.7274	188.3480	187.9761	186.2293	185.9025	184.3811	184.3811	184.0994	184.9671	185.9025	186.5637	187.2549	(39)
Average = Sum(39)m / 12 =												186.2278	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0615	1.0594	1.0573	1.0475	1.0456	1.0371	1.0371	1.0355	1.0404	1.0456	1.0493	1.0532	(40)
HLP (average)												1.0475	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

2.9729 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
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Hot water usage for baths

85.4436	84.1747	82.3877	79.0929	76.6258	73.8901	72.4124	74.1869	76.1190	79.0462	82.4089	85.1548	(42b)
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Hot water usage for other uses

45.0755	43.4364	41.7973	40.1582	38.5191	36.8800	36.8800	38.5191	40.1582	41.7973	43.4364	45.0755	(42c)
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Average daily hot water use (litres/day)

120.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.5192	127.6111	124.1850	119.2511	115.1449	110.7701	109.2924	112.7060	116.2772	120.8435	125.8453	130.2303	(44)
Energy conte	206.7105	181.7165	190.8678	163.2488	155.0071	136.2048	132.1797	139.5536	143.3814	163.9835	179.2897	203.9092	(45)
Energy content (annual)										Total = Sum(45)m =		1996.0527	

Distribution loss (46)m = 0.15 x (45)m

31.0066	27.2575	28.6302	24.4873	23.2511	20.4307	19.8270	20.9330	21.5072	24.5975	26.8935	30.5864	(46)
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Water storage loss (or HIU loss):

Store volume

250.0000 (47)

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

1.8903 (48)

Temperature factor from Table 2b

0.5400 (49)

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

1.0208 (55)

Total storage loss

31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
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If cylinder contains dedicated solar storage

31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
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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)
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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)
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Total heat required for water heating calculated for each month

261.6173	231.3098	245.7746	216.3844	209.9139	189.3404	187.0865	194.4604	196.5170	218.8903	232.4253	258.8160	(62)
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WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
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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)
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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	(63c)
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FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
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Output from w/h	261.6173	231.3098	245.7746	216.3844	209.9139	189.3404	187.0865	194.4604	196.5170	218.8903	232.4253	258.8160	(64)
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Total per year (kWh/year) = Sum(64)m = 2642.5358 (64)

12Total per year (kWh/year)

2643 (64)

Electric shower(s)

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

Heat gains from water heating, kWh/month

112.6567	100.0953	107.3890	96.7887	95.4653	87.7966	87.8752	90.3270	90.1828	98.4500	102.1223	111.7252	(65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	148.6454	(66)

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

178.2588	197.3580	178.2588	184.2008	178.2588	184.2008	178.2588	178.2588	184.2008	178.2588	184.2008	178.2588	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

349.4134	353.0392	343.9022	324.4508	299.8968	276.8195	261.4024	257.7766	266.9136	286.3650	310.9190	333.9963	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	37.8645	(69)
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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)
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Losses e.g. evaporation (negative values) (Table 5)

-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	-118.9163	(71)
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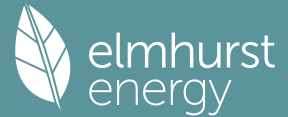
Water heating gains (Table 5)

151.4203	148.9514	144.3400	134.4288	128.3136	121.9397	118.1118	121.4073	125.2539	132.3252	141.8366	150.1683	(72)
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749.6860	769.9421	737.0947	713.6739	677.0628	650.5535	625.3667	625.0363	643.9618	667.5427	707.5500	733.0171	(73)
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6. Solar gains

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[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.3700	10.6334	0.6300		0.7000		0.7700		4.4521 (74)
Northeast				14.5800	11.2829	0.6300		0.7000		0.7700		50.2750 (75)
East				1.3700	19.6403	0.6300		0.7000		0.7700		8.2232 (76)
Southeast				0.6300	36.7938	0.6300		0.7000		0.7700		7.0841 (77)
Southwest				14.9400	36.7938	0.6300		0.7000		0.7700		167.9954 (79)
Northwest				1.3500	11.2829	0.6300		0.7000		0.7700		4.6551 (81)
Solar gains	242.6849	434.6314	650.4432	898.2838	1089.6436	1118.2739	1062.9574	914.7548	735.4888	495.4608	294.5667	205.1641 (83)
Total gains	992.3709	1204.5736	1387.5379	1611.9577	1766.7064	1768.8275	1688.3241	1539.7911	1379.4506	1163.0035	1002.1167	938.1812 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.4199	65.5517	65.6814	66.2974	66.4140	66.9620	66.9620	67.0645	66.7498	66.4140	66.1786	65.9343
alpha	5.3613	5.3701	5.3788	5.4198	5.4276	5.4641	5.4641	5.4710	5.4500	5.4276	5.4119	5.3956
util living area	0.9986	0.9958	0.9868	0.9476	0.8351	0.6409	0.4759	0.5404	0.8103	0.9737	0.9964	0.9990 (86)
MIT	19.6758	19.8763	20.1681	20.5540	20.8442	20.9714	20.9952	20.9909	20.9025	20.5077	20.0205	19.6444 (87)
Th 2	20.0324	20.0341	20.0359	20.0440	20.0455	20.0526	20.0526	20.0539	20.0498	20.0455	20.0424	20.0392 (88)
util rest of house	0.9981	0.9943	0.9822	0.9293	0.7848	0.5569	0.3759	0.4342	0.7364	0.9612	0.9950	0.9986 (89)
MIT 2	18.4765	18.7340	19.1060	19.5887	19.9154	20.0365	20.0510	20.0506	19.9830	19.5422	18.9252	18.4412 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.6249	18.8753	19.2374	19.7082	20.0303	20.1522	20.1679	20.1670	20.0968	19.6617	19.0608	18.5901 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.6249	18.8753	19.2374	19.7082	20.0303	20.1522	20.1679	20.1670	20.0968	19.6617	19.0608	18.5901 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9918	0.9769	0.9213	0.7839	0.5661	0.3883	0.4472	0.7405	0.9543	0.9927	0.9978 (94)
Useful gains	989.4519	1194.6873	1355.5378	1485.1394	1384.9340	1001.3410	655.5140	688.6185	1021.4922	1109.8969	994.8217	936.1177 (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	2703.4997	2632.2239	2394.3308	2012.7993	1548.6304	1023.7182	657.8477	693.4979	1109.2017	1684.5925	2231.4428	2694.6094 (97)
Space heating kWh	1275.2516	966.0246	772.8620	379.9151	121.7901	0.0000	0.0000	0.0000	0.0000	427.5735	890.3672	1308.3178 (98a)
Space heating requirement - total per year (kWh/year)	6142.1020											
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	1275.2516	966.0246	772.8620	379.9151	121.7901	0.0000	0.0000	0.0000	0.0000	427.5735	890.3672	1308.3178 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	6142.1020											
Space heating per m2	(98c) / (4) = 34.5469 (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	1275.2516	966.0246	772.8620	379.9151	121.7901	0.0000	0.0000	0.0000	0.0000	427.5735	890.3672	1308.3178 (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)	1381.6377	1046.6139	837.3369	411.6090	131.9503	0.0000	0.0000	0.0000	0.0000	463.2433	964.6448	1417.4624 (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	261.6173	231.3098	245.7746	216.3844	209.9139	189.3404	187.0865	194.4604	196.5170	218.8903	232.4253	258.8160 (64)
Efficiency of water heater (217)m	87.1273	86.9065	86.4476	85.3086	82.8843	79.8000	79.8000	79.8000	79.8000	85.5337	86.7741	79.8000 (216)
Fuel for water heating, kWh/month	300.2702	266.1594	284.3047	253.6489	253.2612	237.2686	234.4443	243.6847	246.2619	255.9113	267.8510	296.8883 (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	37.0387	29.7138	26.7540	19.6011	15.1405	12.3699	13.8116	17.9529	23.3190	30.5958	34.5579	38.0681 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-79.7884	-107.7443	-148.3605	-159.4715	-165.8736	-152.5031	-150.3779	-144.7155	-134.1545	-119.3699	-85.9083	-69.5301 (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	-60.7305	-125.5630	-245.7298	-363.7598	-476.1028	-476.8041	-471.4010	-401.5247	-297.3827	-178.0101	-80.5379	-48.2136 (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)												

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(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												6654.4983	(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												3139.9543	(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)												298.9232	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4743.5577	(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												5435.8182	(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	6654.4983	0.2100	1397.4447 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3139.9543	0.2100	659.3904 (264)
Space and water heating			2056.8351 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	298.9232	0.1443	43.1439 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1517.7976	0.1356	-205.7507
PV Unit electricity exported	-3225.7601	0.1263	-407.4738
Total			-613.2245 (269)
Total CO2, kg/year			1498.6837 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.4300 (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	6654.4983	1.1300	7519.5831 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3139.9543	1.1300	3548.1484 (278)
Space and water heating			11067.7315 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	298.9232	1.5338	458.4984 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1517.7976	1.5011	-2278.2988
PV Unit electricity exported	-3225.7601	0.4637	-1495.7675
Total			-3774.0663 (283)
Total Primary energy kWh/year			7882.2644 (286)
Target Primary Energy Rate (TPER)			44.3300 (287)

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Plot Reference	Barns Green 5BH 1½ DET 212			Issued on Date	21/05/2026
Assessment Reference	Barns Green 5BH 1½ DET 212	Plot Type Ref	Barns Green 5BH 1½ DET 212		
Plot Address	Land at , Muntham Drive and, Chapel Road, Barns Green, West Sussex			SAP Version	10.2
SAP Rating	84 B	DER	3.08	TER	8.24
Environmental	97 A	% DER < TER			62.62
CO ₂ Emissions (t/year)	0.62	DFEE	37.82	TFEE	39.15
Compliance Check	See BREL	% DFEE < TFEE			3.40
% DPER < TPER	26.54	DPER	32.00	TPER	43.56
Assessor Details	Mr. Ivan Ball			Assessor ID	DE88-0001
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	109.8100 (1b)	x 2.4000 (2b)	= 263.5440 (1b) - (3b)
First floor	111.8300 (1c)	x 2.4000 (2c)	= 268.3920 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 531.9360 (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	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) = 0.0752 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3252 (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) = 0.2764 (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	0.3524	0.3455	0.3386	0.3041	0.2971	0.2626	0.2626	0.2557	0.2764	0.2971	0.3110	0.3248 (22b)
Effective ac	0.5621	0.5597	0.5573	0.5462	0.5441	0.5345	0.5345	0.5327	0.5382	0.5441	0.5484	0.5527 (25)

3. Heat losses and heat loss parameter

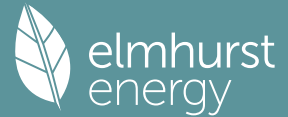
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			27.3600	1.1450	31.3282		(27)
External Doors			3.7800	1.0000	3.7800		(26a)
Ground Floor			109.8100	0.1300	14.2753		(28a)
Exposed Floor			2.0200	0.1300	0.2626		(28b)
External Wall	244.2500	31.1400	213.1100	0.1800	38.3598		(29a)
External Roof	111.8300		111.8300	0.1000	11.1830		(30)
Total net area of external elements Aum(A, m ²)			467.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.1889		(33)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	20.6500	0.0280	0.5782
E2 Other lintels (including other steel lintels)	13.9500	0.0240	0.3348
E3 Sill	40.5000	0.0190	0.7695
E4 Jamb	52.5500	0.0460	2.4173
E5 Ground floor (normal)	36.0000	0.0370	1.3320
E16 Corner (normal)	16.8000	-0.0790	-1.3272
E17 Corner (inverted - internal area greater than external area)	49.2200	0.0000	0.0000
E6 Intermediate floor within a dwelling			

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E10 Eaves (insulation at ceiling level) 52.5500 0.0510 2.6800
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7846 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 105.9736 (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	98.6712	98.2478	97.8329	95.8839	95.5193	93.8218	93.8218	93.5074	94.4756	95.5193	96.2569	97.0281
Average = Sum(39)m / 12 =	204.6447	204.2214	203.8065	201.8575	201.4928	199.7953	199.7953	199.4810	200.4492	201.4928	202.2305	203.0017
	201.8557											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9233	0.9214	0.9195	0.9107	0.9091	0.9014	0.9014	0.9000	0.9044	0.9091	0.9124	0.9159
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.0301 (42)											
Hot water usage for mixer showers	0.0000 (42a)											
Hot water usage for baths	86.5531 (42b)											
Hot water usage for other uses	45.6609 (42c)											
Average daily hot water use (litres/day)	121.7583 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	132.2140	129.2682	125.7976	120.7996	116.6400	112.2085	110.7116	114.1695	117.7871	122.4127	127.4794	131.9214
Energy content (annual)	209.3947	184.0761	193.3462	165.3686	157.0199	137.9734	133.8961	141.3657	145.2432	166.1129	181.6178	206.5570
Distribution loss (46)m = 0.15 x (45)m	2021.9717											
Water storage loss (or HIU loss):	31.4092	27.6114	29.0019	24.8053	23.5530	20.6960	20.0844	21.2049	21.7865	24.9169	27.2427	30.9836
Store volume	300.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.6800 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.9072 (55)											
Total storage loss	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232
If cylinder contains dedicated solar storage	28.1232 (56)											
Primary loss	37.2980	33.6885	37.2980	36.0948	37.2980	36.0948	37.2980	36.0948	37.2980	36.0948	37.2980	36.0948
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	274.8158	243.1662	258.7674	228.6794	222.4411	201.2842	199.3173	206.7869	208.5540	231.5340	244.9286	271.9782
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	274.8158	243.1662	258.7674	228.6794	222.4411	201.2842	199.3173	206.7869	208.5540	231.5340	244.9286	271.9782
12Total per year (kWh/year)	2792.2531 (64)											
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)											
Heat gains from water heating, kWh/month	121.9607	108.4774	116.6246	105.6337	104.5460	96.5248	96.8574	99.3410	98.9420	107.5695	111.0366	121.0171

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

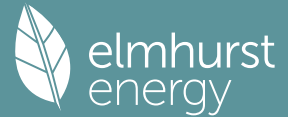
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	151.5031	151.5031	151.5031	151.5031	151.5031	151.5031	151.5031	151.5031	151.5031	151.5031	151.5031	151.5031
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	217.6297	240.9472	217.6297	224.8840	217.6297	224.8840	217.6297	217.6297	224.8840	217.6297	224.8840	217.6297
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	391.1742	395.2334	385.0044	363.2282	335.7396	309.9041	292.6445	288.5853	298.8143	320.5905	348.0792	373.9146
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1503	38.1503	38.1503	38.1503	38.1503	38.1503	38.1503	38.1503	38.1503	38.1503	38.1503	38.1503
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
Losses e.g. evaporation (negative values) (Table 5)	-121.2025	-121.2025	-121.2025	-121.2025	-121.2025	-121.2025	-121.2025	-121.2025	-121.2025	-121.2025	-121.2025	-121.2025
Water heating gains (Table 5)	163.9256	161.4247	156.7534	146.7135	140.5189	134.0622	130.1847	133.5229	137.4195	144.5826	154.2175	162.6574
Total internal gains	841.1805	866.0562	827.8385	803.2766	762.3391	737.3013	708.9098	708.1889	729.5687	751.2538	795.6316	822.6527

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	1.4400	11.2829	0.5000	0.7000	0.7700	3.9408 (75)
Southeast	12.6000	36.7938	0.5000	0.7000	0.7700	112.4467 (77)
Southwest	1.4400	36.7938	0.5000	0.7000	0.7700	12.8511 (79)
Northwest	11.8800	11.2829	0.5000	0.7000	0.7700	32.5117 (81)
Solar gains	161.7503	287.6287	425.7073	581.3791	700.3969	716.9751
Total gains	1002.9308	1153.6849	1253.5458	1384.6557	1462.7360	1454.2764
						1391.1434
						1298.3210
						1208.6645
						1077.8163
						991.5762
						136.9978 (83)
						959.6504 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)											21.0000 (85)		
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.2116	75.3675	75.5210	76.2502	76.3882	77.0372	77.0372	77.1586	76.7859	76.3882	76.1095	75.8204	
alpha	6.0141	6.0245	6.0347	6.0833	6.0925	6.1358	6.1358	6.1439	6.1191	6.0925	6.0740	6.0547	
util living area	0.9996	0.9988	0.9967	0.9860	0.9414	0.7990	0.6175	0.6799	0.9104	0.9915	0.9988	0.9997 (86)	
Living	19.7816	19.9222	20.1389	20.4553	20.7486	20.9409	20.9898	20.9824	20.8569	20.4805	20.0796	19.7617	
Non living	18.6971	18.8785	19.1570	19.5644	19.9227	20.1278	20.1625	20.1602	20.0509	19.6000	19.0863	18.6763	
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	20.3767	19.9222	20.1389	20.4553	20.7486	20.9409	20.9898	20.9824	20.8569	20.4805	20.0796	19.9349 (87)	
Th 2	20.1477	20.1493	20.1509	20.1584	20.1598	20.1663	20.1663	20.1675	20.1638	20.1598	20.1569	20.1540 (88)	
util rest of house	0.9994	0.9984	0.9955	0.9802	0.9157	0.7240	0.5080	0.5702	0.8619	0.9870	0.9984	0.9996 (89)	
MIT 2	19.5694	18.8785	19.1570	19.5644	19.9227	20.1278	20.1625	20.1602	20.0509	19.6000	19.0863	18.9426 (90)	
Living area fraction									fLA = Living area / (4) =				0.1109 (91)
MIT	19.6590	18.9943	19.2659	19.6632	20.0143	20.2180	20.2543	20.2514	20.1403	19.6976	19.1964	19.0526 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.6590	18.9943	19.2659	19.6632	20.0143	20.2180	20.2543	20.2514	20.1403	19.6976	19.1964	19.0526 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9993	0.9976	0.9936	0.9756	0.9102	0.7292	0.5200	0.5819	0.8603	0.9834	0.9975	0.9993 (94)
Useful gains	1002.2213	1150.8776	1245.5769	1350.8546	1331.3389	1060.3993	723.3959	755.4843	1039.7905	1059.9336	989.1257	959.0114 (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	3143.1297	2878.3536	2601.7774	2172.6393	1675.2719	1122.4449	730.1053	768.2726	1210.7747	1833.1047	2446.2660	3015.1129 (97)
Space heating kWh	1592.8359	1160.8639	1009.0132	591.6850	255.8862	0.0000	0.0000	0.0000	0.0000	575.2393	1049.1410	1529.7395 (98a)
Space heating requirement - total per year (kWh/year)												7764.4039
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	1592.8359	1160.8639	1009.0132	591.6850	255.8862	0.0000	0.0000	0.0000	0.0000	575.2393	1049.1410	1529.7395 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7764.4039
Space heating per m2										(98c) / (4) =		35.0316 (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 %)												298.2385 (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	1592.8359	1160.8639	1009.0132	591.6850	255.8862	0.0000	0.0000	0.0000	0.0000	575.2393	1049.1410	1529.7395 (98)
Space heating efficiency (main heating system 1)	298.2385	298.2385	298.2385	298.2385	298.2385	0.0000	0.0000	0.0000	0.0000	298.2385	298.2385	298.2385 (210)
Space heating fuel (main heating system)	534.0812	389.2401	338.3242	198.3932	85.7992	0.0000	0.0000	0.0000	0.0000	192.8789	351.7792	512.9248 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	274.8158	243.1662	258.7674	228.6794	222.4411	201.2842	199.3173	206.7869	208.5540	231.5340	244.9286	271.9782 (64)
Efficiency of water heater (217)m	174.3748	174.3748	174.3748	174.3748	174.3748	174.3748	174.3748	174.3748	174.3748	174.3748	174.3748	174.3748 (216)
Fuel for water heating, kWh/month	157.6007	139.4503	148.3973	131.1425	127.5649	115.4319	114.3040	118.5876	119.6010	132.7796	140.4611	155.9734 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	45.2192	36.2765	32.6630	23.9303	18.4844	15.1019	16.8621	21.9180	28.4693	37.3533	42.1905	46.4759 (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												2603.4208 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												174.3748
Water heating fuel used												1601.2942 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												364.9445 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)

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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	4569.6595 (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	2603.4208	0.1551	403.7499 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1601.2942	0.1408	225.4017 (264)
Space and water heating			629.1516 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	364.9445	0.1443	52.6728 (268)
Total CO2, kg/year			681.8244 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.0800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2603.4208	1.5741	4098.1681 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1601.2942	1.5205	2434.7369 (278)
Space and water heating			6532.9050 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	364.9445	1.5338	559.7641 (282)
Total Primary energy kWh/year			7092.6691 (286)
Dwelling Primary energy Rate (DPER)			32.0000 (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	109.8100 (1b)	x 2.4000 (2b)	= 263.5440 (1b) - (3b)
First floor	111.8300 (1c)	x 2.4000 (2c)	= 268.3920 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	221.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 531.9360 (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) = 0.0752 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3252 (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) = 0.2764 (21)

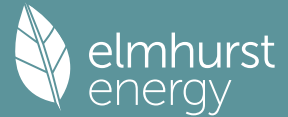
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3524	0.3455	0.3386	0.3041	0.2971	0.2626	0.2626	0.2557	0.2764	0.2971	0.3110	0.3248 (22b)
Effective ac	0.5621	0.5597	0.5573	0.5462	0.5441	0.5345	0.5345	0.5327	0.5382	0.5441	0.5484	0.5527 (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 Semi-glazed door			3.7800	1.0000	3.7800		(26a)
TER Opening Type			27.3600	1.1450	31.3282		(27)
Ground Floor			109.8100	0.1300	14.2753		(28a)

6. Solar gains						
[Jan]	Area m2	Solar flux Table 6a	Specific data g	Specific data FF	Access factor	Gains W

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		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	1.4400	11.2829	0.6300	0.7000	0.7700	4.9654 (75)
Southeast	12.6000	36.7938	0.6300	0.7000	0.7700	141.6829 (77)
Southwest	1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (79)
Northwest	11.8800	11.2829	0.6300	0.7000	0.7700	40.9648 (81)

Solar gains	203.8054	362.4122	536.3913	732.5376	882.5001	903.3886	859.6144	743.5665	603.6606	411.4687	246.8902	172.6172 (83)
Total gains	1040.6823	1224.1647	1359.9261	1531.5107	1640.5356	1633.3864	1561.2206	1444.4518	1325.9257	1158.4189	1038.2182	990.9663 (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	71.2503	71.3902	71.5279	72.1817	72.3053	72.8865	72.8865	72.9952	72.6615	72.3053	72.0556	71.7964
alpha	5.7500	5.7593	5.7685	5.8121	5.8204	5.8591	5.8591	5.8663	5.8441	5.8204	5.8037	5.7864
util living area	0.9994	0.9984	0.9953	0.9798	0.9206	0.7627	0.5833	0.6487	0.8921	0.9889	0.9985	0.9996 (86)
MIT	19.7173	19.8760	20.1167	20.4594	20.7648	20.9470	20.9907	20.9835	20.8602	20.4648	20.0325	19.6937 (87)
Th 2	20.1045	20.1061	20.1077	20.1151	20.1164	20.1229	20.1229	20.1241	20.1204	20.1164	20.1136	20.1107 (88)
util rest of house	0.9992	0.9978	0.9935	0.9717	0.8882	0.6825	0.4732	0.5366	0.8368	0.9831	0.9979	0.9994 (89)
MIT 2	18.5824	18.7870	19.0959	19.5346	19.9014	20.0898	20.1196	20.1175	20.0137	19.5463	18.9934	18.5568 (90)
Living area fraction												
MIT	18.7083	18.9077	19.2092	19.6371	19.9972	20.1848	20.2162	20.2135	20.1076	19.6482	19.1087	18.6829 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7083	18.9077	19.2092	19.6371	19.9972	20.1848	20.2162	20.2135	20.1076	19.6482	19.1087	18.6829 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9988	0.9967	0.9910	0.9658	0.8829	0.6887	0.4853	0.5486	0.8358	0.9787	0.9969	0.9991 (94)
Useful gains	1039.4087	1220.1431	1347.6667	1479.1361	1448.4914	1124.8975	757.6912	792.4344	1108.1911	1133.7056	1034.9667	990.0556 (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	3112.5078	3020.0571	2734.8084	2289.5325	1766.2215	1179.3627	763.6444	804.1180	1272.5688	1926.0851	2565.1520	3104.8273 (97)
Space heating kWh	1542.3857	1209.5422	1032.0335	583.4854	236.3912	0.0000	0.0000	0.0000	0.0000	589.5303	1101.7334	1573.3901 (98a)
Space heating requirement - total per year (kWh/year)												7868.4919
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	1542.3857	1209.5422	1032.0335	583.4854	236.3912	0.0000	0.0000	0.0000	0.0000	589.5303	1101.7334	1573.3901 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7868.4919
Space heating per m2										(98c) / (4) =		35.5012 (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	1542.3857	1209.5422	1032.0335	583.4854	236.3912	0.0000	0.0000	0.0000	0.0000	589.5303	1101.7334	1573.3901 (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)	1671.0571	1310.4466	1118.1294	632.1619	256.1118	0.0000	0.0000	0.0000	0.0000	638.7111	1193.6440	1704.6480 (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	268.0235	237.0312	251.9751	222.1062	215.6487	194.7110	192.5249	199.9945	201.9808	224.7417	238.3554	265.1858 (64)
Efficiency of water heater (217)m	87.3417	87.1887	86.8772	86.1221	84.2662	79.8000	79.8000	79.8000	79.8000	86.1193	87.0537	79.8000 (216)
Fuel for water heating, kWh/month	306.8678	271.8599	290.0359	257.8969	255.9137	243.9987	241.2593	250.6197	253.1087	260.9657	273.8027	303.4906 (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	45.2192	36.2765	32.6630	23.9303	18.4844	15.1019	16.8621	21.9180	28.4693	37.3533	42.1905	46.4759 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-90.7579	-122.2530	-167.8593	-179.8285	-186.4840	-171.1963	-168.8148	-162.7847	-151.3760	-135.2117	-97.6176	-79.1273 (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	-70.0256	-144.7001	-283.0634	-418.8589	-548.0730	-548.8644	-542.6320	-462.2297	-342.3940	-205.0540	-92.8321	-55.5964 (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												8524.9099 (211)
Space heating fuel - main system 2												0.0000 (213)

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	3209.8196 (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)	364.9445 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-5427.6344 (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	6758.0396 (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	8524.9099	0.2100	1790.2311 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3209.8196	0.2100	674.0621 (264)
Space and water heating			2464.2932 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	364.9445	0.1443	52.6728 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1713.3109	0.1356	-232.3764
PV Unit electricity exported	-3714.3235	0.1263	-469.2320
Total			-701.6084 (269)
Total CO2, kg/year			1827.2869 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.2400 (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	8524.9099	1.1300	9633.1482 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3209.8196	1.1300	3627.0961 (278)
Space and water heating			13260.2443 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	364.9445	1.5338	559.7641 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1713.3109	1.5013	-2572.2337
PV Unit electricity exported	-3714.3235	0.4637	-1722.4729
Total			-4294.7066 (283)
Total Primary energy kWh/year			9655.4026 (286)
Target Primary Energy Rate (TPER)			43.5600 (287)