

Sustainability & Energy Statement

Land at Dairy Cottage, Heathlands Road, Wokingham

Prepared by Ivan Ball

Bluesky Unlimited
39 Marsh Baldon
Oxfordshire
OX44 9LP

ivan@blueskyunlimited.co.uk

2nd September 2025



Table of Contents

Executive Summary	3
1.0 Introduction	4
2.0 Planning policies	5
3.0 Assessment methodology	9
4.0 Proposal	9
5.0 Energy Efficiency	10
5.1 Demand Reduction (Be Lean)	10
• Passive design measures	
• Active design measures	
5.2 Establishing Baseline Carbon Dioxide Emissions (GAS)	13
• SAP calculations	
5.3 Low-Carbon and Renewable Technologies (Be Clean and Be Green)	15
5.4 Summary of Calculations and Proposals for Low-carbon & Renewable Technologies	19
6.0 Climate Change Adaption and Water Resources	20
• Sustainable drainage systems (SuDs)	
• Water efficiency measures	
7.0 Materials and Waste	22
 Appendix 1:	 DER Worksheets for the Modelled Units based on GAS Baseline
Appendix 2:	DER Worksheets for the Modelled Units based on Air Source Heat Pumps

Executive Summary

This Sustainability and Energy Statement has been prepared in support of a detailed planning application for the erection of five, 2, 3 and 4-bedroom detached houses on land at Dairy Cottage, Heathlands Road, Wokingham.

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

SAP calculations have been prepared for representative units, the results from which have been aggregated across similar unit types to provide an accurate assessment of the emissions from the site. The calculations have been based on the detailed planning drawings and the specification set out in the report.

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 air source heat pumps into all five houses.

All units will benefit from renewable technologies.

In order to demonstrate the reduction from the installation of air source heat pumps a further set of SAP calculations have been prepared for the modelled units but based on the installation of gas boilers. These provide a baseline against which the air source heat pump SAP calculations can be compared and hence 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 air source heat pumps can be summarised as follows;

	Total Emissions	% Reduction
	kg CO ₂ per year	
Baseline (DER emissions based on gas boilers)	9,171	
Emissions after Heat pumps (renewable technologies)	2,517	72.55%

The water efficiency measures incorporated within the houses 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 Hall Hunter Partnership and provides a Sustainability and Energy Statement has been prepared in support of a detailed planning application for the erection of five, 2, 3 and 4-bedroom detached houses on land at Dairy Cottage, Heathlands Road, Wokingham.

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

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

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

Once cost-effective structures have been designed, low-carbon and renewable technologies have been considered to provide 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 - 2024

Paragraph 161 states;

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

Local Policy

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 houses have been established using agreed building specifications and the accommodation schedule set out below.

SAP calculations have been prepared for representative houses, the results from which have been aggregated across similar units 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 proposal is for the construction of five, 2, 3 and 4-bedroom detached houses.

The accommodation schedule in details is;

Unit Type	Number	Area	Total Area
		m ²	m ²
2-Bedroom Single-storey Detached houses (Stables)	2	79.1	158.2
3-Bedroom Single-storey Detached house (Barn)	1	156.8	156.8
3-Bedroom Chalet Detached house (Cottage)	1	159.7	159.7
4-Bedroom Detached house (Farmhouse)	1	256.2	256.2
	5		730.9

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 Proposed Site Plan shows all houses with orientations towards the north and south (Plots 1, 3 and 4), east and west (Plot 2) and southwest and northeast (Plot 5).

All houses will receive direct sunlight throughout the day.

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.

The modelling has been based upon the use of traditional cavity wall construction with external walls built with 102mm facing brick (or tile-hanging on dense concrete block), 150mm fully-filled cavities and a 100mm medium dense concrete block internally.

Ground floors will be insulated with 150mm PIR insulation and roofs (cold) with 450mm of mineral wool insulation. Sloping ceiling and dormer cheeks will be insulated with at least 150mm PIR insulation.

Other constructions will meet the targeted U-values.

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

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

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m ² K	W/m ² K	
Ground Floors	0.18	0.13	28%
External Walls	0.26	0.18	31%
Roofs (lofts)	0.16	0.10	38%
Roofs (sloping)	0.16	0.15	6%
Windows	1.60	1.40	13%
External Doors	1.60	1.20	25%

'g' Value for Glazing	0.55
-----------------------	-------------

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 44% improvement over Building Regulations and will seek to achieve a permeability of 4.5 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 building 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
E10	Eaves (Ceiling)	0.051
E12	Gable (Ceiling)	0.029
E16	Corner (normal)	0.037
E17	Corner (inverted)	-0.079

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 Vaillant aroTHERM air source heat pumps installed to each house.

5.2 Establishing Baseline Carbon Dioxide Emissions - GAS

SAP calculations have been prepared for one of the 2-Bedroom single-storey houses (Stables) at 79.0 m², which are proposed as representative of both units.

SAP calculations have been prepared for the 3-Bedroom single-storey house (Barn) at 156.8 m², which are proposed as representative of both this unit and of the 3-Bedroom chalet house (Cottage) at 159.7 m². The emissions rate for the chalet unit will be slightly less than the single-storey unit and therefore the assessment represents the worst-case scenario.

SAP calculations have been prepared for the 4-Bedroom detached house (Farmhouse).

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

2-Bedroom Single-storey detached house (Stables)	CO ₂ DER
	kg/yr
Space heating	792.43
Water heating	451.39
Electricity for pumps, fans & keep-hot	11.93
Electricity for lighting	26.40
Total	1,282.15
DER Emissions Rate (kg CO₂/yr)	15.16

3-Bedroom Single-storey detached house (Barn)	CO ₂ DER
	kg/yr
Space heating	1,391.48
Water heating	495.49
Electricity for pumps, fans & keep-hot	11.93
Electricity for lighting	38.36
Total	1,937.26
DER Emissions Rate (kg CO₂/yr)	12.02

4-Bedroom Detached house (Farmhouse)	CO ₂ DER
	kg/yr
Space heating	2,075.11
Water heating	767.01
Electricity for pumps, fans & keep-hot	11.93
Electricity for lighting	55.63
Total	2,909.69
DER Emissions Rate (kg CO₂/yr)	11.59

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

	Area	CO ₂ DER
	m ²	kg/yr
2-Bedroom Single-storey detached houses (Stables)	158.2	2,398
3-Bedroom Single-storey & Chalet detached houses (Barn & Cottage)	316.5	3,804
4-Bedroom Detached house (Farmhouse)	256.2	2,969
Total		9,171

The baseline emissions from the site based on the installation of gas heating system to all units is calculated as **9,171 kg CO₂ per year**.

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 Heathlands 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.

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 could meet the requirements of the planning policy it is unlikely; they would allow the houses to achieve Building Regulation compliance using gas heating systems.

Solar hot water heating panels are therefore 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 **20 x 400W** panels would be required to reduce emissions by the 10% required by the planning policy.

The installation of panels would be required to be installed on the front elevations of Plots 1, 2, 3 and 4, which would detrimentally impact on the aesthetics of the development.

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 modelled units but with the benefit of an air source heat pump.

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

2-Bedroom Single-storey detached house (Stables)	CO ₂ DER
	kg/yr
Space heating	186.03
Water heating	201.17
Electricity for pumps, fans & keep-hot and lighting	26.40
Total	413.60
DER Emissions Rate (kg CO₂/yr)	4.89

3-Bedroom Single-storey detached house (Barn)	CO ₂ DER
	kg/yr
Space heating	289.03
Water heating	222.52
Electricity for pumps, fans & keep-hot and lighting	38.36
Total	549.90
DER Emissions Rate (kg CO₂/yr)	3.41

4-Bedroom Detached house (Farmhouse)	CO ₂ DER
	kg/yr
Space heating	348.79
Water heating	244.97
Electricity for pumps, fans & keep-hot and lighting	55.63
Total	649.39
DER Emissions Rate (kg CO₂/yr)	2.59

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

	Area	CO ₂ DER
	m ²	kg/yr
2-Bedroom Single-storey detached houses (Stables)	158.2	774
3-Bedroom Single-storey & Chalet detached houses (Barn & Cottage)	316.5	1,079
4-Bedroom Detached house (Farmhouse)	256.2	664
Total		2,517

The emissions from the site based on the installation of air source heat pumps to all units is calculated as **2,517 kg CO₂ per year**.

The reduction in emissions as a result of the installation of air source heat pumps is therefore **6,654 kg CO₂ per year**, which equates to a reduction of **72.55%**.

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 **9,171 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, are not considered appropriate the use of solar hot water heating, photovoltaic panels and air source heat pumps are considered feasible and appropriate (albeit the use of solar hot water heating and 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 44% 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 air source heat pumps into the five houses.

As a result of these installations the total emissions from the site are assessed as **2,517 kg CO₂ per year**.

The reduction in emissions from the installation of renewable technologies is therefore 6,654 kg CO₂ per year, which equates to a reduction of 72.55%.

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.

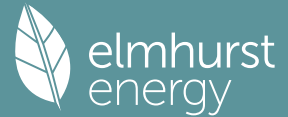
Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

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 a GAS baseline

Full SAP Calculation Printout



Property Reference	Heathlands 2B BUNG DET 79 GAS				Issued on Date	02/09/2025
Assessment Reference	Heathlands 2B BUNG DET 79 GAS	Prop Type Ref		Heathlands 2B BUNG DET 79 GAS		
Property	Land at Dairy Cottage, Heathlands Road, Wokingham, Berks					
SAP Rating	85 B	DER	15.16	TER	10.00	
Environmental	87 B	% DER < TER				-51.60
CO ₂ Emissions (t/year)	1.12	DFEE	42.11	TFEE	43.89	
Compliance Check	See BREL	% DFEE < TFEE				4.05
% DPER < TPER	-56.28	DPER	83.97	TPER	53.73	
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	84.6000 (1b)	2.4000 (2b)	203.0400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.6000		203.0400 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	203.0400 (5)

2. Ventilation rate

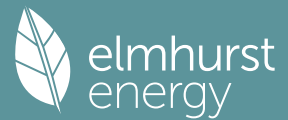
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	20.0000 / (5) = 0.0985 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3235 (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) = 0.2750 (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 infiltr rate	0.3506	0.3437	0.3368	0.3025	0.2956	0.2612	0.2612	0.2544	0.2750	0.2956	0.3093	0.3231 (22b)
Effective ac	0.5615	0.5591	0.5567	0.5457	0.5437	0.5341	0.5341	0.5323	0.5378	0.5437	0.5478	0.5522 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			18.6700	1.3258	24.7519		(27)
Entrance Doors			3.4700	1.2000	4.1640		(26a)
Ground Floor			84.6000	0.1300	10.9980		(28a)
External Wall	99.5800	22.1400	77.4400	0.1800	13.9392		(29a)
External Roof	84.6000		84.6000	0.1000	8.4600		(30)
Total net area of external elements Aum(A, m ²)			268.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.3131		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				14.0500	0.0280	0.3934	
E3 Sill				9.1000	0.0240	0.2184	
E4 Jamb				27.0000	0.0190	0.5130	
E5 Ground floor (normal)				41.4900	0.0460	1.9085	
E16 Corner (normal)				26.4000	0.0370	0.9768	
E17 Corner (inverted - internal area greater than external area)				19.2000	-0.0790	-1.5168	
E10 Eaves (insulation at ceiling level)				41.4900	0.0510	2.1160	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6093 (36)
Point Thermal bridges						(36a) =	0.0000

Full SAP Calculation Printout



Total fabric heat loss (33) + (36) + (36a) = 66.9224 (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	37.6195	37.4596	37.3029	36.5667	36.4290	35.7878	35.7878	35.6690	36.0347	36.4290	36.7076	36.9989
Heat transfer coeff	104.5420	104.3821	104.2253	103.4891	103.3514	102.7102	102.7102	102.5914	102.9572	103.3514	103.6300	103.9213
Average = Sum(39)m / 12 =												103.4885

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2357	1.2338	1.2320	1.2233	1.2216	1.2141	1.2141	1.2127	1.2170	1.2216	1.2249	1.2284
HLP (average)												1.2233
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5444 (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 77.1247 75.9793 74.3663 71.3923 69.1654 66.6960 65.3623 66.9639 68.7079 71.3501 74.3854 76.8640 (42b)

Hot water usage for other uses 40.6869 39.2074 37.7279 36.2483 34.7688 33.2893 33.2893 34.7688 36.2483 37.7279 39.2074 40.6869 (42c)

Average daily hot water use (litres/day) 108.4949 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	117.8116	115.1867	112.0942	107.6406	103.9342	99.9853	98.6516	101.7328	104.9562	109.0780	113.5928	117.5509
Energy conte	186.5848	164.0243	172.2846	147.3546	139.9154	122.9437	119.3105	125.9664	129.4216	148.0178	161.8338	184.0563
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	27.9877	24.6036	25.8427	22.1032	20.9873	18.4415	17.8966	18.8950	19.4132	22.2027	24.2751	27.6084
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
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Combi loss	2.2045	1.9767	2.1242	1.8759	1.8278	1.6472	1.5772	1.6706	1.6788	1.8652	1.9735	2.1789
Total heat required for water heating calculated for each month												
WWHRS	188.7893	166.0010	174.4088	149.2305	141.7432	124.5909	120.8877	127.6370	131.1004	149.8830	163.8073	186.2352
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	188.7893	166.0010	174.4088	149.2305	141.7432	124.5909	120.8877	127.6370	131.1004	149.8830	163.8073	186.2352
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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000
Heat gains from water heating, kWh/month	62.5906	55.0323	57.8157	49.4644	46.9788	41.2906	40.0650	42.3015	43.4524	49.6822	54.3031	61.7435

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	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.4249	127.7918	115.4249	119.2724	115.4249	119.2724	115.4249	115.4249	119.2724	115.4249	119.2724	115.4249
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.7856	231.1596	225.1770	212.4408	196.3636	181.2532	171.1586	168.7845	174.7671	187.5034	203.5806	218.6909
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000
Losses e.g. evaporation (negative values) (Table 5)	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749
Water heating gains (Table 5)	84.1271	81.8932	77.7092	68.7005	63.1436	57.3480	53.8509	56.8568	60.3505	66.7772	75.4210	82.9885
Total internal gains	492.5031	505.0103	482.4767	464.5793	439.0976	419.0392	401.5999	402.2318	415.5556	433.8710	462.4396	481.2699

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	4.6800	10.6334	0.5500	0.7000	0.7700	13.2774 (74)						
East	1.4900	19.6403	0.5500	0.7000	0.7700	7.8078 (76)						
South	8.8500	46.7521	0.5500	0.7000	0.7700	110.3921 (78)						
West	3.6500	19.6403	0.5500	0.7000	0.7700	19.1264 (80)						
Solar gains	150.6037	258.8566	360.1868	456.0946	519.6228	519.6668	499.4359	451.4936	393.3330	287.7272	180.8154	128.6070
Total gains	643.1068	763.8669	842.6635	920.6739	958.7204	938.7060	901.0358	853.7255	808.8886	721.5982	643.2550	609.8769

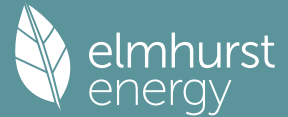
7. Mean internal temperature (heating season)

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	56.1975	56.2836	56.3683	56.7693	56.8449	57.1998	57.1998	57.2660	57.0626	56.8449	56.6921	56.5331
alpha	4.7465	4.7522	4.7579	4.7846	4.7897	4.8133	4.8133	4.8177	4.8042	4.7897	4.7795	4.7689
util living area	0.9945	0.9870	0.9715	0.9269	0.8283	0.6570	0.4924	0.5381	0.7700	0.9459	0.9881	0.9957

Full SAP Calculation Printout



MIT	19.6197	19.8435	20.1353	20.5013	20.7911	20.9492	20.9896	20.9843	20.8904	20.5093	19.9939	19.5775 (87)
Th 2	19.8915	19.8930	19.8945	19.9014	19.9027	19.9088	19.9088	19.9099	19.9064	19.9027	19.9001	19.8974 (88)
util rest of house	0.9926	0.9828	0.9620	0.9021	0.7728	0.5623	0.3750	0.4179	0.6845	0.9221	0.9835	0.9942 (89)
MIT 2	18.3040	18.5890	18.9567	19.4072	19.7312	19.8807	19.9056	19.9046	19.8356	19.4275	18.7872	18.2544 (90)
Living area fraction									fLA = Living area / (4) =			0.3015 (91)
MIT	18.7008	18.9673	19.3121	19.7371	20.0508	20.2029	20.2325	20.2302	20.1536	19.7537	19.1511	18.6533 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7008	18.9673	19.3121	19.7371	20.0508	20.2029	20.2325	20.2302	20.1536	19.7537	19.1511	18.6533 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9898	0.9780	0.9556	0.8977	0.7811	0.5892	0.4106	0.4543	0.7057	0.9181	0.9792	0.9919 (94)
Useful gains	636.5565	747.0582	805.2412	826.4457	748.8860	553.0415	369.9387	387.8414	570.8388	662.4859	629.8753	604.9256 (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	1505.4856	1468.3701	1335.3474	1121.5226	863.0665	575.4726	373.0946	392.9437	623.2637	946.0513	1248.8541	1502.0107 (97)
Space heating kWh	646.4833	484.7216	394.3991	212.4554	84.9503	0.0000	0.0000	0.0000	0.0000	210.9726	445.6647	667.4313 (98a)
Space heating requirement - total per year (kWh/year)												3147.0783
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	646.4833	484.7216	394.3991	212.4554	84.9503	0.0000	0.0000	0.0000	0.0000	210.9726	445.6647	667.4313 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3147.0783
Space heating per m2										(98c) / (4) =		37.1995 (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	646.4833	484.7216	394.3991	212.4554	84.9503	0.0000	0.0000	0.0000	0.0000	210.9726	445.6647	667.4313 (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)	775.1598	581.2010	472.9006	254.7427	101.8589	0.0000	0.0000	0.0000	0.0000	252.9648	534.3701	800.2773 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	188.7893	166.0010	174.4088	149.2305	141.7432	124.5909	120.8877	127.6370	131.1004	149.8830	163.8073	186.2352 (64)
Efficiency of water heater (217)m	86.8168	86.6172	86.2658	85.5520	84.1545	81.8000	81.8000	81.8000	81.8000	85.5335	86.5237	86.8709 (216)
Fuel for water heating, kWh/month	217.4572	191.6491	202.1760	174.4326	168.4322	152.3116	147.7845	156.0354	160.2694	175.2330	189.3208	214.3816 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	22.6672	18.1845	16.3731	11.9956	9.2658	7.5702	8.4525	10.9869	14.2710	18.7243	21.1490	23.2972 (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												3773.4751 (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												2149.4835 (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)												182.9373 (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												6191.8960 (238)

Full SAP Calculation Printout



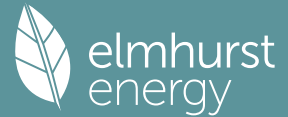
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3773.4751	0.2100	792.4298 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2149.4835	0.2100	451.3915 (264)
Space and water heating			1243.8213 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	182.9373	0.1443	26.4035 (268)
Total CO2, kg/year			1282.1541 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.1600 (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	3773.4751	1.1300	4264.0269 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2149.4835	1.1300	2428.9164 (278)
Space and water heating			6692.9432 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	182.9373	1.5338	280.5954 (282)
Total Primary energy kWh/year			7103.6394 (286)
Dwelling Primary energy Rate (DPER)			83.9700 (287)

Full SAP Calculation Printout



Property Reference	Heathlands 3B BUNG DET 157 GAS				Issued on Date	02/09/2025
Assessment Reference	Heathlands 3B BUNG DET 157 GAS	Prop Type Ref		Heathlands 3B BUNG DET 157 GAS		
Property	Land at Dairy Cottage, Heathlands Road, Wokingham, Berkshire					
SAP Rating	87 B	DER	12.02	TER	6.56	
Environmental	88 B	% DER < TER				-83.23
CO ₂ Emissions (t/year)	1.67	DFEE	39.32	TFEE	42.71	
Compliance Check	See BREL	% DFEE < TFEE				7.94
% DPER < TPER	-79.59	DPER	66.32	TPER	36.93	
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	161.2000 (1b)	2.4000 (2b)	386.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	161.2000		386.8800 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	386.8800 (5)

2. Ventilation rate

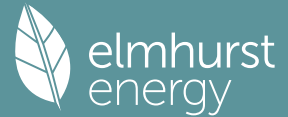
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1034 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3034 (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) = 0.2579 (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	0.3288	0.3224	0.3159	0.2837	0.2772	0.2450	0.2450	0.2385	0.2579	0.2772	0.2901	0.3030 (22b)
Effective ac	0.5541	0.5520	0.5499	0.5402	0.5384	0.5300	0.5300	0.5285	0.5333	0.5384	0.5421	0.5459 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			39.4200	1.1450	45.1374		(27)
Entrance Doors			4.4200	1.2000	5.3040		(26a)
Roof Window			9.6000	1.1450	10.9924		(27a)
Ground Floor			161.2000	0.1300	20.9560		(28a)
External Wall	139.0600	43.8400	95.2200	0.1800	17.1396		(29a)
External Roof	161.2000	9.6000	151.6000	0.1000	15.1600		(30)
Total net area of external elements Aum(A, m ²)			461.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.6894		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				24.6000	0.0280	0.6888	
E3 Sill				12.6000	0.0240	0.3024	
E4 Jamb				51.3000	0.0190	0.9747	
E5 Ground floor (normal)				57.9400	0.0460	2.6652	
E16 Corner (normal)				31.2000	0.0370	1.1544	
E17 Corner (inverted - internal area greater than external area)				21.6000	-0.0790	-1.7064	
E10 Eaves (insulation at ceiling level)				32.4800	0.0510	1.6565	
E12 Gable (insulation at ceiling level)				13.2900	0.0290	0.3854	

Full SAP Calculation Printout



E14 Flat roof
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1700 0.0410 0.4990 6.6200 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 121.3094 (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 70.7364 70.4684 70.2057 68.9720 68.7411 67.6665 67.6665 67.4675 68.0805 68.7411 69.2081 69.6963 (38)
Average = Sum(39)m / 12 = 192.0458 191.7778 191.5151 190.2813 190.0505 188.9759 188.9759 188.7769 189.3898 190.0505 190.5175 191.0057 (39)
190.2802

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 1.1914 1.1897 1.1881 1.1804 1.1790 1.1723 1.1723 1.1711 1.1749 1.1790 1.1819 1.1849 (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 2.9506 (42)
Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 85.0103 83.7478 81.9699 78.6918 76.2371 73.5154 72.0452 73.8106 75.7329 78.6453 81.9909 84.7229 (42b)
Hot water usage for other uses 44.8469 43.2161 41.5853 39.9545 38.3237 36.6929 36.6929 38.3237 39.9545 41.5853 43.2161 44.8469 (42c)
Average daily hot water use (litres/day) 30.8493 27.1192 28.4850 24.3631 23.1331 20.3271 19.7264 20.8269 21.3981 24.4728 26.7571 30.4313 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Energy conte 129.8572 126.9639 123.5552 118.6463 114.5609 110.2083 108.7381 112.1344 115.6874 120.2306 125.2071 129.5698 (44)
Energy content (annual) 205.6621 180.7949 189.8998 162.4209 154.2210 135.5140 131.5093 138.8458 142.6542 163.1519 178.3804 202.8751 (45)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1985.9292
30.8493 27.1192 28.4850 24.3631 23.1331 20.3271 19.7264 20.8269 21.3981 24.4728 26.7571 30.4313 (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 2.2069 1.9872 2.1455 1.9068 1.8672 1.6938 1.6612 1.7114 1.7127 1.8921 1.9888 2.1823 (61)
Total heat required for water heating calculated for each month
WWHRS 207.8690 182.7821 192.0453 164.3276 156.0882 137.2078 133.1705 140.5572 144.3669 165.0440 180.3693 205.0573 (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 207.8690 182.7821 192.0453 164.3276 156.0882 137.2078 133.1705 140.5572 144.3669 165.0440 180.3693 205.0573 (64)
12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2008.8852 (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 = 2009 (64)
Heat gains from water heating, kWh/month 68.9344 60.6111 63.6780 54.4816 51.7453 45.4818 44.1422 46.5941 47.8607 54.7210 59.8087 68.0015 (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 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 167.6889 185.6556 167.6889 173.2785 167.6889 173.2785 167.6889 173.2785 167.6889 173.2785 167.6889 167.6889 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 332.4620 335.9119 327.2182 308.7104 285.3477 263.3899 248.7208 245.2709 253.9646 272.4724 295.8352 317.7929 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 (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) -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 (71)
Water heating gains (Table 5) 92.6537 90.1951 85.5888 75.6689 69.5501 63.1692 59.3308 62.6264 66.4732 73.5498 83.0676 91.3999 (72)
Total internal gains 663.0634 682.0213 650.7547 627.9167 592.8454 567.0965 542.9993 542.8450 560.9751 583.9698 622.4401 647.1405 (73)

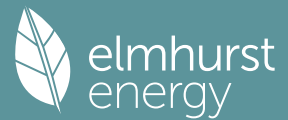
6. Solar gains

[Jan] Area Solar flux g FF Access Gains
m2 W/m2 Specific data or Table 6b Specific data or Table 6c factor Table 6d W
North 8.9100 10.6334 0.5500 0.7000 0.7700 25.2780 (74)
East 1.9800 19.6403 0.5500 0.7000 0.7700 10.3754 (76)
South 18.0000 46.7521 0.5500 0.7000 0.7700 224.5263 (78)
West 10.5300 19.6403 0.5500 0.7000 0.7700 55.1785 (80)
South 6.0000 26.0000 0.5500 0.7000 1.0000 54.0540 (82)
West 3.6000 26.0000 0.5500 0.7000 1.0000 32.4324 (82)
Solar gains 401.8447 723.8869 1081.0148 1468.2177 1745.4256 1772.7393 1692.8181 1482.8445 1216.1563 825.8272 488.8332 338.8472 (83)
Total gains 1064.9081 1405.9082 1731.7695 2096.1343 2338.2711 2339.8357 2235.8175 2025.6896 1777.1314 1409.7971 1111.2733 985.9876 (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)

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.2905	58.3720	58.4520	58.8310	58.9025	59.2374	59.2374	59.2999	59.1079	58.9025	58.7581	58.6079
alpha	4.8860	4.8915	4.8968	4.9221	4.9268	4.9492	4.9492	4.9533	4.9405	4.9268	4.9172	4.9072
util living area	0.9969	0.9883	0.9603	0.8676	0.6985	0.5072	0.3701	0.4250	0.6845	0.9373	0.9918	0.9979 (86)
MIT	19.5839	19.8788	20.2643	20.6801	20.9112	20.9849	20.9974	20.9950	20.9402	20.5666	19.9779	19.5297 (87)
Th 2	19.9269	19.9283	19.9296	19.9357	19.9369	19.9422	19.9422	19.9432	19.9402	19.9369	19.9345	19.9321 (88)
util rest of house	0.9959	0.9845	0.9478	0.8319	0.6357	0.4276	0.2821	0.3293	0.5984	0.9111	0.9886	0.9972 (89)
MIT 2	18.2834	18.6592	19.1410	19.6335	19.8698	19.9346	19.9415	19.9416	19.9039	19.5209	18.7921	18.2178 (90)
Living area fraction	18.5121	18.8736	19.3385	19.8175	20.0529	20.1192	20.1271	20.1268	20.0861	19.7048	19.0006	18.4485 (91)
MIT	18.5121	18.8736	19.3385	19.8175	20.0529	20.1192	20.1271	20.1268	20.0861	19.7048	19.0006	18.4485 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5121	18.8736	19.3385	19.8175	20.0529	20.1192	20.1271	20.1268	20.0861	19.7048	19.0006	18.4485 (93)

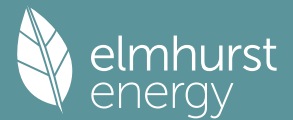
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9938	0.9793	0.9392	0.8274	0.6429	0.4412	0.2976	0.3461	0.6110	0.9040	0.9845	0.9956 (94)
Useful gains	1058.3456	1376.7693	1626.4147	1734.3117	1503.3702	1032.3117	665.3678	701.0965	1085.8486	1274.4241	1094.0173	981.6647 (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	2729.3654	2679.8250	2458.7649	2077.3919	1587.4729	1042.9994	666.5403	703.5389	1133.7063	1730.3657	2267.2652	2721.5392 (97)
Space heating kWh	1243.2387	875.6534	619.2686	247.0177	62.5724	0.0000	0.0000	0.0000	0.0000	339.2206	844.7385	1294.4666 (98a)
Space heating requirement - total per year (kWh/year)												5526.1765
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	1243.2387	875.6534	619.2686	247.0177	62.5724	0.0000	0.0000	0.0000	0.0000	339.2206	844.7385	1294.4666 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5526.1765
Space heating per m2										(98c) / (4) =		34.2815 (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	1243.2387	875.6534	619.2686	247.0177	62.5724	0.0000	0.0000	0.0000	0.0000	339.2206	844.7385	1294.4666 (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)	1490.6939	1049.9442	742.5282	296.1843	75.0268	0.0000	0.0000	0.0000	0.0000	406.7393	1012.8759	1552.1183 (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	207.8690	182.7821	192.0453	164.3276	156.0882	137.2078	133.1705	140.5572	144.3669	165.0440	180.3693	205.0573 (64)
Efficiency of water heater (217)m	87.3900	87.1852	86.7433	85.6396	83.5858	81.8000	81.8000	81.8000	81.8000	86.1256	87.1626	87.4353 (217)
Fuel for water heating, kWh/month	237.8638	209.6480	221.3949	191.8827	186.7401	167.7357	162.8001	171.8303	176.4877	191.6317	206.9343	234.5247 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	32.9308	26.4183	23.7868	17.4272	13.4613	10.9980	12.2798	15.9618	20.7328	27.2026	30.7252	33.8461 (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												6626.1109 (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												2359.4739 (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)												265.7708 (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)

Full SAP Calculation Printout



Energy used	0.0000 (237)
Total delivered energy for all uses	9337.3557 (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	6626.1109	0.2100	1391.4833 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2359.4739	0.2100	495.4895 (264)
Space and water heating			1886.9728 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	265.7708	0.1443	38.3589 (268)
Total CO2, kg/year			1937.2610 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.0200 (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	6626.1109	1.1300	7487.5053 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2359.4739	1.1300	2666.2056 (278)
Space and water heating			10153.7109 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	265.7708	1.5338	407.6481 (282)
Total Primary energy kWh/year			10691.4598 (286)
Dwelling Primary energy Rate (DPER)			66.3200 (287)

Full SAP Calculation Printout



Property Reference	Wokingham 4BH DET 251 - GAS			Issued on Date	01/02/2024
Assessment Reference	Wokingham 4BH DET 251 - GAS	Prop Type Ref	4BH DET 251 - GAS		
Property	Dairy Cottage, Heathlands Road, Wokingham, Berks, RG40 3AN				
SAP Rating	87 B	DER	11.59	TER	7.03
Environmental	87 B	% DER < TER			-64.86
CO ₂ Emissions (t/year)	2.62	DFEE	33.98	TFEE	37.25
Compliance Check	See BREL	% DFEE < TFEE			8.79
% DPER < TPER	-69.71	DPER	63.78	TPER	37.58
Assessor Details	Mr. Ivan Ball			Assessor ID	X001-7283
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	143.6000 (1b)	x 2.4000 (2b)	= 344.6400 (1b) - (3b)
First floor	107.5000 (1c)	x 2.2900 (2c)	= 246.1750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	251.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 590.8150 (5)

2. Ventilation rate

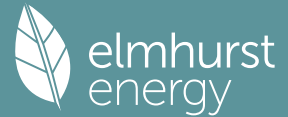
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	
Pressure test	40.0000 / (5) =	
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	4.0000 (17)	
Number of sides sheltered	0.2677 (18)	
	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	
Infiltration rate adjusted to include shelter factor	0.8500 (20)	
	(21) = (18) x (20) =	
	0.2275 (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	0.2901	0.2844	0.2787	0.2503	0.2446	0.2162	0.2162	0.2105	0.2275	0.2446	0.2560	0.2674 (22b)
	0.5421	0.5405	0.5388	0.5313	0.5299	0.5234	0.5234	0.5222	0.5259	0.5299	0.5328	0.5357 (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
Opening Type 1 (Uw = 1.20)			32.4400	1.1450	37.1450		(27)
Opening Type 2			4.2000	1.2000	5.0400		(26a)
Heatloss Floor 1			143.6500	0.1300	18.6745		(28a)
Cavity Walls	147.9000	30.4300	117.4700	0.1800	21.1446		(29a)
Low Level Walls to FF	65.9900	6.2100	59.7800	0.1500	8.9670		(29a)
Ceiling over GF	36.1500		36.1500	0.1000	3.6150		(30)
Ceiling over FF	70.3600		70.3600	0.1000	7.0360		(30)
Sloping Ceiling	41.0300		41.0300	0.1500	6.1545		(30)
Total net area of external elements Aum(A, m ²)			505.0800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	107.7766	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E5 Ground floor (normal)				57.1300	0.0460	2.6280	
E2 Other lintels (including other steel lintels)				17.9000	0.0280	0.5012	
E3 Sill				8.7000	0.0240	0.2088	
E4 Jamb				27.3000	0.0190	0.5187	
E6 Intermediate floor within a dwelling				45.1800	0.0000	0.0000	

Full SAP Calculation Printout



E10 Eaves (insulation at ceiling level)	40.3300	0.0510	2.0568
E12 Gable (insulation at ceiling level)	4.8500	0.0290	0.1406
E16 Corner (normal)	22.2000	0.0370	0.8214
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0790	-0.7584
R1 Head of roof window	5.4000	0.0240	0.1296
R2 Sill of roof window	5.4000	0.0240	0.1296
R3 Jamb of roof window	13.5000	0.0190	0.2565
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6329 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	114.4095 (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	105.6899	105.3713	105.0589	103.5920	103.3175	102.0399	102.0399	101.8033	102.5320	103.3175	103.8728	104.4532 (38)
Average = Sum(39)m / 12 =	220.0994	219.7808	219.4684	218.0015	217.7270	216.4494	216.4494	216.2128	216.9415	217.7270	218.2823	218.8627 (39)
												218.0002
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8765	0.8753	0.8740	0.8682	0.8671	0.8620	0.8620	0.8611	0.8640	0.8671	0.8693	0.8716 (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													3.0684 (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	87.2966	86.0001	84.1744	80.8081	78.2875	75.4925	73.9828	75.7957	77.7697	80.7604	84.1960	87.0015	(42b)
Hot water usage for other uses	46.0531	44.3784	42.7038	41.0291	39.3544	37.6798	37.6798	39.3544	41.0291	42.7038	44.3784	46.0531	(42c)
Average daily hot water use (litres/day)													122.8041 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	133.3497	130.3785	126.8782	121.8372	117.6419	113.1723	111.6626	115.1502	118.7988	123.4642	128.5745	133.0546	(44)
Distribution loss (46)m = 0.15 x (45)m	211.1933	185.6573	195.0070	166.7891	158.3687	139.1586	135.0462	142.5800	146.4908	167.5398	183.1779	208.3313	(45)
Water storage loss:													
Store volume	31.6790	27.8486	29.2511	25.0184	23.7553	20.8738	20.2569	21.3870	21.9736	25.1310	27.4767	31.2497	(46)
a) If manufacturer declared loss factor is known (kWh/day):													
Temperature factor from Table 2b													300.0000 (47)
Enter (49) or (54) in (55)													1.2200 (48)
Total storage loss													0.7800 (49)
If cylinder contains dedicated solar storage													0.9516 (55)
Primary loss	29.4996	26.6448	29.4996	28.5480	29.4996	28.5480	29.4996	29.4996	28.5480	29.4996	28.5480	29.4996	(56)
Combi loss	29.4996	26.6448	29.4996	28.5480	29.4996	28.5480	29.4996	29.4996	28.5480	29.4996	28.5480	29.4996	(57)
Total heat required for water heating calculated for each month	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
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	(61)
PV diverter	295.5505	261.8509	279.3642	248.4251	242.7259	190.2186	187.8082	195.3420	197.5508	251.8970	264.8139	292.6885	(62)
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	(63a)
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	(63b)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
12Total per year (kWh/year)	295.5505	261.8509	279.3642	248.4251	242.7259	190.2186	187.8082	195.3420	197.5508	251.8970	264.8139	292.6885	(64)
Electric shower(s)													
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
	114.1079	101.3701	108.7259	97.9278	96.5437	64.2798	63.5128	66.0178	66.7178	99.5930	103.3770	113.1562	(65)

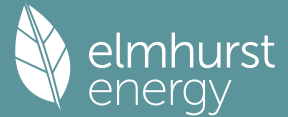
5. Internal gains (see Table 5 and 5a)

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	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.8553	254.4826	229.8553	237.5171	229.8553	237.5171	229.8553	229.8553	237.5171	229.8553	237.5171	229.8553 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	417.3408	421.6715	410.7583	387.5254	358.1980	330.6344	312.2202	307.8895	318.8027	342.0356	371.3630	398.9266 (68)
Pumps, fans	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418 (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)	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344 (71)
Total internal gains	153.3708	150.8484	146.1370	136.0108	129.7630	89.2775	85.3667	88.7336	92.6636	133.8616	143.5792	152.0917 (72)
	872.5922	899.0279	858.7759	833.0787	789.8416	726.4544	696.4675	695.5037	718.0088	777.7779	824.4848	852.8990 (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				1.0100	11.2829		0.6300		0.7000		0.7700		3.4827 (75)
East				1.4400	19.6403		0.6300		0.7000		0.7700		8.6433 (76)
Southeast				17.3700	36.7938		0.6300		0.7000		0.7700		195.3200 (77)
Southwest				1.0100	36.7938		0.6300		0.7000		0.7700		11.3571 (79)
Northwest				11.6100	11.2829		0.6300		0.7000		0.7700		40.0338 (81)
Solar gains	258.8369	457.5348	669.1234	899.5388	1070.5798	1090.2135	1039.7151	908.1541	748.4147	517.4011	313.0837	219.5181	(83)

Full SAP Calculation Printout



Total gains 1131.4291 1356.5627 1527.8994 1732.6175 1860.4214 1816.6679 1736.1826 1603.6578 1466.4235 1295.1790 1137.5685 1072.4171 (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	79.2256	79.3404	79.4533	79.9880	80.0888	80.5616	80.5616	80.6497	80.3788	80.0888	79.8851	79.6732
alpha	6.2817	6.2894	6.2969	6.3325	6.3393	6.3708	6.3708	6.3766	6.3586	6.3393	6.3257	6.3115
util living area	0.9996	0.9985	0.9949	0.9749	0.8975	0.7253	0.5431	0.6087	0.8728	0.9874	0.9987	0.9997 (86)
MIT	20.5658	20.6065	20.6652	20.7461	20.8130	20.8461	20.8527	20.8518	20.8290	20.7421	20.6392	20.5595 (87)
Th 2	20.1875	20.1886	20.1896	20.1946	20.1956	20.1999	20.1999	20.2007	20.1982	20.1956	20.1937	20.1917 (88)
util rest of house	0.9994	0.9980	0.9930	0.9654	0.8612	0.6495	0.4473	0.5089	0.8158	0.9811	0.9982	0.9996 (89)
MIT 2	19.6561	19.7092	19.7853	19.8918	19.9712	20.0075	20.0118	20.0124	19.9919	19.8887	19.7560	19.6520 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.7924	19.8436	19.9171	20.0197	20.0973	20.1331	20.1377	20.1381	20.1172	20.0165	19.8883	19.7879 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7924	19.8436	19.9171	20.0197	20.0973	20.1331	20.1377	20.1381	20.1172	20.0165	19.8883	19.7879 (93)

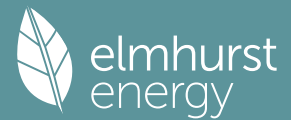
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9993	0.9977	0.9922	0.9628	0.8561	0.6427	0.4397	0.5008	0.8091	0.9793	0.9980	0.9995 (94)
Useful gains	1130.6894	1353.4965	1515.9929	1668.1978	1592.7290	1167.5373	763.4101	803.1092	1186.4306	1268.3148	1135.2608	1071.9223 (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	3409.8574	3284.3123	2944.6194	2424.1181	1828.3107	1197.6392	765.7415	808.2168	1305.3889	2050.2329	2791.4531	3411.6029 (97)
Space heating kWh	1695.7009	1297.5082	1062.8981	544.2626	175.2728	0.0000	0.0000	0.0000	0.0000	581.7471	1192.4584	1740.7223 (98a)
Space heating requirement - total per year (kWh/year)												8290.5705
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	1695.7009	1297.5082	1062.8981	544.2626	175.2728	0.0000	0.0000	0.0000	0.0000	581.7471	1192.4584	1740.7223 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8290.5705
Space heating per m2												(98c) / (4) = 33.0170 (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 %)												83.9000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1695.7009	1297.5082	1062.8981	544.2626	175.2728	0.0000	0.0000	0.0000	0.0000	581.7471	1192.4584	1740.7223 (98)
Space heating efficiency (main heating system 1)	83.9000	83.9000	83.9000	83.9000	83.9000	0.0000	0.0000	0.0000	0.0000	83.9000	83.9000	83.9000 (210)
Space heating fuel (main heating system)	2021.0976	1546.4937	1266.8631	648.7039	208.9068	0.0000	0.0000	0.0000	0.0000	693.3815	1421.2854	2074.7584 (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	295.5505	261.8509	279.3642	248.4251	242.7259	190.2186	187.8082	195.3420	197.5508	251.8970	264.8139	292.6885 (64)
Efficiency of water heater (217)m	82.4382	82.2497	81.8636	80.8687	78.4421	74.9000	74.9000	74.9000	74.9000	80.9738	82.1168	79.9000 (216)
Fuel for water heating, kWh/month	358.5118	318.3610	341.2558	307.1955	309.4330	253.9634	250.7453	260.8037	263.7528	311.0845	322.4844	354.8530 (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	47.7594	38.3144	34.4978	25.2746	19.5228	15.9503	17.8094	23.1493	30.0686	39.4517	44.5606	49.0868 (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												9881.4905 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.9000
Water heating fuel used												3652.4441 (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)

Full SAP Calculation Printout



Electricity for lighting (calculated in Appendix L)	385.4456 (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	14005.3802 (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	9881.4905	0.2100	2075.1130	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3652.4441	0.2100	767.0133	(264)
Space and water heating			2842.1263	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	385.4456	0.1443	55.6317	(268)
Total CO2, kg/year			2909.6872	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.5900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9881.4905	1.1300	11166.0842	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3652.4441	1.1300	4127.2619	(278)
Space and water heating			15293.3461	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	385.4456	1.5338	591.2093	(282)
Total Primary energy kWh/year			16014.6562	(286)
Dwelling Primary energy Rate (DPER)			63.7800	(287)

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

Full SAP Calculation Printout



Property Reference	Heathlands 2B BUNG DET 79				Issued on Date	02/09/2025	
Assessment Reference	Heathlands 2B BUNG DET 79			Prop Type Ref	Heathlands 2B BUNG DET 79		
Property	Land at Dairy Cottage, Heathlands Road, Wokingham, Berks						
SAP Rating	80 C	DER	4.89	TER	9.57		
Environmental	96 A	% DER < TER				48.90	
CO ₂ Emissions (t/year)	0.37	DFEE	42.11	TFEE	43.89		
Compliance Check	See BREL	% DFEE < TFEE				4.05	
% DPER < TPER	0.30	DPER	51.24	TPER	51.40		
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	84.6000 (1b)	2.4000 (2b)	203.0400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	203.0400 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.0985 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3235 (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) = 0.2750 (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 infiltr rate	0.3506	0.3437	0.3368	0.3025	0.2956	0.2612	0.2612	0.2544	0.2750	0.2956	0.3093	0.3231 (22b)
Effective ac	0.5615	0.5591	0.5567	0.5457	0.5437	0.5341	0.5341	0.5323	0.5378	0.5437	0.5478	0.5522 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			18.6700	1.3258	24.7519		(27)
Entrance Doors			3.4700	1.2000	4.1640		(26a)
Ground Floor			84.6000	0.1300	10.9980		(28a)
External Wall	99.5800	22.1400	77.4400	0.1800	13.9392		(29a)
External Roof	84.6000		84.6000	0.1000	8.4600		(30)
Total net area of external elements Aum(A, m ²)			268.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.3131		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				14.0500	0.0280	0.3934	
E3 Sill				9.1000	0.0240	0.2184	
E4 Jamb				27.0000	0.0190	0.5130	
E5 Ground floor (normal)				41.4900	0.0460	1.9085	
E16 Corner (normal)				26.4000	0.0370	0.9768	
E17 Corner (inverted - internal area greater than external area)				19.2000	-0.0790	-1.5168	
E10 Eaves (insulation at ceiling level)				41.4900	0.0510	2.1160	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6093 (36)
Point Thermal bridges							(36a) = 0.0000

Full SAP Calculation Printout



Total fabric heat loss (33) + (36) + (36a) = 66.9224 (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	37.6195	37.4596	37.3029	36.5667	36.4290	35.7878	35.7878	35.6690	36.0347	36.4290	36.7076	36.9989 (38)
Average = Sum(39)m / 12 =	104.5420	104.3821	104.2253	103.4891	103.3514	102.7102	102.7102	102.5914	102.9572	103.3514	103.6300	103.9213 (39)
												103.4885
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2357	1.2338	1.2320	1.2233	1.2216	1.2141	1.2141	1.2127	1.2170	1.2216	1.2249	1.2284 (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	2.5444 (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	77.1247	75.9793	74.3663	71.3923	69.1654	66.6960	65.3623	66.9639	68.7079	71.3501	74.3854	76.8640 (42b)
Hot water usage for other uses	40.6869	39.2074	37.7279	36.2483	34.7688	33.2893	33.2893	34.7688	36.2483	37.7279	39.2074	40.6869 (42c)
Average daily hot water use (litres/day)												108.4949 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	117.8116	115.1867	112.0942	107.6406	103.9342	99.9853	98.6516	101.7328	104.9562	109.0780	113.5928	117.5509 (44)
Energy content (annual)	186.5848	164.0243	172.2846	147.3546	139.9154	122.9437	119.3105	125.9664	129.4216	148.0178	161.8338	184.0563 (45)
Distribution loss (46)m = 0.15 x (45)m	27.9877	24.6036	25.8427	22.1032	20.9873	18.4415	17.8966	18.8950	19.4132	22.2027	24.2751	27.6084 (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	37.2980	33.6885	37.2980	36.0948	37.2980	36.0948	37.2980	37.2980	36.0948	37.2980	36.0948	37.2980 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.0060	223.1144	237.7058	210.6654	205.3365	186.2545	184.7317	191.3876	192.7324	213.4390	225.1446	249.4775 (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	252.0060	223.1144	237.7058	210.6654	205.3365	186.2545	184.7317	191.3876	192.7324	213.4390	225.1446	249.4775 (64)
12Total per year (kWh/year)	2571.9953 (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	114.3764	101.8102	109.6216	99.6441	98.8588	91.5274	92.0077	94.2208	93.6813	101.5529	104.4584	113.5356 (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	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186	127.2186 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.4249	127.7918	115.4249	119.2724	115.4249	119.2724	115.4249	115.4249	119.2724	115.4249	119.2724	115.4249 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.7856	231.1596	225.1770	212.4408	196.3636	181.2532	171.1586	168.7845	174.7671	187.5034	203.5806	218.6909 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219	35.7219 (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)	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749	-101.7749 (71)
Water heating gains (Table 5)	153.7317	151.5032	147.3408	138.3945	132.8747	127.1214	123.6662	126.6408	130.1129	136.4958	145.0811	152.6017 (72)
Total internal gains	559.1077	571.6203	549.1083	531.2733	505.8287	488.8126	471.4153	472.0158	485.3180	500.5896	529.0997	547.8831 (73)

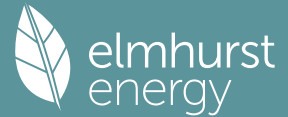
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.6800	10.6334		0.5500		0.7000		0.7700		13.2774 (74)
East				1.4900	19.6403		0.5500		0.7000		0.7700		7.8078 (76)
South				8.8500	46.7521		0.5500		0.7000		0.7700		110.3921 (78)
West				3.6500	19.6403		0.5500		0.7000		0.7700		19.1264 (80)
Solar gains	150.6037	258.8566	360.1868	456.0946	519.6228	519.6668	499.4359	451.4936	393.3330	287.7272	180.8154	128.6070	(83)
Total gains	709.7114	830.4768	909.2951	987.3679	1025.4515	1008.4793	970.8512	923.5094	878.6510	788.3168	709.9151	676.4901	(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

Full SAP Calculation Printout



tau	56.1975	56.2836	56.3683	56.7693	56.8449	57.1998	57.1998	57.2660	57.0626	56.8449	56.6921	56.5331
alpha	4.7465	4.7522	4.7579	4.7846	4.7897	4.8133	4.8133	4.8177	4.8042	4.7897	4.7795	4.7689
util living area	0.9917	0.9819	0.9625	0.9092	0.7995	0.6203	0.4591	0.5010	0.7298	0.9276	0.9825	0.9933 (86)
Living	19.6999	19.9203	20.2059	20.5567	20.8232	20.9602	20.9923	20.9884	20.9135	20.5702	20.0712	19.6584
Non living	18.4058	18.6851	19.0426	19.4693	19.7608	19.8873	19.9065	19.9061	19.8524	19.4960	18.8837	18.3572
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	20.3349	19.9203	20.2059	20.5567	20.8232	20.9602	20.9923	20.9884	20.9135	20.5702	20.0712	19.8461 (87)
Th 2	19.8915	19.8930	19.8945	19.9014	19.9027	19.9088	19.9088	19.9099	19.9064	19.9027	19.9001	19.8974 (88)
util rest of house	0.9890	0.9763	0.9505	0.8804	0.7405	0.5274	0.3486	0.3874	0.6421	0.8982	0.9759	0.9911 (89)
MIT 2	19.2992	18.6851	19.0426	19.4693	19.7608	19.8873	19.9065	19.9061	19.8524	19.4960	18.8837	18.6347 (90)
Living area fraction									fLA = Living area / (4) =			0.3015 (91)
MIT	19.6115	19.0576	19.3933	19.7972	20.0811	20.2108	20.2339	20.2324	20.1723	19.8199	19.2418	19.0000 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6115	19.0576	19.3933	19.7972	20.0811	20.2108	20.2339	20.2324	20.1723	19.8199	19.2418	19.0000 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9882	0.9706	0.9436	0.8772	0.7510	0.5542	0.3821	0.4217	0.6651	0.8955	0.9707	0.9888 (94)
Useful gains	701.3144	806.0720	858.0446	866.0947	770.0832	558.9089	370.9227	389.4596	584.3706	705.9196	689.0853	668.8813 (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	1600.6955	1477.7998	1343.8118	1127.7440	866.2020	576.2868	373.2379	393.1754	625.1919	952.8904	1258.2536	1538.0336 (97)
Space heating kWh	669.1396	451.4011	361.4108	188.3875	71.5124	0.0000	0.0000	0.0000	0.0000	183.7463	409.8012	646.6493 (98a)
Space heating requirement - total per year (kWh/year)												2982.0481
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	669.1396	451.4011	361.4108	188.3875	71.5124	0.0000	0.0000	0.0000	0.0000	183.7463	409.8012	646.6493 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2982.0481
Space heating per m2										(98c) / (4) =		35.2488 (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 %)												250.0928 (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	669.1396	451.4011	361.4108	188.3875	71.5124	0.0000	0.0000	0.0000	0.0000	183.7463	409.8012	646.6493 (98)
Space heating efficiency (main heating system 1)	250.0928	250.0928	250.0928	250.0928	250.0928	0.0000	0.0000	0.0000	0.0000	250.0928	250.0928	250.0928 (210)
Space heating fuel (main heating system)	267.5565	180.4934	144.5106	75.3270	28.5943	0.0000	0.0000	0.0000	0.0000	73.4712	163.8596	258.5637 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	252.0060	223.1144	237.7058	210.6654	205.3365	186.2545	184.7317	191.3876	192.7324	213.4390	225.1446	249.4775 (64)
Efficiency of water heater (217)m	179.8854	179.8854	179.8854	179.8854	179.8854	179.8854	179.8854	179.8854	179.8854	179.8854	179.8854	179.8854 (216)
Fuel for water heating, kWh/month	140.0926	124.0314	132.1429	117.1110	114.1486	103.5406	102.6941	106.3942	107.1418	118.6528	125.1601	138.6869 (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	22.6672	18.1845	16.3731	11.9956	9.2658	7.5702	8.4525	10.9869	14.2710	18.7243	21.1490	23.2972 (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												1192.3764 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												179.8854
Water heating fuel used												1429.7970 (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)												182.9373 (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)

Full SAP Calculation Printout



Appendix Q - special features

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2805.1107 (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	1192.3764	0.1560	186.0278 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1429.7970	0.1407	201.1658 (264)
Space and water heating			387.1935 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	182.9373	0.1443	26.4035 (268)
Total CO2, kg/year			413.5970 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8900 (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	1192.3764	1.5776	1881.0445 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1429.7970	1.5202	2173.6204 (278)
Space and water heating			4054.6649 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	182.9373	1.5338	280.5954 (282)
Total Primary energy kWh/year			4335.2602 (286)
Dwelling Primary energy Rate (DPER)			51.2400 (287)

Full SAP Calculation Printout



Property Reference	Heathlands 3B BUNG DET 157				Issued on Date	02/09/2025
Assessment Reference	Heathlands 3B BUNG DET 157	Prop Type Ref	Heathlands 3B BUNG DET 157			
Property	Land at Dairy Cottage, Heathlands Road, Wokingham, Berkshire					
SAP Rating	83 B	DER	3.41	TER	6.34	
Environmental	97 A	% DER < TER				46.21
CO ₂ Emissions (t/year)	0.49	DFEE	39.32	TFEE	42.71	
Compliance Check	See BREL	% DFEE < TFEE				7.94
% DPER < TPER	0.59	DPER	35.50	TPER	35.71	
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	161.2000 (1b)	2.4000 (2b)	386.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	161.2000		4
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	386.8800 (5)

2. Ventilation rate

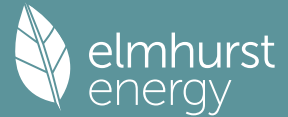
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1034 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3034 (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) = 0.2579 (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	0.3288	0.3224	0.3159	0.2837	0.2772	0.2450	0.2450	0.2385	0.2579	0.2772	0.2901	0.3030 (22b)
Effective ac	0.5541	0.5520	0.5499	0.5402	0.5384	0.5300	0.5300	0.5285	0.5333	0.5384	0.5421	0.5459 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			39.4200	1.1450	45.1374		(27)
Entrance Doors			4.4200	1.2000	5.3040		(26a)
Roof Window			9.6000	1.1450	10.9924		(27a)
Ground Floor			161.2000	0.1300	20.9560		(28a)
External Wall	139.0600	43.8400	95.2200	0.1800	17.1396		(29a)
External Roof	161.2000	9.6000	151.6000	0.1000	15.1600		(30)
Total net area of external elements Aum(A, m ²)			461.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	114.6894		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				24.6000	0.0280	0.6888	
E3 Sill				12.6000	0.0240	0.3024	
E4 Jamb				51.3000	0.0190	0.9747	
E5 Ground floor (normal)				57.9400	0.0460	2.6652	
E16 Corner (normal)				31.2000	0.0370	1.1544	
E17 Corner (inverted - internal area greater than external area)				21.6000	-0.0790	-1.7064	
E10 Eaves (insulation at ceiling level)				32.4800	0.0510	1.6565	
E12 Gable (insulation at ceiling level)				13.2900	0.0290	0.3854	

Full SAP Calculation Printout



E14 Flat roof
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss

12.1700 0.0410 0.4990
6.6200 (36)
(33) + (36) + (36a) = 0.0000
121.3094 (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 70.7364 70.4684 70.2057 68.9720 68.7411 67.6665 67.6665 67.4675 68.0805 68.7411 69.2081 69.6963 (38)
192.0458 191.7778 191.5151 190.2813 190.0505 188.9759 188.9759 188.7769 189.3898 190.0505 190.5175 191.0057 (39)
Average = Sum(39)m / 12 = 190.2802

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 1.1914 1.1897 1.1881 1.1804 1.1790 1.1723 1.1723 1.1711 1.1749 1.1790 1.1819 1.1849 (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
Hot water usage for mixer showers 2.9506 (42)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 85.0103 83.7478 81.9699 78.6918 76.2371 73.5154 72.0452 73.8106 75.7329 78.6453 81.9909 84.7229 (42b)
Hot water usage for other uses 44.8469 43.2161 41.5853 39.9545 38.3237 36.6929 36.6929 38.3237 39.9545 41.5853 43.2161 44.8469 (42c)
Average daily hot water use (litres/day) 119.5879 (43)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Daily hot water use 129.8572 126.9639 123.5552 118.6463 114.5609 110.2083 108.7381 112.1344 115.6874 120.2306 125.2071 129.5698 (44)
Energy conte 205.6621 180.7949 189.8998 162.4209 154.2210 135.5140 131.5093 138.8458 142.6542 163.1519 178.3804 202.8751 (45)
Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1985.9292
30.8493 27.1192 28.4850 24.3631 23.1331 20.3271 19.7264 20.8269 21.3981 24.4728 26.7571 30.4313 (46)

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):
Temperature factor from Table 2b 1.6800 (48)
Enter (49) or (54) in (55) 0.5400 (49)
Total storage loss 0.9072 (55)

28.1232 25.4016 28.1232 27.2160 28.1232 27.2160 28.1232 28.1232 27.2160 28.1232 27.2160 28.1232 (56)
If cylinder contains dedicated solar storage
28.1232 25.4016 28.1232 27.2160 28.1232 27.2160 28.1232 28.1232 27.2160 28.1232 27.2160 28.1232 (57)
Primary loss 37.2980 33.6885 37.2980 36.0948 37.2980 36.0948 37.2980 37.2980 36.0948 37.2980 36.0948 37.2980 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month
271.0833 239.8850 255.3209 225.7317 219.6421 198.8248 196.9305 204.2670 205.9650 228.5730 241.6912 268.2962 (62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)
PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h
271.0833 239.8850 255.3209 225.7317 219.6421 198.8248 196.9305 204.2670 205.9650 228.5730 241.6912 268.2962 (64)
Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2756.2106 (64)
2756 (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
120.7196 107.3864 115.4786 104.6536 103.6154 95.7070 96.0638 98.5032 98.0812 106.5849 109.9601 119.7929 (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
147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 147.5292 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
167.6889 185.6556 167.6889 173.2785 167.6889 173.2785 167.6889 167.6889 173.2785 167.6889 173.2785 167.6889 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
332.4620 335.9119 327.2182 308.7104 285.3477 263.3899 248.7208 245.2709 253.9646 272.4724 295.8352 317.7929 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 37.7529 (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)
-118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 -118.0234 (71)

Water heating gains (Table 5)
162.2575 159.8011 155.2132 145.3522 139.2680 132.9264 129.1180 132.3967 136.2238 143.2593 152.7224 161.0119 (72)

Total internal gains
729.6672 748.6274 717.3791 694.5999 659.5633 636.8537 612.7865 612.6153 630.7257 650.6794 689.0949 713.7525 (73)

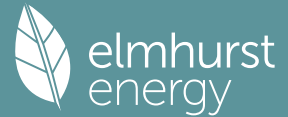
6. Solar gains

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

North 8.9100 10.6334 0.5500 0.7000 0.7700 25.2780 (74)
East 1.9800 19.6403 0.5500 0.7000 0.7700 10.3754 (76)
South 18.0000 46.7521 0.5500 0.7000 0.7700 224.5263 (78)
West 10.5300 19.6403 0.5500 0.7000 0.7700 55.1785 (80)
South 6.0000 26.0000 0.5500 0.7000 1.0000 54.0540 (82)
West 3.6000 26.0000 0.5500 0.7000 1.0000 32.4324 (82)

Solar gains 401.8447 723.8869 1081.0148 1468.2177 1745.4256 1772.7393 1692.8181 1482.8445 1216.1563 825.8272 488.8332 338.8472 (83)
Total gains 1131.5118 1472.5142 1798.3939 2162.8176 2404.9890 2409.5929 2305.6046 2095.4598 1846.8820 1476.5066 1177.9281 1052.5997 (84)

Full SAP Calculation Printout



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	58.2905	58.3720	58.4520	58.8310	58.9025	59.2374	59.2374	59.2999	59.1079	58.9025	58.7581	58.6079
alpha	4.8860	4.8915	4.8968	4.9221	4.9268	4.9492	4.9492	4.9533	4.9405	4.9268	4.9172	4.9072
util living area	0.9960	0.9858	0.9545	0.8560	0.6840	0.4935	0.3592	0.4113	0.6646	0.9269	0.9896	0.9972 (86)
Living	19.6270	19.9199	20.2997	20.7018	20.9190	20.9866	20.9977	20.9957	20.9475	20.5978	20.0198	19.5732
Non living	18.3384	18.7108	19.1835	19.6562	19.8762	19.9355	19.9416	19.9419	19.9087	19.5557	18.8449	18.2733
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	20.2976	19.9199	20.2997	20.7018	20.9190	20.9866	20.9977	20.9957	20.9475	20.5978	20.0198	19.7727 (87)
Th 2	19.9269	19.9283	19.9296	19.9357	19.9369	19.9422	19.9422	19.9432	19.9402	19.9369	19.9345	19.9321 (88)
util rest of house	0.9947	0.9813	0.9406	0.8186	0.6212	0.4157	0.2736	0.3184	0.5789	0.8977	0.9855	0.9962 (89)
MIT 2	19.2936	18.7108	19.1835	19.6562	19.8762	19.9355	19.9416	19.9419	19.9087	19.5557	18.8449	18.5722 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.4702	18.9234	19.3798	19.8400	20.0595	20.1203	20.1273	20.1271	20.0913	19.7389	19.0515	18.7833 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4702	18.9234	19.3798	19.8400	20.0595	20.1203	20.1273	20.1271	20.0913	19.7389	19.0515	18.7833 (93)

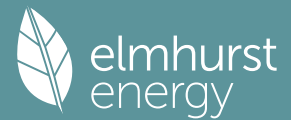
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9940	0.9755	0.9317	0.8149	0.6288	0.4290	0.2887	0.3348	0.5918	0.8910	0.9807	0.9947 (94)
Useful gains	1124.6738	1436.4763	1675.6529	1762.4030	1512.2531	1033.7417	665.5462	701.4936	1092.9589	1315.6237	1155.2207	1047.0592 (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	2913.3641	2689.3695	2466.6707	2081.6868	1588.7275	1043.1951	666.5662	703.5956	1134.6995	1736.8597	2276.9655	2785.4898 (97)
Space heating kWh	1330.7856	841.9442	588.5172	229.8844	56.8969	0.0000	0.0000	0.0000	0.0000	313.3996	807.6562	1293.3924 (98a)
Space heating requirement - total per year (kWh/year)												5462.4765
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	1330.7856	841.9442	588.5172	229.8844	56.8969	0.0000	0.0000	0.0000	0.0000	313.3996	807.6562	1293.3924 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5462.4765
Space heating per m2										(98c) / (4) =		33.8863 (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 %)												296.6710 (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	1330.7856	841.9442	588.5172	229.8844	56.8969	0.0000	0.0000	0.0000	0.0000	313.3996	807.6562	1293.3924 (98)
Space heating efficiency (main heating system 1)	296.6710	296.6710	296.6710	296.6710	296.6710	0.0000	0.0000	0.0000	0.0000	296.6710	296.6710	296.6710 (210)
Space heating fuel (main heating system)	448.5728	283.7972	198.3737	77.4880	19.1785	0.0000	0.0000	0.0000	0.0000	105.6388	272.2397	435.9685 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	271.0833	239.8850	255.3209	225.7317	219.6421	198.8248	196.9305	204.2670	205.9650	228.5730	241.6912	268.2962 (64)
Efficiency of water heater	174.3428	174.3428	174.3428	174.3428	174.3428	174.3428	174.3428	174.3428	174.3428	174.3428	174.3428	174.3428 (216)
Fuel for water heating, kWh/month	155.4886	137.5938	146.4476	129.4757	125.9829	114.0424	112.9559	117.1640	118.1379	131.1055	138.6299	153.8900 (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	32.9308	26.4183	23.7868	17.4272	13.4613	10.9980	12.2798	15.9618	20.7328	27.2026	30.7252	33.8461 (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												1841.2571 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												174.3428
Water heating fuel used												1580.9143 (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)												265.7708 (232)

Full SAP Calculation Printout



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	3687.9422 (238)

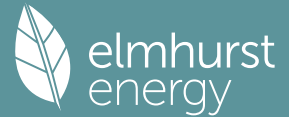
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1841.2571	0.1570	289.0264 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1580.9143	0.1408	222.5168 (264)
Space and water heating			511.5432 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	265.7708	0.1443	38.3589 (268)
Total CO2, kg/year			549.9021 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4100 (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	1841.2571	1.5811	2911.1511 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1580.9143	1.5204	2403.6892 (278)
Space and water heating			5314.8403 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	265.7708	1.5338	407.6481 (282)
Total Primary energy kWh/year			5722.4884 (286)
Dwelling Primary energy Rate (DPER)			35.5000 (287)

Full SAP Calculation Printout



Property Reference	Wokingham 4BH DET 251 - ASHP				Issued on Date	01/02/2024
Assessment Reference	Wokingham 4BH DET 251 - ASHP		Prop Type Ref	4BH DET 251 - ASHP		
Property	Dairy Cottage, Heathlands Road, Wokingham, Berks, RG40 3AN					
SAP Rating	86 B	DER	2.59	TER	7.03	
Environmental	97 A	% DER < TER				63.16
CO ₂ Emissions (t/year)	0.6	DFEE	33.98	TFEE	37.25	
Compliance Check	See BREL	% DFEE < TFEE				8.79
% DPER < TPER	28.39	DPER	26.91	TPER	37.58	
Assessor Details	Mr. Ivan Ball				Assessor ID	X001-7283
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	143.6000 (1b)	x 2.4000 (2b)	= 344.6400 (1b) - (3b)
First floor	107.5000 (1c)	x 2.2900 (2c)	= 246.1750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	251.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 590.8150 (5)

2. Ventilation rate

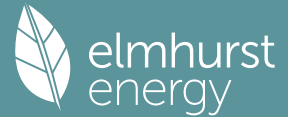
			m3 per hour
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0677	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2677	(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) =	0.2275	(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	0.2901	0.2844	0.2787	0.2503	0.2446	0.2162	0.2162	0.2105	0.2275	0.2446	0.2560	0.2674 (22b)
	0.5421	0.5405	0.5388	0.5313	0.5299	0.5234	0.5234	0.5222	0.5259	0.5299	0.5328	0.5357 (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
Opening Type 1 (Uw = 1.20)			32.4400	1.1450	37.1450		(27)
Opening Type 2			4.2000	1.2000	5.0400		(26a)
Heatloss Floor 1			143.6500	0.1300	18.6745		(28a)
Cavity Walls	147.9000	30.4300	117.4700	0.1800	21.1446		(29a)
Low Level Walls to FF	65.9900	6.2100	59.7800	0.1500	8.9670		(29a)
Ceiling over GF	36.1500		36.1500	0.1000	3.6150		(30)
Ceiling over FF	70.3600		70.3600	0.1000	7.0360		(30)
Sloping Ceiling	41.0300		41.0300	0.1500	6.1545		(30)
Total net area of external elements Aum(A, m ²)			505.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	107.7766		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E5 Ground floor (normal)				57.1300	0.0460	2.6280	
E2 Other lintels (including other steel lintels)				17.9000	0.0280	0.5012	
E3 Sill				8.7000	0.0240	0.2088	
E4 Jamb				27.3000	0.0190	0.5187	
E6 Intermediate floor within a dwelling				45.1800	0.0000	0.0000	

Full SAP Calculation Printout



E10 Eaves (insulation at ceiling level)	40.3300	0.0510	2.0568
E12 Gable (insulation at ceiling level)	4.8500	0.0290	0.1406
E16 Corner (normal)	22.2000	0.0370	0.8214
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0790	-0.7584
R1 Head of roof window	5.4000	0.0240	0.1296
R2 Sill of roof window	5.4000	0.0240	0.1296
R3 Jamb of roof window	13.5000	0.0190	0.2565
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6329 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	114.4095 (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	105.6899	105.3713	105.0589	103.5920	103.3175	102.0399	102.0399	101.8033	102.5320	103.3175	103.8728	104.4532 (38)
Average = Sum(39)m / 12 =	220.0994	219.7808	219.4684	218.0015	217.7270	216.4494	216.4494	216.2128	216.9415	217.7270	218.2823	218.8627 (39)
												218.0002
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8765	0.8753	0.8740	0.8682	0.8671	0.8620	0.8620	0.8611	0.8640	0.8671	0.8693	0.8716 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0684 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	91.8912	90.5265	88.6047	85.0612	82.4079	79.4658	77.8766	79.7850	81.8629	85.0110	88.6274	91.5805 (42b)
Hot water usage for other uses	48.4769	46.7141	44.9513	43.1885	41.4257	39.6629	39.6629	41.4257	43.1885	44.9513	46.7141	48.4769 (42c)
Average daily hot water use (litres/day)												129.2675 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	140.3681	137.2406	133.5560	128.2497	123.8336	119.1287	117.5396	121.2107	125.0514	129.9623	135.3415	140.0574 (44)
Energy content (annual)	222.3087	195.4288	205.2706	175.5675	166.7039	146.4827	142.1539	150.0842	154.2009	176.3576	192.8188	219.2961 (45)
Distribution loss (46)m = 0.15 x (45)m												2146.6736
Water storage loss:												
Store volume	33.3463	29.3143	30.7906	26.3351	25.0056	21.9724	21.3231	22.5126	23.1301	26.4536	28.9228	32.8944 (46)
a) If manufacturer declared loss factor is known (kWh/day):												300.0000 (47)
Temperature factor from Table 2b												1.2200 (48)
Enter (49) or (54) in (55)												0.7800 (49)
Total storage loss												0.9516 (55)
If cylinder contains dedicated solar storage												
Primary loss	29.4996	26.6448	29.4996	28.5480	29.4996	28.5480	29.4996	29.4996	28.5480	29.4996	28.5480	29.4996 (57)
Combi loss	29.4996	26.6448	29.4996	28.5480	29.4996	28.5480	29.4996	29.4996	28.5480	29.4996	28.5480	29.4996 (57)
Total heat required for water heating calculated for each month	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	54.8576	53.0880	54.8576	54.8576 (59)
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 (61)
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 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	306.6659	271.6224	289.6278	257.2035	251.0611	197.5427	194.9159	202.8462	205.2609	260.7148	274.4548	303.6533 (62)
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 (64)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	117.8037	104.6191	112.1385	100.8466	99.3151	66.7151	65.8761	68.5129	69.2814	102.5250	106.5827	116.8020 (65)

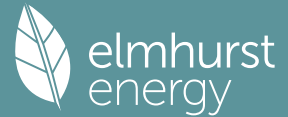
5. Internal gains (see Table 5 and 5a)

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	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180	153.4180 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.8553	254.4826	229.8553	237.5171	229.8553	237.5171	229.8553	229.8553	237.5171	229.8553	237.5171	229.8553 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	417.3408	421.6715	410.7583	387.5254	358.1980	330.6344	312.2202	307.8895	318.8027	342.0356	371.3630	398.9266 (68)
Pumps, fans	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418	38.3418 (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)	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344	-122.7344 (71)
Total internal gains	158.3384	155.6832	150.7238	140.0647	133.4881	92.6599	88.5431	92.0873	96.2241	137.8024	148.0315	156.9920 (72)
	874.5598	900.8627	860.3628	834.1326	790.5667	729.8367	699.6440	698.8574	721.5694	778.7187	825.9370	854.7993 (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				1.0100	11.2829		0.6300		0.7000		0.7700		3.4827 (75)
East				1.4400	19.6403		0.6300		0.7000		0.7700		8.6433 (76)
Southeast				17.3700	36.7938		0.6300		0.7000		0.7700		195.3200 (77)
Southwest				1.0100	36.7938		0.6300		0.7000		0.7700		11.3571 (79)
Northwest				11.6100	11.2829		0.6300		0.7000		0.7700		40.0338 (81)
Solar gains	258.8369	457.5348	669.1234	899.5388	1070.5798	1090.2135	1039.7151	908.1541	748.4147	517.4011	313.0837	219.5181	(83)

Full SAP Calculation Printout



Total gains 1133.3967 1358.3975 1529.4862 1733.6714 1861.1465 1820.0502 1739.3591 1607.0115 1469.9841 1296.1198 1139.0207 1074.3174 (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	79.2256	79.3404	79.4533	79.9880	80.0888	80.5616	80.5616	80.6497	80.3788	80.0888	79.8851	79.6732
alpha	6.2817	6.2894	6.2969	6.3325	6.3393	6.3708	6.3708	6.3766	6.3586	6.3393	6.3257	6.3115
util living area	0.9996	0.9985	0.9948	0.9748	0.8973	0.7242	0.5421	0.6075	0.8718	0.9873	0.9987	0.9997 (86)
Living	20.5661	20.6067	20.6654	20.7462	20.8131	20.8462	20.8527	20.8518	20.8292	20.7422	20.6394	20.5597
Non living	19.6564	19.7095	19.7855	19.8919	19.9712	20.0076	20.0118	20.0124	19.9920	19.8889	19.7562	19.6522
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	20.7780	20.6067	20.6654	20.7462	20.8131	20.8462	20.8527	20.8518	20.8292	20.7422	20.6394	20.6213 (87)
Th 2	20.1875	20.1886	20.1896	20.1946	20.1956	20.1999	20.1999	20.2007	20.1982	20.1956	20.1937	20.1917 (88)
util rest of house	0.9994	0.9980	0.9930	0.9653	0.8611	0.6484	0.4465	0.5079	0.8146	0.9810	0.9982	0.9996 (89)
MIT 2	19.9758	19.7095	19.7855	19.8919	19.9712	20.0076	20.0118	20.0124	19.9920	19.8889	19.7562	19.7495 (90)
Living area fraction									fLA = Living area / (4) =			0.1497 (91)
MIT	20.0959	19.8438	19.9173	20.0199	20.0973	20.1332	20.1377	20.1381	20.1174	20.0166	19.8885	19.8800 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0959	19.8438	19.9173	20.0199	20.0973	20.1332	20.1377	20.1381	20.1174	20.0166	19.8885	19.8800 (93)

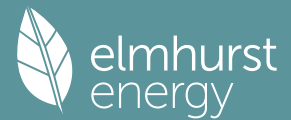
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9994	0.9977	0.9922	0.9627	0.8559	0.6416	0.4389	0.4998	0.8078	0.9792	0.9980	0.9995	(94)
Useful gains	1132.7278	1355.3042	1517.5029	1669.0387	1593.0313	1167.8129	763.4349	803.1689	1187.5117	1269.1422	1136.6936	1073.8336	(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	3476.6670	3284.3678	2944.6659	2424.1442	1828.3204	1197.6488	765.7425	808.2191	1305.4245	2050.2584	2791.4968	3431.7688	(97)
Space heating kWh	1743.8907	1296.3307	1061.8093	543.6759	175.0551	0.0000	0.0000	0.0000	0.0000	581.1505	1191.4583	1754.3038	(98a)
Space heating requirement - total per year (kWh/year)												8347.6743	
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	1743.8907	1296.3307	1061.8093	543.6759	175.0551	0.0000	0.0000	0.0000	0.0000	581.1505	1191.4583	1754.3038	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8347.6743	
Space heating per m2										(98c) / (4) =		33.2444	(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 %)												372.6813 (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	1743.8907	1296.3307	1061.8093	543.6759	175.0551	0.0000	0.0000	0.0000	0.0000	581.1505	1191.4583	1754.3038	(98)
Space heating efficiency (main heating system 1)	372.6813	372.6813	372.6813	372.6813	372.6813	0.0000	0.0000	0.0000	0.0000	372.6813	372.6813	372.6813	(210)
Space heating fuel (main heating system)	467.9308	347.8390	284.9108	145.8823	46.9718	0.0000	0.0000	0.0000	0.0000	155.9377	319.6990	470.7249	(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	306.6659	271.6224	289.6278	257.2035	251.0611	197.5427	194.9159	202.8462	205.2609	260.7148	274.4548	303.6533	(64)
Efficiency of water heater (217)m	174.3809	174.3809	174.3809	174.3809	174.3809	174.3809	174.3809	174.3809	174.3809	174.3809	174.3809	174.3809	(216)
Fuel for water heating, kWh/month	175.8598	155.7638	166.0892	147.4952	143.9728	113.2823	111.7760	116.3236	117.7083	149.5088	157.3881	174.1322	(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	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	47.7594	38.3144	34.4978	25.2746	19.5228	15.9503	17.8094	23.1493	30.0686	39.4517	44.5606	49.0868	(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												2239.8963	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												174.3809	
Water heating fuel used												1729.3002	(219)
Space cooling fuel												0.0000	(221)

Full SAP Calculation Printout



Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	385.4456 (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	4354.6420 (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	2239.8963	0.1557	348.7900 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1729.3002	0.1417	244.9673 (264)
Space and water heating			593.7572 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	385.4456	0.1443	55.6317 (268)
Total CO2, kg/year			649.3890 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.5900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2239.8963	1.5765	3531.1838 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1729.3002	1.5238	2635.1908 (278)
Space and water heating			6166.3746 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	385.4456	1.5338	591.2093 (282)
Total Primary energy kWh/year			6757.5839 (286)
Dwelling Primary energy Rate (DPER)			26.9100 (287)