

Energy Assessment / SAP Details Applied

For the proposed development at:

Land Rear 2 Gloucester Road, Reading, RG30 2TH

Energy Calculations Ltd

SAP ◆ CODE ◆ SBEM ◆ DESIGN

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Land Rear 2 Gloucester Road, Reading, RG30 2TH

11th August 2022

Property reference: SAP 10 – M00029

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Appendix 1 SAP calculations Compliance (BREL)

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1. SUMMARY

The calculations provided, draw upon the detailed SAP 10 assessment. This gives as accurate a guide as possible to the energy usage of the final development in operation, to comply with part L 2021

The Energy Assessment relates to a replacement dwelling at Land Rear 2 Gloucester Road, Reading, RG30 2TH

Overheating has been removed from SAP and is now an independent regulation part O

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4: Services & Thermals

The total CO₂ emissions has been calculated taking full account of energy demands for space heating and hot water, and electricity for pumps, fans, lights.. The baseline was determined by using the typical orientation and the use of building elements (walls, windows etc.) with U-values and other reference values and in most cases consistent with achieving compliance with Approved Document Part LA: 2021. The tabulated calculations results are in appendix 1.

4.1: SAP Details applied

Element	U – Value Element	Element	U – Value Element
Walls	0.20	Floor	0.15
Windows	1.00 (g- value 0.57)	Doors	1.20
Flat roof	0.14	Roof Slope	0.15
Roof lights	1.00 (g- value 0.64)		

4.2: Services

Accredited construction details applied to table K1 default and LABC

Air pressure test 4.00 or less

100% Low energy lighting

Intermittent extract fans

Air to water heat pump minimum COP winter and summer 170 with air flow temperature <= 35°C

Under floor heating with time and temperature zone controls

Water cylinder – Applied 210ltr. heat loss 1.57 per 24hr.

Ventilation – Intermittent extract fans

Lighting – Efficacy lm/W 90

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4.3 : Details -

With reference to the heat pump and the water cylinder efficiency please check these efficiencies with use as they can vary in efficiency, and could result in the dwelling failing Part L building regulations.

With reference to the thermal bridging these are required to be checked to ensure they are correct, both LABC and Table K1 details have been used and are attached, they are required to be signed on completion for us to be able to produce the as built SAP and EPC.

With reference to the construction details a full specification / u – value calculations will be required before the As built SAP and EPC can be issued

All the U – values and services are required to be confirmed they are suitable for the proposed dwelling, as these have been applied for the efficiencies only.

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5: Results - shows the summary for the calculations

TER = Target Emission Rate kgCO₂/yr/m²
DER = Dwelling Emission Rate kgCO₂/yr/m²
TFEE = Target Fabric Energy Efficiency kWh/m²/yr
DFEE = Dwelling Fabric Energy Efficiency kWh/m²/yr
TPER = Target Primary Energy Rate kWh/m²/yr
DPER = Dwelling Primary Energy Rate kWh/m²/yr

Table 1

TER	DER	% Reduction	TFEE	DFEE	% Reduction	DPER	TPER	% Reduction	SAP Rating
18.85	8.49	54.96	55.67	55.49	0.31	88.47	100.47	11.94	71 C

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6. CONSIDERATION OF Renewable and low carbon technologies

6.1 OVERVIEW OF RENEWABLE ENERGY

Energy from renewable sources has been defined in Article 2 of EU Directive 2010/13/EU '*on the energy performance of buildings*' and includes wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. For the purposes of this energy Assessment and the use of renewable energy on a domestic scale these can be summarised as follows:

- _ Bio-fuels — combustion of solid or liquid bio-fuels to produce heat or electricity.
- _ Decentralised energy.
- _ Heat pumps — extraction of heat from the earth, atmosphere or water bodies.
- _ Hydroelectricity — use of water cycle driven flows to generate electricity.
- _ Photovoltaic — direct generation of electricity from sunlight.
- _ Solar thermal — direct heating of water for space heating or domestic hot water.
- _ Wind turbines — use of solar driven air movement to generate electricity.

The technologies and their potential application to this site are discussed in more detail in the following sections. However, one further pertinent point must be made. The reason for adopting renewable energy technologies is to reduce greenhouse gas emissions, mainly carbon dioxide, and none of the technologies are wholly “zero carbon”. This is because, when the whole life cycle is taken into account some energy has to be put into every system to manufacture and maintain the equipment (which has a finite life) or to operate the equipment, and generally at present this energy is derived from non-renewable sources. Examples include the energy needed to refine and process the silicon used to manufacture photovoltaic panels, the diesel fuel used to transport wood pellets and to power the wood processing machinery for the production of wood fuel pellets.

Finally, due to the dynamic and innovative nature of the renewable energy technology industry even apparently similar products can differ in vital practical details which means that detailed design of installations must be undertaken by experts, often working closely with the product manufacturers, as virtually no two products are identical or interchangeable.

The following sections contain a summary of each possibly applicable technology, and a comparison of the advantages and disadvantages of technologies relevant to this development.

6.2 DECENTRALISED ENERGY

In addition to addressing the well understood and widely accepted planning policy requirement to install systems that will deliver a proportion of the development's energy needs from renewable sources, a further consideration is the availability of decentralised energy. If it is feasible, new developments should incorporate community energy generating schemes so that future developments can be connected or where there are existing networks, the feasibility of connecting the subject development should be investigated. However in this case the development is too small to feasibly construct a new community heating scheme and at present, there is no such network available locally.

6.3 BIO-FUELS

Key planning and design issues regarding the use of bio-fuels include the building space and organisation to accommodate and operate the plant. The equipment would plant space and access and maintenance. Facilities are required for fuel storage and must be provided along with loading access for the fuel to be safely and efficiently delivered and stored. Finally, systems utilising bio fuels, particularly biomass, are rarely available at the small scale that would be appropriate for use in a building where the heat loads are so low.

For these reasons the use of bio-fuels is not considered suitable for this development.

6.4 HEAT PUMPS

Heat pumps collect low temperature heat from renewable sources and "concentrate" it to a usable temperature. Fossil fuel based (grid) electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy. A typical heat pump can deliver 3 kWh of heat energy for every 1 kWh of input energy i.e. an efficiency of 300%. A heat pump operating in this way would therefore be deemed to have delivered 2 kWh of renewable energy. **Air source heat pumps have been chosen for the space and hot water for this development.**

6.4.1 Ground source heat pumps

There are two types of ground source heat pump system - a closed loop and open loop system. The first circulates anti-freeze through plastic pipe horizontally or vertically, the second uses ground water. Generally they work best where there is a constant heating or cooling demand or the property is off mains gas. In this case the property has access to mains gas and would not have a constant energy demand. Due to the small scale of the site a vertical closed loop system could be considered. Typically boreholes are around 10-100m deep and it is estimated that 1-2 boreholes might be required.

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The viability of a heat pump is dependent on the site ground conditions and geology and this requires a geological desk study and trial boreholes to obtain the necessary information. An environmental impact assessment is generally not required for a closed loop system. There is no visual impact to consider as the system is hidden from view.

Due to the uncertainty regarding ground conditions and the small scale of the development a ground source heat pump system is not considered suitable for this development

6.5 HYDROELECTRICITY

There is no suitable source of water in the locality which could be utilised as an energy source.

6.6 PHOTOVOLTAIC

Photovoltaic (PV) systems use areas of semiconductor material that produce electricity when exposed to light. They are connected to the building electricity supply via an inverter which converts the output to a form which is compatible with the mains electricity voltage and frequency. This also allows excess electricity to be exported at times when the actual demand from the dwellings is less than that being produced by the PV system. This ensures that all the electricity produced is used and achieves a reduction in carbon dioxide emissions. For all purposes relating to planning, the exported electricity is by convention treated as if it were used on site.

The output of photovoltaic systems is generally specified as kW peak, or kWp with each 1kWp of system expected to produce an average 850 kWh of electricity per year, although this may be reduced depending on location, orientation and over shading. The area required to produce an output of 1 kWp varies but for this exercise 6.7m² has been used. (The developer will be required to submit a quotation and technical evaluation to ensure that the calculated quantity of panels will produce the required on site generation per annum)

Because the availability of sunlight, to produce electricity, will generally not align with demand, it is normal for the system to be connected to the electricity grid and excess production exported. The introduction of the feed-in-tariff has improved the economics of solar PV systems.

There are no direct environmental consequences from the installation of PV panels but the installation can have a visual impact that may require consideration.

6.7 SOLAR THERMAL PANELS

Solar thermal panels harness solar energy to heat domestic hot water. They are usually used in conjunction with the main heating system as they can only provide a portion of the demand for hot water, depending on the time of year. Overall, it is estimated that a suitably sized system can provide up to 60% of the annual energy demand for providing hot water. These require the installation of a water cylinder in each dwelling. This is not currently planned for as it is proposed to use a combi boiler due to the small size of the dwellings. It is for this reason that solar thermal is not considered entirely suitable for the development.

6.8 WIND TURBINES

Micro wind turbines produce electricity and can be grid-connected in the same way as photovoltaic panels.

Although wind turbines are one of the most cost effective renewable energy technologies, for smaller turbines the capital cost is relatively high compared to the amount of power generated. Adjacent trees and buildings create turbulence and the location affects wind speed and to be effective an average wind speed of no less than 5m/s is required. From the Energy Saving Trust's wind prediction tool, the predicted average wind speed at the development site is 2.4 m/s, significantly less than 5 m/s. In addition noise and vibration from roof mounted turbines can prove unacceptable and wind turbines are less likely to meet with the approval of local residents and planners.

For these reasons wind turbines are not considered suitable for this development.

6.9 Consideration of Heat and power:

Combined Heat and Power (CHP) and Combined Cooling Heat and Power (CCHP) or Tri-generation Systems are recognised as a very desirable way of reducing energy wastage and resulting carbon dioxide emissions.

While generally operating on fossil fuel, mainly natural gas, their advantage is that the waste heat normally associated with electricity generation is put to good use providing space heating and hot water. This means that the overall fuel efficiency can be increased significantly — typically to above 80% compared to 30-40% for grid electricity. The main effect is to approximately halve the carbon dioxide emissions associated with electricity use on the development for all the electricity produced by the CHP plant. However, space and water heating for the development is provided by mains gas and so a CHP unit would only reduce emissions associated with lighting, fans, pumps and domestic appliances. As such, the reduction in CO₂ would not be that great.

Generally CHP and CCHP are most suited to community heating systems particularly where there is a constant demand for heat throughout the year and therefore they are not considered to be viable on developments of less than approximately 50 units.

However, some systems for individual dwellings have been developed such as the Baxi Ecogen micro CHP. However the technology is new and is still proving its long term reliability.

The installation may be complex and can only be carried out by British Gas & one other supplier and therefore is relatively expensive. For these reasons it is considered that micro CHP installations are not a practical option at the present time for a very small development such as this.

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Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Elmhurst Sap 10 SAP 10 program, 1.0

Date: Thu 11 Aug 2022 16:48:30

Project Information			
Assessed By	Matthew Carter	Building Type	House, Detached
OCDEA Registration	EES/003584	Assessment Date	2022-08-11

Dwelling Details			
Assessment Type	As designed	Total Floor Area	45 m ²
Site Reference	00029	Plot Reference	00001
Address	2 Rear Gloucester Road, Reading		

Client Details	
Name	Client
Company	Company
Address	Address, Town, AA11 1AA

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	18.85 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	5.42 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	100.47 kWh _{PE} /m ²		
Dwelling primary energy	56.75 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	55.7 kWh/m ²		
Dwelling fabric energy efficiency	55.5 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.2	Walls (1) (0.2)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.15	Heatloss Floor 1 (0.15)	OK
Roofs	0.16	0.14	Roof (1) (0.14)	OK
Windows, doors, and roof windows	1.6	1.07	Front Door (1.2)	OK
Rooflights	2.2	1	R lights , South (1)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	89.89	0.2
Ground floor: Heatloss Floor 1, Heatloss Floor 1	30.45	0.15
Exposed roof: Roof (1)	21.32	0.14
Exposed roof: Roof (2)	10.74	0.14

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front Door , Door	2.23	East	N/A	1.2
Front Windows, Windows	0.71	East	0.7	1 (!)
R lights , Roof lights	3.16	South	0.7	1 (!)
Side , Roof lights	0.34	South	0.7	1 (!)
Rear , Roof lights	0.28	North	0.7	1 (!)

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Government-approved scheme	0.042	LABC

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Government-approved scheme	0.035 (!)	LABC
External wall	E5: Ground floor (normal)	Government-approved scheme	0.046	LABC
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.001 (!)	LABC
External wall	E13: Gable (insulation at rafter level)	Government-approved scheme	0.052	LABC
External wall	E16: Corner (normal)	Government-approved scheme	0.042	LABC
External wall	E11: Eaves (insulation at rafter level)	Government-approved scheme	0.039 (!)	LABC
External wall	E14: Flat roof	SAP table default	0.16	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
Roof	R4: Ridge (vaulted ceiling)	SAP table default	0.12	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity

Efficiency	276.4%
Emitter type	Underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Samsung Electronics Air Conditioner Europe B.V.
Model	AE050RXYDEG
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	210 litres
Declared heat loss	1.57 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A

Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

7 Lighting

Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		