



Sustainability Statement Report

for the proposed design and construction of the

Care Home, Boorley Gardens, Botley, Hampshire, SO32 2BX

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1.0 Introduction

The report reviews the proposed construction of a residential care home in Botley, Hampshire in relation to the expected energy usage of the scheme and the options available to the development team in order to reduce the environmental impact and address mandatory sustainability requirements. This will include a review of the options available for the implementation of Low and Zero Carbon Technologies within the scheme to potentially reduce the annual carbon production.

The development is a proposed new build care home building consisting of 70 bedrooms with ensuite bathrooms, residents lounge spaces and ancillary support accommodation. This report relates to attaining a level of compliance against Hampshire County Council's Climate Change Strategy.

Hampshire County Council declared a Climate Emergency in June 2019 and set two targets for the County Council, and Hampshire as a whole. HCC have set a pathway for how much carbon to target and reduce in order to be carbon neutral by 2050, and prepare to be resilient to the impacts of a 2°C temperature rise.

HCC's Climate Change Strategy recognises the changing climate as the biggest threat based on the following:

- Our vision for a well-adapted and resilient Hampshire will be essential to ensure that Hampshire's economy, environment, and society continues to thrive and prosper.
- Our policy is to focus on embedding climate resilience and mitigation across key policies and sectors, working with communities across Hampshire.

The sustainability strategy will aim to enhance the low carbon 'fabric first' principles adopted to reduce both embodied carbon and operational energy. It will explain the proposals for targeting BREEAM 'Excellent' accreditation and outline the project's Low Carbon Strategy and 'fabric first' principles.

Hampshire County Council is committed to achieving carbon neutral status by using government legislation, local plans and supplementary planning documents to ensure developments are sustainable, energy efficient, and use renewable energy. This includes the following key policies :

- Minimising energy use in new developments
- Sustainable site layout, landscaping, layout, and orientation of buildings
- Climate change resilience and adaptation
- Use of sustainable resources and materials and sustainable management of waste
- Water efficiency
- Design to encourage use of sustainable forms of transport

This report identifies possible low carbon construction solutions and renewable energy technologies and investigates the feasibility of utilising various renewable energy technologies to the development. Each proposed solution is described in relation to the site along with any associated issues which need to be taken into consideration.

The objectives of the feasibility study are as follows:

- To address mandatory legislative and best practice requirements relating to building materials, waste and recycling (both in construction and in the operational building) and water use/flood risk
- To undertake an initial review of the full range of renewable energy options for the proposed site
- To undertake a technical appraisal on the renewable energy options that may be appropriate for the current design of the dwellings
- To evaluate the potential role of renewables in minimising running costs of the potential occupiers
- To assess the environmental, social and planning issues that may be associated with each option.

BSRIA Guide BG/1 (2008) provides a good guide to the possible implementation to renewable technologies but quite rightly states that there is a mistaken belief that buildings will benefit from improved efficiency and reduced carbon dioxide emissions by being enhanced with renewable technologies. The starting point for any low and zero carbon building is to first reduce the loads through the 'Fabric First' approach, then improve the efficiency of the energy consuming plant and then reduce the carbon taken from the mains fuel supplies by considering on site generation.

In order to assess the amount of low or zero carbon technologies that would be required we have undertaken a preliminary SBEM calculations for the project. This exercise will provide a base Target Emission Rate (TER) in units of $\text{kgCO}_2/\text{m}^2.\text{annum}$. This value will then be applied across the total floor area of the development and summated to provide a total $\text{kgCO}_2/\text{m}^2.\text{annum}$ figure that will be used to calculate the quantity of low or zero carbon technologies to be provided.

2.0 Environmental Drivers

With the UK Government pushing low and zero carbon buildings, the client must acknowledge the national and regional building policies, tools and statutory and voluntary codes which may affect the proposed development.

2.1 Building Regulations

The proposed development has to comply with the Building Regulations Approved Documents Part L Volume 2 2021 (ADL 2021) “Conservation of fuel and power in buildings other than dwellings” . The ADL 2021 is the governments primary legislative tool to implement the requirements set out Energy Performance of Building Directive Articles 7, 9 and 10.

For compliance with ADL 2021 the SBEM calculation software tool has been utilised in the production of energy information to allow comparison between the building with and without the proposed LZC technologies. The 2021 updated ADL seeks to reduce the carbon dioxide emissions by up to 30% over and above the standards previously required by the Building Regulations 2013 and this will be considered in this report.

Energy Performance Certificates (EPCs) are statutory requirements for all buildings whenever they are built, rented or sold. The certificates demonstrate how energy efficient a building is, by providing an A-G rating similar to the labels seen on white goods. The assessments use standard methods and assumptions allowing dwellings to be compared with others of a similar type. The EPC is accompanied by a recommendation report that lists cost effective and low/zero carbon generating systems. The EPC will also provide a ‘provisional’ rating that illustrates the rating that could be achieved if all the recommended measures were implemented.

3.0 Materials and Waste

3.1 Reusing land and buildings

The care home building is to be built on a greenfield site with a development zone designated by the local authority; therefore adaptive reuse is not applicable for this project.

3.2 Reuse and recycling materials

This issue is not relevant with regards to demolition waste. Reuse and recycling of construction waste will be dealt with in the following sections of this report.

3.3 Sustainable materials and construction techniques

The use of various construction products can lead to a wide range of environmental impacts across the life cycle of a build process: through initial procurement, wastage, maintenance and replacement.

When considered all together, construction products make a significant contribution to the overall life cycle impacts of any one building.

ADL 2021 has given rise to reductions in the operational energy consumption of buildings and these regulations are being progressively tightened in their scope. As a result, the issue of greenhouse gas emissions from other aspects of buildings, such as embodied emissions, are becoming increasingly important in terms of reducing the overall emissions that lead to climate change. This has given increased significance to the procurement, maintenance and replacement of construction products over the lifetime of a building.

It is considered that this development will follow a sustainable resource management approach to be considered to help minimise the contribution that occupying a new development of any size makes in this regard. This can be achieved by designing the proposed development to use materials more efficiently, specifying materials which have been responsibly sourced, with the lowest possible environmental impact and where possible, utilising reclaimed or recycled materials. By managing the construction process in this way, it is possible to minimise the overall volume of waste produced by any building development.

Procurement of materials for the proposed development will prioritise renewable or sustainable sources with low energy impact, for example, all timber will be sourced in accordance with UK Governments Timber Procurement Policy and have Forest Stewardship Council, Pan European Forest Certification or the UK Woodland Assurance Scheme. It is also intended that all other materials will be sourced from companies holding EMS, IS14001 and BES6001 certification. Where feasible, inherently non-VOC emitting products shall be used in the design of the buildings, for example, concrete, glass and metal.

When selecting materials for this development, preference will be given to the use of locally sourced materials and local suppliers where viable. This will benefit the local economy as well as having environmental benefits through reducing transportation requirements. This will be addressed and considered in more detail during the detailed design stage.

It is also recognised that exposed elements of a building or landscaping are at risk of damage through impact and wear and tear. This can result in significant and unnecessary materials use

and waste generation across the life of a building. In turn this also highlights the need to consider future repairs and replacements, as well as their associated costs, when designing and specifying materials for a new building. This shall be minimised by risk areas being identified and designed out, and suitable protection measures being provided. In addition to this, climate change can significantly accelerate the deterioration of materials used in a building. It is therefore important to consider the impact of climate change and its associated environmental changes on the vulnerable elements within the built environment. Impacts of climate change shall also be mitigated by good design and specification to ensure increased confidence in the durability of new buildings and their individual elements.

As statistics consistently show, at least one-third of all waste in the UK, at around 120 million tonnes of waste per year, is generated by the construction and demolition sector, which is the largest contributor of waste in the UK. It is therefore clear that best practice solutions to limit this include off-site construction, where construction waste can be reduced or even halved, by the adoption of waste management methods such as the waste hierarchy.

The principal contractor of the proposed development shall be required to produce a Resource Management Plan, aimed at promoting resource efficiency and to prevent illegal waste activities. Resource efficiency includes minimising waste at source and ensuring clients, designers and principal contractors assess the use, reuse and recycling of materials and products both on site and off site.

This Resource Management Plan will define procedures and commitments to minimise non-hazardous and hazardous waste; waste minimisation targets and in turn provide details of waste minimisation actions to be undertaken as well as procedures to sort, reuse and recycle construction waste either on site or through a licensed external contractor.

In addition, re-profiling will take place of the existing ground using ground stabilisation techniques to improve the CBR values and maintain a balanced cut & fill. All existing topsoil will be stripped off and stored on site to be used in the soft landscaping works. At the time of writing this report there is no intention to take excavated soil off site.

The proposed development has a building method which relies heavily on a contemporary interpretation of a traditional brick aesthetic. Materials to the elevations will thus comprise of brickwork, panels of rendered blockwork, metal framed windows and in some sections there is proposed use of a weather board cladding hung on a galvanized steel frame system. More details are provided in the Design and Access Statement and in the accompanying drawings.

3.4 Green roofs and walls

A full use of a green roof in the area of the second floor flat roof areas is feasible due to its potential use as an area of shared outdoor space for residents. For the rest of the roofscape of the building there is a pitched roof and this upper roof area could also potentially incorporate Photovoltaic Panels, making a green roof feasible as a design solution.

3.5 Building lifecycle considerations

It is an accepted reality that many buildings are stripped out or even demolished considerably earlier than their design life would predict or their structural stability should require. In most cases only high value materials are reclaimed or reused and many resources are either used for

low grade uses, or taken to landfill. However, this risk can be reduced by considering building adaptability and also future disassembly to allow easy material separation and reuse. This includes exposed and reversible connections, layer independence and standardisation which can facilitate disassembly.

The design of the care home shall look at the possibility of alternative building uses, area function and different tenancies over the expected life cycle. Over the course of the buildings design, various considerations have included:

- It has been considered that future options for how the various units of accommodation within this building may evolve over time to suit changing needs has been recognised, such as modularity.
- Routes and methods for major plant replacement such as, networks and connections have flexibility and capacity for expansion.
- Accessibility for local plant and service distribution routes, e.g. detailed information on building conduits and connections infrastructure.

The design team will also give due consideration to the principles of 'Designing for Deconstruction', enabling the structural steel main frame of the building with bolted connections to be dismantled, reused and recycled. The internal structure will have mechanical fixings which will not facilitate the extraction of materials intact. Building documentation shall be compiled identifying the components and materials specified for their potential reuse and recycling.

3.6 Recycling space

The applicant is committed to supporting the government's targets for recycling and landfill waste reduction. The following measures will be implemented to encourage and help ensure the occupants will be able to maximise recycling of waste:

- Refuse storage is to be provided where both recyclable and non-recyclable waste can be stored.
- In the interior design of each floor area, space will be provided for segregated recycling waste bins. This will involve the installation of recycling bins, in addition to non-recyclable bins, where waste can be segregated into paper, cans, plastics and glass.
- External storage for waste and recycling will be provided in the service yard and will be adequately screened.

Planned waste collection services, vehicle specifications and best practice will impact the design and planning of waste collection at the proposed development. Access routes will be planned to accommodate typical refuse collection vehicles and developed in accordance with guidelines specified within BS5906:2005 Waste Management in Buildings – Code of Practice.

4.0 Water Usage and Flood Risk

In England the average person uses about 150 litres of water a day for a range of uses including sanitation, where significant savings are possible. Given that climate projections forecast half as much rainfall in summer in the South East of England by 2080, it is important to build water efficiency in to our building stock and minimise the need for major infrastructure enhancements to meet these pressures as well as growing demands.

Under these scenarios and with the expected high population growth, unless adaptation interventions are made, deficits are expected to be already widespread by the 2050s. The UK is expected to be in deficit by up to 16% of the total water demand in the 2050s and of up to 29% in the 2080s leading to major impacts on cost and resource levels.

The current technical guidance issued by the BRE is BREEAM Non Domestic New Construction 2018 v3.0. Water consumption is dealt with under issue 'Wat 01' the aim of this issue is to reduce the consumption of potable water for sanitary use in new buildings through the use of water efficient components and water recycling systems.

4.1 Calculation of Water Efficiency Performance

Non-domestic building's water efficient performance is determined using the BREEAM Wat 01 calculator and includes the efficiency of the following domestic-scale water-consuming components (where specified):

- WCs
- Taps (wash-hand basins and, where specified, kitchen taps and waste disposal unit)
- Showers
- Baths
- Washing machines (domestic and commercial or industrial sized)
- Commercial Kitchen appliances

The calculator tool defines the building types and activity areas for which the above components must be assessed. The 'Standard' method will be used to determine the building's water efficiency performance.

This method uses the building's actual component specification and default usage patterns for the building type and its activity areas to determine water efficiency (measured in litres/person/day and m³/person/yr) for a building.

The modelled output is compared with the output for a baseline component specification and the water demand saving determined as a percentage improvement.

In order to conserve water a fittings based approach will be used to determine the water

consumption of the development. This approach is transparent and compatible with developers' procurement.

Water will be monitored via a water meter on the mains water, thus ensuring compliance with water conservation policies.

4.2 Greywater/Rainwater

Greywater comes from inside the building, almost all of it comes from showers/bath and laundry. Additional but lesser amounts come from wash hand basin sinks, not enough water will be produced in the building to make grey water recycling viable, therefore this has been discounted.

Rainwater harvesting has been considered however due to the low demand from the development rainwater harvesting would not be practical, particular given the vulnerability of the residents.

4.3 Resilient buildings and Flood Risk

The location of the care home, within the village of Hedge End, Hampshire inevitably tidal or coastal flooding is not an issue. Equally the river networks within the area are at such a level and distance from the site to not be considered an issue. In addition water courses are also considered to be low risk to the site.

The Flood Risk Assessment and SuDS appraisal (separate report) has been undertaken in accordance with National Planning Policy in relation to development and Flood Risk and BCC requirements in respect of the proposed development.

- External levels shall be arranged to direct any overland flows away from proposed buildings to follow the existing site falls.
- The ground conditions should be fully investigated to determine the suitability of infiltration techniques for the disposal of surface water on the site.
- Should infiltration not be appropriate, the discharge of surface water from the site should be limited to pre-development flows and volumes utilising permeable paving for the parking areas, a swale/filter strip for the carriageway run off and a balancing pond for surface water storage, subject to detailed design.

Subject to the mitigation measures proposed, the development should not be subject to significant flood risk and furthermore should not increase the flood risk to the surrounding area.

In conclusion the proposed location of the development should not be subject to significant flood risk.

5.0 Low and Zero Carbon Technologies

The term low or zero carbon energy (LZC) is applied to renewable sources of energy and to technologies which either emit less carbon or are significantly more efficient than traditional energy sources.

Renewable energy is defined as a naturally available energy source which is constantly replenished and can be harnessed for use – this could include solar, wind, tidal and river water power.

Due to the location of the building, tidal and river water power have not been evaluated in this report.

The following section provides an overview of LZC technologies which are currently available and may be suitable for inclusion in the development.

5.1 Wind Turbines

Wind turbines harness the kinetic energy in wind and convert this via the rotor blades into mechanical energy which is then converted into electrical energy via an integral generator. Within the UK wind power is currently one of the most successful and fastest growing renewable energy technologies.

Wind turbines are normally installed either in groups as large wind farms these being either offshore or on land in suitable open areas or as smaller individual turbines in more urban areas.

The larger wind turbine installed in wind farms are more efficient although it is being increasingly recognised that smaller devices installed at the point of use, i.e. urban settings, can play an important role in reducing carbon emissions if they become mainstream.

Wind turbines can be used to generate electricity either in parallel with the normal AC mains supply or, for standalone DC applications, with battery back-up.

There are a number of 'off-the-shelf' wind turbines available for installation on either ground mounted masts or building mounted support structures.

The most common type of wind turbine is the horizontal axis wind turbine (HAWT) which can range in generation capacity from a few hundred watts to several megawatts. Vertical axis wind turbines (VAWT) are less efficient than the horizontal axis wind turbine but are generally quieter, have lower visual impact and have higher resistance to extreme conditions, but depending upon the design may not be self-starting. Grid connected units often use the generator as a motor to provide the starting impulse.

Typically wind turbine can be efficient in the production of electricity where the average wind speeds are more than 5-6 m/s.

To ensure maximum wind flow wind turbines should be located in open areas away from obstructions.

Support mast and structures are required to take advantage of the higher upper level wind speeds or roof mounted to minimise any potential turbulence caused by the building structure.

The wind characteristics at each location needs to be evaluated to determine the feasibility of installing wind turbines and wind turbines need to be sited carefully to avoid visual intrusion and noise problems. In urban areas higher wind turbulence can be expected which makes it difficult to carry out precise calculations of the annual turbine output, however average figures can be used to provide useful guidance.

The installation of wind turbines will require planning approval and payback periods of approximately 20 years can be achieved without grant funding for small building integrated applications.

Typically a good quality and correctly installed wind turbine installation can have lifespan of more than 20 years.

It is important to point out that the performance of a wind turbine depends largely on the available wind resource in terms of wind speeds and occurrence. Variations in the output and respective carbon savings can be considerable due to the exponential character of electricity generation with the increase/decrease of wind speed.

Due to planning implications, urban site restrictions, effect on local environment, likely cost and relatively poor wind speeds experienced at this location we do not consider wind turbines as a viable option, and will therefore not be reviewed further in terms of its viability and carbon reduction potential.

5.2 Solar Electricity Generation (Photovoltaic Cells)

Photovoltaic (PV) modules convert sunlight directly into DC electricity. These systems have virtually no moving parts to maintain and are silent in operation.

PV systems normally comprise of a number of multiple PV cell modules, which can be either mounted onto flat or sloping roofs or even be integrated into buildings' elements including facades, atria and shading devices. Ideally PV arrays should be inclined at an elevation between 30° and 40° and orientated toward south.

Two types of solar cells are commonly used in commercial PV system, these being Polycrystalline and Monocrystalline. Polycrystalline cells are more expensive to produce and have a higher typical quoted efficiency of between 15%-18%, Monocrystalline have a typical efficiency of between 13%-16%.

Solar cells produce a DC output and where the system is required to be 'grid connected' additional Inverter and control equipment will have to be installed. Grid connected systems up to 4kW (1 phase) and 10kW (3 phase) will have to comply with Engineering Recommendation G83/1. Systems above this size have to comply with Engineering Recommendation G59/2.

CIBSE TM 25 quotes that a typical PV array of 1m² using Polycrystalline or Monocrystalline cells installed within the UK will produce a useful output of between 90- 110kWh/annum assuming that the PV arrays are correctly installed and orientated.

The efficiency of PV arrays can fall by up to 10% if they are not regularly cleaned. Panels installed at an inclination of more than 15° should generally be self-cleaning via rainfall, however localised issues such as bird populations may cause issues, and an appropriate cleaning and maintenance regime should be established.

The anticipated life span of good quality solar cells is between 25 and 30 years although the output of the cells will reduce with ageing. Cell output is affected by temperature and air circulation around the cell should be maintained.

Photovoltaic generation is a technically suitable proposition for use on this project due to the respective roof orientations and the amount of open roof space on the building that will be capable of holding a significantly sized photovoltaic array, and will therefore be reviewed further in terms of its viability and carbon reduction potential. There is little potential for exporting electricity to the grid due to the buildings electrical base electrical load from plant and other electrical equipment being in excess of the maximum generation capacity of the solar PV system that is feasible as part of the scheme. Furthermore the UK government has significantly reduced the feed in tariffs associated with solar PV so that the additional cost for this type of technology would have unrealistic payback periods.

5.3 Solar Water Heating

Solar thermal water heating systems are well established and proven renewable energy systems, which are used extensively in many countries outside the UK and have been proven to be one of the most cost effective renewable energy systems available.

Solar thermal water heating can be applied cost effectively in a number of domestic building types which have a suitable level of domestic hot water demand.

Solar thermal water heating has been used within the UK for a number of years and following extensive research and ongoing monitoring of installed systems these are now accepted as being a technically proven LZC energy source which will in most cases, when correctly installed provide a significant contribution to hot water demand.

As the UK does not have sufficient all year round sunshine, solar water heating systems normally operate in conjunction with a back-up source of heat, such as gas or electricity, with the solar system acting as a pre-heat to the feed water to the main hot water heater or storage cylinder. It is advisable in this type of system to install suitable controls to monitor the temperature of the hot water storage cylinder to ensure that this is kept above the minimum required to prevent Legionella growth.

External solar collectors normally comprise of either flat plate or evacuated tube collectors which for maximum efficiency should be inclined at an elevation between 30° and 40° mounted on unshaded roofs with a southerly orientation, although orientations up to 45° east or west of south are acceptable.

Good quality flat plate collectors are normally glazed which eliminates the need for regular cleaning when pitched up above 15 degrees.

Typically the average energy which can be generated from good quality solar collectors installed within the UK is 450kWh/m² for flat plate collectors and 580kWh/m² for evacuated tube collectors.

Solar thermal systems are virtually silent in operation and can be integrated within the building design to minimise their visual impact.

Solar thermal systems generally have payback periods in excess of 10 years but actual figures depend on the system type, location, orientation, the availability of grants and the fuel which they displace.

The viability of solar water heating will not be considered for the development, due to the number of panels required to meet the expected demand which will prove prohibitive in terms of capital cost and the spatial requirements for each system.

5.4 CHP (Combined Heating and Power) Units

Combined Heat and Power (CHP) units generate electricity via gas or diesel engines. A by-product of the electricity generation is heat and the CHP units reuse this heat to heat water, thus increasing the overall efficiency of the system.

To operate at maximum efficiently CHP systems require a constant and steady base electrical and heat load within the development and generally plant will only be economic if it can run for more than 4,500 hours per year.

Most small-scale CHP installations comprise of packaged units, which utilise modified spark ignition gas reciprocating engines. Units are typically available in the range of 50kWe to 800kWe output which typically have a heat to power ratio of typically 1.5:1.

CHP installations can offer a more efficient and economic method of supplying energy demand compared to centrally generated electricity supplied via the grid due to the utilisation of the heat which is normally rejected to the atmosphere from central generating stations, and by reducing network distribution losses due to local generation and use.

CHP units should be sized just above the base heating load to maximise the delivery of useful heat and power and avoid excessive modulation and dumping of heat.

CHP efficiency is linked to electricity and heat demand and users should be made aware of efficient operating practices and the increasing cost of the fuel gas which will affect on-going running costs.

Capital costs for CHP installations are higher than for alternative systems, but this can be recovered over a relatively short period of time typically 5-10 years for correctly sized and installed systems.

CHP installations will generate noise however this can be reduced by housing the gas engine within a purpose designed acoustic enclosures.

Gas powered CHP units will release carbon dioxide and other emissions as they are burning fossil fuel and carbon dioxide emissions are around 20-50% higher than a conventional high efficiency gas fired boiler plant of similar heat output. The CHP emissions however are more than offset by the reductions achieved at power stations and consequently CHP is widely recognised as having a lesser environmental impact than conventional alternatives.

CHP is complementary to most other LZC energy technologies. However, the use of CHP can reduce the viability of separate installations which use low carbon technologies to deliver heating energy e.g. biomass boilers or solar water heating etc and a full appraisal of all technologies is required.

CHP units work most efficiently on systems that have good base heating and hot water and electricity load profiles such as hospitals and hotels. As the development is a residential care home scheme a CHP system will be considered for the project due to the large domestic water demand.

5.5 Ground Source Heat Pumps

External air temperatures are affected by seasonal weather changes. The temperature fluctuations of the earth reduces as depth increases and typically within the UK at below depths of 10m the ground temperature is relatively constant at around 11°C. Ground Source Heat Pump (GSHP) technology extracts the stored heat from the ground. The scale of the collector systems is determined by the size and usage profile of the heat demand.

The configurations of ground source heat pumps most commonly used are bore holes and horizontal loop systems; the choice of system is normally determined by the site, available land and ground conditions. A ground condition survey will be required to determine site suitability for GSHP systems.

Horizontal closed loop collectors require relatively large area of land free from hard rock, large boulders etc and comprises of pipes buried in trenches, normally at a minimum depth of 1m. Spiral or coiled pipe work known as “Slinkies” are often used in horizontal systems, however we understand these system are not as effective and can cause the ground to freeze if incorrectly installed, so would not recommend the use of “slinkies” as part of a GSHP installation.

Bore hole vertical collectors are used where insufficient land area is available or where ground conditions are not suitable for horizontal closed loop systems. Vertical borehole systems can be installed in a number of configurations (single, double, U-shaped, etc) in approximately 200mm dia bore holes which are drilled to depths of approximately 150m. The spacing between adjacent boreholes of approximately 10 metres should be maintained to prevent thermal interference.

Heat pumps are also reversible and in addition to providing heating can also be configured to provide a source of limited cooling.

Typically the output temperatures provided by heat pump systems is around 45°C and for maximum efficiency heat pumps systems should operate continuously and should be used with suitable low temperature heating systems such as under floor heating systems.

The efficiency of heat pumps is measured by the ratio of the heating capacity to the power input, which is referred to as the Coefficient of Performance (COP). Where GSHP systems are correctly installed in conjunction with suitable under floor heating typical COPs can be as high as 4.

Ground source heat pump systems are generally reliable with low noise and typical life expectancies of up to 25 years. The life expectancy for the ground coil component is approximately 50 years.

The cost of installing GSHP systems is dependent on local conditions but costs are notably higher than standard gas, oil or electric heating systems, mainly because of the civil engineering costs associated with the ground collectors. GSHPs can be more competitive where the availability of gas or oil supplies is limited.

GSHP is a technically viable proposition for use on this project due to the benefits associated with the Renewable Heat Incentive (RHI) scheme which allows the owner of the bore hole array to effectively be the energy supplier for the building and will therefore be reviewed further in terms of its viability and carbon reduction potential.

5.6 Air Source Heat Pumps

Air Source Heat Pump (ASHP) technology is similar in operation to Ground Source Heat Pumps but extracts the stored heat from the surrounding air.

As the air temperature is not stable throughout the year, the variation in air temperature relative to the heating and cooling demands results in lower COPs and ASHP systems will be less efficient at providing heating at the lower winter external air temperatures.

Split system cooling systems utilising air source heat pumps linked to internal cassette units are commonly installed within the UK to provide heating and cooling.

Heat pumps will provide output temperatures between 30–50°C. For maximum efficiency heat pumps systems should operate continuously, produce lower flow temperatures and should be used with suitable low temperature heating systems such as under floor heating systems.

Air source heat pump systems are generally reliable but there can be problem with air noise if sited close to rooms with opening windows or other noise sensitive areas. Air source heat pump systems have typical life expectancies of approximately 15 years.

Air source heat pumps are a technically viable proposition for use on this project due to the benefits associated with the lower water flow temperatures in conjunction with underfloor heating and will therefore be reviewed further in terms of its viability and carbon reduction potential.

5.7 Night Time Cooling

Night time cooling uses the exposed structure of a building as a heat sink to absorb heat in occupied hours which is then cooled at night using external air.

Night time cooling requires the exposed structure to have a high thermal mass and requires a system of automatic windows/louvers to allow cooling air to enter at night.

Typically buildings with night cooling have exposed concrete slab ceilings to provide the exposed thermal element. The use of exposed concrete ceilings can give rise to acoustic problems and an acoustic specialist should be employed to give advice on this.

Other options for night cooling include the use of floor slabs which incorporate hollow sections through which air can be passed.

Night cooling is normally carried out when rooms are unoccupied via an automatic control system.

The development does not have a proposed automatic window system (and is unlikely to be specified for both security and cost considerations) therefore night time cooling is not viable for this project.

5.9 Biomass Boilers

Biomass is an alternative solid fuel to conventional fossil fuels which due to the carbon intake of the source plant has close to neutral carbon emissions.

A number of different types of biomass fuel are available, the most common being the woody biomass which includes forest residues, such as tree thinning, and energy crops, such as willow short rotation coppice.

The biomass is not used in the raw form and is converted into a more manageable form which is usually wood chips, logs or pellets which can be directly fed into the boiler.

The wood pellets are essentially compacted high density wood with low moisture content, which have a higher calorific value per unit than other wood based fuel sources.

A local source of biomass fuel is preferred to minimise the carbon impact of delivery. An onsite storage facility is required for the biomass fuel which needs to be located next to the boiler plant and in some cases local biomass fuel drying facilities may be required.

Biomass boilers are typically installed as an alternative to standard gas-fired boilers to provide the heat source for space heating and hot water. Biomass boilers can achieve efficiencies of more than 80%, with many of the installations sized on a site specific base load with an additional heat source top-up and back-up being provided by conventional high efficiency gas boilers.

Capital costs of biomass boiler installations are higher than conventional systems and costs can vary significantly from site to site, depending on fuel type, heating infrastructure and the cost of the boiler plant. Additional cost will be incurred due to the need for larger boiler rooms fuel storage facilities.

Consideration should be given to the additional maintenance which will be required, in particular to the availability of personnel and the time required maintaining bio fuel systems.

Generally the noise levels of the bio fuelled plant should not be a problem but there may be noise, dust and vibrations associated with the delivery of wood fuels.

There may be local controls on biomass emissions e.g. regulations under the Integrated Pollution Prevention and Control (IPPC) Directive apply to appliances with fuel inputs greater than 0.4MW.

Over their lifecycle, biomass fuels sourced and processed from sustainable sources within 25 miles of the biomass plant can be regarded as carbon neutral and hence the fuel carries no carbon burden. Many biomass fuels transported for greater distances can also be regarded as carbon neutral since the alternative destination of the fuel is often land-fill where it would decompose to generate methane which is a significantly more potent greenhouse gas than the CO₂.

Although biomass boilers are a technically viable proposition for use on this site, there is insufficient space to accommodate the required fuel storage bunker, and deliveries may be an issue and also there is a cost implication as to whether the building operators will be able to fund the boilers and also house them correctly as they take up a large area, therefore this will not be reviewed further in terms of viability and carbon reduction potential.

5.10 Biodiesel Boilers

Biodiesel is non-toxic and biodegradable fuel which helps to reduce harmful emissions into the environments as well as using less carbon dioxide for the same power (approx. 80% less CO₂).

Biodiesel is an alternative fuel to conventional fuel oil which due to the carbon intake of the source plant has close to neutral carbon emissions depending upon blend.

Blended biodiesel has commonly been used in road vehicle for a number of years but in recent times has been seen as an alternative fuel for use in suitable heating boilers.

A limited numbers of manufacturers are now producing boilers which can use biodiesel, although smaller boiler plant burners will only be suitable to run on fuel with a lower content of biodiesel.

On site bulk storage tanks will be required for the biodiesel fuel as with diesel fuel, biodiesel has a limited long-term storage life. In diesel fuel terms, this is referred to as oxidation stability. UK produced biodiesel will include additives to ensure the fuel meets appropriate standards for oxidation stability, and should be suitable for storing for a minimum "best practice" period of 6 months. As with ordinary diesel fuel, it is recommended that biodiesel should not be stored for any longer than this.

A local source of biodiesel fuel is preferred to minimise the carbon impact of delivery. Biodiesel boilers efficiencies are generally less than conventional oil and gas boilers.

Capital costs of biodiesel boiler installations are higher than conventional gas fired systems and costs can vary significantly from site to site, depending on fuel type, heating infrastructure and the cost of the boiler plant.

Additional cost will be incurred due to the need for larger boiler rooms and fuel storage facilities.

Generally the noise levels of the biodiesel fuelled plant should not be a problem but there may be noise and vibrations associated with the delivery.

There may be local controls on biodiesel emissions e.g. regulations under the Integrated Pollution Prevention and Control (IPPC) Directive apply to appliances with fuel inputs greater than 0.4MW.

The capacity of the boiler required for the site would not allow the use of 100% biodiesel and would require a blended fuel; consequently this has been discounted in favour of more suitable LZC technologies and therefore will not be reviewed further in terms of its viability and carbon reduction potential.

6.0 Energy Efficiency

As stated in the introduction to this report the first step should always be to improve the energy efficiency of the building and hence reduce the annual energy consumption and carbon dioxide emissions.

The current building regulations require all new developments to undertake energy calculations to demonstrate a reduction in the carbon emissions of the building over a notional building constructed to the previous version of the building regulations.

There are many ways of achieving a 'pass' result for these calculations and this section of the report will briefly review the options available to the design team.

6.1 'U' Values

'U' values are a method for assessing the insulation levels of various elements used in the construction of the building.

By improving the 'U' values over the values indicated in the building regulations the annual energy consumption can be reduced through the reduction in heat losses through the fabric. This approach is commonly referred to as the 'Fabric First' methodology and should always be the initial consideration when designing a new building or significant extension.

The following 'U' values have been proposed by the energy assessor and used to determine the energy usage within the calculations for the development;

External wall U-value:	0.18		
Flat Roof U-value:	0.12		
Pitched Roof U-value:	0.12		
Window U-values:	1.10	G Value	0.57
Door U-values:	1.10		
Ground Floor U-value:	0.12		

These 'U' values will be the maximum applied to the development and may be reduced to provide greater efficiency during the detailed design when further cost analysis has been undertaken.

6.2 Efficiencies

The efficiency of the building services equipment such as it lighting systems, heating systems or ventilation systems etc. will contribute to the overall carbon dioxide emissions for the development. The more efficient the equipment the greater the reduction in carbon emissions; especially when used in conjunction with appropriate controls.

It is proposed that highly efficient fittings and plant will be installed to all dwellings. These will include;

- The installation of low energy lamps in the form of high efficacy LED and automatic controls throughout the building.
- The extension will be heated by means of underfloor heating with local control utilising intelligent controls.

- Ventilation shall be by means of local low carbon extract fans in bedrooms/ensuite.
- All pumps and fan motors shall be inverter driven

6.3 Air Tightness

In the same way that improved 'U' values contribute to the reduction in heat loss through the building as does the air tightness. The more air-tight the building is the less the heat loss will be.

However a building that is too air tight may require supplementary ventilation to ensure the minimum fresh air rates are still provided for the occupants; this may result in the requirement for additional ventilation systems which will use energy and contribute to the annual energy consumption and carbon dioxide emissions.

The calculations for the new build care home have been based on an air permeability rate of $7 \text{ m}^3/(\text{hr.m}^2) @ 50 \text{ Pa}$.

7.0 Proposal for the Reduction of Energy Usage

In order to establish the comparable energy benchmarks for the development three options for the heating and DHW strategy have been modelled as follows.

1. Electric panel heaters for the space heating, centralised gas fired hot water plant and photovoltaic panels, mounted at roof level.
2. LPHW underfloor heating for the space heating from a communal gas fired system feeding centralised DHW cylinder/s.
3. LPHW underfloor heating for the space heating from communal air-source heat-pump (ASHP) feeding centralised DHW cylinder/s.

The ventilation systems required for the extension have been modelled on a local extract system.

The summertime overheating requirements have been based on restricted opening windows to each bedroom. This coupled together with the majority of these rooms not having suitable crossflow ventilation has caused them to fail the summertime overheating requirements. In order to achieve a pass it is required to stipulate a minimum air change rate (ACH) required and these minimum rates will be identified. The ventilation systems will need to be specified to meet the required air-change rates.

The U Value figures have been largely based on industry good practice for the Ground Floor and External Walls. A target U Value for the pitched and flat roof areas has also been utilised as per the previous detail.

The target whole-unit U Value for the external windows/doors has been based on 1.1 W/m²K with a glazing G Value of min. 0.57, in order to achieve a pass on the L2 requirements.

For comparison three options has been modelled in the L2 SBEM software to see how it performs against the Target Carbon Emission Rate (TER).

Option 1

Electric heating, hot water and PV	-	non compliant with Part L 2021
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Option 2

Gas fired UFH heating and hot water. No PV	-	non compliant with Part L 2021
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Option 3

Gas fired UFH heating, CHP serving hot water with 40 kWp of PV	-	compliant with Part L 2021
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The above demonstrates that only option 3 would be a viable proposal given the fabric and form of the proposed building extension development

Compliance with option 1 could potentially be achieved by increasing the amount of PV associated with the building however the amount of available roof space to site the PV panels is restrictive so this would need to be carefully assessed.

8.0 Conclusion

The purpose of this report is to establish those measures that will need to be incorporated into the detailed design of proposed care home in order to achieve compliance with Part L2 of the Building Regulations. The current version of Part L2 was introduced in 2022 and requires at least a 30% improvement in carbon performance over the 2013 standards and this will be achieved by adopting the following outline building specification for each apartment within the new development.

U Values

Ground Floor 0.18 W/m²K

External Wall 0.18 W/m²K

Warm Roof 0.16 W/m²K

Flat Roof 0.16 W/m²K

Party walls and floors between existing and new build 0.0 W/m²K

Windows, Glazed Doors & Entrance Doors 1.2 W/m²K – whole-unit U Value, based on double glazed units with a modelled glazing G Value of 0.57.

Thermal Mass

The precise thermal mass has been provisionally modelled, which results in a value of 56.27 kJ/m²K

This is based on steel frame structure with masonry external walls, solid ground floor, insulated flat roof and internal stud partitions.

Ventilation

Design air permeability rate – 7 m³h/m²(@50Pa).

Local Extract Ventilation System

Serving the ensuite areas of each bedroom and laundry areas

Main Heating

Under floor heating fed from Gas Fired Heating

Controls – programmer and local room thermostats.

Water Heating

CHP feeding storage cylinders

Max 2.5 kWh/day loss.

Renewables

40kWp PV array on flat roof areas.

Internal Lighting

Max 8W per fitting.
Min. 120 lm/cW efficacy

Results of provisional SBEM assessment

Target CO ₂ emission rate (TER), kgCO ₂ /m ² :annum	27.05
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	25.3
Target primary energy rate (TPER), kWh _{pe} /m ² :annum	162.9
Building primary energy rate (BPER), kWh _{pe} /m ² :annum	131.12
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	44.36	48.54
Cooling	0.02	0.01
Auxiliary	15.03	23.35
Lighting	11.67	10.9
Hot water	79.27	66.01
Equipment*	35.52	35.52
TOTAL**	127.63	148.8

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Performance Asset Rating

More energy efficient



A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

27

This is how energy efficient the building is.

9.0 Appendix A – BRUKL Report – pre design stage 3

BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2021

Project name

Hedge End Care Home

As designed

Date: Thu Dec 07 16:51:14 2023

Administrative information

Building Details

Address: Halebourne Group, Hedge End Care Home,
Hedge End, Boorley Green, Botley,

Certifier details

Name: James Houghton
Telephone number: 07747698604
Address: Suite 2 The Offices Cooperage Bowburn,
Durham, DH6 5AT

Certification tool

Calculation engine: SBEM
Calculation engine version: v6.1.e.0
Interface to calculation engine: DesignBuilder SBEM
Interface to calculation engine version: v7.2.0
BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 1387.01

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	27.05
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	25.3
Target primary energy rate (TPER), kWh _e /m ² .annum	162.9
Building primary energy rate (BPER), kWh _e /m ² .annum	131.12
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.18	0.18	Gnd - Zone 96_P_8
Floors	0.18	0.12	0.12	Gnd - Zone 96_S_3
Pitched roofs	0.16	0.12	0.12	Block 1 - Zone 96_R_4
Flat roofs	0.18	0.12	0.12	Second - Zone 3_R_4
Windows** and roof windows	1.6	1.1	1.1	Gnd - Zone 6_G_11
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m ² K NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	7

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m ²]	4307.4	4307.4		Retail/Financial and Professional Services
External area [m ²]	7023.4	7023.4		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	SOU	SOU		Offices and Workshop Businesses
Infiltration [m ³ /hm ² @ 50Pa]	7	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	1570.89	2235.95		Storage or Distribution
Average U-value [W/m ² K]	0.22	0.32		Hotels
Alpha value* [%]	25.62	18.23	100	Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				
				Residential Institutions: Residential Schools
				Residential Institutions: Universities and Colleges
				Secure Residential Institutions
				Residential Spaces
				Non-residential Institutions: Community/Day Centre
				Non-residential Institutions: Libraries, Museums, and Galleries
				Non-residential Institutions: Education
				Non-residential Institutions: Primary Health Care Building
				Non-residential Institutions: Crown and County Courts
				General Assembly and Leisure, Night Clubs, and Theatres
				Others: Passenger Terminals
				Others: Emergency Services
				Others: Miscellaneous 24hr Activities
				Others: Car Parks 24 hrs
				Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	44.36	48.54
Cooling	0.02	0.01
Auxiliary	15.03	23.35
Lighting	11.67	10.9
Hot water	79.27	66.01
Equipment*	35.52	35.52
TOTAL**	127.63	148.8

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
 ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	9.67	11.66
Wind turbines	0	0
CHP generators	22.72	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>32.39</i>	<i>11.66</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	465.25	412.74
Primary energy [kWh _{PE} /m ²]	131.12	162.9
Total emissions [kg/m ²]	25.3	27.05

10.0 Appendix B – EPC – pre design stage 3

Energy Performance Certificate		HM Government	
Non-Domestic Building			
Halebourne Group Hedge End Care Home Hedge End Boorley Green Botley		Certificate Reference Number: 5123-1754-4125-2024-8814	
This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document <i>Energy Performance Certificates for the construction, sale and let of non-dwellings</i> available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.			
Energy Performance Asset Rating			
More energy efficient			
			
..... Net zero CO ₂ emissions			
A 0-25			
B 26-50			
C 51-75			
D 76-100			
E 101-125			
F 126-150			
G Over 150			
Less energy efficient			
 27 This is how energy efficient the building is.			
Technical information		Benchmarks	
Main heating fuel:	Natural Gas	Buildings similar to this one could have ratings as follows:	
Building environment:	Heating and Natural Ventilation		
Total useful floor area (m ²):	4307.4	29	If newly built
Building complexity:	Level 4	115	If typical of the existing stock
Building emission rate (kgCO ₂ /m ² per year):	25.3		
Primary energy use (kWh _{pe} /m ² per year):	131.12		