

Sustainability & Energy Statement

Land adjoining 205 Henley Road, Caversham

Prepared by Ivan Ball

Bluesky Unlimited
39 Marsh Baldon
Oxfordshire
OX44 9LP

ivan@blueskyunlimited.co.uk

31st October 2025



Table of Contents

Executive Summary	3
1.0 Introduction	4
2.0 Planning policies	5
3.0 Assessment methodology	8
4.0 Proposal	8
5.0 Energy Efficiency	9
5.1 Demand Reduction (Be Lean and Be Clean)	9
• Passive design measures	
• Active design measures	
5.2 Low-Carbon and Renewable Technologies (Be Green)	12
5.3 Establishing Carbon Dioxide Emissions	15
• SAP calculations	
5.4 Summary of Calculations and Proposals for Low-carbon & Renewable Technologies	16
6.0 Climate Change Adaption and Water Resources	17
• Sustainable drainage systems (SuDs)	
• Water efficiency measures	
7.0 Materials and Waste	19

Appendix 1: TER and DER Worksheets for the Proposed House

Appendix 2: Side Elevation showing the Indicative Location of Photovoltaic Panels

Executive Summary

This Sustainability and Energy Statement has been prepared in support of a detailed planning application for the erection of a dwelling to adjoin no. 205 Henley Road, Caversham with associated parking, amenity space, and use of existing site access.

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

SAP calculations have been prepared for the house based on Part L (2021) of the Building Regulations and have used the construction specification set out in the Statement and the detailed planning drawings.

The fabric insulation standards and the construction specification of the house exceed the minimum required by the Building Regulations and represent current good practice standards.

It is proposed to install an air source heat pump into the house. All space heating and hot water will be provided from renewable technologies and there will be no on-site CO₂ or NO_x emissions.

In addition, the roof of the house includes the installation of photovoltaic panels and the Side Elevation attached as Appendix 2 show the indicative location of 8 x 400W panels (3.2 kW).

The TER and DER Worksheets for the house are attached as Appendix 1 but the total reduction in site carbon dioxide emissions can be summarised as follows;

	Total Emissions	% Reduction
	kg CO ₂ per year	
Baseline (Building Regulations TER)	1,221	
Be Green - after efficiency, Heat Pumps & PV panels (DER)	177	85.50%

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

The key sustainability findings can be summarised as;

- ❖ Reduction in carbon dioxide emissions compared to the maximum permissible by the Building Regulations (Part L - 2021) through energy efficiency measures;
- ❖ A total reduction in (TER) carbon dioxide emissions of at least 85% from energy efficiency, low-carbon and renewable technologies will be achieved (based on Part L – 2021);
- ❖ The water use will achieve a standard of 110 litres per person per day;
- ❖ Secured by Design principles will be followed;
- ❖ The house will be provided with an EV charging point.

1.0 Introduction

This report has been commissioned by Solve Planning and provides a Sustainability and Energy Statement in support of a detailed planning application for the erection of a dwelling to adjoin no. 205 Henley Road, Caversham with associated parking, amenity space, and use of existing site access.

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

The house has 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 house 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 a cost-effective structure has been designed, low-carbon and renewable technologies have been considered to provide heat and/or electricity.

The following hierarchy has been followed:

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

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

2.0 Planning Policy Context

National Policy

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

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

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

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

- National Planning Policy Framework – December 2024

Paragraph 161 states;

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

Local Policy

The local planning policies are set out in the **Reading Borough Local Plan**, which was adopted in November 2019. Of particular relevance to the subject area of this Statement are the following policies;

CC2: Sustainable Design and Construction

Proposals for new development, including the construction of new buildings and the redevelopment and refurbishment of existing building stock, will be acceptable where the design of buildings and site layouts use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and take account of the effects of climate change.

To meet these requirements:

- *All major non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Excellent' standards, where possible;*
- *All minor non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Very Good' standard as a minimum;*
- *All non-residential development or conversions to residential should incorporate water conservation measures so that predicted per capita consumption does not exceed the appropriate levels set out in the applicable BREEAM standard. Both residential and non-residential development should include recycling greywater and rainwater harvesting where systems are energy and cost effective.*

CC3: Adaptation to Climate Change

All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development:

- *Wherever possible, new buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements;*
- *Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example by including measures such as solar shading, thermal mass, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, green walls, etc;*
- *Use of trees and other planting, where appropriate as part of a landscape scheme, to provide shading of amenity areas, buildings and streets and to help to connect habitat, designed with native plants that are carefully selected, managed and adaptable to meet the predicted changed climatic conditions; and*
- *All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change.*

CC4: Decentralised Energy

- *In meeting the sustainability requirements of this plan, developments of the sizes set out below shall demonstrate how consideration has been given to securing energy for the development from a decentralised energy source.*
- *Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq m shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.*
- *Where there is existing decentralised energy provision present within the vicinity of an application site, further developments of 10 dwellings or more or non-residential development of 1,000 sq m or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.*

CC5: Waste Minimisation and Storage

Development should demonstrate measures to minimise the generation of waste in the construction, use and life of buildings and promote more sustainable approaches to waste management, including the reuse and recycling of construction waste and the promotion of layouts and designs that provide adequate, well-designed space to facilitate waste storage, reuse, recycling and composting.

In addition to the Local Plan the Council have published further guidance within the **Sustainable Design and Construction Supplementary Planning Document**, which was adopted in December 2019.

The SPD sets out the Councils requirement that all residential developments of 10 units or more should achieve 'zero carbon' with a preference for the reduction to be achieved on site but if it is not feasible then at least 35% should be achieved on site with the balance offset using a carbon offset payment system.

3.0 Assessment Methodology

SAP calculations have been prepared for the house, which provide an accurate assessment of the emissions from the building. These have been based on agreed building specifications and the detailed planning drawings for the dwelling.

Emission Factors

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

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

4.0 Proposal

The proposal is for the construction of a single 4-Bedroom end-terrace house arranged over 2½-storeys.

The proposed accommodation schedule can be expressed as:

Unit Type	Number	Area
		m ²
4-Bedroom 2½-storey End-terrace house	1	119.7
Total	1	119.7

5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean and Be Clean)

Design

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

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

Passive Design Measures

The passive design measures proposed include;

(i) Passive Solar Gain

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

The Site Layout positions the house in context with surrounding development but provides it with orientations towards the northwest (toward Henley Road) and the southeast (rear elevation) as well as providing secondary openings on the southwest elevation. The house will enjoy access to direct sunlight throughout the day and the window openings provide for cross ventilation to reduce summer overheating.

(ii) 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.

(iii) Efficient Building Fabric

a. Building Envelope

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

It is assumed the house will be built using traditional load bearing cavity wall construction with the ground and exposed floor insulated with 150mm PIR insulation or similar.

The modelling has been based upon the use of 350mm external walls built with 102mm facing brickwork, fully filled 150mm cavities with 100mm medium density concrete block internally.

Roofs (lofts) will be insulated with 450mm of mineral wool insulation and sloping ceilings and dormer windows will be insulated with 100mm of PIR insulation between rafters and 50mm underneath.

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 Floor	0.18	0.11	39%
External Walls	0.26	0.18	31%
Low Level Walls to the 2 nd Floor	0.26	0.15	42%
Roofs (cold)	0.16	0.10	38%
Sloping Roofs & Dormers	0.16	0.15	6%
Windows and Glazed Doors	1.60	1.20	25%
External Doors	1.60	1.20	25%

'g' Value for Glazing	0.5
-----------------------	------------

b. Air Leakage

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

The Building Regulations set a minimum standard for air permeability of 8 m³ of air per hour per m² of envelope area, at 50Pa. The SAP modelling has been based on achieving a 50% improvement over Building Regulations and will target a permeability of 4.0 m³/hr/m² for the house.

c. Thermal Bridging

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

The thermal details for the house will be modelled at the detailed working drawing stage but for the purposes of this assessment the thermal details formulated by the Recognised Construction Details have been used. Any details not available on the RCD website will be modelled. These will enable the buildings to achieve the higher energy efficiency requirements of the Building Regulations.

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

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

d. Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2021 to address the possibility of overheating and poor air quality. The ventilation to the En-Suites and Bathrooms will be comprised of continuous extract ventilation as per System 3 criteria. This will reduce the number of external penetrations required to the building envelope.

Active Design Measures will include;

(i) Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

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

(ii) Space Heating and Hot Water

The SAP modelling has been based upon the installation of an air source heat pump.

5.2 Low-Carbon and Renewable Technologies (Be Green)

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

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

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

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

Wind

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

The Government wind speed database predicts local wind speeds at Henley Road to be 4.8 m/s at 10m above ground level and 5.6 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

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

The use of wind turbines is not proposed.

Combined Heat and Power and Community Heating

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

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

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

CHP is not proposed.

Ground Source Heat Pumps (GSHP)

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 house has a private garden space it is unlikely there will be sufficient ground area to sustain a horizontal collection system for a GSHP and the installation is likely to require one or more bore holes.

This would be cost prohibitive and therefore the use of a ground source heat pump is not proposed at this stage.

Solar

(i) Solar Water Heating

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

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

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

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

Solar hot water panels could be used to reduce emissions but the incremental increase in the reduction of CO₂ does not represent good value when compared with other technologies.

Solar hot water heating panels are not proposed.

(ii) Photovoltaics

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

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

The installation of photovoltaic panels is appropriate and the Side Elevation attached as Appendix 2 demonstrates a total of eight panels could be installed without detrimentally impacting on the aesthetics of the proposal. The panels are assumed to have an output of 400W each (3.2 kW) and the array reduces emissions by a total of 266 kg CO₂ per year.

Air Source Heat Pumps (ASHP)

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

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

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

The SAP modelling has been based on the installation of an air source heat pump.

5.3 Establishing Carbon Dioxide Emissions

SAP calculations have been prepared for the house based on the specification set out above and using the detailed planning drawings.

The TER and DER Worksheets are attached as Appendix 1 but the emissions can be summarised as follows;

4-Bedroom 2½-storey End-terrace house	CO ₂ TER	CO ₂ DER
	kg/yr	kg/yr
Space heating	820.36	186.95
Hot water	639.97	220.09
Pumps, fans and electric keep-hot & Lighting	48.08	36.15
Energy saving/ generation technologies	-287.07	-265.88
Total Emissions	1,221.35	177.30
Emissions Rate (kg/m²/yr)	10.20	1.48

Summary

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

- 1,221 kg CO₂ per year

With total actual site emissions (DER) assessed as:

- 177 kg CO₂ per year

The site carbon dioxide emissions are reduced by 1,044 kg CO₂ per year as a result of the energy efficiency measures and renewable technologies, which equates to a reduction of 85.50% of the TER emissions.

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

The application seeks consent for the construction of a single 4-Bedroom 2½-storey end-terrace house.

SAP calculations have been prepared for the dwelling using the specification set out above and based on the detailed planning drawings.

Various technologies have been considered above and whilst wind turbines, combined heat and power, a ground source heat pump and solar hot water heating panels are not considered appropriate the use of photovoltaic panels and an air source heat pumps are considered appropriate and feasible.

Be Lean

The construction standards for the fabric of the house proposes U-values, which demonstrate good practice and improve upon those required by the Building Regulations. Air tightness standards are targeted at a 50% improvement upon the minimum required by the Building Regulations. In addition, it is proposed to install energy efficiency mechanical and electrical services.

Be Clean and Be Green

As a result of the energy efficiency measures incorporated into the fabric specification of the house, the installation of an air source heat pump and the installation of a photovoltaic array of 3.2 kW on the southwest orientated roof of the house the total emissions based upon the maximum permissible by the Building Regulations (TER) are calculated as **1,221 kg CO₂ per year**, with actual (DER) emissions after energy efficiency measures and the installation of renewable technologies of **177 kg CO₂ per year**.

The emissions are reduced by a total of **1,044 kg CO₂ per year**, which equates to a reduction of **85.50%**.

The space heating and hot water to the house will be provided from renewable technologies.

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

The proposal meets the requirements of the adopted 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

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 110 litres per person per day is achieved.

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

The following devices will be incorporated within the house:

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

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

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

7.0 Materials and Waste

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

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

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

All insulation materials to will have a zero ozone depleting potential

Construction waste

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

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

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

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

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

Appendix 1 – TER and DER Worksheets for the Proposed House

Full SAP Calculation Printout



Property Reference	Caversham 4BH END 120				Issued on Date	03/11/2025
Assessment Reference	Caversham 4BH END 120	Prop Type Ref	Caversham 4BH END 120			
Property	205, Henley Road, Caversham, Berkshire					
SAP Rating	91 B	DER	1.48	TER	10.20	
Environmental	99 A	% DER < TER				85.49
CO ₂ Emissions (t/year)	0.12	DFEE	33.02	TFEE	35.46	
Compliance Check	See BREL	% DFEE < TFEE				6.89
% DPER < TPER	58.89	DPER	21.90	TPER	53.26	
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	44.8700 (1b)	x 2.5000 (2b)	= 112.1750 (1b) - (3b)
First floor	43.1900 (1c)	x 2.5000 (2c)	= 107.9750 (1c) - (3c)
Second floor	31.6300 (1d)	x 2.1900 (2d)	= 69.2697 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4197 (5)

2. Ventilation rate

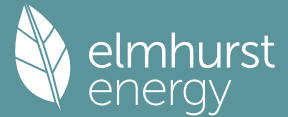
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1382 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3382 (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) = 0.2875 (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	0.3665	0.3593	0.3522	0.3162	0.3090	0.2731	0.2731	0.2659	0.2875	0.3090	0.3234	0.3378 (22b)
Effective ac	0.5672	0.5646	0.5620	0.5500	0.5478	0.5373	0.5373	0.5354	0.5413	0.5478	0.5523	0.5570 (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			19.4900	1.1450	22.3168		(27)
External Doors			2.2100	1.2000	2.6520		(26a)
Ground Floor			36.1100	0.1100	3.9721		(28a)
Exposed Floor			8.7600	0.1100	0.9636		(28b)
External Wall	120.7800	21.7000	99.0800	0.1800	17.8344		(29a)
Low Level Walls	25.3500		25.3500	0.1500	3.8025		(29a)
Roof to GF Bay	1.6800		1.6800	0.1000	0.1680		(30)
Roof over FF	11.5600		11.5600	0.1000	1.1560		(30)
Roof over SF	16.1600		16.1600	0.1000	1.6160		(30)
Sloping Ceiling	21.6600		21.6600	0.1500	3.2490		(30)
Total net area of external elements A _{um} (A, m ²)			242.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.7304		(33)
Main dwelling							
Party Wall			41.1000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

Full SAP Calculation Printout



E2 Other lintels (including other steel lintels)													17.0500	0.0280	0.4774
E3 Sill													14.5000	0.0240	0.3480
E4 Jamb													30.0000	0.0190	0.5700
E5 Ground floor (normal)													20.9300	0.0460	0.9628
E16 Corner (normal)													36.0000	0.0370	1.3320
E6 Intermediate floor within a dwelling													28.5800	0.0000	0.0000
E10 Eaves (insulation at ceiling level)													15.3600	0.0510	0.7834
E12 Gable (insulation at ceiling level)													2.7000	0.0290	0.0783
E18 Party wall between dwellings													10.0000	0.0410	0.4100
E11 Eaves (insulation at rafter level)													5.6600	0.0180	0.1019
E14 Flat roof													3.6000	0.0410	0.1476
E17 Corner (inverted - internal area greater than external area)													8.0000	-0.0790	-0.6320
Thermal bridges (Sum(L x Psi) calculated using Appendix K)															4.5793 (36)
Point Thermal bridges															0.0000
Total fabric heat loss														(33) + (36) + (36a) =	62.3097 (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	54.1698	53.9207	53.6765	52.5296	52.3150	51.3160	51.3160	51.1310	51.7008	52.3150	52.7491	53.2029	(38)		
Average = Sum(39)m / 12 =	116.4796	116.2304	115.9862	114.8393	114.6247	113.6257	113.6257	113.4407	114.0105	114.6247	115.0588	115.5127	(39)		
	116.4796	116.2304	115.9862	114.8393	114.6247	113.6257	113.6257	113.4407	114.0105	114.6247	115.0588	115.5127	(39)		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
HLP (average)	0.9732	0.9711	0.9691	0.9595	0.9577	0.9493	0.9493	0.9478	0.9525	0.9577	0.9613	0.9651	(40)		
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31			
	31	28	31	30	31	30	31	31	30	31	30	31			

4. Water heating energy requirements (kWh/year)															

Assumed occupancy															2.8621 (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															
	83.2928	82.0557	80.3138	77.1019	74.6969	72.0301	70.5896	72.3194	74.2028	77.0564	80.3344	83.0112	(42b)		
Hot water usage for other uses															
	43.9409	42.3430	40.7452	39.1473	37.5495	35.9516	35.9516	37.5495	39.1473	40.7452	42.3430	43.9409	(42c)		
Average daily hot water use (litres/day)															117.1717 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Energy conte	127.2336	124.3988	121.0589	116.2492	112.2463	107.9817	106.5412	109.8688	113.3501	117.8015	122.6774	126.9520	(44)		
Energy content (annual)	201.5069	177.1422	186.0631	159.1393	151.1051	132.7761	128.8524	136.0406	139.7720	159.8556	174.7765	198.7762	(45)		
Distribution loss (46)m = 0.15 x (45)m															
	30.2260	26.5713	27.9095	23.8709	22.6658	19.9164	19.3279	20.4061	20.9658	23.9783	26.2165	29.8164	(46)		
Water storage loss:															
Store volume															200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):															1.6800 (48)
Temperature factor from Table 2b															0.5400 (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															
	266.9281	236.2322	251.4842	222.4501	216.5263	196.0869	194.2735	201.4617	203.0828	225.2767	238.0873	264.1974	(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															
	266.9281	236.2322	251.4842	222.4501	216.5263	196.0869	194.2735	201.4617	203.0828	225.2767	238.0873	264.1974	(64)		
12Total per year (kWh/year)															2716.0872 (64)
Electric shower(s)															2716 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)		
															0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =															
Heat gains from water heating, kWh/month															
	119.3380	106.1718	114.2029	103.5625	102.5794	94.7967	95.1803	97.5704	97.1228	105.4889	108.7618	118.4300	(65)		

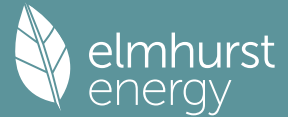
5. Internal gains (see Table 5 and 5a)															

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	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	(66)		
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	149.3574	165.3600	149.3574	154.3360	149.3574	154.3360	149.3574	149.3574	154.3360	149.3574	154.3360	149.3574	(67)		
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	284.8091	287.7645	280.3169	264.4619	244.4478	225.6373	213.0708	210.1154	217.5630	233.4180	253.4321	272.2425	(68)		
Pumps, fans	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	(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)	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	(71)		
Total internal gains	160.4005	157.9938	153.4985	143.8368	137.8755	131.6621	127.9306	131.1430	134.8928	141.7862	151.0581	159.1801	(72)		
	660.4986	677.0499	649.1044	628.5663	597.6123	577.5670	556.2904	556.5474	572.7234	590.4932	624.7578	646.7117	(73)		

6. Solar gains															

[Jan]															
				Area	Solar flux		g	FF		Access		Gains			
				m2	Table 6a		Specific data	Specific data		factor		W			
					W/m2		or Table 6b	or Table 6c		Table 6d					
Northeast				0.8100	11.2829		0.5000	0.7000		0.7700		2.2167	(75)		
Southeast				8.1900	36.7938		0.5000	0.7000		0.7700		73.0904	(77)		
Southwest				3.3300	36.7938		0.5000	0.7000		0.7700		29.7181	(79)		

Full SAP Calculation Printout



Northwest	7.1600		11.2829		0.5000		0.7000		0.7700		19.5946 (81)	
Solar gains	124.6198	219.5184	319.5982	428.2529	509.1200	518.3884	494.3925	432.0822	356.9142	247.8032	150.5851	105.7948 (83)
Total gains	785.1184	896.5683	968.7027	1056.8192	1106.7323	1095.9554	1050.6829	988.6296	929.6376	838.2963	775.3429	752.5065 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	71.3585	71.5114	71.6620	72.3777	72.5132	73.1507	73.1507	73.2700	72.9039	72.5132	72.2396	71.9558
alpha	5.7572	5.7674	5.7775	5.8252	5.8342	5.8767	5.8767	5.8847	5.8603	5.8342	5.8160	5.7971
util living area	0.9968	0.9925	0.9821	0.9425	0.8372	0.6422	0.4726	0.5220	0.7745	0.9582	0.9923	0.9975 (86)
Living	19.9241	20.0913	20.3235	20.6349	20.8706	20.9783	20.9969	20.9946	20.9381	20.6391	20.2302	19.8971
Non living	18.8479	19.0622	19.3570	19.7455	20.0099	20.1134	20.1247	20.1251	20.0816	19.7582	19.2464	18.8184
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	20.4496	20.0913	20.3235	20.6349	20.8706	20.9783	20.9969	20.9946	20.9381	20.6391	20.2302	20.0513 (87)
Th 2	20.1057	20.1075	20.1092	20.1172	20.1187	20.1258	20.1258	20.1271	20.1231	20.1187	20.1157	20.1125 (88)
util rest of house	0.9957	0.9901	0.9761	0.9235	0.7894	0.5634	0.3805	0.4260	0.7013	0.9404	0.9894	0.9967 (89)
MIT 2	19.6043	19.0622	19.3570	19.7455	20.0099	20.1134	20.1247	20.1251	20.0816	19.7582	19.2464	19.0516 (90)
Living area fraction										FLA = Living area / (4) =		0.1429 (91)
MIT	19.7250	19.2092	19.4951	19.8726	20.1329	20.2370	20.2493	20.2493	20.2040	19.8840	19.3869	19.1945 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7250	19.2092	19.4951	19.8726	20.1329	20.2370	20.2493	20.2493	20.2040	19.8840	19.3869	19.1945 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9952	0.9867	0.9708	0.9172	0.7902	0.5738	0.3936	0.4397	0.7086	0.9344	0.9860	0.9955 (94)
Useful gains	781.3416	884.6779	940.3728	969.2915	874.5663	628.8821	413.5942	434.6754	658.7594	783.2927	764.5211	749.1051 (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	1796.7024	1663.1680	1507.2546	1260.0864	966.6174	640.5030	414.6596	436.6718	695.9179	1064.1769	1413.7183	1732.0493 (97)
Space heating kWh	755.4284	523.1453	421.7601	209.3723	68.4860	0.0000	0.0000	0.0000	0.0000	208.9778	467.4220	731.3105 (98a)
Space heating requirement - total per year (kWh/year)												3385.9025
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	755.4284	523.1453	421.7601	209.3723	68.4860	0.0000	0.0000	0.0000	0.0000	208.9778	467.4220	731.3105 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3385.9025
Space heating per m2										(98c) / (4) =		28.2889 (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 %)												282.7225 (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	755.4284	523.1453	421.7601	209.3723	68.4860	0.0000	0.0000	0.0000	0.0000	208.9778	467.4220	731.3105 (98)
Space heating efficiency (main heating system 1)	282.7225	282.7225	282.7225	282.7225	282.7225	0.0000	0.0000	0.0000	0.0000	282.7225	282.7225	282.7225 (210)
Space heating fuel (main heating system)	267.1979	185.0385	149.1781	74.0558	24.2238	0.0000	0.0000	0.0000	0.0000	73.9162	165.3289	258.6672 (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	266.9281	236.2322	251.4842	222.4501	216.5263	196.0869	194.2735	201.4617	203.0828	225.2767	238.0873	264.1974 (64)
Efficiency of water heater (217)m	173.6872	173.6872	173.6872	173.6872	173.6872	173.6872	173.6872	173.6872	173.6872	173.6872	173.6872	173.6872 (216)
Fuel for water heating, kWh/month	153.6832	136.0102	144.7915	128.0751	124.6645	112.8966	111.8525	115.9911	116.9245	129.7025	137.0782	152.1110 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	31.0335	24.8962	22.4163	16.4231	12.6857	10.3643	11.5723	15.0422	19.5383	25.6353	28.9550	31.8960 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-46.1327	-68.0245	-101.5125	-115.8530	-124.7768	-115.0998	-113.6540	-106.0186	-92.2112	-77.3908	-51.2639	-39.4402 (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	-14.7779	-33.1070	-69.3133	-110.9515	-153.4999	-157.6852	-155.8678	-130.7595	-94.8467	-51.5141	-20.8853	-11.5980 (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												1197.6063 (211)
Space heating fuel - main system 2												0.0000 (213)

Full SAP Calculation Printout



Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	173.6872
Water heating fuel used	1563.7809 (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)	250.4583 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2056.1842 (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	955.6613 (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	1197.6063	0.1561	186.9512 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1563.7809	0.1407	220.0870 (264)
Space and water heating			407.0382 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	250.4583	0.1443	36.1489 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1051.3781	0.1343	-141.2187
PV Unit electricity exported	-1004.8062	0.1241	-124.6653
Total			-265.8840 (269)
Total CO2, kg/year			177.3031 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.4800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1197.6063	1.5779	1889.7093 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1563.7809	1.5204	2377.5704 (278)
Space and water heating			4267.2796 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	250.4583	1.5338	384.1612 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1051.3781	1.4964	-1573.2938
PV Unit electricity exported	-1004.8062	0.4553	-457.5210
Total			-2030.8147 (283)
Total Primary energy kWh/year			2620.6261 (286)
Dwelling Primary energy Rate (DPER)			21.9000 (287)

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

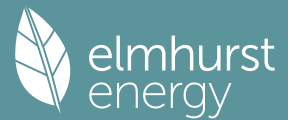
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	44.8700 (1b)	x 2.5000 (2b)	= 112.1750 (1b) - (3b)
First floor	43.1900 (1c)	x 2.5000 (2c)	= 107.9750 (1c) - (3c)
Second floor	31.6300 (1d)	x 2.1900 (2d)	= 69.2697 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4197 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1382 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3882 (18)
Number of sides sheltered	2 (19)

Full SAP Calculation Printout



Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$
$$(21) = (18) \times (20) = 0.3300 \quad (21)$$

	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													
Effective ac	0.4207	0.4125	0.4042	0.3630	0.3547	0.3135	0.3135	0.3052	0.3300	0.3547	0.3712	0.3877	(22b)
	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5544	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			2.2100	1.0000	2.2100			(26a)
TER Opening Type			19.4900	1.1450	22.3168			(27)
Ground Floor			36.1100	0.1300	4.6943			(28a)
Exposed Floor			8.7600	0.1300	1.1388			(28b)
External Wall	120.7800	21.7000	99.0800	0.1800	17.8344			(29a)
Low Level Walls	25.3500		25.3500	0.1800	4.5630			(29a)
Roof to GF Bay	1.6800		1.6800	0.1100	0.1848			(30)
Roof over FF	11.5600		11.5600	0.1100	1.2716			(30)
Roof over SF	16.1600		16.1600	0.1100	1.7776			(30)
Sloping Ceiling	21.6600		21.6600	0.1100	2.3826			(30)
Total net area of external elements Aum(A, m2)			242.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.3739			(33)
Main dwelling								
Party Wall			41.1000	0.0000	0.0000			(32)

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

250.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	17.0500	0.0500	0.8525	
E2 Other lintels (including other steel lintels)	14.5000	0.0500	0.7250	
E3 Sill	30.0000	0.0500	1.5000	
E4 Jamb	20.9300	0.1600	3.3488	
E5 Ground floor (normal)	36.0000	0.0900	3.2400	
E6 Intermediate floor within a dwelling	28.5800	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	15.3600	0.0600	0.9216	
E12 Gable (insulation at ceiling level)	2.7000	0.0600	0.1620	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
E11 Eaves (insulation at rafter level)	5.6600	0.0400	0.2264	
E14 Flat roof	3.6000	0.0800	0.2880	
E17 Corner (inverted - internal area greater than external area)	8.0000	-0.0900	-0.7200	

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

Point Thermal bridges	(36a) =	11.1443	(36)
Total fabric heat loss	(33) + (36) + (36a) =	69.5182	(37)

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

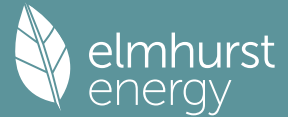
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.2070	55.8788	55.5570	54.0459	53.7631	52.4470	52.4470	52.2032	52.9539	53.7631	54.3351	54.9331	(38)
Heat transfer coeff	125.7252	125.3970	125.0752	123.5641	123.2813	121.9652	121.9652	121.7214	122.4721	123.2813	123.8533	124.4513	(39)
Average = Sum(39)m / 12 =												123.5627	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0504	1.0477	1.0450	1.0324	1.0300	1.0190	1.0190	1.0170	1.0232	1.0300	1.0348	1.0398	(40)
HLP (average)												1.0324	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8621	(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	83.2928	82.0557	80.3138	77.1019	74.6969	72.0301	70.5896	72.3194	74.2028	77.0564	80.3344	83.0112	83.0112	(42b)
Hot water usage for other uses	43.9409	42.3430	40.7452	39.1473	37.5495	35.9516	35.9516	37.5495	39.1473	40.7452	42.3430	43.9409	43.9409	(42c)
Average daily hot water use (litres/day)													117.1717	(43)
Daily hot water use	127.2336	124.3988	121.0589	116.2492	112.2463	107.9817	106.5412	109.8688	113.3501	117.8015	122.6774	126.9520	126.9520	(44)
Energy conte	201.5069	177.1422	186.0631	159.1393	151.1051	132.7761	128.8524	136.0406	139.7720	159.8556	174.7765	198.7762	198.7762	(45)
Energy content (annual)										Total = Sum(45)m =			1945.8058	
Distribution loss (46)m = 0.15 x (45)m	30.2260	26.5713	27.9095	23.8709	22.6658	19.9164	19.3279	20.4061	20.9658	23.9783	26.2165	29.8164	29.8164	(46)
Water storage loss:														
Store volume													200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.4330	223.1399	236.9891	208.4226	202.0312	182.0594	179.7784	186.9667	189.0553	210.7816	224.0598	249.7023	249.7023	(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	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	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.4330	223.1399	236.9891	208.4226	202.0312	182.0594	179.7784	186.9667	189.0553	210.7816	224.0598	249.7023	249.7023	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =			2545.4193	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month														

Full SAP Calculation Printout



107.7419 95.6980 102.6068 92.3405 90.9833 83.5747 83.5843 85.9744 85.9008 93.8928 97.5398 106.8339 (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	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	143.1054	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.3574	165.3600	149.3574	154.3360	149.3574	154.3360	149.3574	149.3574	154.3360	149.3574	154.3360	149.3574	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.8091	287.7645	280.3169	264.4619	244.4478	225.6373	213.0708	210.1154	217.5630	233.4180	253.4321	272.2425	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	37.3105	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	-114.4844	(71)
Water heating gains (Table 5)	144.8144	142.4077	137.9124	128.2506	122.2894	116.0759	112.3444	115.5569	119.3067	126.2000	135.4720	143.5940	(72)
Total internal gains	647.9125	664.4638	636.5183	615.9801	585.0262	561.9809	540.7043	540.9613	557.1373	577.9070	612.1717	634.1256	(73)

6. Solar gains

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

Northeast					0.8100	11.2829	0.6300	0.7000	0.7700			2.7931	(75)	
Southeast					8.1900	36.7938	0.6300	0.7000	0.7700			92.0939	(77)	
Southwest					3.3300	36.7938	0.6300	0.7000	0.7700			37.4448	(79)	
Northwest					7.1600	11.2829	0.6300	0.7000	0.7700			24.6892	(81)	

Solar gains	157.0209	276.5932	402.6938	539.5987	641.4912	653.1694	622.9346	544.4236	449.7118	312.2320	189.7372	133.3015	(83)	
Total gains	804.9334	941.0569	1039.2121	1155.5788	1226.5174	1215.1503	1163.6388	1085.3849	1006.8491	890.1390	801.9089	767.4270	(84)	

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	66.1109	66.2839	66.4544	67.2672	67.4214	68.1490	68.1490	68.2855	67.8669	67.4214	67.1101	66.7876	
alpha	5.4074	5.4189	5.4303	5.4845	5.4948	5.5433	5.5433	5.5524	5.5245	5.4948	5.4740	5.4525	
util living area	0.9965	0.9914	0.9786	0.9319	0.8161	0.6215	0.4578	0.5095	0.7641	0.9546	0.9918	0.9973	(86)
MIT	19.8165	20.0090	20.2727	20.6172	20.8667	20.9767	20.9963	20.9936	20.9306	20.6041	20.1527	19.7886	(87)
Th 2	20.0415	20.0438	20.0460	20.0564	20.0584	20.0675	20.0675	20.0692	20.0640	20.0584	20.0544	20.0503	(88)
util rest of house	0.9954	0.9886	0.9716	0.9098	0.7640	0.5397	0.3626	0.4097	0.6869	0.9351	0.9886	0.9964	(89)
MIT 2	18.6629	18.9095	19.2439	19.6722	19.9487	20.0545	20.0664	20.0670	20.0183	19.6663	19.1017	18.6337	(90)
Living area fraction	18.8277	19.0665	19.3909	19.8072	20.0799	20.1863	20.1992	20.1994	20.1487	19.8003	19.2518	18.7987	(91)
MIT	18.8277	19.0665	19.3909	19.8072	20.0799	20.1863	20.1992	20.1994	20.1487	19.8003	19.2518	18.7987	(92)
Temperature adjustment	18.8277	19.0665	19.3909	19.8072	20.0799	20.1863	20.1992	20.1994	20.1487	19.8003	19.2518	18.7987	(93)
adjusted MIT	18.8277	19.0665	19.3909	19.8072	20.0799	20.1863	20.1992	20.1994	20.1487	19.8003	19.2518	18.7987	(93)

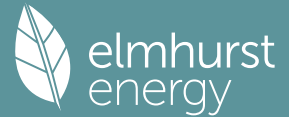
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9933	0.9847	0.9652	0.9028	0.7653	0.5505	0.3762	0.4239	0.6945	0.9283	0.9849	0.9947	(94)
Useful gains	799.5454	926.6658	1003.0511	1043.3008	938.6613	668.9378	437.7483	460.1280	699.2500	826.3300	789.7659	763.3758	(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	1826.4948	1776.4420	1612.3287	1347.7403	1033.0797	681.3323	438.9803	462.4634	740.7913	1134.2276	1505.0430	1816.8269	(97)
Space heating kWh	764.0503	571.0496	453.3025	219.1965	70.2473	0.0000	0.0000	0.0000	0.0000	229.0758	514.9995	783.7677	(98a)
Space heating requirement - total per year (kWh/year)	764.0503	571.0496	453.3025	219.1965	70.2473	0.0000	0.0000	0.0000	0.0000	229.0758	514.9995	783.7677	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	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)
Space heating kWh	764.0503	571.0496	453.3025	219.1965	70.2473	0.0000	0.0000	0.0000	0.0000	229.0758	514.9995	783.7677	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	764.0503	571.0496	453.3025	219.1965	70.2473	0.0000	0.0000	0.0000	0.0000	229.0758	514.9995	783.7677	(98c)
Space heating per m ²										(98c) / (4) =		30.1252	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
764.0503	571.0496	453.3025	219.1965	70.2473	0.0000	0.0000	0.0000	0.0000	0.0000	229.0758	514.9995	783.7677	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	827.7902	618.6887	491.1187	237.4826	76.1076	0.0000	0.0000	0.0000	0.0000	248.1861	557.9626	849.1524	(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)													

Full SAP Calculation Printout



	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	252.4330	223.1399	236.9891	208.4226	202.0312	182.0594	179.7784	186.9667	189.0553	210.7816	224.0598	249.7023	(64)
Efficiency of water heater	86.3806	86.0725	85.4898	84.1730	81.9427	79.8000	79.8000	79.8000	79.8000	84.2468	85.8641	86.4444	(216)
(217)m													(217)
Fuel for water heating, kWh/month	292.2334	259.2463	277.2132	247.6122	246.5519	228.1446	225.2862	234.2941	236.9114	250.1953	260.9468	288.8588	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	31.0335	24.8962	22.4163	16.4231	12.6857	10.3643	11.5723	15.0422	19.5383	25.6353	28.9550	31.8960	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.0436	-61.2381	-88.7971	-100.7079	-109.2728	-102.1702	-100.8471	-94.8438	-84.4052	-70.3595	-47.4947	-37.1439	(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	-22.6549	-47.8429	-95.4566	-143.9247	-190.8781	-192.0573	-189.8606	-160.5464	-117.3566	-68.6781	-30.3259	-17.9062	(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												3906.4889	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3047.4943	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												250.4583	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2217.8122	(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												5072.6293	(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	3906.4889	0.2100	820.3627 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3047.4943	0.2100	639.9738 (264)
Space and water heating			1460.3365 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	250.4583	0.1443	36.1489 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-940.3239	0.1344	-126.3948
PV Unit electricity exported	-1277.4883	0.1258	-160.6746
Total			-287.0695 (269)
Total CO2, kg/year			1221.3451 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.2000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3906.4889	1.1300	4414.3325 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3047.4943	1.1300	3443.6685 (278)
Space and water heating			7858.0010 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	250.4583	1.5338	384.1612 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-940.3239	1.4968	-1407.4490
PV Unit electricity exported	-1277.4883	0.4617	-589.7782
Total			-1997.2272 (283)
Total Primary energy kWh/year			6375.0359 (286)
Target Primary Energy Rate (TPER)			53.2600 (287)

Appendix 2 – Side Elevation showing the Indicative Location of Photovoltaic Panels

8 x 400W Photovoltaic Panels

