Energy Statement

Land at Badminton Road, Old Sodbury

Date: 11th November 2021

SUMMARY

This report sets out measures to achieve energy reductions at the proposed development site: at Old Sodbury ('the Development') demonstrating compliance with:

i) Planning Policy Framework.
ii) Approved Document Part L of the Building Regulations

The Energy Statement concludes that the following combination of measures, summarised below will be incorporated into the Development demonstrating how the energy standard will be delivered

Measures incorporated to deliver the energy standard.

Fabric first: Demand-reduction measures	Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. High-efficiency double-glazed windows throughout. Quality of build will be confirmed by achieving good air-tightness results throughout. Efficient-building services including renewable heating systems. Low-energy lighting throughout the building.
Renewable and low-carbon energy technologies	Air Source Heat Pumps 32A Car charging points

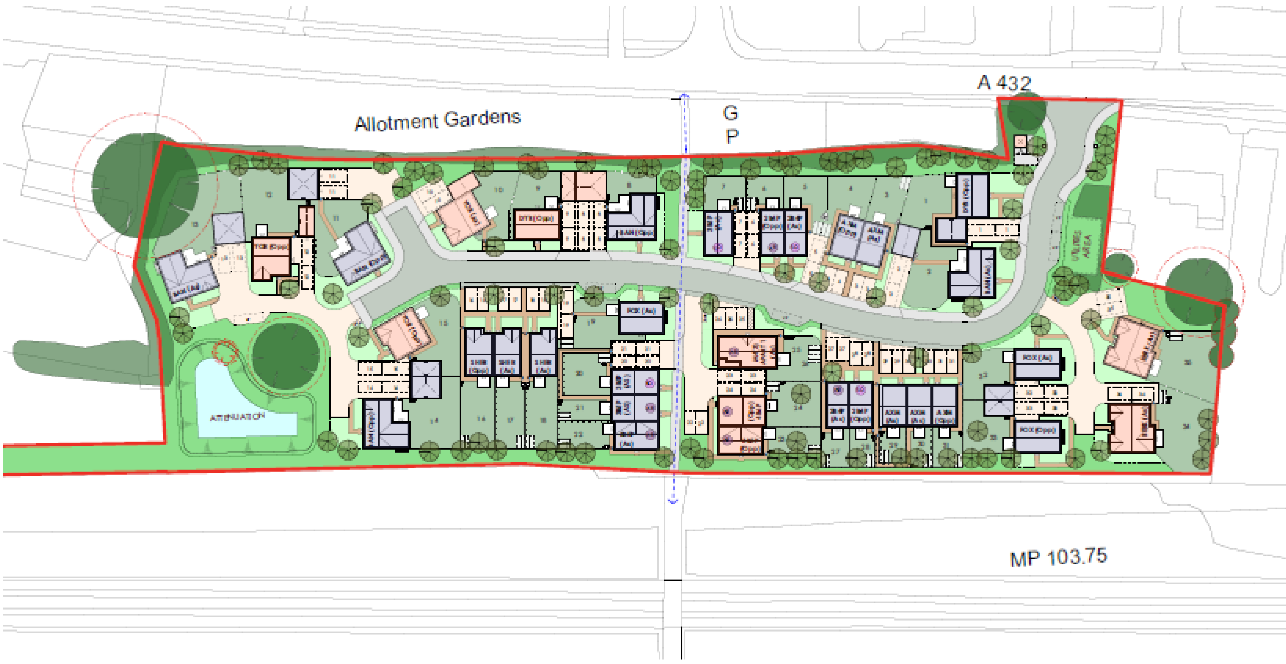
INTRODUCTION

Site Description

This Energy Statement has been prepared for the residential development at Land at Old Sodbury. This falls under the jurisdiction of South Gloucestershire Council.

The Development consists of 35 dwellings, a mixture of Maisonettes, Detached, semi- detached and terraced houses.

Site Plan for Land at Old Sodbury



Purpose of the Energy Statement

This Statement sets out how the Applicant intends to meet:

i) Planning Policy Framework.
ii) Approved Document Part L of the Building Regulations

To meet the energy standard at Land at Old Sodbury will be set out in this Statement as follows:

Baseline energy demand: The Development's Baseline in kWh will be calculated to establish the minimum on-site standard for compliance with AD Part L 2013

Fabric first – reduced energy demand: The Development's reduced energy in kWh will be calculated to explain how the Applicant's design specification will lead to a reduced energy demand and an improved fabric energy efficiency. The better the design of the building fabric in terms of, for example, insulation, air tightness and orientation to maximise solar gain, the less energy required to heat the dwelling and so the better the fabric energy efficiency.

Low-carbon and renewable energy: Low-carbon and renewable energy technologies will be assessed for their suitability and viability in relation to the Development. Solutions will be put forward for the development and the resulting conclusions presented.

BASELINE Design Specification

Introduction

In order to measure the effectiveness of demand-reduction measures, it is first necessary to specify the baseline energy design

The resulting ADL 2013 Baseline will be calculated using Part L model designs which will be applied to the Development details.

This baseline energy demand, will represent the maximum kWh energy permitted for the Development in order to comply with AD Part L 2013

Following calculations, the resulting Baseline will represent the total maximum energy in kWh permitted for the Development

Baseline design specification for Old Sodbury

Element	Baseline Design Specification
Ground Floor U-Value ($W/m^2.K$)	0.15
External Wall U-Value ($W/m^2.K$)	0.26
Party Wall U-Value ($W/m^2.K$)	0 (fully filled and sealed)
Roof – insulated at ceiling U-Value ($W/m^2.K$)	0.10
Roof – insulated at slope U-Value ($W/m^2.K$)	0.10
Roof – flat, U-Value ($W/m^2.K$)	0.13
Glazing U-Value, including frame ($W/m^2.K$)	1.27
Door U-Value ($W/m^2.K$)	1.2
Design Air Permeability	5
Space Heating	LPG
Heating Controls	Heating System Controls
Domestic Hot Water	LPG
Ventilation	Natural ventilation with intermittent extract fans
Low Energy Lighting	100%
Thermal Bridging	Appendix R Values

FABRIC-FIRST APPROACH - REDUCED ENERGY DEMAND

Introduction

Many Local Planning Authorities are now recognising the benefits of a fabric-first approach, where the lifetime energy consumption of a building takes precedence over the use of bolt-on renewable energy technologies.

It is clear that the fabric-first approach can create buildings with a very comfortable living and working environment. The internal temperature is consistent and fuel bills are kept to a minimum. One key advantage of a fabric-first approach is that it does not require changes to the behavioral patterns of the occupants and, as such, a building designed using a fabric-first approach will often perform more effectively once completed than a building that incorporates a low-carbon or renewable-energy technology that requires behavioral change (e.g. solar thermal). This becomes an increasingly important consideration as energy costs rise and the issue of fuel poverty becomes commonplace.

We have also considered the benefits of both an Air Source Heat Pump to replace LPG and a better fabric-first approach as the priority solution for the Development, to improve energy consumption

The Development - Reduced Energy Demand

It is proposed to integrate the following design measures to reduce energy demand:

Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs

High-efficiency double-glazed windows throughout
Quality of build will be confirmed by achieving good air-tightness results
Efficient-building services including an Air Source Heat Pump.
Low-energy lighting throughout the building
32A Vehicle charging points on all properties

The fabric-first and renewable design specification at Old Sodbury

Element	Fabric-First Design Specification
Ground Floor U-Value ($W/m^2.K$)	0.12
External Wall U-Value ($W/m^2.K$)	0.18
Party Wall U-Value ($W/m^2.K$)	0 (fully filled and sealed)
Roof – insulated at ceiling U-Value ($W/m^2.K$)	0.09
Roof – insulated at slope U-Value ($W/m^2.K$)	0.09
Roof – Dormer U-Value ($W/m^2.K$)	0.09
Glazing U-Value – including Frame ($W/m^2.K$)	1.2
Door U-Value ($W/m^2.K$)	1.0
Design Air Permeability	5
Space Heating	ASHP
Heating Controls	Time & Temp Zone Controls
Domestic Hot Water	Cylinder – 210L
Ventilation	System 1
Low Energy Lighting	100% Low energy
LCZ Energy	ASHP
Thermal Bridging	BRE Guidance

Conclusion

By incorporating sustainable design and energy-reduction design measures it is proposed to reduce energy consumption and improve the target emission rate by 20-30% above AD Part L 2013 Building Regulations

LOW-CARBON AND RENEWABLE ENERGY

Introduction

The Applicant will adopt ASHP technology and a fabric-first approach as the priority solution for this Development and steps have been taken to reduce energy demand through high-quality sustainable design.

The low-carbon and renewable energy solutions applicable to this development scheme are assessed and potentially-viable solutions recorded.

Viability of the following low-carbon and renewable energy technologies have been considered:

- Wind
- Solar
- Aerothermal
- Geothermal
- Biomass

Wind	*The ability to generate electricity via a turbine or similar device which harnesses natural wind energy. This could be considered as an onsite solution to reducing energy (turbines included within the development), or offsite (investing financially into a nearby wind Farm)*
Installation considerations	§ Wind turbines come in a variety of sizes and shapes. Turbines of 1 Kw can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical or horizontal-axis turbines are available. § A roof-mounted 1 kW micro wind system costs up to £3,000. A 2.5kW pole-mounted system costs between £9,900 and £19,000. A 6 kW pole-mounted system costs between £21,000 and £30,000 (taken from the Energy Saving Trust, TBC by supplier) § Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required. § Noise considerations can be an issue dependent on density and build-up of the surrounding area. § Buildings in the immediate area can disrupt wind speed and reduce performance of the system. § Planning permission will be required along with suitable space to site the turbine, whether ground installed or roof mounted.
Advantages	§ Generation of clean electricity which can be exported to the grid or used onsite. § Can benefit from the Feed in Tariff, reducing payback costs.
Disadvantages	§ Planning restrictions and local climate often limit installation opportunities. § Annual maintenance required. § High initial capital cost. It is usual for an investor to consider a series of turbines to make the investment financially sound.
Development feasibility	§ Installing a large turbine in an area such as this is not considered to be appropriate due to its appearance and physical impact on the built-up environment. Residents' and neighbours' concerns may include the look of the turbine, the

hum of the generator and the possibility of stroboscopic shadowing from the blades on homes.

- Wind speed has been checked for the development scheme using http://www.rensmart.com/Weather/BERR.
  The wind speed at ten metres for the development scheme is 4.0 metres per second (m/s) which is below the minimum of 5 m/s and threshold for technical viability.

- Typical payback times for a single turbine are expected to be greater than 15 years which means that the cost of installing and maintaining a single wind turbine is not considered a commercially-viable option.

5.3 Solar PV and Solar Thermal

The ability to generate energy (either electricity, hot water or a combination of the two) through harnessing natural solar energy. This could include the use of solar thermal panels, photovoltaic (PV) panels, or a combined solution. PV panels, similarly to turbines, can be considered both on and offsite.

Solar Photovoltaics convert solar radiation into electricity which can be used on site or exported to the national grid.

Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or evacuated tube panels, absorbing heat from the sun, and transferring this energy to a water cylinder. A well designed solar thermal system will account for 50-60% of a dwelling's annual hot water demand. Sizing the system to meet a higher demand will lead to excess heat generation in the summer months, and overheating of the system.

Installation considerations

- Operate most efficiently on a south-facing sloping roof (between 30 and 45-degree pitch.)
- Shading must be minimal (one shaded panel can impact the output of the rest of the array.)
- Panels must not be laid horizontally on a flat roof as they will not self-clean. Panels will therefore need to be installed at an angle and with appropriate space between them, to avoid over-shading.
- Large arrays may require upgrades to substations if exporting electricity to the grid.
- Local planning requirements may restrict installation of panels on certain elevations.

	§ Installation must take into account pitch and fall of the roof, along with any additional plant on the roof to ensure there is sufficient room. § The average domestic solar PV system is 4kWp and costs £5,000 - £8,000 (including VAT at 5 per cent) - (taken from the Energy Saving Trust, TBC by supplier.)
Advantages	§ Relatively straightforward installation, connection to landlord's supply and metering. § Linear improvement in performance as more panels are installed. § Maintenance free. § Installation costs are continually reducing. § Can benefit from the Feed in Tariff to improve financial payback.
Disadvantages	§ Not appropriate for high-rise developments, due to lack of roof space in relation to total floor area. § With Solar Thermal, performance is limited by the hot water demand of the building system oversizing will lead to overheating.
Development feasibility	§ The suitability of Solar panels has been considered for this Development and are concluded as a technically-viable option. § There are potential areas of roof space suitable for the positioning of unshaded Solar PV arrays, but not on every house § The Development is not on land which is protected or listed, so it is considered that Solar panels would not have a negative impact on the local historical environment or the aesthetics of the area. § If PV panels were to be used, the occupants may be entitled to claim the feed-in-tariff for any energy, however, the feed-in-tariff system is reported to be coming to an end. § PV panels could be used in conjunction with calor gas boilers, this could pass SAP 10.3/AD Part L 2021, but is not considered responsible with gas boiler usage on new build reportedly coming to an end in 2025

Aerothermal	*The transfer of latent heat in the atmosphere to a compressed refrigerant gas to warm the water in a heating system. This includes air to water heat pumps and air conditioning systems.* Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water. They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.
Installation Considerations	§ ASHPs operate effectively in buildings with a low energy demand, as they emit low levels of energy suitable for maintaining rather than dramatically increasing internal temperatures. It is therefore vital that the dwelling has a low heating demand to ensure the system can provide appropriate space-heating capability. § Immersion heater back-up required to ensure appropriate Domestic Hot Water (DHW) temperature in winter months.. § £7,000-£13,000 per dwelling (taken from the Energy Saving Trust, TBC by supplier.)
Advantages	§ Air source systems are a good alternative solution to providing heating and hot water to well-insulated, low heat loss dwellings. § They require additional space when compared to a gas boiler. Space for an external unit is needed, as is space for the hot water cylinder and internal pump. § Heat pumps are generally quiet to run. § Running costs between heat pumps and modern gas boilers are comparable.
§	

Disadvantages	. § Residents need to be made aware of the most efficient way of using a heat pump; as the low flow rates used by such a system mean that room temperature cannot be changed as reactively as a conventional gas or oil boiler system. § Back-up immersion heating can slightly increase running costs.
Development feasibility	§ ASHPs are considered a technically-viable option for this development scheme achieving compliance with the new AD Part L 2021 requirements and increased electrical availability

Geothermal	*The transfer of latent heat from the ground to a compressed refrigerant gas to warm the water in a heating system. This includes ground source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils.* Ground Source Heat Pumps (GSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the ground) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the ground, either through coils or in bore holes and piles, circulating a mix of water and antifreeze to extract energy from the ground, where the year-round temperature is relatively consistent (approx. 10 C at 4 metres depth). This leads to a reliable source of heat for the building. Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for GSHPs tend to be higher than those of ASHPs.
Installation	§ Require appropriate ground conditions to sink piles/bore holes or excavate for coils (which also require a large area of land.) § Decision between coils or piles can lead to significant extra cost.

Considerations	§ Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators. § Similar to ASHPs, perform best in well-insulated buildings with a low heating demand. § Electric immersion heater required for winter use. § £11,000-£15,000 per dwelling dependent on the size of the system (taken from the Energy Saving Trust, TBC by supplier.)
Advantages	§ Perform well in well-insulated buildings, with limited heating demand. § More efficient than ASHPs.
Disadvantages	§ The coils can be damaged by natural earthworks and by intensive gardening practices – occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit. § Will not perform well in buildings that are left unoccupied and unheated for a long period of time. § Back up immersion heating can drastically increase running costs. § Large area of ground needed for coil installation.
Development feasibility	§ GSHPs are considered a technically-viable option for this development scheme as there are no physical constraints in terms of ground conditions and area available for installation. § The capital installation cost would, however, be high which leads us to the conclusion that GSHPs would not be a commercially-viable option for this development scheme.

Biomass	*Providing a heating system fuelled by plant based materials such as wood, crops or food waste.* Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale

	or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.
Installation considerations	§ Biomass boilers are larger than conventional gas-fired boilers and also require what can be significant storage space for the fuel source. This needs to be considered at planning stage to ensure an appropriate plant room can be provided. § Flue required to expel exhaust gases – design needs to be in line with the requirements of the Building Regulations. § Need to consider whether fuel deliveries will be reliable and consistent to the location of the site (especially relevant in rural areas) and whether the plant room can be easily accessed by the delivery vehicle. § £9,000-£21,000 per dwelling dependent on size (taken from Energy Saving Trust, TBC by Supplier).
Advantages	§ Considerable reduction in carbon.
Disadvantages	§ Limited reduction in running costs compared to A-rated gas boilers, but at a substantially higher up-front cost. § Plant room space required for boiler and storage. § Dependent on consistent delivery of fuel. § Ongoing maintenance costs (need to be cleaned regularly to remove ash)
Development Feasibility	§ Biomass is considered a technically-viable option for this development scheme as there are no apparent physical constraints on site in terms of installing biomass boilers or storing a sufficient supply. § There are, however, concerns regarding a sustainable supply of biomass to the site. § The capital installation cost would, however, be high which leads us to the conclusion that biomass would not be a commercially-viable option for this development scheme.

The following low-carbon and renewable energy technologies, summarised below are considered potentially-viable options for this scheme

Summary of Feasibility for Land at Old Sodbury, South Gloucestershire

- Solar PV
- Solar Thermal
- Wind
- Aerothermal
- Geothermal
- Biomass

CONCLUSIONS AND RECOMMENDATIONS

We have demonstrated commitment to delivering an improved energy standard at Land at Old Sodbury

Considering all these options we propose Air Source Heat Pumps, across the site to all plots that will reduce energy consumption and improve the target emission rate by 20-30% above AD Part L 2013

- This energy standard is delivered through Air Source Heat Pumps and fabric-first approach to design, encompassing energy efficiency measures, low-carbon and renewable energy
- Part of the development's energy will be generated through the use of renewable technologies.
- 32A Vehicle charging points on all properties

The following measures, summarised below, are incorporated in the development proposals.

Measures incorporated to deliver the energy standard.

Fabric first: Demand-reduction measures	§ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. § High-efficiency double-glazed windows throughout. § Quality of build will be confirmed by achieving good air-tightness results throughout. § Efficient-building services including high-efficiency heating systems. § Low-energy lighting throughout the building.
Renewable and low-carbon energy technologies	§ Air Source Heat Pumps § 32A Vehicle charging points on all properties