

Sustainability & Energy Statement

Land to the East of Lodge Road, Hurst

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Executive Summary

This Sustainability and Energy Statement has been prepared in support of an outline application for up to 99 new homes, green infrastructure, open space, pedestrian and cycle links, recreational facilities and other associated infrastructure and access points on Lodge Road and Tape Lane with required improvements (all matters reserved except access) on land to the east of Lodge Road, Hurst.

The adopted planning policy (CC05) requires a reduction in emissions of at least 10% through the installation of low-carbon and/or renewable technologies.

The application seeks outline consent but in order to demonstrate compliance with the policy it is necessary to assume an accommodation schedule to which carbon emissions rates can be applied. SAP calculations have been used for similar accommodation built to a similar construction specification to that proposed. When aggregated across similar unit types the calculations provide an assessment of the likely carbon dioxide emissions arising from the site and have allowed different systems to be tested.

The fabric insulation standards and the construction specification of the homes will exceed the minimum required by the Building Regulations. Whilst various technologies are considered appropriate it is proposed to install exhaust air heat pumps into all apartments and air source heat pumps into all houses.

All units will benefit from renewable technologies.

In order to demonstrate the reduction from the installation of heat pumps a further set of SAP calculations have been prepared for the same modelled units but based on the installation of gas boilers.

These provide a baseline against which the heat pump SAP calculations can be compared and hence allow a calculation of the reduction from renewable technologies.

The DER Worksheets for both options are attached as Appendices 1 and 2.

The carbon dioxide emissions and the reductions from the installation of heat pumps can be summarised as follows;

	Total Emissions	% Reduction
	kg CO ₂ per year	
Baseline (DER emissions based on gas boilers)	114,589	
Emissions after Heat pumps (renewable technologies)	44,737	60.96%

The water efficiency measures incorporated within the homes will ensure the water use is less than 105 litres per person per day (excluding 5 l/p/d for external water use) and achieves the enhanced standard required by the Building Regulations.

The proposals significantly exceed the requirements of the planning policy.

1.0 Introduction

This report has been commissioned by Mactaggart and Mickel Strategic Land (Mac Mic) and provides a Sustainability and Energy Statement in support of an outline application for up to 99 new homes, green infrastructure, open space, pedestrian and cycle links, recreational facilities and other associated infrastructure and access points on Lodge Road and Tape Lane with required improvements (all matters reserved except access) on land to the east of Lodge Road, Hurst.

The report describes the methodology used in assessing the development and the initiatives proposed.

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

The objective will be 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 further emissions reductions.

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 - 2023

Paragraph 157 states;

“The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk 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

Wokingham Borough Local Development Framework – Adopted Core Strategy Development Plan Document, January 2010

CP1 – Sustainable development

Planning permission will be granted for development proposals that:

- 1) *Maintain or enhance the high quality of the environment;*
- 2) *Minimise the emission of pollutants into the wider environment;*
- 3) *Limit any adverse effects on water quality (including ground water);*
- 4) *Ensure the provision of adequate drainage;*
- 5) *Minimise the consumption and use of resources and provide for recycling;*
- 6) *Incorporate facilities for recycling of water and waste to help reduce per capita water consumption;*
- 7) *Avoid areas of best and most versatile agricultural land;*
- 8) *Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;*
- 9) *Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);*
- 10) *Provide attractive, functional, accessible, safe, secure and adaptable schemes;*
- 11) *Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6; and*
- 12) *Contribute towards the goal of reaching zero-carbon developments as soon as possible by:*
 - a) *Including appropriate on-site renewable energy features; and*
 - b) *Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.*

CP2 - Inclusive communities

To ensure that new development contributes to the provision of sustainable and inclusive communities (including the provision of community facilities) to meet long term needs, planning permission will be granted for proposals that address the requirements of:

- a) *An ageing population, particularly in terms of housing, health and wellbeing;*
- b) *Children, young people and families, including the co-ordination of services to meet their needs;*
- c) *People with special needs, including those with a physical, sensory or learning disability or problems accessing services; and*
- d) *The specific identified needs of minority groups in the borough, including Gypsies, Travellers and Travelling Showpeople and black and minority ethnic groups. Proposals for gypsies, travellers and travelling showpeople (including allocations in other Development Plan Documents) will demonstrate that:*

- i) *The site is located either within or close to the development limits of a settlement in policy CP9 in order to maximise the possibilities for social inclusion and sustainable patterns of living; and*
- ii) *The proposed site is not disproportionate to the scale of the existing settlement whether singly or cumulatively with any existing sites in the area.*

Wokingham Borough Development Plan – Adopted Managing Development Delivery Local Plan, February 2014

Policy CC01 – Presumption in Favour of Sustainable Development

- 1. *Planning applications that accord with the policies in the Development Plan for Wokingham Borough will be approved without delay, unless material considerations indicate otherwise.*
- 2. *Where there are no policies relevant to the application or relevant policies are out of date at the time of making the decision then the Council will grant permission unless material considerations indicate otherwise – taking into account whether:*
 - a. *Any adverse impacts of planning permission would significantly and demonstrably outweigh the benefits, when assessed against the policies in the National Planning Policy Framework (NPPF) taken as a whole; or*
 - b. *Specific policies in the National Planning Policy Framework indicate that development should be restricted.*

Policy CC04: Sustainable Design and Construction

Planning permission will only be granted for proposals that seek to deliver high quality sustainably designed and constructed developments by:

- 1. *In respect of all new homes:*
 - a) *Seeking to achieve the requirements of the full Code for Sustainable Homes Level 4;**
 - b) *Meet internal potable water consumption targets of 105 litres or less per person per day (as part of the requirement to meet full Code for Sustainable Homes Level 4).*

Policy CC05: Renewable energy and decentralised energy networks

- 1. *Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged*
- 2. *Planning permission will only be granted for proposals that deliver a minimum 10% reduction in carbon emissions through renewable energy or low carbon technology where the development is for:*
 - a) *Schemes of more than 10 dwellings (gross), or*
 - b) *Non-residential proposals of more than 1,000 sq m gross floorspace.*

3. *Proposals for renewable energy and decentralised energy works, including wind turbines, must demonstrate that:*
- a) They are appropriate in scale, location and technology type;*
 - b) Are compatible with the surrounding area, including the impact of noise and odour;*
 - c) Do not have a damaging impact on the local topography and landscape;*
 - d) There is no significant impact upon heritage assets, including views important to their setting;*
 - e) In the case of wind turbines, take account of their cumulative effect and properly reflect their increasing impact on the landscape and on local amenity.*

Sustainable Design and Construction SPD, 28th May 2010 and Companion Document to the Sustainable Design and Construction Supplementary Planning Document, 28th May 2010.

These documents have been used to inform this Sustainability and Energy Statement.

3.0 Assessment Methodology

The carbon dioxide emissions from the apartments and houses have been established using agreed building specifications and the assumed accommodation schedule set out below.

SAP calculations, which have been prepared for similar units to those proposed to a similar specification have been used to calculate the total emissions from the site. The results from the SAP calculations have been aggregated across similar unit types in order to estimate the total emissions from the site.

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
Grid supplied and displaced electricity	0.136
Mains gas	0.210

4.0 Proposal

The energy strategy within this Statement has been based on the following, assumed accommodation schedule and the Illustrative Masterplan.

Unit Type	Number	Area	Total Area
		m ²	m ²
1 & 2-Bedroom Maisonette apartments & FOGs	18	72.00	1,296.0
2-Bedroom Terrace & Semi-detached houses	10	79.80	798.0
2-Bedroom Detached houses	8	79.80	638.4
3-Bedroom Detached houses	16	93.00	1,488.0
3-Bedroom Detached houses	4	95.00	380.0
3-Bedroom Detached houses	13	98.00	1,274.0
4-Bedroom Detached houses	6	106.50	639.0
4-Bedroom Detached houses	4	107.50	430.0
4-Bedroom Detached houses	5	120.00	600.0
4-Bedroom Detached houses	1	126.00	126.0
4-Bedroom Detached houses	6	132.50	795.0
5-Bedroom Detached houses	3	144.50	433.5
Self-Build Plots (Detached)	5	150.00	750.0
	99		9,647.9

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 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 Illustrative Masterplan shows the majority of homes are positioned generally with either a northwest and southeast orientation or a southwest and northeast orientation. This maximises the benefit from solar gain and therefore reduces the number of homes with a solely northerly outlook.

The majority of homes will be positioned to receive direct sunlight at some point throughout the day and all houses will be designed with at least dual aspects.

Natural Daylighting

The orientation and the size of the windows have been optimised to maximise the amount of natural daylight and therefore reduce the demand for artificial lighting.

Efficient Building Fabric

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 home's heating requirements.

The strategy follows a fabric first approach and the specification proposed for the various thermal elements exceeds the limiting U-values required by the Building Regulations (Part L – 2021).

Ground floors will be insulated with 150mm 'Quinn Therm' PIR insulation or similar.

The modelling has been based upon the use of traditional load-bearing construction with external walls built with 102mm facing brickwork (or tile-hanging, render or weather-boarding on dense concrete block), 150mm fully filled cavities using Dritherm 32 insulation (or similar) and 100mm medium density blockwork internally.

Roofs (lofts) will be insulated with 400mm of mineral wool insulation comprising 100mm between joists and 300mm over.

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%
Party Walls	0.20	0.00	100%
Roofs (lofts)	0.16	0.11	31%
Windows	1.60	1.20	25%
External Doors	1.60	1.20	38%

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 homes will target a 38% improvement over Building Regulations and will seek to achieve a permeability of 5.0 m³/hr/m² or better.

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 building 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 within a dwelling	0.000
E7	Party Floor	0.036
E10	Eaves (Ceiling)	0.051
E12	Gable (Ceiling)	0.029
E16	Corner (normal)	0.037
E17	Corner (inverted)	-0.079
E18	Party Wall	0.041
E20	Exposed Floor	0.038

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 Cloakrooms, En-Suites and Bathrooms will be comprised of continuous extract ventilation as per System 3 criteria. This reduces the number of external penetrations required to the building envelope.

Active Design Measures will include;

Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

Part L of the Building Regulations requires all light fitting to have lamps with a minimum luminous efficacy of 80 light source lumens per circuit-watt.

Space Heating and Hot Water

The baseline SAP modelling has been based upon the use of a Vaillant gas boiler installed to each unit but the proposed specification is based upon the installation of a NIBE F205P exhaust air heat pump to the apartments and a Vaillant aroTHERM air source heat pump installed to each house.

5.2 Establishing Baseline Carbon Dioxide Emissions - GAS

The assessment has been based on the assumed accommodation set out above and the proposed construction specification.

SAP calculations have been used for a Maisonette apartment at 71.4 m², which are proposed as representative of all maisonette apartments and flats-over-garages (FOGs).

SAP calculations have been used for a 2-bedroom Semi-detached house at 86.0 m², which are proposed as representative of all terrace and semi-detached houses.

SAP calculations have been used for a 3-bedroom Detached house at 96.0 m², which are proposed as representative of all the detached houses in the floor area range 79.8 – 98.0 m².

SAP calculations have been prepared for a 3-bedroom detached house at 102.5 m², which are proposed as representative of all the detached houses in the floor area range 106.5 – 120.0 m².

SAP calculations have been prepared for a 4-bedroom detached house at 159.0 m², which are proposed as representative of all the detached houses in the floor area range 126.0 – 150.0 m².

The DER Worksheets are attached as Appendix 1 but the emissions can be summarised as follows:

Maisonette apartment – 71.4 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	5.25
Water heating	6.29
Electricity for pumps, fans & lighting	0.54
Total	11.48

2-Bedroom Semi-detached house – 86.0 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	6.83
Water heating	5.30
Electricity for pumps, fans & lighting	0.48
Total	10.64

3-Bedroom Detached house – 96 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	7.88
Water heating	4.89
Electricity for pumps, fans & lighting	0.46
Total	11.11

3-Bedroom Detached house – 102.5 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	9.38
Water heating	4.63
Electricity for pumps, fans & lighting	0.45
Total	14.46

4-Bedroom Detached house – 159.0 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	8.46
Water heating	3.11
Electricity for pumps, fans & lighting	0.35
Total	11.92

Using the above results, the total site CO₂ emissions from the site for the baseline scenario (GAS) can be calculated as follows;

Unit Type	Area	CO ₂ DER
	m ²	kg/yr
Maisonette apartments and Flats-over-Garages (FOGs)	1,296.0	14,878
Terrace & Semi-detached houses	798.0	8,491
Detached houses (79.8 – 98.0 m ²)	3,780.4	42,000
Detached houses (106.5 – 120.0 m ²)	1,669.0	24,134
Detached houses (126.0 – 150.0 m ²)	2,104.5	25,086
Total	9,647.9	114,589

The baseline emissions from the site based on the installation of gas heating system to all units is calculated as **114,589 kg CO₂ per year**.

Please note all the floor areas used above are assumed as the detailed design and the accommodation mix does not form part of the application. However, in order to quantify the emissions and demonstrate how the proposal meets the requirements of the policy it is necessary to assume the scale and design of the buildings.

5.3 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. This section determines the appropriateness of each renewable technology.

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 Lodge 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. In addition the use of wind turbines will have a detrimental aesthetic impact on the appearance of the development.

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. Below London the groundwater in the lower London aquifer is at a fairly constant temperature of 12° C. 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.

Whilst the houses are set in private garden areas it is unlikely there will be sufficient external ground area to sustain a horizontal collection system and the installation of ground source heat pumps is likely to require the use of a bore hole collection system to each house.

The use of ground source heat pumps with bore-hole collection systems to the houses is feasible but would be an expensive option when compared with some other technologies. The installation of ground source heat pumps into apartments is not feasible.

Ground source heat pumps are 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).

Whilst the installation of solar hot water heating panels would meet the requirements of the planning policy it is unlikely they would allow the apartments and houses to achieve Building Regulation compliance using gas heating systems.

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.

Whilst the installation of photovoltaic panels to the dwellings is feasible, it is calculated that a total of **255 x 400W** panels would be required to reduce emissions by the 10% required by the planning policy.

It is unlikely this quantum could be accommodated without detrimentally impacting on the aesthetics of the site and therefore photovoltaic panels are not proposed.

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. These heat pumps can be reversed to provide cooling to an area although this reduces the coefficient of performance of the pumps.

A further set of SAP calculations have been prepared for the units modelled above but with the benefit of an exhaust air heat pump installed to each apartment and air source heat pump installed to each house.

The DER Worksheets for the proposed specification are attached as Appendix 2 but the emissions can be summarised as follows:

Maisonette apartment – 71.4 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	1.44
Water heating	2.13
Electricity for pumps, fans & lighting	0.37
Total	3.95

2-Bedroom Semi-detached house – 86.0 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	1.34
Water heating	3.30
Electricity for pumps, fans & lighting	0.34
Total	4.99

3-Bedroom Detached house – 96 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	1.68
Water heating	3.01
Electricity for pumps, fans & lighting	0.33
Total	5.03

3-Bedroom Detached house – 102.5 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	2.00
Water heating	2.84
Electricity for pumps, fans & lighting	0.33
Total	5.18

4-Bedroom Detached house – 159.0 m ²	CO ₂ DER
	kg/m ² /yr
Space heating	1.74
Water heating	1.77
Electricity for pumps, fans & lighting	0.28
Total	3.79

Using the above results, the total site CO₂ emissions from the site based on the installation of exhaust air heat pumps and air source heat pumps can be calculated as follows;

Unit Type	Area	CO ₂ DER
	m ²	kg/yr
Maisonette apartments and Flats-over-Garages (FOGs)	1,296.0	5,119
Terrace & Semi-detached houses	798.0	3,982
Detached houses (79.8 – 98.0 m ²)	3,780.4	19,015
Detached houses (106.5 – 120.0 m ²)	1,669.0	8,645
Detached houses (126.0 – 150.0 m ²)	2,104.5	7,976
Total	9,647.9	44,737

The emissions from the site based on the installation of exhaust air and air source heat pumps to all units is calculated as **44,737 kg CO₂ per year**.

The reduction in emissions as a result of the installation of heat pumps is therefore **69,852 kg CO₂ per year**, which equates to a reduction of **60.96%**.

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

The baseline carbon emissions based on the installation of gas heating systems are assessed as **114,589 kg CO₂ per year**.

The local planning policy requires a reduction in emissions of 10% through the installation of low-carbon and/or renewable technologies.

Various technologies are considered above 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 and appropriate (albeit the use of photovoltaic panels are not proposed).

Be Lean

The construction standards proposed include U-values, which demonstrate good practice and improve upon those required by the Building Regulations. Air tightness standards are targeted at a 50% improvement upon the minimum required by the Building Regulations.

Be Clean and Be Green

Various technologies are considered above and it is proposed to install exhaust air heat pumps into the apartments and air source heat pumps into all houses.

As a result of these installations the total emissions from the site are assessed as **44,737 kg CO₂ per year**.

The reduction in emissions from the installation of renewable technologies is therefore 69,852 kg CO₂ per year, which equates to a reduction of 60.96%.

The proposal significantly exceeds the emissions reduction target required by the planning policy.

6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The site lies within Flood Zone 1 and is classified as being of low risk.

Surface Water Management

The houses have private gardens and discretely located rainwater butts could be provided to store rainwater for use with landscaping maintenance.

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 105 litres per person per day is achieved. This is the standard required by the planning policy.

Water efficient devices will be fully evaluated, and installed, wherever possible. 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 homes:

- 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). This is the equivalent of the 105 litres per person per day required by the planning policy.

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.

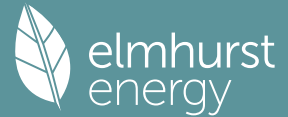
Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

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 – DER Worksheets for the Modelled Units based on Gas Baseline

Full SAP Calculation Printout



Property Reference	Hurst 2BF GND 72 - GAS			Issued on Date	20/08/2024
Assessment Reference	Hurst 2BF GND 72 - GAS	Prop Type Ref	Hurst 2BF GND 72 - GAS		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10				
SAP Rating	89 B	DER	11.48	TER	10.89
Environmental	91 B	% DER < TER			-5.42
CO ₂ Emissions (t/year)	0.72	DFEE	26.05	TFEE	28.84
Compliance Check	See BREL	% DFEE < TFEE			9.66
% DPER < TPER	-7.60	DPER	61.18	TPER	56.86
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)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.4000		
Dwelling volume			

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) =	0.0584 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2584	(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) =	0.2196 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.2800	0.2745	0.2690	0.2416	0.2361	0.2086	0.2086	0.2031	0.2196	0.2361	0.2471	0.2580 (22b)
	0.5392	0.5377	0.5362	0.5292	0.5279	0.5218	0.5218	0.5206	0.5241	0.5279	0.5305	0.5333 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			9.1800	1.1450	10.5115		(27)
Heatloss Floor			71.4000	0.1300	9.2820		(28a)
External Wall	59.2800	9.1800	50.1000	0.1800	9.0180		(29a)
Total net area of external elements Aum(A, m ²)			130.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8115		(33)
Party Wall			22.6100	0.0000	0.0000		(32)
Party Ceiling			71.4000				(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)				7.2000	0.0280	0.2016	
E3 Sill				7.2000	0.0240	0.1728	
E4 Jamb				15.0000	0.0190	0.2850	
E5 Ground floor (normal)				24.7000	0.0460	1.1362	
E16 Corner (normal)				4.8000	0.0370	0.1776	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.9732 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	30.7847 (37)

Full SAP Calculation Printout



Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	30.4910	30.4049	30.3206	29.9243	29.8502	29.5050	29.5050	29.4411	29.6379	29.8502	30.0001	30.1569 (38)
Average = Sum(39)m / 12 =	61.2757	61.1896	61.1052	60.7089	60.6348	60.2897	60.2897	60.2257	60.4226	60.6348	60.7848	60.9416 (39)
												60.7086

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8582	0.8570	0.8558	0.8503	0.8492	0.8444	0.8444	0.8435	0.8463	0.8492	0.8513	0.8535 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.8503 (41)
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2796 (42)											
Hot water usage for mixer showers	0.0000 (42a)											
Hot water usage for baths	0.0000 (42b)											
Hot water usage for other uses	0.0000 (42c)											
Average daily hot water use (litres/day)	101.2651 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.9610	107.5110	104.6246	100.4678	97.0083	93.3226	92.0777	94.9536	97.9623	101.8094	106.0234	109.7177 (44)
Energy content (annual)	174.1514	153.0943	160.8041	137.5354	130.5919	114.7511	111.3600	117.5724	120.7973	138.1544	151.0497	171.7914 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1681.6532											
Water storage loss:	26.1227	22.9641	24.1206	20.6303	19.5888	17.2127	16.7040	17.6359	18.1196	20.7232	22.6575	25.7687 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	1.8328	1.6487	1.7781	1.5780	1.4569	1.2315	1.1792	1.2839	1.3609	1.5665	1.6491	1.8121 (61)
Total heat required for water heating calculated for each month	175.9841	154.7429	162.5822	139.1134	132.0487	115.9826	112.5392	118.8563	122.1582	139.7209	152.6988	173.6035 (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	175.9841	154.7429	162.5822	139.1134	132.0487	115.9826	112.5392	118.8563	122.1582	139.7209	152.6988	173.6035 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 1700.0308 (64)											
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	58.3635	51.3160	53.9119	46.1250	43.7860	38.4626	37.3220	39.4138	40.5053	46.3280	50.6363	57.5737 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.5688	122.4155	110.5688	114.2544	110.5688	114.2544	110.5688	110.5688	114.2544	110.5688	114.2544	110.5688 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.5423	202.6233	197.3792	186.2152	172.1227	158.8777	150.0293	147.9483	153.1923	164.3563	178.4488	191.6938 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981 (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)	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851 (71)
Water heating gains (Table 5)	78.4456	76.3631	72.4622	64.0625	58.8522	53.4203	50.1640	52.9755	56.2574	62.2688	70.3282	77.3839 (72)
Total internal gains	449.7511	461.5962	440.6046	424.7266	401.7381	383.7469	367.9565	368.6870	380.8986	397.3883	423.2259	439.8410 (73)

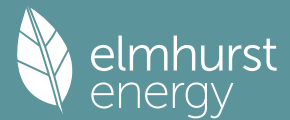
6. Solar gains

[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			
Southeast					4.0500	36.7938	0.5000	0.7000				0.7700	36.1436 (77)			
Southwest					1.8900	36.7938	0.5000	0.7000				0.7700	16.8670 (79)			
Northwest					3.2400	11.2829	0.5000	0.7000				0.7700	8.8668 (81)			
Solar gains					61.8774	108.3454	156.0659	206.4857	243.2497	246.7552	235.7075	207.4750	173.3999	121.8540	74.6513	52.6071 (83)
Total gains					511.6285	569.9416	596.6705	631.2123	644.9878	630.5021	603.6640	576.1620	554.2985	519.2423	497.8771	492.4481 (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	80.9185	81.0323	81.1442	81.6739	81.7737	82.2419	82.2419	82.3291	82.0609	81.7737	81.5719	81.3620
alpha	6.3946	6.4022	6.4096	6.4449	6.4516	6.4828	6.4828	6.4886	6.4707	6.4516	6.4381	6.4241
util living area	0.9940	0.9871	0.9726	0.9217	0.8013	0.6019	0.4382	0.4787	0.7186	0.9341	0.9861	0.9953 (86)
MIT	20.1838	20.3298	20.5151	20.7574	20.9252	20.9899	20.9989	20.9980	20.9705	20.7688	20.4380	20.1530 (87)
Th 2	20.2032	20.2042	20.2052	20.2100	20.2109	20.2150	20.2150	20.2158	20.2134	20.2109	20.2091	20.2072 (88)

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util rest of house	0.9922	0.9833	0.9644	0.8992	0.7533	0.5325	0.3607	0.3982	0.6495	0.9102	0.9813	0.9938 (89)
MIT 2	19.2533	19.4389	19.6718	19.9674	20.1493	20.2093	20.2146	20.2151	20.1943	19.9864	19.5810	19.2173 (90)
Living area fraction									FLA = Living area /	(4) =		0.4188 (91)
MIT	19.6430	19.8120	20.0249	20.2982	20.4742	20.5362	20.5430	20.5429	20.5194	20.3141	19.9399	19.6091 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6430	19.8120	20.0249	20.2982	20.4742	20.5362	20.5430	20.5429	20.5194	20.3141	19.9399	19.6091 (93)

8. Space heating requirement

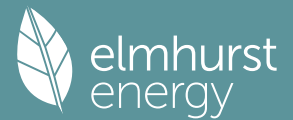
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906	0.9810	0.9622	0.9020	0.7701	0.5613	0.3932	0.4320	0.6773	0.9138	0.9792	0.9924 (94)	
Useful gains	506.8105	559.0936	574.0916	569.3533	496.7066	353.8946	237.3816	248.8906	375.4540	474.4776	487.5353	488.7128 (95)	
Ext temp.	4.3000	4.9000	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	940.1520	912.4586	826.4443	691.9755	532.0231	357.8901	237.7246	249.5117	387.8739	589.0096	780.4695	939.0557 (97)	
Space heating kWh	322.4061	237.4613	187.7505	88.2880	26.2755	0.0000	0.0000	0.0000	0.0000	85.2118	210.9126	335.0552 (98a)	
Space heating requirement - total per year (kWh/year)												1493.3608	
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	322.4061	237.4613	187.7505	88.2880	26.2755	0.0000	0.0000	0.0000	0.0000	85.2118	210.9126	335.0552 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1493.3608	
Space heating per m2											(98c) / (4) =	20.9154 (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 %)												83.7000 (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	322.4061	237.4613	187.7505	88.2880	26.2755	0.0000	0.0000	0.0000	0.0000	85.2118	210.9126	335.0552 (98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000 (210)
Space heating fuel (main heating system)	385.1924	283.7053	224.3136	105.4815	31.3924	0.0000	0.0000	0.0000	0.0000	101.8062	251.9864	400.3048 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	175.9841	154.7429	162.5822	139.1134	132.0487	115.9826	112.5392	118.8563	122.1582	139.7209	152.6988	173.6035 (64)
Efficiency of water heater (217)m	83.3255	82.7371	81.7683	79.7844	76.9731	75.0000	75.0000	75.0000	75.0000	79.6611	82.3805	75.0000 (216)
Fuel for water heating, kWh/month	211.2009	187.0297	198.8327	174.3617	171.5519	154.6434	150.0523	158.4750	162.8775	175.3941	185.3579	83.4947 (217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	22.9740	18.4306	16.5947	12.1580	9.3912	7.6727	8.5670	11.1357	14.4641	18.9777	21.4353	23.6125 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-11.2388	-17.6403	-28.3524	-35.4556	-41.2073	-39.5502	-38.9867	-35.2238	-29.0879	-21.5479	-12.9231	-9.4896 (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												1784.1826 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												75.0000
Water heating fuel used												2137.6989 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												185.4135 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-320.7036 (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												3872.5914 (238)

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

Full SAP Calculation Printout

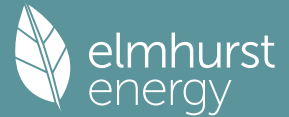


	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1784.1826	0.2100	374.6783 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2137.6989	0.2100	448.9168 (264)
Space and water heating			823.5951 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	185.4135	0.1443	26.7609 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-320.7036	0.1325	-42.4978
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-42.4978 (269)
Total CO2, kg/year			819.7874 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.4800 (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	1784.1826	1.1300	2016.1263 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2137.6989	1.1300	2415.5997 (278)
Space and water heating			4431.7261 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	185.4135	1.5338	284.3933 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-320.7036	1.4896	-477.7306
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-477.7306 (283)
Total Primary energy kWh/year			4368.4896 (286)
Dwelling Primary energy Rate (DPER)			61.1800 (287)

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Property Reference	Hurst 2BH SEMI 86 - GAS				Issued on Date	20/08/2024	
Assessment Reference	Hurst 2BH SEMI 86 - GAS			Prop Type Ref	Hurst 2BH SEMI 86 - GAS		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10						
SAP Rating	92 A	DER	10.64	TER	10.91		
Environmental	91 B	% DER < TER				2.47	
CO ₂ Emissions (t/year)	0.76	DFEE	31.30	TFEE	33.50		
Compliance Check	See BREL	% DFEE < TFEE				6.55	
% DPER < TPER	1.84	DPER	55.86	TPER	56.91		
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)
Ground floor	43.0000 (1b)	x 2.4000 (2b)	= 103.2000 (1b) - (3b)
First floor	43.0000 (1c)	x 2.4000 (2c)	= 103.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.4000 (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	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) =	Air changes per hour 20.0000 / (5) = 0.0969 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2969 (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) = 0.2524 (21)

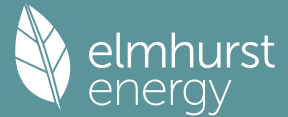
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3218	0.3155	0.3091	0.2776	0.2713	0.2397	0.2397	0.2334	0.2524	0.2713	0.2839	0.2965 (22b)
Effective ac	0.5518	0.5498	0.5478	0.5385	0.5368	0.5287	0.5287	0.5272	0.5318	0.5368	0.5403	0.5440 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			13.4400	1.1450	15.3893		(27)
Entrance Door			1.8900	1.2000	2.2680		(26a)
Heatloss Floor			43.0000	0.1300	5.5900		(28a)
External Wall	89.4200	15.3300	74.0900	0.1800	13.3362		(29a)
External Roof	43.0000		43.0000	0.1000	4.3000		(30)
Total net area of external elements Aum(A, m ²)			175.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8835		(33)
Party Wall			45.0700	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
E2 Other lintels (including other steel lintels)	Psi-value
E3 Sill	Total
E4 Jamb	10.1500
E5 Ground floor (normal)	0.0280
E16 Corner (normal)	0.0240
E6 Intermediate floor within a dwelling	0.0190
E10 Eaves (insulation at ceiling level)	0.0460
	0.0370
	0.0000
	0.0510
	0.9501

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E18 Party wall between dwellings
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.3900 0.0410 0.3850 3.4024 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 44.2859 (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 37.5819 37.4450 37.3108 36.6804 36.5625 36.0135 36.0135 35.9118 36.2250 36.5625 36.8011 37.0505 (38)
Average = Sum(39)m / 12 = 81.8678 81.7309 81.5967 80.9663 80.8484 80.2994 80.2994 80.1977 80.5109 80.8484 81.0870 81.3364 (39)
80.9658

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 0.9520 0.9504 0.9488 0.9415 0.9401 0.9337 0.9337 0.9325 0.9362 0.9401 0.9429 0.9458 (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 2.5669 (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 77.5624 76.4105 74.7883 71.7974 69.5579 67.0745 65.7332 67.3440 69.0978 71.7551 74.8076 77.3002 (42b)
Hot water usage for other uses 40.9178 39.4299 37.9420 36.4541 34.9661 33.4782 33.4782 34.9661 36.4541 37.9420 39.4299 40.9178 (42c)
Average daily hot water use (litres/day) 109.1106 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 118.4802 115.8404 112.7303 108.2515 104.5240 100.5528 99.2114 102.3101 105.5519 109.6970 114.2375 118.2180 (44)
Energy content (annual) 187.6437 164.9551 173.2623 148.1909 140.7094 123.6413 119.9876 126.6813 130.1560 148.8578 162.7522 185.1008 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1811.9384
28.1466 24.7433 25.9893 22.2286 21.1064 18.5462 17.9981 19.0022 19.5234 22.3287 24.4128 27.7651 (46)
Water storage loss:
Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Combi loss 2.2057 1.9782 2.1263 1.8784 1.8307 1.6529 1.5952 1.6735 1.6814 1.8675 1.9753 2.1802 (61)
Total heat required for water heating calculated for each month
WWHRS 189.8494 166.9334 175.3886 150.0692 142.5401 125.2942 121.5827 128.3547 131.8374 150.7253 164.7275 187.2810 (62)
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 (63a)
Solar input -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h 189.8494 166.9334 175.3886 150.0692 142.5401 125.2942 121.5827 128.3547 131.8374 150.7253 164.7275 187.2810 (64)
Total per year (kWh/year) 1834.5836 (64)
Electric shower(s) 1835 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month 62.9430 55.3421 58.1413 49.7431 47.2436 41.5240 40.2947 42.5399 43.6972 49.9621 54.6089 62.0911 (65)

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

Metabolic gains (Table 5), Watts
(66)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 128.3459 128.3459 128.3459 128.3459 128.3459 128.3459 128.3459 128.3459 128.3459 128.3459 128.3459 128.3459 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 122.4055 135.5203 122.4055 126.4856 122.4055 126.4856 122.4055 122.4055 126.4856 122.4055 126.4856 122.4055 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 231.5234 233.9259 227.8717 214.9831 198.7134 183.4223 173.2069 170.8044 176.8586 189.7472 206.0168 221.3080 (68)
Pumps, fans 35.8346 35.8346 35.8346 35.8346 35.8346 35.8346 35.8346 35.8346 35.8346 35.8346 35.8346 35.8346 (69)
Losses e.g. evaporation (negative values) (Table 5) 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Water heating gains (Table 5) -102.6768 -102.6768 -102.6768 -102.6768 -102.6768 -102.6768 -102.6768 -102.6768 -102.6768 -102.6768 -102.6768 -102.6768 (71)
Total internal gains 84.6007 82.3544 78.1469 69.0876 63.4994 57.6722 54.1595 57.1773 60.6906 67.1534 75.8457 83.4557 (72)
503.0334 516.3044 492.9279 475.0601 449.1221 429.0839 411.2756 411.8909 425.5386 443.8098 472.8520 491.6730 (73)

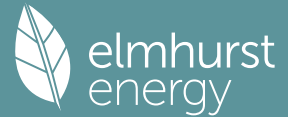
6. Solar gains

[Jan] Area Solar flux g Specific data FF Access Gains
m2 Table 6a W/m2 or Table 6b Specific data or Table 6c factor Table 6d W
Southeast 4.7700 36.7938 0.5000 0.7000 0.7700 42.5691 (77)
Southwest 0.6300 36.7938 0.5000 0.7000 0.7700 5.6223 (79)
Northwest 8.0400 11.2829 0.5000 0.7000 0.7700 22.0029 (81)
Solar gains 70.1943 126.8754 193.0091 271.6861 334.0107 344.6592 326.8516 278.3574 219.9402 145.4585 85.4076 59.2105 (83)
Total gains 573.2277 643.1798 685.9369 746.7461 783.1328 773.7430 738.1272 690.2483 645.4788 589.2683 558.2596 550.8835 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
tau Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
alpha 72.9496 73.0718 73.1920 73.7618 73.8694 74.3744 74.3744 74.4687 74.1791 73.8694 73.6520 73.4262
5.8633 5.8715 5.8795 5.9175 5.9246 5.9583 5.9583 5.9646 5.9453 5.9246 5.9101 5.8951

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util living area	0.9964	0.9923	0.9825	0.9437	0.8376	0.6435	0.4756	0.5285	0.7847	0.9602	0.9920	0.9972 (86)
MIT	19.9707	20.1235	20.3412	20.6437	20.8757	20.9792	20.9970	20.9946	20.9364	20.6436	20.2574	19.9421 (87)
Th 2	20.1236	20.1249	20.1262	20.1324	20.1336	20.1389	20.1389	20.1399	20.1369	20.1336	20.1312	20.1288 (88)
util rest of house												
MIT 2	0.9953	0.9899	0.9768	0.9251	0.7903	0.5656	0.3842	0.4328	0.7130	0.9432	0.9890	0.9963 (89)
Living area fraction	18.9207	19.1163	19.3926	19.7689	20.0289	20.1271	20.1380	20.1380	20.0939	19.7760	19.2926	18.8882 (90)
MIT	19.1880	19.3726	19.6341	19.9916	20.2444	20.3440	20.3566	20.3560	20.3083	19.9968	19.5381	19.1565 (91)
Temperature adjustment												0.0000 (92)
adjusted MIT	19.1880	19.3726	19.6341	19.9916	20.2444	20.3440	20.3566	20.3560	20.3083	19.9968	19.5381	19.1565 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9936	0.9871	0.9726	0.9216	0.7969	0.5848	0.4075	0.4572	0.7284	0.9398	0.9862	0.9949	(94)
Useful gains	569.5645	634.8508	667.1519	688.1741	624.0787	452.4560	300.7894	315.5945	470.1524	553.8204	550.5708	548.0469	(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	1218.8453	1182.8608	1071.6956	898.0454	690.8025	461.2373	301.6537	317.2637	499.8392	759.7190	1008.5721	1216.5055	(97)
Space heating kWh	483.0649	368.2628	300.9805	151.1073	49.6425	0.0000	0.0000	0.0000	0.0000	153.1886	329.7609	497.3332	(98a)
Space heating requirement - total per year (kWh/year)												2333.3406	
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	483.0649	368.2628	300.9805	151.1073	49.6425	0.0000	0.0000	0.0000	0.0000	153.1886	329.7609	497.3332	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2333.3406	
Space heating per m2											(98c) / (4) =	27.1319	(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 %)													83.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	483.0649	368.2628	300.9805	151.1073	49.6425	0.0000	0.0000	0.0000	0.0000	153.1886	329.7609	497.3332	(98)
Space heating efficiency (main heating system 1)	83.4000	83.4000	83.4000	83.4000	83.4000	0.0000	0.0000	0.0000	0.0000	83.4000	83.4000	83.4000	(210)
Space heating fuel (main heating system)	579.2145	441.5621	360.8879	181.1838	59.5234	0.0000	0.0000	0.0000	0.0000	183.6793	395.3967	596.3228	(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	189.8494	166.9334	175.3886	150.0692	142.5401	125.2942	121.5827	128.3547	131.8374	150.7253	164.7275	187.2810	(64)
Efficiency of water heater (217)m	86.4325	86.2299	85.8497	84.9834	83.4086	81.8000	81.8000	81.8000	81.8000	84.9987	86.0862	86.4910	(216)
Fuel for water heating, kWh/month	219.6505	193.5910	204.2973	176.5866	170.8939	153.1714	148.6341	156.9129	161.1704	177.3265	191.3519	216.5324	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.4334	20.4036	18.3712	13.4595	10.3965	8.4941	9.4841	12.3278	16.0125	21.0093	23.7300	26.1403	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-25.1113	-37.7365	-57.9570	-69.0726	-77.3105	-73.1194	-72.0852	-66.5479	-57.0546	-44.7449	-28.3158	-21.3792	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-10.1539	-22.7187	-48.5797	-77.7615	-106.7725	-108.7540	-107.0238	-88.3142	-61.5223	-33.5786	-13.8474	-7.8975	(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												2797.7705	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												81.8000	
Water heating fuel used												2170.1188	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												205.2624	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1317.3590	(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												3941.7927	(238)

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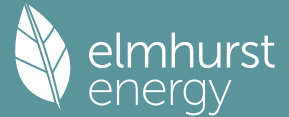
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2797.7705	0.2100	587.5318 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2170.1188	0.2100	455.7249 (264)
Space and water heating			1043.2568 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	205.2624	0.1443	29.6257 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-630.4348	0.1334	-84.1164
PV Unit electricity exported	-686.9242	0.1243	-85.3640
Total			-169.4804 (269)
Total CO2, kg/year			915.3314 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.6400 (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	2797.7705	1.1300	3161.4807 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2170.1188	1.1300	2452.2342 (278)
Space and water heating			5613.7149 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	205.2624	1.5338	314.8383 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-630.4348	1.4931	-941.2749
PV Unit electricity exported	-686.9242	0.4561	-313.2934
Total			-1254.5682 (283)
Total Primary energy kWh/year			4804.0858 (286)
Dwelling Primary energy Rate (DPER)			55.8600 (287)

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Property Reference	Hurst 3BH DET 96 - GAS			Issued on Date	20/08/2024
Assessment Reference	Hurst 3BH DET 96 - GAS	Prop Type Ref	Hurst 3BH DET 96 - GAS		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10				
SAP Rating	93 A	DER	11.11	TER	11.19
Environmental	90 B	% DER < TER			0.71
CO ₂ Emissions (t/year)	0.88	DFEE	34.73	TFEE	37.38
Compliance Check	See BREL	% DFEE < TFEE			7.09
% DPER < TPER	0.33	DPER	58.28	TPER	58.47
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)
Ground floor	48.0000 (1b)	x 2.4000 (2b)	= 115.2000 (1b) - (3b)
First floor	48.0000 (1c)	x 2.4000 (2c)	= 115.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 230.4000 (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) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3302 (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) = 0.2807 (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	0.3579	0.3508	0.3438	0.3087	0.3017	0.2666	0.2666	0.2596	0.2807	0.3017	0.3158	0.3298 (22b)
Effective ac	0.5640	0.5615	0.5591	0.5477	0.5455	0.5355	0.5355	0.5337	0.5394	0.5455	0.5499	0.5544 (25)

3. Heat losses and heat loss parameter

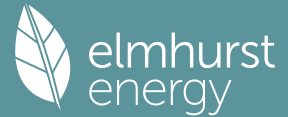
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			14.8400	1.1450	16.9924		(27)
Entrance Door			1.8900	1.2000	2.2680		(26a)
Heatloss Floor			48.0000	0.1300	6.2400		(28a)
External Wall	137.8100	16.7300	121.0800	0.1800	21.7944		(29a)
External Roof	48.0000		48.0000	0.1000	4.8000		(30)
Total net area of external elements Aum(A, m ²)			233.8100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.0948		(33)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.3800	0.0280	0.3186
E3 Sill	7.6800	0.0240	0.1843
E4 Jamb	24.3000	0.0190	0.4617
E5 Ground floor (normal)	28.7100	0.0460	1.3207
E16 Corner (normal)	19.2000	0.0370	0.7104
E6 Intermediate floor within a dwelling	28.7100	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	18.1400	0.0510	0.9251
E12 Gable (insulation at ceiling level)	10.5200	0.0290	0.3051

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Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss

(33) + (36) + (36a) = 56.3207 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8846	42.6955	42.5102	41.6398	41.4770	40.7189	40.7189	40.5785	41.0109	41.4770	41.8064	42.1508	(38)
Heat transfer coeff	99.2053	99.0162	98.8309	97.9605	97.7977	97.0396	97.0396	96.8992	97.3316	97.7977	98.1271	98.4715	(39)
Average = Sum(39)m / 12 =												97.9597	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0334	1.0314	1.0295	1.0204	1.0187	1.0108	1.0108	1.0094	1.0139	1.0187	1.0222	1.0257	(40)
HLP (average)												1.0204	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6993 (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													
80.1319	78.9418	77.2660	74.1760	71.8622	69.2966	67.9108	69.5750	71.3869	74.1322	77.2858	79.8610		(42b)
Hot water usage for other uses													
42.2734	40.7361	39.1989	37.6617	36.1245	34.5873	34.5873	36.1245	37.6617	39.1989	40.7361	42.2734		(42c)
Average daily hot water use (litres/day)												112.7252	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.4053	119.6780	116.4649	111.8377	107.9867	103.8839	102.4981	105.6995	109.0486	113.3311	118.0220	122.1344	(44)
Energy conte	193.8600	170.4199	179.0022	153.1002	145.3709	127.7374	123.9626	130.8780	134.4679	153.7893	168.1439	191.2329	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	29.0790	25.5630	26.8503	22.9650	21.8056	19.1606	18.5944	19.6317	20.1702	23.0684	25.2216	28.6849	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	2.2103	1.9849	2.1366	1.8912	1.8461	1.6693	1.6355	1.6890	1.6948	1.8790	1.9834	2.1850	(61)
Total heat required for water heating calculated for each month													
WWHRS	196.0703	172.4047	181.1388	154.9914	147.2170	129.4067	125.5980	132.5670	136.1627	155.6683	170.1274	193.4179	(62)
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	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.0703	172.4047	181.1388	154.9914	147.2170	129.4067	125.5980	132.5670	136.1627	155.6683	170.1274	193.4179	(64)
12Total per year (kWh/year)												1894.7702	(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	65.0110	57.1608	60.0524	51.3786	48.7973	42.8900	41.6264	43.9392	45.1343	51.6047	56.4037	64.1312	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
132.3057	146.4813	132.3057	136.7158	132.3057	136.7158	132.3057	132.3057	132.3057	136.7158	132.3057	136.7158	132.3057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
249.6943	252.2854	245.7560	231.8558	214.3093	197.8180	186.8008	184.2098	190.7391	204.6393	222.1859	238.6771		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	(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)													
-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	(71)
Water heating gains (Table 5)													
87.3804	85.0607	80.7156	71.3592	65.5878	59.5695	55.9495	59.0580	62.6865	69.3611	78.3385	86.1978		(72)
Total internal gains	535.8696	550.3166	525.2665	506.4201	478.6920	457.5926	438.5452	439.0627	453.6307	472.7954	503.7295	523.6699	(73)

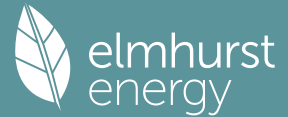
6. Solar gains

[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				5.4500	11.2829	0.5000	0.7000	0.7700	14.9149 (75)			
Southwest				8.7600	36.7938	0.5000	0.7000	0.7700	78.1773 (79)			
Northwest				0.6300	11.2829	0.5000	0.7000	0.7700	1.7241 (81)			
Solar gains	94.8163	167.0340	243.2233	325.9717	387.5749	394.6513	376.3747	328.9056	271.6417	188.5663	114.5745	80.4917 (83)
Total gains	630.6859	717.3506	768.4898	832.3918	866.2669	852.2439	814.9200	767.9684	725.2724	661.3616	618.3040	604.1616 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	67.2007	67.3290	67.4553	68.0546	68.1679	68.7005	68.7005	68.8000	68.4944	68.1679	67.9391	67.7015	
alpha	5.4800	5.4886	5.4970	5.5370	5.5445	5.5800	5.5800	5.5867	5.5663	5.5445	5.5293	5.5134	
util living area													

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	0.9969	0.9931	0.9846	0.9533	0.8671	0.6901	0.5171	0.5684	0.8133	0.9658	0.9931	0.9975 (86)
MIT	19.8272	19.9937	20.2278	20.5519	20.8188	20.9623	20.9936	20.9894	20.9064	20.5672	20.1426	19.7985 (87)
Th 2	20.0556	20.0572	20.0588	20.0663	20.0678	20.0743	20.0743	20.0755	20.0718	20.0678	20.0649	20.0619 (88)
util rest of house												
	0.9959	0.9908	0.9794	0.9367	0.8221	0.6057	0.4119	0.4603	0.7408	0.9503	0.9904	0.9967 (89)
MIT 2	18.6869	18.9002	19.1983	19.6053	19.9119	20.0523	20.0722	20.0717	20.0072	19.6311	19.0969	18.6549 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.8812	19.0866	19.3737	19.7667	20.0664	20.2074	20.2292	20.2281	20.1605	19.7906	19.2751	18.8498 (91)
Temperature adjustment												0.0000
adjusted MIT	18.8812	19.0866	19.3737	19.7667	20.0664	20.2074	20.2292	20.2281	20.1605	19.7906	19.2751	18.8498 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9876	0.9742	0.9301	0.8220	0.6186	0.4299	0.4787	0.7486	0.9443	0.9872	0.9952	(94)
Useful gains	626.9061	708.4576	748.7003	774.2477	712.0907	527.1609	350.3177	367.6203	542.9262	624.5268	610.3809	601.2578	(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	1446.5314	1404.7018	1272.3236	1064.5034	818.2167	544.1371	352.1782	370.9375	589.8762	898.8226	1194.7095	1442.5866	(97)
Space heating kWh	609.8012	467.8761	389.5757	208.9842	78.9577	0.0000	0.0000	0.0000	0.0000	204.0761	420.7166	625.9486	(98a)
Space heating requirement - total per year (kWh/year)												3005.9362	
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	609.8012	467.8761	389.5757	208.9842	78.9577	0.0000	0.0000	0.0000	0.0000	204.0761	420.7166	625.9486	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3005.9362	
Space heating per m2											(98c) / (4) =	31.3118	(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 %)													83.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	609.8012	467.8761	389.5757	208.9842	78.9577	0.0000	0.0000	0.0000	0.0000	204.0761	420.7166	625.9486	(98)
Space heating efficiency (main heating system 1)	83.4000	83.4000	83.4000	83.4000	83.4000	0.0000	0.0000	0.0000	0.0000	83.4000	83.4000	83.4000	(210)
Space heating fuel (main heating system)	731.1765	561.0025	467.1172	250.5805	94.6735	0.0000	0.0000	0.0000	0.0000	244.6956	504.4563	750.5379	(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	196.0703	172.4047	181.1388	154.9914	147.2170	129.4067	125.5980	132.5670	136.1627	155.6683	170.1274	193.4179	(64)
Efficiency of water heater	86.6981	86.5203	86.1927	85.4637	83.9891	81.8000	81.8000	81.8000	81.8000	85.4177	86.3929	86.7478	(216)
(217)m	86.6981	86.5203	86.1927	85.4637	83.9891	81.8000	81.8000	81.8000	81.8000	85.4177	86.3929	86.7478	(217)
Fuel for water heating, kWh/month	226.1531	199.2650	210.1555	181.3536	175.2810	158.1989	153.5428	162.0624	166.4580	182.2435	196.9229	222.9658	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	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	27.4905	22.0539	19.8571	14.5482	11.2374	9.1811	10.2511	13.3248	17.3076	22.7086	25.6493	28.2545	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-29.5390	-44.0484	-67.1026	-79.2793	-88.1223	-83.1100	-81.9279	-75.9320	-65.5499	-51.9429	-33.1907	-25.1854	(233a)
(233a)m	-29.5390	-44.0484	-67.1026	-79.2793	-88.1223	-83.1100	-81.9279	-75.9320	-65.5499	-51.9429	-33.1907	-25.1854	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-12.7792	-28.4978	-60.7415	-96.9216	-132.7773	-135.1381	-133.0030	-109.9024	-76.7425	-42.0453	-17.4052	-9.9467	(233b)
(233b)m	-12.7792	-28.4978	-60.7415	-96.9216	-132.7773	-135.1381	-133.0030	-109.9024	-76.7425	-42.0453	-17.4052	-9.9467	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3604.2401	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												81.8000	
Water heating fuel used												2234.6026	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												221.8641	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1580.8308	(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												4565.8760	(238)

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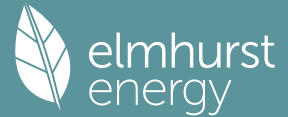
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3604.2401	0.2100	756.8904 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2234.6026	0.2100	469.2665 (264)
Space and water heating			1226.1570 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	221.8641	0.1443	32.0218 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-724.9304	0.1336	-96.8483
PV Unit electricity exported	-855.9004	0.1244	-106.4331
Total			-203.2814 (269)
Total CO2, kg/year			1066.8267 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.1100 (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	3604.2401	1.1300	4072.7913 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2234.6026	1.1300	2525.1009 (278)
Space and water heating			6597.8922 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	221.8641	1.5338	340.3026 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-724.9304	1.4937	-1082.8268
PV Unit electricity exported	-855.9004	0.4564	-390.6224
Total			-1473.4492 (283)
Total Primary energy kWh/year			5594.8463 (286)
Dwelling Primary energy Rate (DPER)			58.2800 (287)

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Property Reference	Hurst 3BH DET 103 - GAS				Issued on Date	20/08/2024	
Assessment Reference	Hurst 3BH DET 103 - GAS			Prop Type Ref	Hurst 3BH DET 103 - GAS		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10						
SAP Rating	85 B	DER	14.46	TER	12.19		
Environmental	87 B	% DER < TER				-18.62	
CO ₂ Emissions (t/year)	1.29	DFEE	41.09	TFEE	43.00		
Compliance Check	See BREL	% DFEE < TFEE				4.44	
% DPER < TPER	-25.51	DPER	80.19	TPER	63.89		
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)
Ground floor	51.2500 (1b)	x 2.4000 (2b)	= 123.0000 (1b) - (3b)
First floor	51.2500 (1c)	x 2.4000 (2c)	= 123.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 246.0000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.1220 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3720 (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) = 0.3162 (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	0.4031	0.3952	0.3873	0.3478	0.3399	0.3004	0.3004	0.2924	0.3162	0.3399	0.3557	0.3715 (22b)
Effective ac	0.5812	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690 (25)

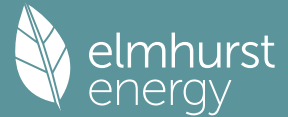
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows & Glazed Doors (Uw = 1.20)			14.4500	1.1450	16.5458		(27)
External Doors			5.0400	1.2000	6.0480		(26a)
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) =	61.7755		(33)

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

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	13.5000	0.0280	0.3780
E2 Other lintels (including other steel lintels)	11.1000	0.0240	0.2664
E3 Sill	34.2000	0.0190	0.6498
E4 Jamb	31.8900	0.0460	1.4669
E5 Ground floor (normal)	24.0000	0.0370	0.8880
E16 Corner (normal)	4.8000	-0.0790	-0.3792
E17 Corner (inverted - internal area greater than external area)	30.2700	0.0000	0.0000
E6 Intermediate floor within a dwelling	19.3000	0.0510	0.9843
E10 Eaves (insulation at ceiling level)			

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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) 4.5732 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 66.3487 (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 47.1855 46.9294 46.6784 45.4992 45.2786 44.2516 44.2516 44.0615 44.6472 45.2786 45.7249 46.1915 (38)
 113.5343 113.2782 113.0271 111.8480 111.6274 110.6004 110.6004 110.4102 110.9960 111.6274 112.0737 112.5402 (39)
 Average = Sum(39)m / 12 = 111.8469

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 HLP (average) 1.1077 1.1052 1.1027 1.0912 1.0890 1.0790 1.0790 1.0772 1.0829 1.0890 1.0934 1.0980 (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 2.7615 (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 81.3396 80.1316 78.4305 75.2939 72.9453 70.3410 68.9343 70.6235 72.4628 75.2494 78.4506 81.0646 (42b)
 Hot water usage for other uses 42.9105 41.3501 39.7897 38.2293 36.6689 35.1086 35.1086 36.6689 38.2293 39.7897 41.3501 42.9105 (42c)
 Average daily hot water use (litres/day) 114.4241 (43)
 Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 124.2501 121.4817 118.2202 113.5232 109.6142 105.4496 104.0429 107.2925 110.6921 115.0391 119.8007 123.9751 (44)
 Energy conte 196.7817 172.9883 181.7000 155.4076 147.5618 129.6625 125.8308 132.8505 136.4945 156.1070 170.6781 194.1150 (45)
 Energy content (annual) Total = Sum(45)m = 1900.1778
 Distribution loss (46)m = 0.15 x (45)m
 29.5173 25.9482 27.2550 23.3111 22.1343 19.4494 18.8746 19.9276 20.4742 23.4161 25.6017 29.1173 (46)
 Water storage loss:
 Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
 If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
 Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
 Combi loss 2.2109 1.9867 2.1401 1.8961 1.8523 1.6762 1.6426 1.6954 1.7001 1.8833 1.9860 2.1858 (61)
 Total heat required for water heating calculated for each month
 198.9927 174.9750 183.8401 157.3037 149.4141 131.3388 127.4735 134.5459 138.1946 157.9904 172.6641 196.3008 (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 198.9927 174.9750 183.8401 157.3037 149.4141 131.3388 127.4735 134.5459 138.1946 157.9904 172.6641 196.3008 (64)
 Total per year (kWh/year) = Sum(64)m = 1923.0335 (64)
 1923 (64)
 12Total per year (kWh/year)
 Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
 Heat gains from water heating, kWh/month 65.9827 58.0153 60.9503 52.1471 49.5274 43.5318 42.2494 44.5966 45.8094 52.3764 57.2470 65.0897 (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
 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 (66)
 Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
 140.6431 155.7120 140.6431 145.3312 140.6431 145.3312 140.6431 145.3312 140.6431 145.3312 140.6431 145.3312 (67)
 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
 260.3071 263.0083 256.2014 241.7104 223.4181 206.2259 194.7405 192.0393 198.8462 213.3372 231.6295 248.8217 (68)
 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 (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)
 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 (71)
 Water heating gains (Table 5)
 88.6864 86.3323 81.9224 72.4265 66.5690 60.4609 56.7868 59.9417 63.6242 70.3984 79.5097 87.4861 (72)
 Total internal gains 557.0590 572.4750 546.1894 526.8905 498.0527 476.4404 456.5928 457.0465 472.2240 491.8011 523.8928 544.3734 (73)

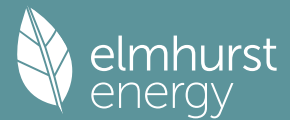
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	5.8500	10.6334	0.5000	0.7000	0.7700	15.0879 (74)						
East	0.6100	19.6403	0.5000	0.7000	0.7700	2.9059 (76)						
South	6.1200	46.7521	0.5000	0.7000	0.7700	69.3990 (78)						
West	1.8700	19.6403	0.5000	0.7000	0.7700	8.9082 (80)						
Solar gains	96.3010	165.6024	231.8357	297.8408	344.5587	347.2292	332.5924	296.7215	254.4139	184.3364	115.6052	82.2605 (83)
Total gains	653.3601	738.0774	778.0251	824.7313	842.6114	823.6696	789.1852	753.7681	726.6379	676.1375	639.4980	626.6339 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
 Utilisation factor for gains for living area, nil,m (see Table 9a)
 tau Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 62.6952 62.8370 62.9765 63.6404 63.7662 64.3583 64.3583 64.4692 64.1290 63.7662 63.5123 63.2490

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alpha	5.1797	5.1891	5.1984	5.2427	5.2511	5.2906	5.2906	5.2979	5.2753	5.2511	5.2342	5.2166
util living area	0.9974	0.9945	0.9890	0.9695	0.9136	0.7712	0.5974	0.6442	0.8619	0.9747	0.9944	0.9979 (86)
MIT	19.6885	19.8509	20.0828	20.4146	20.7162	20.9230	20.9839	20.9764	20.8522	20.4692	20.0258	19.6640 (87)
Th 2	19.9946	19.9966	19.9986	20.0080	20.0098	20.0180	20.0180	20.0195	20.0148	20.0098	20.0062	20.0025 (88)
util rest of house	0.9965	0.9927	0.9850	0.9575	0.8775	0.6849	0.4739	0.5214	0.7951	0.9623	0.9922	0.9972 (89)
MIT 2	18.4653	18.6741	18.9707	19.3939	19.7544	19.9703	20.0125	20.0105	19.9078	19.4674	18.9052	18.4396 (90)
Living area fraction	18.7827	18.9795	19.2593	19.6588	20.0040	20.2175	20.2646	20.2611	20.1529	19.7274	19.1960	18.7574 (92)
MIT	18.7827	18.9795	19.2593	19.6588	20.0040	20.2175	20.2646	20.2611	20.1529	19.7274	19.1960	18.7574 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7827	18.9795	19.2593	19.6588	20.0040	20.2175	20.2646	20.2611	20.1529	19.7274	19.1960	18.7574 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9949	0.9901	0.9810	0.9521	0.8773	0.7041	0.5061	0.5532	0.8060	0.9577	0.9896	0.9959 (94)
Useful gains	650.0447	730.7405	763.2154	785.1900	739.1820	579.9374	399.4117	417.0099	585.6351	647.5238	632.8178	624.0547 (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	1644.2828	1594.9024	1442.1480	1203.3445	926.9528	621.3026	405.3048	426.3103	671.8494	1018.8626	1355.6472	1638.2908 (97)
Space heating kWh	739.7131	580.7168	505.1258	301.0712	139.7014	0.0000	0.0000	0.0000	0.0000	276.2761	520.4372	754.5916 (98a)
Space heating requirement - total per year (kWh/year)												3817.6333
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	739.7131	580.7168	505.1258	301.0712	139.7014	0.0000	0.0000	0.0000	0.0000	276.2761	520.4372	754.5916 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3817.6333
Space heating per m2										(98c) / (4) =		37.2452 (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 %)												83.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	739.7131	580.7168	505.1258	301.0712	139.7014	0.0000	0.0000	0.0000	0.0000	276.2761	520.4372	754.5916 (98)
Space heating efficiency (main heating system 1)	83.4000	83.4000	83.4000	83.4000	83.4000	0.0000	0.0000	0.0000	0.0000	83.4000	83.4000	83.4000 (210)
Space heating fuel (main heating system)	886.9462	696.3032	605.6665	360.9967	167.5077	0.0000	0.0000	0.0000	0.0000	331.2663	624.0254	904.7861 (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	198.9927	174.9750	183.8401	157.3037	149.4141	131.3388	127.4735	134.5459	138.1946	157.9904	172.6641	196.3008 (64)
Efficiency of water heater (217)m	86.9134	86.7788	86.5369	86.0182	84.8615	81.8000	81.8000	81.8000	81.8000	85.8791	86.6582	86.9517 (217)
Fuel for water heating, kWh/month	228.9550	201.6333	212.4413	182.8725	176.0682	160.5608	155.8355	164.4815	168.9420	183.9683	199.2473	225.7584 (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	29.2229	23.4437	21.1084	15.4649	11.9456	9.7596	10.8971	14.1645	18.3983	24.1396	27.2656	30.0350 (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												4577.4980 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												81.8000
Water heating fuel used												2260.7643 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												235.8452 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												7160.1075 (238)

Full SAP Calculation Printout



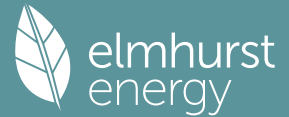
----- 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP -----

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4577.4980	0.2100	961.2746 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2260.7643	0.2100	474.7605 (264)
Space and water heating			1436.0351 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	235.8452	0.1443	34.0397 (268)
Total CO2, kg/year			1482.0041 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.4600 (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	4577.4980	1.1300	5172.5727 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2260.7643	1.1300	2554.6637 (278)
Space and water heating			7727.2364 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	235.8452	1.5338	361.7472 (282)
Total Primary energy kWh/year			8219.0844 (286)
Dwelling Primary energy Rate (DPER)			80.1900 (287)

Full SAP Calculation Printout



Property Reference	Hurst 4BH DET 156 - GAS			Issued on Date	20/08/2024
Assessment Reference	Hurst 4BH DET 156 - GAS	Prop Type Ref	Hurst 4BH DET 156 - GAS		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10				
SAP Rating	87 B	DER	11.92	TER	9.04
Environmental	88 B	% DER < TER			-31.86
CO ₂ Emissions (t/year)	1.64	DFEE	36.48	TFEE	37.80
Compliance Check	See BREL	% DFEE < TFEE			3.48
% DPER < TPER	-39.24	DPER	66.01	TPER	47.41
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)
Ground floor	80.1800 (1b)	x 2.4000 (2b)	= 192.4320 (1b) - (3b)
First floor	78.8600 (1c)	x 2.4000 (2c)	= 189.2640 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 381.6960 (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	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) = 0.0786 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3286 (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) = 0.2793 (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	0.3561	0.3491	0.3422	0.3072	0.3003	0.2653	0.2653	0.2584	0.2793	0.3003	0.3142	0.3282 (22b)
Effective ac	0.5634	0.5609	0.5585	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539 (25)

3. Heat losses and heat loss parameter

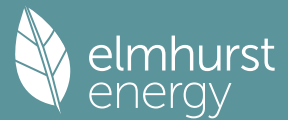
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows & Glazed Doors (Uw = 1.20)			20.1200	1.1450	23.0382		(27)
External Doors			4.1000	1.2000	4.9200		(26a)
Ground Floor			80.2000	0.1300	10.4260		(28a)
External Wall	188.1600	24.2200	163.9400	0.1800	29.5092		(29a)
External Roof	80.2000		80.2000	0.1000	8.0200		(30)
Total net area of external elements Aum(A, m ²)			348.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9134		(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)	20.0500	0.0280	0.5614
E3 Sill	15.4500	0.0240	0.3708
E4 Jamb	39.9000	0.0190	0.7581
E5 Ground floor (normal)	39.2000	0.0460	1.8032
E16 Corner (normal)	28.8000	0.0370	1.0656
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0790	-0.7584
E6 Intermediate floor within a dwelling	39.2000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	30.7000	0.0510	1.5657

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	72.4258	72.5734	72.7187	73.4089	73.5395	74.1535	74.1535	74.2683	73.9158	73.5395	73.2758	73.0021

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alpha	5.8284	5.8382	5.8479	5.8939	5.9026	5.9436	5.9436	5.9512	5.9277	5.9026	5.8851	5.8668	
util living area	0.9991	0.9976	0.9941	0.9787	0.9250	0.7757	0.5947	0.6492	0.8820	0.9853	0.9978	0.9993 (86)	
MIT	19.7924	19.9464	20.1677	20.4819	20.7644	20.9446	20.9904	20.9843	20.8745	20.5100	20.0976	19.7684 (87)	
Th 2	20.1178	20.1194	20.1210	20.1286	20.1300	20.1366	20.1366	20.1378	20.1340	20.1300	20.1271	20.1241 (88)	
util rest of house	0.9988	0.9968	0.9919	0.9702	0.8940	0.6971	0.4847	0.5385	0.8246	0.9780	0.9968	0.9991 (89)	
MIT 2	18.6885	18.8869	19.1707	19.5731	19.9132	20.1015	20.1331	20.1316	20.0395	19.6129	19.0866	18.6625 (90)	
Living area fraction	18.8731	19.0641	19.3375	19.7251	20.0556	20.2425	20.2765	20.2742	fLA = Living area / (4) =				0.1673 (91)
MIT	18.8731	19.0641	19.3375	19.7251	20.0556	20.2425	20.2765	20.2742	20.1792	19.7629	19.2557	18.8475 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8731	19.0641	19.3375	19.7251	20.0556	20.2425	20.2765	20.2742	20.1792	19.7629	19.2557	18.8475 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9981	0.9954	0.9892	0.9650	0.8908	0.7076	0.5031	0.5569	0.8281	0.9737	0.9955	0.9986 (94)
Useful gains	816.5457	939.9219	1006.2734	1065.3391	1021.1474	797.4436	542.7487	567.5665	799.8743	851.9891	803.7134	779.9624 (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	2222.2989	2155.5392	1949.7401	1628.6539	1254.8713	840.3952	547.5819	576.1295	908.3450	1376.1217	1832.1637	2216.0052 (97)
Space heating kWh	1045.8804	816.8948	701.9392	405.5867	173.8906	0.0000	0.0000	0.0000	0.0000	389.9547	740.4843	1068.4159 (98a)
Space heating requirement - total per year (kWh/year)												5343.0465
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	1045.8804	816.8948	701.9392	405.5867	173.8906	0.0000	0.0000	0.0000	0.0000	389.9547	740.4843	1068.4159 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5343.0465
Space heating per m2										(98c) / (4) =		33.5956 (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 %)												83.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1045.8804	816.8948	701.9392	405.5867	173.8906	0.0000	0.0000	0.0000	0.0000	389.9547	740.4843	1068.4159 (98)
Space heating efficiency (main heating system 1)	83.4000	83.4000	83.4000	83.4000	83.4000	0.0000	0.0000	0.0000	0.0000	83.4000	83.4000	83.4000 (210)
Space heating fuel (main heating system)	1254.0532	979.4902	841.6538	486.3150	208.5019	0.0000	0.0000	0.0000	0.0000	467.5715	887.8708	1281.0742 (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	207.7268	182.6570	191.9138	164.2151	155.9813	137.1137	133.0792	140.4609	144.2680	164.9309	180.2458	204.9170 (64)
Efficiency of water heater (217)m	87.2337	87.1155	86.8947	86.3911	85.1513	81.8000	81.8000	81.8000	81.8000	86.3296	87.0254	87.2669 (217)
Fuel for water heating, kWh/month	238.1268	209.6721	220.8579	190.0833	183.1813	167.6207	162.6885	171.7126	176.3668	191.0479	207.1186	234.8165 (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	37.9628	30.4552	27.4215	20.0902	15.5182	12.6785	14.1562	18.4008	23.9008	31.3592	35.4202	39.0179 (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												6406.5305 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												81.8000
Water heating fuel used												2353.2928 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												306.3816 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												9152.2049 (238)

Full SAP Calculation Printout



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

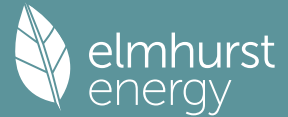
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6406.5305	0.2100	1345.3714	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2353.2928	0.2100	494.1915	(264)
Space and water heating			1839.5629	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	306.3816	0.1443	44.2203	(268)
Total CO2, kg/year			1895.7125	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.9200	(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	6406.5305	1.1300	7239.3795	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2353.2928	1.1300	2659.2208	(278)
Space and water heating			9898.6003	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	306.3816	1.5338	469.9383	(282)
Total Primary energy kWh/year			10498.6394	(286)
Dwelling Primary energy Rate (DPER)			66.0100	(287)

Appendix 2 – DER Worksheets for the Modelled Units based on Heat Pumps

Full SAP Calculation Printout



Property Reference	Hurst 2BF GND 72				Issued on Date	20/08/2024	
Assessment Reference	Hurst 2BF GND 72			Prop Type Ref	Hurst 2BF GND 72		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10						
SAP Rating	85 B	DER	3.95	TER	10.43		
Environmental	97 A	% DER < TER				62.13	
CO ₂ Emissions (t/year)	0.25	DFEE	26.05	TFEE	28.84		
Compliance Check	See BREL	% DFEE < TFEE				9.66	
% DPER < TPER	23.58	DPER	41.54	TPER	54.35		
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)
Ground floor	71.4000 (1b)	2.4000 (2b)	171.3600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.4000		171.3600 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 171.3600 (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) = 0.0584 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2584 (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) = 0.2196 (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)
Factor 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	0.2800	0.2745	0.2690	0.2416	0.2361	0.2086	0.2086	0.2031	0.2196	0.2361	0.2471	0.2580 (22b)
Effective ac	0.5392	0.5377	0.5362	0.5292	0.5279	0.5218	0.5218	0.5206	0.5241	0.5279	0.5305	0.5333 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			9.1800	1.1450	10.5115		(27)
Heatloss Floor			71.4000	0.1300	9.2820		(28a)
External Wall	59.2800	9.1800	50.1000	0.1800	9.0180		(29a)
Total net area of external elements Aum(A, m ²)			130.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8115		(33)
Party Wall			22.6100	0.0000	0.0000		(32)
Party Ceiling			71.4000				(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)				7.2000	0.0280	0.2016	
E3 Sill				7.2000	0.0240	0.1728	
E4 Jamb				15.0000	0.0190	0.2850	
E5 Ground floor (normal)				24.7000	0.0460	1.1362	
E16 Corner (normal)				4.8000	0.0370	0.1776	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.9732 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	30.7847 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	30.4910	30.4049	30.3206	29.9243	29.8502	29.5050	29.5050	29.4411	29.6379	29.8502	30.0001	30.1569 (38)
Average = Sum(39)m / 12 =	61.2757	61.1896	61.1052	60.7089	60.6348	60.2897	60.2897	60.2257	60.4226	60.6348	60.7848	60.9416 (39)
												60.7086
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8582	0.8570	0.8558	0.8503	0.8492	0.8444	0.8444	0.8435	0.8463	0.8492	0.8513	0.8535 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

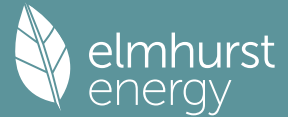
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.2796 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	71.9854	70.9163	69.4108	66.6349	64.5564	62.2516	61.0067	62.5017	64.1294	66.5956	69.4286	71.7420 (42b)
Hot water usage for other uses												
	37.9757	36.5947	35.2138	33.8329	32.4519	31.0710	31.0710	32.4519	33.8329	35.2138	36.5947	37.9757 (42c)
Average daily hot water use (litres/day)												101.2651 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.9610	107.5110	104.6246	100.4678	97.0083	93.3226	92.0777	94.9536	97.9623	101.8094	106.0234	109.7177 (44)
Energy conte	174.1514	153.0943	160.8041	137.5354	130.5919	114.7511	111.3600	117.5724	120.7973	138.1544	151.0497	171.7914 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m												1681.6532
	26.1227	22.9641	24.1206	20.6303	19.5888	17.2127	16.7040	17.6359	18.1196	20.7232	22.6575	25.7687 (46)
Water storage loss:												
Store volume												150.0000 (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 (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	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												
	202.2746	178.4959	188.9273	164.7514	158.7151	141.9671	139.4832	145.6956	148.0133	166.2776	178.2657	199.9146 (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												
	202.2746	178.4959	188.9273	164.7514	158.7151	141.9671	139.4832	145.6956	148.0133	166.2776	178.2657	199.9146 (64)
12Total per year (kWh/year)												2012.7812 (64)
Electric shower(s)												2013 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	57.9053	50.9038	53.4674	45.7305	43.4218	38.1547	37.0272	39.0928	40.1651	45.9363	50.2240	57.1206 (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	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814	113.9814 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	110.5688	122.4155	110.5688	114.2544	110.5688	114.2544	110.5688	110.5688	114.2544	110.5688	114.2544	110.5688 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	200.5423	202.6233	197.3792	186.2152	172.1227	158.8777	150.0293	147.9483	153.1923	164.3563	178.4488	191.6938 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981	34.3981 (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)												
	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851	-91.1851 (71)
Water heating gains (Table 5)												
	77.8298	75.7498	71.8647	63.5146	58.3626	52.9927	49.7678	52.5441	55.7849	61.7424	69.7556	76.7750 (72)
Total internal gains												
	446.1352	457.9829	437.0072	421.1787	398.2486	383.3193	367.5603	368.2556	380.4261	393.8619	419.6533	436.2321 (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				
Southeast			4.0500	36.7938	0.5000	0.7000		0.7700		36.1436 (77)		
Southwest			1.8900	36.7938	0.5000	0.7000		0.7700		16.8670 (79)		
Northwest			3.2400	11.2829	0.5000	0.7000		0.7700		8.8668 (81)		
Solar gains	61.8774	108.3454	156.0659	206.4857	243.2497	246.7552	235.7075	207.4750	173.3999	121.8540	74.6513	52.6071 (83)
Total gains	508.0127	566.3283	593.0730	627.6644	641.4983	630.0745	603.2677	575.7306	553.8260	515.7159	494.3045	488.8392 (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	80.9185	81.0323	81.1442	81.6739	81.7737	82.2419	82.2419	82.3291	82.0609	81.7737	81.5719	81.3620
alpha	6.3946	6.4022	6.4096	6.4449	6.4516	6.4828	6.4828	6.4886	6.4707	6.4516	6.4381	6.4241
util living area												

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	0.9942	0.9875	0.9734	0.9235	0.8041	0.6023	0.4385	0.4790	0.7191	0.9359	0.9866	0.9955 (86)
Living	20.1783	20.3245	20.5103	20.7539	20.9236	20.9898	20.9988	20.9980	20.9704	20.7650	20.4328	20.1474
Non living	19.2463	19.4323	19.6659	19.9635	20.1479	20.2093	20.2146	20.2151	20.1942	19.9823	19.5745	19.2102
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	20.2032	20.2042	20.2052	20.2100	20.2109	20.2150	20.2150	20.2158	20.2134	20.2109	20.2091	20.2072 (88)
util rest of house	0.9925	0.9838	0.9654	0.9012	0.7563	0.5328	0.3610	0.3985	0.6500	0.9125	0.9819	0.9941 (89)
MIT 2	20.2032	20.2042	20.2052	20.2100	20.2109	20.2150	20.2150	20.2158	20.2134	20.2109	20.2091	20.2072 (90)
Living area fraction									FLA = Living area /	(4) =		0.4188 (91)
MIT	20.5369	20.5375	20.5380	20.5408	20.5413	20.5437	20.5437	20.5442	20.5428	20.5413	20.5403	20.5392 (92)
Temperature adjustment												0.0000
adjusted MIT	20.5369	20.5375	20.5380	20.5408	20.5413	20.5437	20.5437	20.5442	20.5428	20.5413	20.5403	20.5392 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9933	0.9855	0.9690	0.9112	0.7772	0.5623	0.3936	0.4324	0.6799	0.9232	0.9841	0.9947	(94)
Useful gains	504.6095	558.1123	574.6925	571.9305	498.5779	354.3044	237.4223	248.9621	376.5605	476.1019	486.4314	486.2496	(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	994.9244	956.8498	857.7981	706.7016	536.0925	358.3464	237.7671	249.5871	389.2917	602.7908	816.9649	995.7364	(97)
Space heating kWh	364.7943	267.9516	210.6306	97.0352	27.9109	0.0000	0.0000	0.0000	0.0000	94.2565	237.9842	379.0582	(98a)
Space heating requirement - total per year (kWh/year)												1679.6213	
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	364.7943	267.9516	210.6306	97.0352	27.9109	0.0000	0.0000	0.0000	0.0000	94.2565	237.9842	379.0582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1679.6213	
Space heating per m2										(98c) / (4) =		23.5241	(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 %)													255.0644 (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	364.7943	267.9516	210.6306	97.0352	27.9109	0.0000	0.0000	0.0000	0.0000	94.2565	237.9842	379.0582	(98)
Space heating efficiency (main heating system 1)	255.0644	255.0644	255.0644	255.0644	255.0644	0.0000	0.0000	0.0000	0.0000	255.0644	255.0644	255.0644	(210)
Space heating fuel (main heating system)	143.0205	105.0525	82.5794	38.0434	10.9427	0.0000	0.0000	0.0000	0.0000	36.9540	93.3036	148.6127	(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	202.2746	178.4959	188.9273	164.7514	158.7151	141.9671	139.4832	145.6956	148.0133	166.2776	178.2657	199.9146	(64)
Efficiency of water heater	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	186.5800	(216)
Fuel for water heating, kWh/month	108.4117	95.6672	101.2581	88.3007	85.0654	76.0891	74.7579	78.0875	79.3297	89.1187	95.5438	107.1468	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
(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	22.9740	18.4306	16.5947	12.1580	9.3912	7.6727	8.5670	11.1357	14.4641	18.9777	21.4353	23.6125	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													658.5088 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													186.5800
Water heating fuel used													1078.7765 (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)													185.4135 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)

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Total delivered energy for all uses

1922.6988 (238)

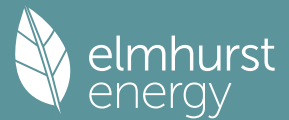
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	658.5088	0.1564	102.9785	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1078.7765	0.1411	152.1910	(264)
Space and water heating			255.1695	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	185.4135	0.1443	26.7609	(268)
Total CO2, kg/year			281.9304	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9500	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	658.5088	1.5789	1039.7508	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1078.7765	1.5217	1641.5329	(278)
Space and water heating			2681.2837	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	185.4135	1.5338	284.3933	(282)
Total Primary energy kWh/year			2965.6771	(286)
Dwelling Primary energy Rate (DPER)			41.5400	(287)

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Property Reference	Hurst 2BH SEMI 86			Issued on Date	20/08/2024
Assessment Reference	Hurst 2BH SEMI 86	Prop Type Ref	Hurst 2BH SEMI 86		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10				
SAP Rating	79 C	DER	4.99	TER	10.47
Environmental	96 A	% DER < TER			52.34
CO ₂ Emissions (t/year)	0.4	DFEE	31.30	TFEE	33.50
Compliance Check	See BREL	% DFEE < TFEE			6.55
% DPER < TPER	3.41	DPER	52.69	TPER	54.55
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)
Ground floor	43.0000 (1b)	x 2.4000 (2b)	= 103.2000 (1b) - (3b)
First floor	43.0000 (1c)	x 2.4000 (2c)	= 103.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.4000 (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	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) =	Air changes per hour 20.0000 / (5) = 0.0969 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2969 (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) = 0.2524 (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	0.3218	0.3155	0.3091	0.2776	0.2713	0.2397	0.2397	0.2334	0.2524	0.2713	0.2839	0.2965 (22b)
Effective ac	0.5518	0.5498	0.5478	0.5385	0.5368	0.5287	0.5287	0.5272	0.5318	0.5368	0.5403	0.5440 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			13.4400	1.1450	15.3893		(27)
Entrance Door			1.8900	1.2000	2.2680		(26a)
Heatloss Floor			43.0000	0.1300	5.5900		(28a)
External Wall	89.4200	15.3300	74.0900	0.1800	13.3362		(29a)
External Roof	43.0000		43.0000	0.1000	4.3000		(30)
Total net area of external elements Aum(A, m ²)			175.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8835		(33)
Party Wall			45.0700	0.0000	0.0000		(32)

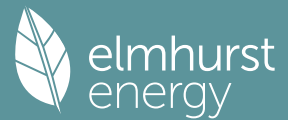
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

List of Thermal Bridges

250.0000 (35)

	Length	Psi-value	Total
K1 Element	10.1500	0.0280	0.2842
E2 Other lintels (including other steel lintels)	6.4500	0.0240	0.1548
E3 Sill	21.9000	0.0190	0.4161
E4 Jamb	18.6300	0.0460	0.8570
E5 Ground floor (normal)	9.6000	0.0370	0.3552
E16 Corner (normal)	9.3900	0.0000	0.0000
E6 Intermediate floor within a dwelling	18.6300	0.0510	0.9501
E10 Eaves (insulation at ceiling level)			

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E18 Party wall between dwellings
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss

9.3900
0.0410
0.3850
3.4024 (36)
0.0000
(33) + (36) + (36a) = 44.2859 (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	37.5819	37.4450	37.3108	36.6804	36.5625	36.0135	36.0135	35.9118	36.2250	36.5625	36.8011	37.0505 (38)
Heat transfer coeff	81.8678	81.7309	81.5967	80.9663	80.8484	80.2994	80.2994	80.1977	80.5109	80.8484	81.0870	81.3364 (39)
Average = Sum(39)m / 12 =												80.9658
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9520	0.9504	0.9488	0.9415	0.9401	0.9337	0.9337	0.9325	0.9362	0.9401	0.9429	0.9458 (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												2.5669 (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												
77.5624	76.4105	74.7883	71.7974	69.5579	67.0745	65.7332	67.3440	69.0978	71.7551	74.8076	77.3002	(42b)
Hot water usage for other uses												
40.9178	39.4299	37.9420	36.4541	34.9661	33.4782	33.4782	34.9661	36.4541	37.9420	39.4299	40.9178	(42c)
Average daily hot water use (litres/day)												109.1106 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
118.4802	115.8404	112.7303	108.2515	104.5240	100.5528	99.2114	102.3101	105.5519	109.6970	114.2375	118.2180	(44)
Energy conte	187.6437	164.9551	173.2623	148.1909	140.7094	123.6413	119.9876	126.6813	130.1560	148.8578	162.7522	185.1008 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												1811.9384
28.1466	24.7433	25.9893	22.2286	21.1064	18.5462	17.9981	19.0022	19.5234	22.3287	24.4128	27.7651	(46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6800 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.3104 (55)
Total storage loss												
40.6224	36.6912	40.6224	39.3120	40.6224	39.3120	40.6224	40.6224	39.3120	40.6224	39.3120	40.6224	(56)
If cylinder contains dedicated solar storage												
40.6224	36.6912	40.6224	39.3120	40.6224	39.3120	40.6224	40.6224	39.3120	40.6224	39.3120	40.6224	(57)
Primary loss	106.3213	96.0322	106.3213	102.8916	106.3213	36.0948	37.2980	36.0948	106.3213	102.8916	106.3213	(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												
334.5874	297.6785	320.2060	290.3945	287.6531	199.0481	197.9079	204.6016	205.5628	295.8015	304.9558	332.0445	(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												
334.5874	297.6785	320.2060	290.3945	287.6531	199.0481	197.9079	204.6016	205.5628	295.8015	304.9558	332.0445	(64)
12Total per year (kWh/year)												3270.4419 (64)
Electric shower(s)												3270 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
147.4486	131.6733	142.6668	131.5867	131.8429	69.9866	69.7342	71.9599	72.1527	134.5523	136.4284	146.6031	(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
128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
122.4055	135.5203	122.4055	126.4856	122.4055	126.4856	122.4055	122.4055	122.4055	126.4856	122.4055	126.4856	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	(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)												
-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)												
198.1836	195.9424	191.7564	182.7594	177.2082	97.2036	93.7288	96.7203	100.2121	180.8498	189.4839	197.0471	(72)
Total internal gains												
613.6162	626.8925	603.5374	585.7318	559.8309	468.6153	450.8449	451.4339	465.0601	554.5063	583.4901	602.2644	(73)

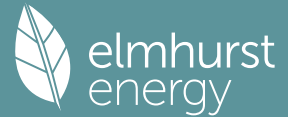
6. Solar gains

[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			
Southeast				4.7700	36.7938	0.5000	0.7000	0.7700	42.5691 (77)			
Southwest				0.6300	36.7938	0.5000	0.7000	0.7700	5.6223 (79)			
Northwest				8.0400	11.2829	0.5000	0.7000	0.7700	22.0029 (81)			
Solar gains	70.1943	126.8754	193.0091	271.6861	334.0107	344.6592	326.8516	278.3574	219.9402	145.4585	85.4076	59.2105 (83)
Total gains	683.8106	753.7678	796.5464	857.4179	893.8416	813.2745	777.6965	729.7913	685.0003	699.9648	668.8977	661.4749 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	72.9496	73.0718	73.1920	73.7618	73.8694	74.3744	74.3744	74.4687	74.1791	73.8694	73.6520	73.4262
alpha	5.8633	5.8715	5.8795	5.9175	5.9246	5.9583	5.9583	5.9646	5.9453	5.9246	5.9101	5.8951
util living area	0.9913	0.9834	0.9658	0.9059	0.7725	0.6162	0.4521	0.5012	0.7534	0.9214	0.9809	0.9928 (86)
Living	20.1086	20.2568	20.4646	20.7370	20.9204	20.9834	20.9977	20.9959	20.9489	20.7461	20.3899	20.0811
Non living	19.0959	19.2838	19.5440	19.8739	20.0697	20.1296	20.1382	20.1385	20.1032	19.8917	19.4581	19.0650
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	20.5440	20.2568	20.4646	20.7370	20.9204	20.9834	20.9977	20.9959	20.9489	20.7461	20.3899	20.2097 (87)
Th 2	20.1236	20.1249	20.1262	20.1324	20.1336	20.1389	20.1389	20.1399	20.1369	20.1336	20.1312	20.1288 (88)
util rest of house	0.9887	0.9785	0.9556	0.8794	0.7198	0.5400	0.3648	0.4098	0.6800	0.8934	0.9743	0.9906 (89)
MIT 2	19.7139	19.2838	19.5440	19.8739	20.0697	20.1296	20.1382	20.1385	20.1032	19.8917	19.4581	19.2567 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	19.9252	19.5314	19.7783	20.0936	20.2862	20.3469	20.3570	20.3567	20.3185	20.1092	19.6953	0.2545 (91)
Temperature adjustment												0.0000
adjusted MIT	19.9252	19.5314	19.7783	20.0936	20.2862	20.3469	20.3570	20.3567	20.3185	20.1092	19.6953	19.4993 (93)

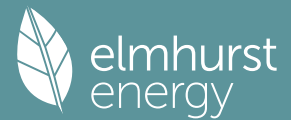
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9880	0.9743	0.9507	0.8780	0.7297	0.5589	0.3871	0.4331	0.6965	0.8925	0.9701	0.9886 (94)
Useful gains	675.6088	734.4117	757.2474	752.8521	652.2148	454.5164	301.0270	316.0679	477.0893	624.7071	648.9016	653.9082 (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	1279.1978	1195.8410	1083.4671	906.3061	694.1819	461.4735	301.6825	317.3200	500.6537	768.8021	1021.3134	1244.3877 (97)
Space heating kWh	449.0703	310.0805	242.7074	110.4869	31.2236	0.0000	0.0000	0.0000	0.0000	107.2067	268.1365	439.3167 (98a)
Space heating requirement - total per year (kWh/year)												1958.2285
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	449.0703	310.0805	242.7074	110.4869	31.2236	0.0000	0.0000	0.0000	0.0000	107.2067	268.1365	439.3167 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1958.2285
Space heating per m2										(98c) / (4) =		22.7701 (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 %)												265.0409 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	449.0703	310.0805	242.7074	110.4869	31.2236	0.0000	0.0000	0.0000	0.0000	107.2067	268.1365	439.3167 (98)
Space heating efficiency (main heating system 1)	265.0409	265.0409	265.0409	265.0409	265.0409	0.0000	0.0000	0.0000	0.0000	265.0409	265.0409	265.0409 (210)
Space heating fuel (main heating system)	169.4343	116.9935	91.5736	41.6867	11.7807	0.0000	0.0000	0.0000	0.0000	40.4491	101.1680	165.7543 (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	334.5874	297.6785	320.2060	290.3945	287.6531	199.0481	197.9079	204.6016	205.5628	295.8015	304.9558	332.0445 (64)
Efficiency of water heater	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200 (216)
Fuel for water heating, kWh/month	204.4905	181.9328	195.7010	177.4810	175.8056	121.6527	120.9558	125.0468	125.6343	180.7857	186.3805	202.9364 (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	25.4334	20.4036	18.3712	13.4595	10.3965	8.4941	9.4841	12.3278	16.0125	21.0093	23.7300	26.1403 (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												738.8401 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												163.6200
Water heating fuel used												1998.8033 (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)												205.2624 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)

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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	2942.9058 (238)

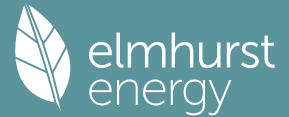
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	738.8401	0.1565	115.6591 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1998.8033	0.1422	284.1356 (264)
Space and water heating			399.7947 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	205.2624	0.1443	29.6257 (268)
Total CO2, kg/year			429.4204 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.9900 (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	738.8401	1.5795	1167.0153 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1998.8033	1.5257	3049.6180 (278)
Space and water heating			4216.6333 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	205.2624	1.5338	314.8383 (282)
Total Primary energy kWh/year			4531.4716 (286)
Dwelling Primary energy Rate (DPER)			52.6900 (287)

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Property Reference	Hurst 3BH DET 96				Issued on Date	20/08/2024	
Assessment Reference	Hurst 3BH DET 96			Prop Type Ref	Hurst 3BH DET 96		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10						
SAP Rating	78 C	DER	5.03	TER	10.80		
Environmental	96 A	% DER < TER				53.43	
CO ₂ Emissions (t/year)	0.44	DFEE	35.53	TFEE	37.38		
Compliance Check	See BREL	% DFEE < TFEE				4.96	
% DPER < TPER	6.16	DPER	52.86	TPER	56.33		
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)
Ground floor	48.0000 (1b)	x 2.4000 (2b)	= 115.2000 (1b) - (3b)
First floor	48.0000 (1c)	x 2.4000 (2c)	= 115.2000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 230.4000 (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		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1302	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3802	(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) =	0.3232	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4121	0.4040	0.3959	0.3555	0.3474	0.3070	0.3070	0.2989	0.3232	0.3474	0.3636	0.3797 (22b)
	0.5849	0.5816	0.5784	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721 (25)

3. Heat losses and heat loss parameter

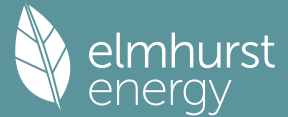
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			14.8400	1.1450	16.9924		(27)
Entrance Door			1.8900	1.2000	2.2680		(26a)
Heatloss Floor			48.0000	0.1300	6.2400		(28a)
External Wall	137.8100	16.7300	121.0800	0.1800	21.7944		(29a)
External Roof	48.0000		48.0000	0.1000	4.8000		(30)
Total net area of external elements A _{um} (A, m ²)			233.8100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.0948		(33)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.3800	0.0280	0.3186
E3 Sill	7.6800	0.0240	0.1843
E4 Jamb	24.3000	0.0190	0.4617
E5 Ground floor (normal)	28.7100	0.0460	1.3207
E16 Corner (normal)	19.2000	0.0370	0.7104
E6 Intermediate floor within a dwelling	28.7100	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	18.1400	0.0510	0.9251
E12 Gable (insulation at ceiling level)	10.5200	0.0290	0.3051

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Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss

(33) + (36) + (36a) = 56.3207 (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	44.4706	44.2199	43.9743	42.8203	42.6044	41.5994	41.5994	41.4133	41.9865	42.6044	43.0412	43.4978	(38)
Heat transfer coeff	100.7913	100.5406	100.2950	99.1410	98.9251	97.9201	97.9201	97.7340	98.3072	98.9251	99.3619	99.8185	(39)
Average = Sum(39)m / 12 =												99.1400	
HLP	1.0499	1.0473	1.0447	1.0327	1.0305	1.0200	1.0200	1.0181	1.0240	1.0305	1.0350	1.0398	(40)
HLP (average)												1.0327	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6993 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													80.1319 (42b)
Hot water usage for other uses													42.2734 (42c)
Average daily hot water use (litres/day)													112.7252 (43)
Daily hot water use													
Energy conte	122.4053	119.6780	116.4649	111.8377	107.9867	103.8839	102.4981	105.6995	109.0486	113.3311	118.0220	122.1344	(44)
Energy content (annual)	193.8600	170.4199	179.0022	153.1002	145.3709	127.7374	123.9626	130.8780	134.4679	153.7893	168.1439	191.2329	(45)
Distribution loss (46)m = 0.15 x (45)m	29.0790	25.5630	26.8503	22.9650	21.8056	19.1606	18.5944	19.6317	20.1702	23.0684	25.2216	28.6849	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6800 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.3104 (55)
Total storage loss	40.6224	36.6912	40.6224	39.3120	40.6224	39.3120	40.6224	40.6224	39.3120	40.6224	39.3120	40.6224	(56)
If cylinder contains dedicated solar storage	40.6224	36.6912	40.6224	39.3120	40.6224	39.3120	40.6224	40.6224	39.3120	40.6224	39.3120	40.6224	(57)
Primary loss	106.3213	96.0322	106.3213	102.8916	106.3213	36.0948	37.2980	37.2980	36.0948	106.3213	102.8916	106.3213	(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	340.8037	303.1432	325.9459	295.3038	292.3146	203.1442	201.8829	208.7984	209.8747	300.7330	310.3475	338.1766	(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	340.8037	303.1432	325.9459	295.3038	292.3146	203.1442	201.8829	208.7984	209.8747	300.7330	310.3475	338.1766	(64)
12Total per year (kWh/year)													3330.4686 (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	149.5155	133.4903	144.5753	133.2191	133.3929	71.3485	71.0559	73.3553	73.5864	136.1920	138.2211	148.6420	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	134.9642	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.3057	146.4813	132.3057	136.7158	132.3057	136.7158	132.3057	132.3057	136.7158	132.3057	136.7158	132.3057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.6943	252.2854	245.7560	231.8558	214.3093	197.8180	186.8008	184.2098	190.7391	204.6393	222.1859	238.6771	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	36.4964	(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)	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	-107.9713	(71)
Water heating gains (Table 5)	200.9617	198.6463	194.3216	185.0265	179.2915	99.0952	95.5053	98.5958	102.2033	183.0537	191.9738	199.7876	(72)
Total internal gains	646.4509	660.9022	635.8725	617.0874	589.3957	497.1183	478.1010	478.6005	493.1476	583.4880	614.3648	634.2597	(73)

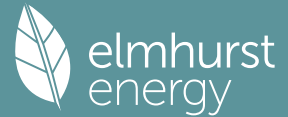
6. Solar gains

[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				5.4500	11.2829	0.5000	0.7000	0.7700	14.9149 (75)			
Southwest				8.7600	36.7938	0.5000	0.7000	0.7700	78.1773 (79)			
Northwest				0.6300	11.2829	0.5000	0.7000	0.7700	1.7241 (81)			
Solar gains	94.8163	167.0340	243.2233	325.9717	387.5749	394.6513	376.3747	328.9056	271.6417	188.5663	114.5745	80.4917 (83)
Total gains	741.2672	827.9361	879.0959	943.0591	976.9706	891.7696	854.4757	807.5062	764.7893	772.0543	728.9393	714.7514 (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)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	66.1433	66.3082	66.4706	67.2443	67.3910	68.0827	68.0827	68.2124	67.8146	67.3910	67.0948	66.7879
alpha	5.4096	5.4205	5.4314	5.4830	5.4927	5.5388	5.5388	5.5475	5.5210	5.4927	5.4730	5.4525
util living area	0.9933	0.9869	0.9733	0.9276	0.8195	0.6699	0.4985	0.5470	0.7917	0.9390	0.9855	0.9945 (86)
Living	19.9230	20.0878	20.3184	20.6294	20.8637	20.9665	20.9944	20.9910	20.9167	20.6531	20.2441	19.8991
Non living	18.7987	19.0091	19.3003	19.6858	19.9455	20.0474	20.0649	20.0651	20.0072	19.7219	19.2162	18.7744
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	20.4491	20.0878	20.3184	20.6294	20.8637	20.9665	20.9944	20.9910	20.9167	20.6531	20.2441	20.0531 (87)
Th 2	20.0419	20.0441	20.0462	20.0562	20.0580	20.0667	20.0667	20.0683	20.0634	20.0580	20.0543	20.0503 (88)
util rest of house	0.9913	0.9829	0.9647	0.9046	0.7677	0.5855	0.3958	0.4412	0.7165	0.9146	0.9802	0.9928 (89)
MIT 2	19.5463	19.0091	19.3003	19.6858	19.9455	20.0474	20.0649	20.0651	20.0072	19.7219	19.2162	19.0043 (90)
Living area fraction									fLA = Living area /	(4) =		0.1704 (91)
MIT	19.7001	19.1929	19.4738	19.8466	20.1020	20.2040	20.2233	20.2228	20.1622	19.8806	19.3913	19.1831 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7001	19.1929	19.4738	19.8466	20.1020	20.2040	20.2233	20.2228	20.1622	19.8806	19.3913	19.1831 (93)

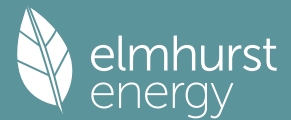
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9903	0.9780	0.9581	0.8985	0.7703	0.5986	0.4133	0.4592	0.7252	0.9090	0.9752	0.9906 (94)
Useful gains	734.0973	809.7408	842.2453	847.3364	752.6061	533.7879	353.1939	370.8122	554.6395	701.8302	710.8609	708.0334 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1552.2008	1437.0189	1301.2102	1085.2543	831.1678	548.7486	354.7937	373.6218	595.9567	918.0837	1221.2912	1495.5869 (97)
Space heating kWh	608.6690	421.5309	341.4699	171.3009	58.4499	0.0000	0.0000	0.0000	0.0000	160.8926	367.5099	585.9398 (98a)
Space heating requirement - total per year (kWh/year)												2715.7629
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	608.6690	421.5309	341.4699	171.3009	58.4499	0.0000	0.0000	0.0000	0.0000	160.8926	367.5099	585.9398 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2715.7629
Space heating per m2										(98c) / (4) =		28.2892 (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 %)												263.1443 (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	608.6690	421.5309	341.4699	171.3009	58.4499	0.0000	0.0000	0.0000	0.0000	160.8926	367.5099	585.9398 (98)
Space heating efficiency (main heating system 1)	263.1443	263.1443	263.1443	263.1443	263.1443	0.0000	0.0000	0.0000	0.0000	263.1443	263.1443	263.1443 (210)
Space heating fuel (main heating system)	231.3062	160.1900	129.7653	65.0977	22.2121	0.0000	0.0000	0.0000	0.0000	61.1424	139.6610	222.6686 (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	340.8037	303.1432	325.9459	295.3038	292.3146	203.1442	201.8829	208.7984	209.8747	300.7330	310.3475	338.1766 (64)
Efficiency of water heater (217)m	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200	163.6200 (216)
Fuel for water heating, kWh/month	208.2898	185.2727	199.2091	180.4815	178.6546	124.1561	123.3852	127.6118	128.2696	183.7996	189.6758	206.6842 (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	27.4905	22.0539	19.8571	14.5482	11.2374	9.1811	10.2511	13.3248	17.3076	22.7086	25.6493	28.2545 (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												1032.0434 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												163.6200
Water heating fuel used												2035.4899 (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)												221.8641 (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)

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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	3289.3974 (238)

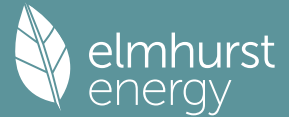
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1032.0434	0.1561	161.1275 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2035.4899	0.1421	289.3283 (264)
Space and water heating			450.4559 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	221.8641	0.1443	32.0218 (268)
Total CO2, kg/year			482.4777 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.0300 (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	1032.0434	1.5780	1628.5466 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2035.4899	1.5257	3105.5066 (278)
Space and water heating			4734.0532 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	221.8641	1.5338	340.3026 (282)
Total Primary energy kWh/year			5074.3558 (286)
Dwelling Primary energy Rate (DPER)			52.8600 (287)

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Property Reference	Hurst 3BH DET 103			Issued on Date	20/08/2024
Assessment Reference	Hurst 3BH DET 103	Prop Type Ref	Hurst 3BH DET 103		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10				
SAP Rating	77 C	DER	5.18	TER	11.88
Environmental	95 A	% DER < TER			56.40
CO ₂ Emissions (t/year)	0.49	DFEE	41.09	TFEE	43.00
Compliance Check	See BREL	% DFEE < TFEE			4.44
% DPER < TPER	12.65	DPER	54.38	TPER	62.26
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)
Ground floor	51.2500 (1b)	x 2.4000 (2b)	= 123.0000 (1b) - (3b)
First floor	51.2500 (1c)	x 2.4000 (2c)	= 123.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 246.0000 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.1220 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3720 (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) = 0.3162 (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	0.4031	0.3952	0.3873	0.3478	0.3399	0.3004	0.3004	0.2924	0.3162	0.3399	0.3557	0.3715 (22b)
Effective ac	0.5812	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows & Glazed Doors (Uw = 1.20)			14.4500	1.1450	16.5458		(27)
External Doors			5.0400	1.2000	6.0480		(26a)
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) =	61.7755		(33)

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

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	13.5000	0.0280	0.3780
E2 Other lintels (including other steel lintels)	11.1000	0.0240	0.2664
E3 Sill	34.2000	0.0190	0.6498
E4 Jamb	31.8900	0.0460	1.4669
E5 Ground floor (normal)	24.0000	0.0370	0.8880
E16 Corner (normal)	4.8000	-0.0790	-0.3792
E17 Corner (inverted - internal area greater than external area)	30.2700	0.0000	0.0000
E6 Intermediate floor within a dwelling	19.3000	0.0510	0.9843
E10 Eaves (insulation at ceiling level)			

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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) 4.5732 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 66.3487 (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 47.1855 46.9294 46.6784 45.4992 45.2786 44.2516 44.2516 44.0615 44.6472 45.2786 45.7249 46.1915 (38)
113.5343 113.2782 113.0271 111.8480 111.6274 110.6004 110.6004 110.4102 110.9960 111.6274 112.0737 112.5402 (39)
Average = Sum(39)m / 12 = 111.8469

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 1.1077 1.1052 1.1027 1.0912 1.0890 1.0790 1.0790 1.0772 1.0829 1.0890 1.0934 1.0980 (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 2.7615 (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 81.3396 80.1316 78.4305 75.2939 72.9453 70.3410 68.9343 70.6235 72.4628 75.2494 78.4506 81.0646 (42b)
Hot water usage for other uses 42.9105 41.3501 39.7897 38.2293 36.6689 35.1086 35.1086 36.6689 38.2293 39.7897 41.3501 42.9105 (42c)
Average daily hot water use (litres/day) 114.4241 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 124.2501 121.4817 118.2202 113.5232 109.6142 105.4496 104.0429 107.2925 110.6921 115.0391 119.8007 123.9751 (44)
Energy content (annual) 196.7817 172.9883 181.7000 155.4076 147.5618 129.6625 125.8308 132.8505 136.4945 156.1070 170.6781 194.1150 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1900.1778
29.5173 25.9482 27.2550 23.3111 22.1343 19.4494 18.8746 19.9276 20.4742 23.4161 25.6017 29.1173 (46)
Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.6800 (48)
Temperature factor from Table 2b 0.7800 (49)
Enter (49) or (54) in (55) 1.3104 (55)
Total storage loss
40.6224 36.6912 40.6224 39.3120 40.6224 39.3120 40.6224 40.6224 39.3120 40.6224 39.3120 40.6224 (56)
If cylinder contains dedicated solar storage
40.6224 36.6912 40.6224 39.3120 40.6224 39.3120 40.6224 40.6224 39.3120 40.6224 39.3120 40.6224 (57)
Primary loss 106.3213 96.0322 106.3213 102.8916 106.3213 36.0948 37.2980 36.0948 106.3213 102.8916 106.3213 (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
343.7254 305.7116 328.6437 297.6112 294.5055 205.0693 203.7512 210.7709 211.9013 303.0508 312.8817 341.0587 (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
343.7254 305.7116 328.6437 297.6112 294.5055 205.0693 203.7512 210.7709 211.9013 303.0508 312.8817 341.0587 (64)
Total per year (kWh/year) = Sum(64)m = 3358.6813 (64)
3359 (64)
12Total per year (kWh/year)
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month
150.4870 134.3443 145.4723 133.9863 134.1213 71.9886 71.6771 74.0112 74.2602 136.9626 139.0637 149.6003 (65)

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

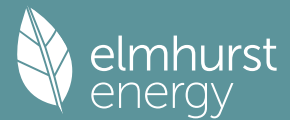
Metabolic gains (Table 5), Watts
(66)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 138.0747 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 140.6431 155.7120 140.6431 145.3312 140.6431 145.3312 140.6431 140.6431 145.3312 140.6431 145.3312 140.6431 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 260.3071 263.0083 256.2014 241.7104 223.4181 206.2259 194.7405 192.0393 198.8462 213.3372 231.6295 248.8217 (68)
Pumps, fans 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 36.8075 (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) -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 -110.4598 (71)
Total internal gains 202.2674 199.9172 195.5273 186.0921 180.2706 99.9842 96.3402 99.4774 103.1392 184.0896 193.1441 201.0757 (72)
667.6401 683.0599 656.7942 637.5561 608.7543 515.9637 496.1462 496.5822 511.7390 602.4923 634.5272 654.9629 (73)

6. Solar gains

[Jan] Area Solar flux g FF Access Gains
m2 Table 6a W/m2 Specific data or Table 6b Specific data or Table 6c factor Table 6d W
North 5.8500 10.6334 0.5000 0.7700 0.7700 15.0879 (74)
East 0.6100 19.6403 0.5000 0.7700 0.7700 2.9059 (76)
South 6.1200 46.7521 0.5000 0.7700 0.7700 69.3990 (78)
West 1.8700 19.6403 0.5000 0.7700 0.7700 8.9082 (80)
Solar gains 96.3010 165.6024 231.8357 297.8408 344.5587 347.2292 332.5924 296.7215 254.4139 184.3364 115.6052 82.2605 (83)
Total gains 763.9411 848.6623 888.6300 935.3969 953.3130 863.1930 828.7386 793.3037 766.1529 786.8287 750.1324 737.2234 (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	62.6952	62.8370	62.9765	63.6404	63.7662	64.3583	64.3583	64.4692	64.1290	63.7662	63.5123	63.2490
alpha	5.1797	5.1891	5.1984	5.2427	5.2511	5.2906	5.2906	5.2979	5.2753	5.2511	5.2342	5.2166
util living area												
	0.9946	0.9898	0.9806	0.9505	0.8736	0.7476	0.5722	0.6171	0.8405	0.9542	0.9886	0.9955 (86)
Living	19.8025	19.9627	20.1903	20.5092	20.7828	20.9337	20.9868	20.9806	20.8709	20.5662	20.1374	19.7786
Non living	18.6105	18.8156	19.1049	19.5063	19.8226	19.9778	20.0136	20.0123	19.9238	19.5818	19.0460	18.5859
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	20.3874	19.9627	20.1903	20.5092	20.7828	20.9337	20.9868	20.9806	20.8709	20.5662	20.1374	19.9495 (87)
Th 2	19.9946	19.9966	19.9986	20.0080	20.0098	20.0180	20.0180	20.0195	20.0148	20.0098	20.0062	20.0025 (88)
util rest of house												
	0.9929	0.9865	0.9739	0.9328	0.8283	0.6600	0.4522	0.4971	0.7694	0.9341	0.9843	0.9941 (89)
MIT 2	19.4428	18.8156	19.1049	19.5063	19.8226	19.9778	20.0136	20.0123	19.9238	19.5818	19.0460	18.8412 (90)
Living area fraction												
										fLA = Living area / (4) =		0.2595 (91)
MIT	19.6879	19.1133	19.3866	19.7665	20.0718	20.2259	20.2661	20.2636	20.1696	19.8373	19.3293	19.1288 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6879	19.1133	19.3866	19.7665	20.0718	20.2259	20.2661	20.2636	20.1696	19.8373	19.3293	19.1288 (93)

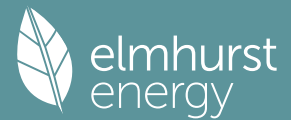
8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9922	0.9826	0.9687	0.9275	0.8315	0.6800	0.4835	0.5282	0.7821	0.9298	0.9802	0.9923 (94)
Useful gains	757.9819	833.9151	860.7759	867.5653	792.7260	586.9924	400.7057	419.0579	599.2069	731.5706	735.3047	731.5589 (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	1747.0592	1610.0538	1456.5329	1215.4005	934.5198	622.2265	405.4762	426.5782	673.6964	1031.1322	1370.5781	1680.0916 (97)
Space heating kWh	735.8735	521.5652	443.2432	250.4413	105.4946	0.0000	0.0000	0.0000	0.0000	222.8738	457.3968	705.7084 (98a)
Space heating requirement - total per year (kWh/year)												3442.5969
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	735.8735	521.5652	443.2432	250.4413	105.4946	0.0000	0.0000	0.0000	0.0000	222.8738	457.3968	705.7084 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3442.5969
Space heating per m2										(98c) / (4) =		33.5863 (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 %)												260.5299 (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	735.8735	521.5652	443.2432	250.4413	105.4946	0.0000	0.0000	0.0000	0.0000	222.8738	457.3968	705.7084 (98)
Space heating efficiency (main heating system 1)	260.5299	260.5299	260.5299	260.5299	260.5299	0.0000	0.0000	0.0000	0.0000	260.5299	260.5299	260.5299 (210)
Space heating fuel (main heating system)	282.4526	200.1939	170.1314	96.1277	40.4923	0.0000	0.0000	0.0000	0.0000	85.5463	175.5640	270.8742 (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	343.7254	305.7116	328.6437	297.6112	294.5055	205.0693	203.7512	210.7709	211.9013	303.0508	312.8817	341.0587 (64)
Efficiency of water heater (217)m	163.6949	163.6949	163.6949	163.6949	163.6949	163.6949	163.6949	163.6949	163.6949	163.6949	163.6949	163.6949 (216)
Fuel for water heating, kWh/month	209.9793	186.7570	200.7660	181.8085	179.9112	125.2754	124.4701	128.7584	129.4489	185.1315	191.1371	208.3503 (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	29.2229	23.4437	21.1084	15.4649	11.9456	9.7596	10.8971	14.1645	18.3983	24.1396	27.2656	30.0350 (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												1321.3824 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												163.6949
Water heating fuel used												2051.7937 (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)												235.8452 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)

Full SAP Calculation Printout



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	3609.0213 (238)

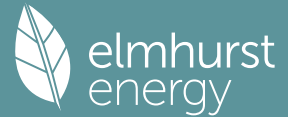
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1321.3824	0.1555	205.4891 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2051.7937	0.1421	291.6355 (264)
Space and water heating			497.1246 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	235.8452	0.1443	34.0397 (268)
Total CO2, kg/year			531.1643 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.1800 (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	1321.3824	1.5757	2082.1240 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2051.7937	1.5257	3130.3418 (278)
Space and water heating			5212.4658 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	235.8452	1.5338	361.7472 (282)
Total Primary energy kWh/year			5574.2130 (286)
Dwelling Primary energy Rate (DPER)			54.3800 (287)

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Property Reference	Hurst 4BH DET 156			Issued on Date	20/08/2024
Assessment Reference	Hurst 4BH DET 156	Prop Type Ref	Hurst 4BH DET 156		
Property	Land to the East of, Lodge Road, Hurst, Berks, RG10				
SAP Rating	81 B	DER	3.79	TER	8.93
Environmental	96 A	% DER < TER			57.56
CO ₂ Emissions (t/year)	0.55	DFEE	36.48	TFEE	37.80
Compliance Check	See BREL	% DFEE < TFEE			3.48
% DPER < TPER	15.33	DPER	39.64	TPER	46.82
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)
Ground floor	80.1800 (1b)	x 2.4000 (2b)	= 192.4320 (1b) - (3b)
First floor	78.8600 (1c)	x 2.4000 (2c)	= 189.2640 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 381.6960 (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	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) = 0.0786 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3286 (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) = 0.2793 (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	0.3561	0.3491	0.3422	0.3072	0.3003	0.2653	0.2653	0.2584	0.2793	0.3003	0.3142	0.3282 (22b)
Effective ac	0.5634	0.5609	0.5585	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows & Glazed Doors (Uw = 1.20)			20.1200	1.1450	23.0382		(27)
External Doors			4.1000	1.2000	4.9200		(26a)
Ground Floor			80.2000	0.1300	10.4260		(28a)
External Wall	188.1600	24.2200	163.9400	0.1800	29.5092		(29a)
External Roof	80.2000		80.2000	0.1000	8.0200		(30)
Total net area of external elements Aum(A, m ²)			348.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9134		(33)

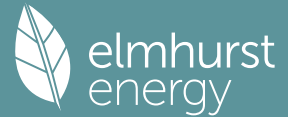
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.0500	0.0280	0.5614
E3 Sill	15.4500	0.0240	0.3708
E4 Jamb	39.9000	0.0190	0.7581
E5 Ground floor (normal)	39.2000	0.0460	1.8032
E16 Corner (normal)	28.8000	0.0370	1.0656
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0790	-0.7584
E6 Intermediate floor within a dwelling	39.2000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	30.7000	0.0510	1.5657

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E12 Gable (insulation at ceiling level) 8.5000 0.0290 0.2465
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6129 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.5263 (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
	70.9669	70.6567	70.3527	68.9248	68.6577	67.4140	67.4140	67.1837	67.8931	68.6577	69.1981	69.7631 (38)
Heat transfer coeff	152.4931	152.1830	151.8790	150.4511	150.1839	148.9403	148.9403	148.7100	149.4193	150.1839	150.7244	151.2894 (39)
Average = Sum(39)m / 12 =												150.4498
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9588	0.9569	0.9550	0.9460	0.9443	0.9365	0.9365	0.9350	0.9395	0.9443	0.9477	0.9513 (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												2.9476 (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	84.9514	83.6898	81.9131	78.6373	76.1844	73.4645	71.9953	73.7596	75.6805	78.5909	81.9342	84.6643 (42b)
Hot water usage for other uses	44.8159	43.1862	41.5566	39.9269	38.2972	36.6675	36.6675	38.2972	39.9269	41.5566	43.1862	44.8159 (42c)
Average daily hot water use (litres/day)												119.5051 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	129.7673	126.8760	123.4697	118.5642	114.4816	110.1320	108.6629	112.0568	115.6074	120.1474	125.1204	129.4801 (44)
Energy conte	205.5197	180.6698	189.7683	162.3084	154.1142	135.4202	131.4183	138.7497	142.5554	163.0389	178.2570	202.7346 (45)
Energy content (annual)										Total = Sum(45)m =		1984.5545
Distribution loss (46)m = 0.15 x (45)m	30.8280	27.1005	28.4652	24.3463	23.1171	20.3130	19.7127	20.8125	21.3833	24.4558	26.7385	30.4102 (46)
Water storage loss:												300.0000 (47)
Store volume												1.6800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												1.3104 (55)
Enter (49) or (54) in (55)												
Total storage loss	40.6224	36.6912	40.6224	39.3120	40.6224	39.3120	40.6224	40.6224	39.3120	40.6224	39.3120	40.6224 (56)
If cylinder contains dedicated solar storage	40.6224	36.6912	40.6224	39.3120	40.6224	39.3120	40.6224	40.6224	39.3120	40.6224	39.3120	40.6224 (57)
Primary loss	106.3213	96.0322	106.3213	102.8916	106.3213	36.0948	37.2980	37.2980	36.0948	106.3213	102.8916	106.3213 (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	352.4635	313.3931	336.7120	304.5120	301.0579	210.8270	209.3387	216.6700	217.9622	309.9826	320.4606	349.6783 (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	352.4635	313.3931	336.7120	304.5120	301.0579	210.8270	209.3387	216.6700	217.9622	309.9826	320.4606	349.6783 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3443.0580 (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	153.3924	136.8984	148.1550	136.2808	136.3000	73.9030	73.5350	75.9726	76.2755	139.2675	141.5837	152.4663 (65)

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

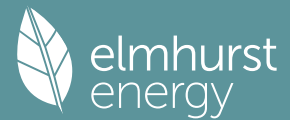
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.3777	147.3777	147.3777	147.3777	147.3777	147.3777	147.3777	147.3777	147.3777	147.3777	147.3777	147.3777 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	182.7065	202.2822	182.7065	188.7967	182.7065	188.7967	182.7065	182.7065	188.7967	182.7065	188.7967	182.7065 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.1945	333.6209	324.9865	306.6049	283.4015	261.5935	247.0245	243.5981	252.2324	270.6140	293.8175	315.6254 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7378	37.7378	37.7378	37.7378	37.7378	37.7378	37.7378	37.7378	37.7378	37.7378	37.7378	37.7378 (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)	-117.9021	-117.9021	-117.9021	-117.9021	-117.9021	-117.9021	-117.9021	-117.9021	-117.9021	-117.9021	-117.9021	-117.9021 (71)
Water heating gains (Table 5)	206.1725	203.7179	199.1331	189.2789	183.1990	102.6431	98.8373	102.1138	105.9382	187.1875	196.6441	204.9278 (72)
Total internal gains	786.2868	806.8343	774.0394	751.8939	716.5202	620.2466	595.7816	595.6316	614.1807	707.7213	746.4715	770.4731 (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	1.4200	11.2829	0.5000	0.7700		3.8861 (75)
Southeast	4.3200	36.7938	0.5000	0.7700	0.7700	38.5532 (77)
Southwest	9.7900	36.7938	0.5000	0.7700	0.7700	87.3693 (79)
Northwest	4.5900	11.2829	0.5000	0.7700	0.7700	12.5613 (81)
Solar gains	142.3699	247.9718	353.7970	462.6946	540.4574	546.3145
Total gains	928.6567	1054.8061	1127.8364	1214.5885	1256.9776	1166.5611
						522.6415
						1118.4231
						1058.7657
						391.2743
						277.9743
						171.5213
						917.9928
						121.1952 (83)
						891.6683 (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	72.4258	72.5734	72.7187	73.4089	73.5395	74.1535	74.1535	74.2683	73.9158	73.5395	73.2758	73.0021
alpha	5.8284	5.8382	5.8479	5.8939	5.9026	5.9436	5.9436	5.9512	5.9277	5.9026	5.8851	5.8668
util living area	0.9982	0.9958	0.9902	0.9674	0.8961	0.7574	0.5756	0.6282	0.8662	0.9746	0.9956	0.9986 (86)
Living	19.8689	20.0221	20.2414	20.5481	20.8107	20.9512	20.9919	20.9867	20.8878	20.5789	20.1735	19.8452
Non living	18.7865	18.9835	19.2638	19.6532	19.9617	20.1062	20.1337	20.1326	20.0513	19.6966	19.1832	18.7609
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	20.4214	20.0221	20.2414	20.5481	20.8107	20.9512	20.9919	20.9867	20.8878	20.5789	20.1735	20.0068 (87)
Th 2	20.1178	20.1194	20.1210	20.1286	20.1300	20.1366	20.1366	20.1378	20.1340	20.1300	20.1271	20.1241 (88)
util rest of house	0.9976	0.9945	0.9867	0.9552	0.8582	0.6779	0.4681	0.5195	0.8052	0.9627	0.9939	0.9981 (89)
MIT 2	19.5870	18.9835	19.2638	19.6532	19.9617	20.1062	20.1337	20.1326	20.0513	19.6966	19.1832	19.0066 (90)
Living area fraction									fLA = Living area / (4) =			0.1673 (91)
MIT	19.7266	19.1572	19.4273	19.8029	20.1037	20.2475	20.2772	20.2755	20.1912	19.8442	19.3489	19.1738 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7266	19.1572	19.4273	19.8029	20.1037	20.2475	20.2772	20.2755	20.1912	19.8442	19.3489	19.1738 (93)

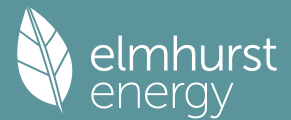
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9973	0.9923	0.9830	0.9495	0.8569	0.6889	0.4861	0.5376	0.8098	0.9576	0.9917	0.9974 (94)
Useful gains	926.1574	1046.7066	1108.6438	1153.2218	1077.0533	803.6874	543.6491	569.1804	814.2175	943.9096	910.3720	889.3880 (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	2352.4493	2169.7035	1963.3863	1640.3528	1262.0966	841.1418	547.6901	576.3215	910.1383	1388.3279	1846.2023	2265.3835 (97)
Space heating kWh	1061.1612	754.6539	635.9284	350.7344	137.6722	0.0000	0.0000	0.0000	0.0000	330.6472	673.7978	1023.7406 (98a)
Space heating requirement - total per year (kWh/year)												4968.3356
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	1061.1612	754.6539	635.9284	350.7344	137.6722	0.0000	0.0000	0.0000	0.0000	330.6472	673.7978	1023.7406 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4968.3356
Space heating per m2										(98c) / (4) =		31.2395 (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 %)												279.1773 (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	1061.1612	754.6539	635.9284	350.7344	137.6722	0.0000	0.0000	0.0000	0.0000	330.6472	673.7978	1023.7406 (98)
Space heating efficiency (main heating system 1)	279.1773	279.1773	279.1773	279.1773	279.1773	0.0000	0.0000	0.0000	0.0000	279.1773	279.1773	279.1773 (210)
Space heating fuel (main heating system)	380.1029	270.3134	227.7865	125.6314	49.3135	0.0000	0.0000	0.0000	0.0000	118.4363	241.3512	366.6990 (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	352.4635	313.3931	336.7120	304.5120	301.0579	210.8270	209.3387	216.6700	217.9622	309.9826	320.4606	349.6783 (64)
Efficiency of water heater (217)m	173.3543	173.3543	173.3543	173.3543	173.3543	173.3543	173.3543	173.3543	173.3543	173.3543	173.3543	173.3543 (216)
Fuel for water heating, kWh/month	203.3197	180.7819	194.2335	175.6588	173.6663	121.6162	120.7577	124.9868	125.7323	178.8145	184.8588	201.7131 (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	37.9628	30.4552	27.4215	20.0902	15.5182	12.6785	14.1562	18.4008	23.9008	31.3592	35.4202	39.0179 (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												1779.6343 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												173.3543
Water heating fuel used												1986.1397 (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)												306.3816 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)

Full SAP Calculation Printout



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	4072.1555 (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	1779.6343	0.1556	276.8562 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1986.1397	0.1421	282.2747 (264)
Space and water heating			559.1309 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	306.3816	0.1443	44.2203 (268)
Total CO2, kg/year			603.3513 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1779.6343	1.5759	2804.5872 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1986.1397	1.5256	3030.0663 (278)
Space and water heating			5834.6535 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	306.3816	1.5338	469.9383 (282)
Total Primary energy kWh/year			6304.5918 (286)
Dwelling Primary energy Rate (DPER)			39.6400 (287)