

Renewable Energy Reporting

16x New Dwellings at Little Acres, Longfield Avenue, Longfield, DA3 7LA

Prepared on behalf of:
Mr William Cook

BE2664

Build Energy Ltd
Aerodrome Studios,
2-8 Airfield Way,
Christchurch,
Dorset
BH23 3TS

0330 055 34 05
info@buildenergy.co.uk

Issue	Issue Date	Written by	Notes
VI	27/01/2022	Matthew Ray	

The present document, its content, its appendices and/or amendments (“the Document”) have been created by Build Energy Limited (“Build Energy”) for informative purposes. They contain private information referring to Build Energy and/or its subsidiaries (the “Company”), and are addressed exclusively to its recipients. Consequently, they shall not be, totally or partially, disclosed, published and/or distributed without the previous and written consent of Build Energy, unless it is made an explicit reference to the ownership of Build Energy in the intellectual property rights. The whole content of this Document, whether text, images, brands, logotypes, colour combinations or any other element, its structure or design, selection and presentation of the materials included therein are protected by both industrial and intellectual property rights – Build Energy’s ownership – and shall be respected by both recipient and addressee of the present Document. In particular, but without restricting the generality of confidentiality obligation, any reproduction – except for private use, transformation, distribution, public communication – at any third party’s disposal – and generally, any other way of exploitation – through any procedure – of the whole or part of the Document, as well as its design, selection and presentation of materials included therein is strictly forbidden.



Low
Carbon Energy
Assessor



Company No. 07833780 VAT Reg.126036639

Contents

Policy	3
Consideration of Renewable Technology	3
Photovoltaic Solar Panels	3
Solar Hot Water Systems	3
Biomass Heating.....	4
Heat Pumps	5
Proposed Technology and Energy Savings	6
Conclusion	7

Gravesham Borough Council

Policy

In accordance with the policy CS18 of the Gravesham Borough Council Local Plan, the use of on-site low-carbon renewable energy sources is required to demonstrate improved carbon savings for the proposed development. This report outlines the strategy employed in meeting this requirement and the results achieved.

Consideration of Renewable Technology

Photovoltaic Solar Panels

Photovoltaic panel systems convert energy from the sun into electricity through semi-conductor cells mounted in collector panels. The panels are connected to an inverter to turn the DC output into AC for use in the building to which they are attached and to be fed back into the grid when not required. Photovoltaic arrays provide a quiet and effective renewable energy source with a relatively low aesthetic impact. The major benefit of PV systems is the significant reductions they can achieve in comparison to other technologies, in terms of CO₂ and energy use. The PV panels should ideally be orientated between southeast and southwest (optimally south). The optimal tilt angle (inclination of panel from horizontal) should be calculated to ensure the best possible output of the system during the year. In the UK, the angles of most pitched roofs are suitable for mounting PV panels. Panels can also be mounted on A-frames on flat roofed buildings. PV technology comes in a range of forms: PV panels that can be retrofitted to the roof of an existing building or equally, sunk to fit flush with the roof line; PV cells that are 'laminated' between sheets of glass to provide shading in a glazed area, and PV cladding.

PV systems are low maintenance as they have no moving parts and panels generally have 25-year warranties, although the lifetime of the panel can be expected to be beyond this time. PV systems should not be shaded. Shading caused by other buildings, greenery and roof 'furniture' such as chimneys or satellite dishes, even over a small area of the panel, can significantly reduce performance. Excess energy can be exported to the grid. Although the Feed-in Tariffs are generally not high, exporters can negotiate with their utility company. Future consideration may be given to the benefits of battery storage.

Payback times for this technology are usually approximately twenty years; but this is reducing year on year as the technology matures and are set to reduce further as fuel prices increase. Integrating PV into a building and replacing other building materials can further offset the cost.

Solar Hot Water Systems

Solar water heating systems use the energy from the sun to heat water stored in a hot water cylinder inside the building. A solar collector comprises a housing that contains piping, through which the carrier fluid circulates, and a glass panel to retain the radiation from the sun. The temperature inside the collector increases and this heat is then transferred to a carrier fluid. In an open loop system, the hot water is heated directly.

Solar thermal panels are generally black in appearance for maximising energy absorption and the glass panels have a special coating in order to retain as much heat as possible. Two types of collector exist: flat plate and evacuated tube. Flat plate collectors can be mounted on or flush with the roof. The air in the collection tubes can be evacuated to reduce heat losses within the frame by convection. Evacuated tube collectors need to be re-evacuated every few years. They are more difficult to install but are more efficient and allow higher temperature heating.

Solar thermal collectors offer a good price-performance ratio. Solar hot water systems are best suited to developments with high hot water requirements, such as hotels, care homes and leisure centres. Many systems have been installed in the UK and they work well, even without direct sunlight. Solar thermal systems should be sized to the hot water requirements of the user since any excess heat that is generated cannot be exported

elsewhere. The optimal angle for mounting depends on when the water demand is greatest. Ideally, the collectors should be mounted onto a non-shaded, south-facing roof.

Solar thermal technology is a cost effective way to reduce carbon emissions, especially if it is replacing electric water heating. Due to limited roof space, solar hot water cannot be used effectively alongside photovoltaic arrays. Accordingly, it is considered preferable to install photovoltaic panels as these represent a greater carbon saving.

Biomass Heating

With the long term availability of fossil fuels such as oil and gas, and the persistent number of price rises of oil and natural gas a growing concern in the UK, alternative heating methods such as wood burning boilers are becoming more popular.

Due to technical advances in wood burning technology, and improvements in the preparation of wood fuels, efficiencies of new wood pellet burning boilers have increased to around 90%, with carbon monoxide emissions dropping dramatically. There are three types of wood burning boiler - logs, woodchips and wood pellets. Wood logs are the most readily available, generally produced as a by-product from forestry and woodland from sawmills, tree surgery and wind damage.

Wood chips have a high moisture content which tends to restrict their efficiency to only 50% and they tend to suffer from blockages hence we would be cautious about their use on this site. Storage space requirements are also high due to the irregularity of the chips. Wood pellets are made from dry waste wood, such as used pallets and off-cuts/sawdust from furniture manufacturers. The waste wood is compressed into uniform, high density pellets that are easier to transport, handle and store than other forms of wood fuel.

Biomass combustion systems (BCS) are generally more mechanically complex than conventional boiler heating systems, especially when it comes to fuel delivery, storage, handling and combustion. The complexity is necessary because of the different combustion characteristics of biomass as compared to conventional fossil fuels. The increased complexity means higher capital costs than for conventional systems. BCSs typically require more frequent maintenance and greater operator attention than conventional systems. As a result, the degree of operator dedication to the system is critical to its success. They often require special attention to fire insurance premiums, air quality standards, ash disposal options and general safety issues.

Domestic scale boilers such as Woodchip-fed systems remain very costly and the requirements for siting both the boiler and the fuel source were considered impractical for this development.

There are also some concerns on current availability of suitable fuel within a reasonable distance of the development as well as the additional traffic that would be associated with it. The use of efficient heat pumps is considered more suitable.

Biomass can be burnt directly to provide heat in buildings using wood from forests, urban tree pruning, and farmed coppices or as liquid biofuel, such as bio diesel. In non-domestic applications, biomass boilers replace conventional fossil fuel boilers and come with automated features to enable reduced user intervention. Due to the size of the proposed project, biomass energy has not been considered as an economically suitable technology for this development.

Heat Pumps

Heat pumps transfer heat from a lower temperature source to one of a higher temperature. These are split into three main categories:

- Air source heat pumps operate by converting the energy of the outside air into heat, creating a comfortable temperature inside the building as well as supplying energy for the hot water system. Air-to-water systems provide hot water for direct use or to supply 'wet' heating through underfloor heating or radiators. Air-to-air systems provide hot air, either directly into an internal space, or to be distributed by fans.
- Ground source heat pumps apply the same principle to heat energy stored underground. In this case a circuit of piping is buried horizontally or via a bore hole.
- Water source heat pumps absorb heat from a local water source, such as a lake, river, well, or borehole.

The most prevalent system is an air source heat pump. As with all heat pumps, air source models are most efficient when supplying low temperature systems such as underfloor heating. An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can extract heat from the air even when the outside temperature is as low as minus 15°C. Cold water or another fluid is circulated through pipes, picking up the ambient temperature and then passing through the heat exchanger (the evaporator) in the heat pump unit. The heat exchanger extracts heat from the fluid, using a refrigerant compression cycle to upgrade the heat to a usable temperature (+55°C). This heat is then transferred to the heating system via another heat exchanger, the condenser of the heat pump.

Accordingly, ASHP heating systems generally run at a lower temperature than conventional heating systems. There are two main types of air source heat pumps. An air-to-water system uses the heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system would, so they are better suited to underfloor heating systems than radiator systems. An air-to-air system produces warm air, which is circulated by fans to heat the building. Whilst heat pumps are not a wholly renewable energy source due to use of electricity, the renewable component is considered as the heat is extracted from the air. It is measured as the difference between heat outputs, less the primary electrical energy input. Using this heat, for every Watt of electrical energy supplied to the system, 4 Watts or more of heating energy can be supplied to a heating system. This 'Coefficient of Performance' (CoP) of 4 is effectively an 'efficiency' of 400% for the system and compares very favourably with even the best gas condensing boiler's efficiency of around 85%. The smaller the temperature difference between the source and the output temperature of the heat pump (i.e. the temperature of the distribution system) the higher the heat pump's CoP.

Unlike boilers, there is no pollution on-site and as the mix of power stations used to supply the electricity grid gets 'cleaner', with more renewable electricity generation being brought on line, so the carbon emissions from the heat pumps system will decrease even further. The key operational benefit of air source heat pumps for the user is the reduction in fuel bills. In addition, space savings can be made over other plant types as an air source heat pump unit is compact, and requires no storage space for fuel.

Since air source heat pumps produce less heat than traditional boilers, it is essential that the building where the air source heat pump is proposed is well insulated and draught proofed for the heating system to be effective. Fans and compressors integral to the air source heat pump unit generate some noise, but this is generally acceptable especially where outdoor units can be located away from windows and adjacent buildings. By selecting a heat pump with an outdoor sound rating of 7.6 dB or lower and mounting the unit on a noise-absorbing base these issues can be resolved for the site. Costs for installing a typical system vary but they are considerably more economical to install than an equivalent capacity ground source heat system and can produce similar levels of energy and carbon savings. Actual running costs and savings for space heating will vary depending on several factors - including the size and use pattern of the building and how well insulated it is.

Proposed Technology and Energy Savings

Taking various factors into account such as location, ease of installation and aesthetics, photovoltaics have been selected as the favoured choice of renewable energy. Therefore, each house will have a 0.50 kWp array to supply electricity to the dwellings from a renewable source.

In addition, an ASHP (Air Source Heat Pump) is proposed per dwelling. This will provide heating and hot water and replace the need for mains gas. This is in anticipation of the announcement from Government that no new homes are to connect to mains gas from 2025.

The development has been assessed using the SAP methodology, the results of which provide the predicted CO₂ emissions and the CO₂ saved. Full details of the assumptions that have been used to produce these calculations are outlined within the accompanying SAP Specification Document.

The table below summarises the results (the CO₂ figures can be found within the associated SAP documents):

CO ₂ Emissions (Kg CO ₂ /year)	House Type 1	House Type 2	Site Total
Space heating	1,195.63	764.12	13,520.45
Water heating	638.38	509.13	8,533.83
Electricity for pumps, fans and electric keep hot	62.28	62.28	996.48
Electricity for lighting	197.09	116.15	2,101.22
Total CO₂ Emissions (before PV)	2,093.38	1,451.68	25,151.98
CO ₂ saved by Solar PV	224.11	224.11	3,585.76
Total CO₂ Emissions	1,869.27	1,227.57	21,566.22
% CO₂ Saving	11%	15%	14%

The table below summarises the overall SAP results including the CO₂ emission and fabric energy efficiency targets pass rates and the predicted EPC:

Type 1	ASHP+PV	Type 2	ASHP+PV
CO₂ Emissions (DER) Kg CO₂/m²			
TER	28.93	TER	37.29
DER	21.78	DER	26.86
%	24.7%	%	28.0%
Fabric Efficiency (DFEE) kWh/m²/year			
TFEE	64.4	TFEE	75.8
DFEE	59.1	DFEE	70.6
%	8.2%	%	6.9%
Predicted EPC	C (80)	Predicted EPC	C (80)

In addition to the use of renewable low-carbon technologies, the development is proposed to include the following improvements in fabric energy efficiency to assist in further reducing the dwelling's energy use and emissions. Please see the accompanying Specification Document for further information.

- Improved U-values for construction (Floors, Walls and Roof)
- Highly efficient double glazing
- Improved air pressure test target
- Natural ventilation with extraction fans with cross-ventilation possible
- 100% low energy lighting
- Water efficiency of 110 litres per person per day (105 litres internally) – Part G

Conclusion

These results demonstrate that if the accompanying specification is adhered to, it is possible to exceed both the TER (Target Emission Rate) and TFEE (Target Fabric Energy Efficiency) as set by Part L1A of the Building Regulations through SAP2012 methodology by 14%, site-wide.

The use of both ASHPs and Solar PV renewable technologies meets the carbon reduction requirements set out in Policy CS18 of the Gravesham Borough Council's Local Plan.