

31 January 2022

VAHNEA STUDENT RESIDENCES

SUSTAINABILITY AND ENERGY EFFICIENCY REPORT

31 January 2022

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1. INTRODUCTION

1.1. Overview

Ridge & Partners LLP have been appointed by Cover Storey Architects to complete a Sustainability and Energy Efficiency Report for the Vahnea Student Residences development, Bognor Regis.

This report is an updated version of the Sustainability and Energy Efficiency Report that was submitted in support of the initial planning application for this scheme – BR/270/18/PL.

The proposed scheme is a part conversion and extension of an existing building to provide 6 additional storeys over the existing rooftop, to provide for up to 104 student residential units, with access from Bedford Street, associated servicing and ancillary accommodation. The scheme also includes an entrance and stair core extension to the existing building to provide access from Bedford Street.

In order to demonstrate that energy and sustainability requirements set out in the Building Regulations and local planning policy will be met - analysis has been undertaken using energy modelling software to identify the most appropriate, commercially viable energy strategy to meet the site low carbon targets.

1.2. Project Background

The scheme is a new student residences development that is proposed to include two main connected cores - a 6 storey block and a 1 storey block, with a shared courtyard.

The development plot is shown in Figure 1.1, below. The Application Site is located on Bedford Street within the retail district of Bognor Regis.

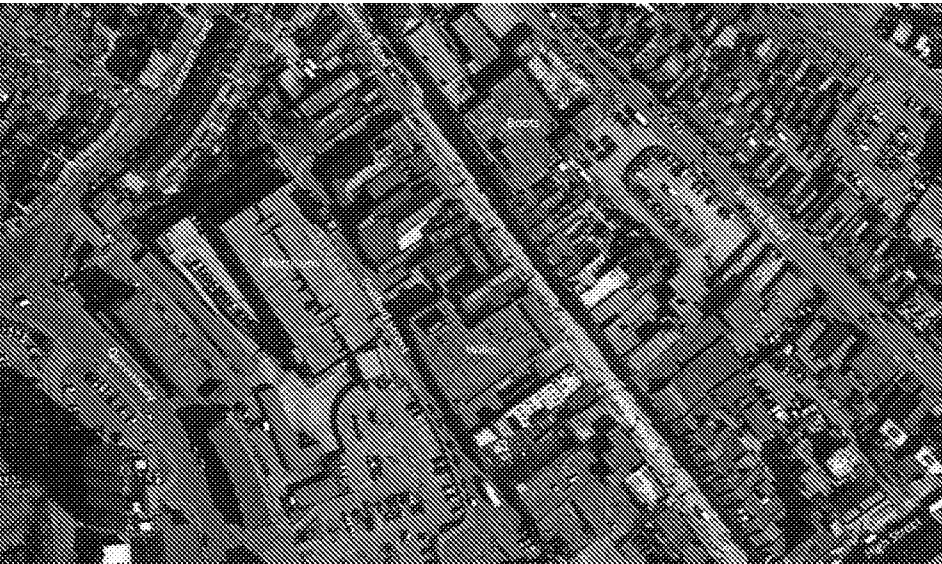


Figure 1.1 – Aerial View of Application Site (with boundary line indicated in red)

The development proposals are shown illustratively in the section included as Figure 1.2, below.

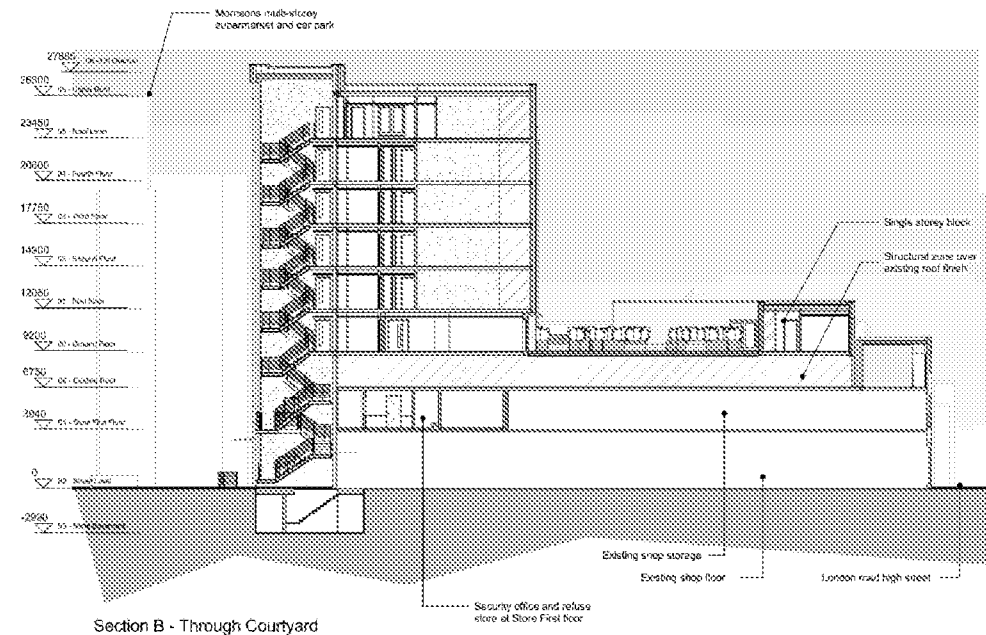


Figure 1.2 – Section (Image Source: Drawing produced by Cover Storey Architects)

1.3. Objectives

The overarching objectives of this report are:

- To demonstrate to the Planning Authority, Arun District Council, that the proposed development will comply with their core policies;
- To provide an initial assessment of the measures required to comply with the requirements of Part L of the Building Regulations; and
- To contribute to the development of a low carbon strategy for the site which will be carried through to detailed design, construction and operation.

## 2. POLICY CONTEXT

### 2.1. Overview

This report supplements the planning application for the proposed Vahnea Student Residences development, Bognor Regis, and aims to address strategic issues raised by local, regional and national policies relating to climate change and sustainability.

There is increasing awareness and legislation regarding low and zero carbon (LZC) technologies in the built environment. Rather than considering alternative energy sources at the end of a development, stakeholders are increasingly recognising the benefits of an early appraisal of such technologies.

Against a context of the relevant planning policies, this report focuses on minimising energy consumption during the life of the development, supplemented by on-site LZC energy sources where feasible.

### 2.2. Part L of the Building Regulations

Approved Document Part L sets out the energy efficiency requirements of the Building Regulations that apply to new build developments and refurbishment construction works.

The extension areas of the proposed scheme will constitute the majority of the new halls of residence. As the extension to the existing Wilko store is over 100m<sup>2</sup> in size and constitutes more than 25% of the total useful floor area of the existing building, it will be assessed for compliance under Part L of the Building Regulations as a new building.

Part of the proposed halls of residence is within the existing floorplate of the existing Wilko store. These areas form a significantly smaller proportion of the works. The approach that is proposed for these areas of the scheme at this preliminary stage are outlined below:

- Fixed building services are to meet the efficiency requirements stipulated in Part L; and
- Fabric improvements/ renovations will meet the requirements and threshold limits detailed in Part L.

The current section of Part L that applies to new build, non-residential developments is *Approved Document L2A: Conservation of Fuel and Power in New Buildings other than Dwellings (2013)*.

Notably, however, a revised version of Part L has now been published by the UK government. The section in the revised Part L that would apply to this scheme is *Approved Document L: Conservation of Fuel and Power - Volume 2: Buildings Other Than Dwellings (2021)*.

As of 15 June 2022, the revised Part L (2021) will come into force. Transitional arrangements will apply to schemes where a building notice or initial notice has been given to, or full plans deposited with, a local authority before 15 June 2022 provided that the building work is started before 15 June 2023. At this stage, it is anticipated that it is likely that this scheme will fall under the requirements of the revised Part L.

Part L sets an overall carbon emissions target for new buildings in the form of the Target Emission Rate (TER). In order to comply, the calculated Building Emission Rate (BER) for a new non-domestic building need to be less than or equal to the TER. Revised Part L (2021) will introduce a ~27% reduction in the target TER from the current version of Part L – making compliance with this emerging regulatory document more onerous.

Part L 2021 also sets a target primary energy target (TPER) for new buildings. In order to comply, the calculated Building Primary Energy Rate (BPER) for a new non-domestic building needs to be less than or equal to the TPER.

### 2.3. Arun Local Plan 2018

The Arun Local Plan 2011-2031 was adopted on the 18<sup>th</sup> of July 2018. It sets out Arun District Council's vision for the development of Arun up to 2031. The Plan contains strategic and development management planning policies that will shape the future of the area and will inform the consideration of planning applications.

Arun District Council promotes sustainable development to reduce the effects of global warming. There are a number of key policies within the Arun Local Plan that outline Arun District Council's approach to low carbon development.

The Arun Local Plan stipulates that development in the District must be designed to mitigate against the impacts of climate change by reducing greenhouse gas emissions in line with the energy hierarchy. The energy hierarchy is outlined below:

1. Reduce the use of energy;
2. Use energy more efficiently;
3. Move to energy from renewable sources; and
4. Use remaining fossil fuels cleanly.

Three key policies relating to energy usage are *Policy ECC SP1 – Adapting to Climate Change*, *Policy ECC SP2 – Energy and Climate Change Mitigation* and *Policy ECC DM1 – Renewable Energy*.

These policies are detailed below:

#### ***Policy ECC SP1 – Adapting to Climate Change***

*The Council will support development which is located and appropriately designed to adapt to impacts arising from climate change such as the increased probability of tidal and fluvial flooding; water stress; health impacts as a result of extreme temperatures and a decline in the quality of habitats and richness of biodiversity.*

*In order to achieve this, development must be designed to take account of the following issues:*

- a. Location (in relation to flood risk and vulnerability to coastal erosion);
- b. Water efficiency;
- c. Shade, cooling, ventilation, solar gain;
- d. Connectivity to the green infrastructure network;
- e. Layout and massing;
- f. Resilience of buildings and building material to extreme weather events; and
- g. Capacity of drainage systems and incorporation of Sustainable Urban Drainage Systems (SuDS)

#### ***Policy ECC SP2 – Energy and Climate Change Mitigation***

*All new residential and commercial development (including conversions, extensions and changes of use) will be expected to be energy efficient and to demonstrate how they will:*

- a. Achieve energy efficiency measures that reflect the current standards applicable at the time of submission;
- b. Use design and layout to promote energy efficiency; and
- c. Incorporate decentralised, renewable and low carbon energy supply systems, for example small scale renewable energy systems such as solar panels.

All major developments must produce 10% of the total predicted energy requirements from renewable or low carbon energy generation on site, unless it can be demonstrated that this is unviable. Energy efficiency measures will be taken into consideration when the total predicted energy requirements are calculated. The Council will consider 'allowable solutions' where it is clearly demonstrated that the provision of onsite renewable or low carbon energy generation is unviable or not feasible.

Where planning permission is required to retrofit energy efficiency measures into existing development, schemes will be permitted, subject to the Design and Built Heritage policies.

In assessing the achievement of these standards the Council will consider:

- Site constraints;
- Technical viability;
- Financial viability; and
- Delivery of additional benefits.

#### Policy ECC DM1 – Renewable Energy

The Council will support renewable energy development subject to the criteria in this Policy. Schemes will be expected to contribute to the social, economic and environmental development and overall regeneration of the District.

Within areas of protected or sensitive landscapes, areas or buildings, development should generally be small scale or community based.

The Council will support proposals for appropriately located renewable energy development, and their ancillary development where they meet the following criteria:

- The proposal is located and designed to minimise adverse impacts to landscape, habitats, the historic environment and residential amenity including visual, noise and odour impacts;
- The location and design of proposals will need to take account of the Council's landscape assessment and landscape sensitivity studies (or successor documents) and proposals for large scale renewable energy projects will need to be supported by a zone of theoretical visibility and viewpoint assessment;
- Priority should be given to proposals that integrate with existing or new development where appropriate to do so having regard to (a); and
- All proposals will need to demonstrate a suitable connection to the electricity distribution network, or appropriate energy storage facility, and provide evidence to demonstrate that the connection will not result in unacceptable impacts upon the landscape, natural and historic environment or visual and residential amenity.

## 2.4. Arun District Design Guide SPD

The Arun District Design Guide was adopted in January 2021. It encourages sustainable development and managed future growth to ensure that change across the District is appropriate to meet the needs of the local area.

The Guide includes a section dedicated to Climate Change & Sustainability – Section K – that sets out a requirement to maximise energy efficiency and minimise whole life carbon.

It is a requirement in the Guide that design must demonstrate that each step of the energy hierarchy is followed. The energy hierarchy published in the SPD is included in Figure 2.1.

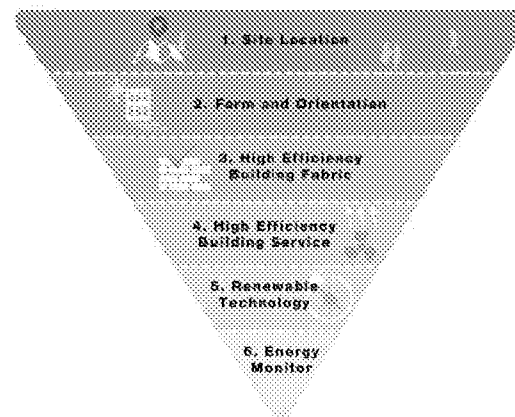


Figure 2.1 – The Energy Hierarchy Published in the Arun District Design Guide SPD

This is a more detailed breakdown of the 4 step energy hierarchy that is set out in the Arun Local Plan.

The Guide also sets out a checklist for items relating to Energy & Carbon that should be considered for new developments, as set out below:

1. Set targets for energy and carbon reductions beyond the relevant Part L Building Regulations.
2. Demonstrates consideration of embodied carbon (emissions from the manufacture, transport and construction of building materials, together with end of life emissions).
3. Incorporates passive solar design measures such as avoiding single aspects, including south facing windows on habitable rooms, minimising north facing glazing, using roof lights and sunpipes and providing shading to south facing windows through tree cover.
4. Uses heat recovery systems wherever mechanical ventilation is installed (MVHR).
5. Considers the ventilation strategy alongside proposed air tightness levels, to ensure buildings are not left susceptible to mould growth. This may include hydrothermal modelling.

The SPD also considers wider sustainability objectives for new developments, beyond the scope of energy and carbon. The wider sustainability strategy for the scheme is addressed in the BREEAM Pre-Assessment Report that has been undertaken by Ridge & Partners LLP and is submitted under separate cover.

## 2.5. Key Energy Performance Targets

In summary, the key energy performance targets outlined in relevant policy documents are as below:

- Compliance with the requirements of Part L of the Building Regulations;
- Development of an energy strategy in line with the principles outlined in the Arun energy hierarchy; and
- Demonstrate that 10% of the building energy requirements for the scheme will be met from renewable or low carbon sources.

3. ADOPTION OF THE ENERGY HIERACHY

3.1. Overview

In line with the energy hierarchy referenced in the Arun District Design Guide SPD, the following steps of the energy hierarchy have been assessed in turn for application to the development:

- 1. Site Location
- 2. Form and Orientation
- 3. High Efficiency Building Fabric
- 4. High Efficiency Building Services
- 5. Renewable Technology
- 6. Energy Monitor

3.2. Passive Design

The first 3 steps of the energy hierarchy are passive design considerations. Passive design uses local climatic conditions to reduce the amount of applied energy required to heat, cool or light a building. Passive design centres around the building envelope and its relationship with its surroundings. Some of the key proposed passive design measures will be detailed within this section of the report.

3.2.1. Site Location

The development site is located in the town centre of Bognor Regis, UK. The UK has a temperate oceanic climate – with a relatively narrow temperature range throughout the year and precipitation fairly evenly distributed throughout the year. The heating season in the UK typically runs from October to March/ April. Bognor Regis however, does experience relatively milder conditions than inland areas due to its proximity to the coast.

Being located in the centre of Bognor Regis will likely mean that the site will be subject to the Urban Heat Island effect – i.e. temperatures are typically higher than surrounding rural areas. This may make the building more prone to overheating risk.

Key passive design measures due to these climatic considerations are set out below:

- Enhanced, thermally efficient building fabric is proposed (refer to Table 3.1) to reduce winter heating loads associated with the local climate.
- Excessive glazing areas not proposed – to aid in mitigating peak solar gains, reducing overheating risk.
- Solar control glazing to be proposed (refer to Table 3.2) – to further aid in mitigating peak solar gains.

3.2.2. Building Form and Orientation

The building disposition has been largely dictated through the size and form of the Wilko store below, and the need to integrate the massing of the scheme with the surrounding context of the development.

The provision of glazing to occupied spaces can aid in allowing beneficial solar gains in the heating season, but extensive glazing could also increase overheating risk. A balance has been struck on this scheme, with the aim of providing sufficient glazing to provide adequate daylighting and beneficial solar heat gains, whilst not providing excessive glazing that could lead to occupant comfort issues. Dynamic thermal modelling will be undertaken as the design for the scheme progresses to develop the thermal comfort strategy for the scheme further.

Additionally, it is proposed to install glazing with performance in line with the properties detailed in Table 3.2. Solar control glazing (a G value of 0.29) will aid in controlling solar heat gains, whilst a visible light transmittance of approximately 65% will aid in ensuring that adequate daylighting is still maintained.

3.2.3. High Efficiency Building Fabric

The specification of building elements with low U values on a scheme can facilitate significant energy savings by reducing the heat loss from the building during the heating season, and therefore the associated energy usage of the heating system.

Table 3.1 demonstrates the improvements that are proposed for the building fabric thermal performance of the extension areas of the scheme over Part L (2021) limiting standards.

Table 3.1 – Building Fabric Performance Targets for Extension

| ELEMENT                            | PERFORMANCE TARGET | PART L (2021) LIMITING VALUES | IMPROVEMENT |
|------------------------------------|--------------------|-------------------------------|-------------|
| External Wall U Value (W/m²K)      | 0.18               | 0.26                          | 31%         |
| Glazing U Value (W/m²K)            | 1.3                | 1.6                           | 19%         |
| Heat Loss Floor U Value (W/m²K)    | 0.15               | 0.18                          | 17%         |
| Roof U Value (W/m²K)               | 0.15               | 0.18                          | 17%         |
| Air Permeability (m³/hr.m² @ 50Pa) | 3                  | 8                             | 63%         |

For the areas of the halls of residence proposed within the envelope of the existing building - the fabric improvements and renovations will meet the requirements of Part L. Further analysis of the existing building fabric at detailed design stage will determine where Part L threshold levels are currently met and therefore inform the finalised approach for these areas of the scheme.

Furthermore, it is proposed that all new glazing on the scheme will meet/ exceed the further glazing performance targets set out in Table 3.2, below.

Table 3.2 – Further Glazing Properties

| ELEMENT                        | PERFORMANCE TARGET |
|--------------------------------|--------------------|
| Glazing Solar Transmission (%) | ≤29                |
| Visible Light Transmission (%) | ≥65                |

3.3. High Efficiency Building Services

Part L of the Building Regulations set out the minimum performance requirements for fixed building services systems in new developments. It is proposed that the efficiency of the proposed fixed building services plant for this scheme will meet/exceed the minimum standards set out in this regulatory guidance.

This section of the report will address the energy reduction strategy to be adopted for primary system energy uses within the development relating to the fixed building services systems.

3.3.1. Boiler Technology

Should gas fired boiler plant be opted for, all boilers will be specified to achieve a seasonal efficiency in excess of 95%. The specification will also ensure that the flue gas emissions from boilers will reflect the most stringent criteria for NO<sub>x</sub> (nitrous oxide) in the pollution category of BREEAM. The NO<sub>x</sub> levels for the boilers will be ≤40mg/kWh.

3.3.2. Reduction in Domestic Hot Water Loads

BREEAM water conservation credits have been targeted in the BREEAM Pre-Assessment undertaken for the scheme. Therefore, the domestic hot water (DHW) consumption will be reduced and a saving in DHW system energy requirements will be achieved.

It is proposed that the DHW storage cylinder/s will come equipped with factory installed insulation and that all DHW service flow, return and secondary return pipework will be fully insulated to reduce heat losses.

It is proposed for there to be timeclock control on the secondary return circulation system, to minimise the auxiliary energy usage associated with the secondary return pump operation.

3.3.3. Heat Recovery Ventilation Systems

For an airtight building with air permeability equal to or less than 3.0m<sup>3</sup>/m<sup>2</sup>.hr it would be appropriate for heat recovery systems to be installed - it is therefore proposed to incorporate Mechanical Ventilation with Heat Recovery (MVHR) systems within the student clusters that comprise the scheme. These systems have the capability to recoup heat from the extracted warmed air and transfer it to the incoming fresh air supply stream. This reduces heat lost in the heating season and therefore can reduce the overall heating load of a development significantly. In the summer condition, MVHR systems can be equipped with a bypass function when the heat recovery function is not required.

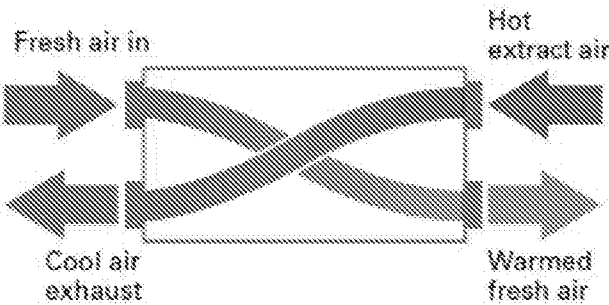


Figure 3.1 – MVHR Diagram (Image Source: www.nfan.co.uk)

3.3.4. Lighting

It is proposed to install energy efficient lighting systems throughout the scheme to aid in reducing the electrical loads associated with these systems.

External Lighting

In line with the requirements of BREEAM, it is proposed that the following criteria will be met for the external lighting design:-

- 1. The average initial luminous efficacy of the external light fittings within the construction zone is not less than 60 luminaire lumens per circuit Watt.
- 2. All external light fittings are automatically controlled for prevention of operation during daylight hours and presence detection in areas of intermittent pedestrian traffic.

Internal Lighting

Energy efficiency will be an important consideration in the detailed design of the internal lighting systems on the scheme.

It is proposed to install LED light fittings throughout.

As a minimum, it is proposed that all general lighting will have an average luminaire efficacy of 95 luminaire lumens per circuit-watt.

Additionally, it is proposed to install occupancy sensing lighting controls, as detailed in Table 3.3, below, to reduce the use of energy in these spaces when they are unoccupied.

Table 3.3 – Absence Sensing Lighting Controls

| SPACE TYPE                   | SWITCHING TYPE   |
|------------------------------|------------------|
| Flat Kitchens                | Man-on-auto-off  |
| Office/ Post Room            | Man-on-auto-off  |
| Laundry                      | Auto-on-auto-off |
| Comms Rooms                  | Auto-on-auto-off |
| Cleaners Stores              | Auto-on-auto-off |
| Cycle Store                  | Auto-on-auto-off |
| Bin Store                    | Auto-on-auto-off |
| Corridors/ Circulation Areas | Auto-on-auto-off |

3.3.5. Reduction on Non-Building Regulation Loads

Loads associated with equipment other than fixed building services are not regulated as part of the Part L energy performance calculations that have been undertaken for the scheme. It is proposed to mitigate the energy usage of unregulated energy systems as detailed below.

Lifts

In line with the BREEAM requirements, it is anticipated that an analysis of the transportation demand and usage patterns will be undertaken at detailed design stage to determine the optimum no. of and size of lifts and that the energy consumptions reported within this analysis will be calculated in line with BS EN ISO 25745.

Further in line with the BREEAM requirements, it is proposed that the following energy saving measures are specified at detailed design stage:

1. The lifts operate in a standby position during off peak periods. For example, the power side of the lift controller and other operating equipment such as lift car lighting, user displays and ventilation fans switch off when the lift has been idle for a prescribed length of time.
2. The lift car lighting and display lighting provides an average lamp efficacy, (across all fittings in the car) of >55 lamp lumens/ circuit Watt.
3. The lift uses a drive controller capable of variable speed, variable voltage, and variable-frequency control of the drive motor.

#### **General**

All other non-regulated equipment loads are to meet the requirements of the targeted BREEAM Ene08 credits.

#### **3.3.6. Log Book**

A Building Log Book will be provided to the Client as required by the Building Regulations. This document will contain information on the operation and predicted energy use of various systems and will assist the building management team in operating an energy efficient building.

The information within the Log Book shall be presented in a template/ format that accords with the guidance provided in CIBSE TM31.

A Building User Guide (BUG) will also be supplied for the scheme in the format set out by the BREEAM assessment requirements.

### **3.4. Renewable Technologies**

#### **3.4.1. Overview**

In line with the energy hierarchy, after the feasibility of passive and lean measures have been assessed, the next step is to consider the application of renewable technologies to a scheme. Renewable energy is generated from natural resources – such as sun, wind, water, geothermal heat – utilising technology to harness the energy without compromising the ability of the energy stores to naturally replenish.

This section of the report will assess the feasibility of the adoption of a range of renewable technologies to the Vahnea Student Residences development.

The Low and Zero Carbon (LZC) technologies listed below have been assessed for their applicability to this development:

- Small scale hydro;
- Tidal power/ wave power;
- Wind turbines;
- Biomass boilers;
- Biomass single room heaters/ stoves;
- Ground Source Heat Pumps (GSHP's);
- Water Source Heat Pumps (WSHP's);
- Air Source Heat Pumps (ASHP's);
- Fuel cells;
- Photovoltaics;
- Solar thermal;
- CHP; and

- Decentralised energy network.

A series of assessments have been undertaken to assess the viability of the above technologies from an initial feasibility assessment through to final selection.

#### **3.4.2. Preliminary Assessment**

##### **Small Scale Hydropower**

The requirement of a suitable river system with a significant drop reduces the feasibility of small-scale hydropower and therefore it will not be considered further.

##### **Tidal/ Wave Power**

The development site is set back from the coastline and the size of the development is small relative to the significant technology infrastructure costs that would be associated with implementing either of these forms of technology. These technologies have therefore been disregarded at a preliminary stage.

##### **Wind Turbines**

The site is located in a built up, urban area. It is therefore likely that turbulence from surrounding trees and buildings would have an impact on wind turbines were they to be installed on/ in the close vicinity of the building.

Wind turbines may also have a negative acoustic and visual impact on site. It is therefore a possibility that there may be planning objections to the adoption of this form of LZC technology on site.

These factors, in addition to the high capital cost associated with the installation of turbines, have resulted in this technology being discounted.

##### **Biomass Boilers**

One of the major drawbacks of the utilisation of biomass boiler technology is the space requirements for the biomass boilers and the fuel stores. A space allocation for back up boilers would also be necessary. The total plant area would need to be (approximately) treble that of a standard boiler room containing equivalent gas fired boilers only. There may also be issues with the reliability of the biomass fuel supply, and delivery vehicles may encounter access issues. This technology has therefore been discounted as the form of LZC most appropriate for the site.

##### **Single Room Biomass Heaters/ Stoves**

The need for single room biomass heaters is not applicable to the Vahnea Student Residences development due to the proposed centralised heating system. This technology has therefore not been considered further.

##### **Ground Source Heat Pumps (GSHPs)**

Heat pumps use electrical energy - usually grid supplied - to upgrade the energy collected by a ground loop; typically one unit of electricity will produce 3 to 4 units of useful heat. However, the output temperature is normally limited to between 40 and 45°C, or the unit efficiency will drop considerably. Therefore GSHP's are best suited to applications where the building heat load is small and the heat delivery system is either underfloor heating or air heating with coils sized to suit.

The ground heat exchanger that forms part of this system is a sealed loop of pipe buried either vertically or horizontally in the ground. Horizontal arrays tend not to be feasible on restricted sites, as the length of the loops can include multiples of pipework up to 50m in length. Vertical arrays require a series of boreholes which accommodate the pipework and are infilled with a heat conducting grout. Although the external space requirements for a vertical array would be less

than for a horizontal array, due to the very restricted site this is still deemed to be an unfeasible design solution in this instance.

### Water Source Heat Pumps (WSHPs)

WSHP's upgrade the residual heat stored within a water source to a more suitable temperature and are ideally used within a low-temperature heating system i.e. underfloor heating.

A substantial local water source would be required such as an aquifer or lake to provide the residual heat and so the technology has been disregarded for application to this site.

### Air Source Heat Pumps (ASHPs)

An air source heat pump has much smaller space requirements than a ground source heat pump and has lower associated installation costs. However, they do also typically have a slightly lower Coefficient of Performance (CoP).

The units tend to be located externally, and therefore consideration needs to be given to their placement as they may pose a noise issue when operational. Acoustic screening can be implemented to mitigate noise impacts, if determined to be required.

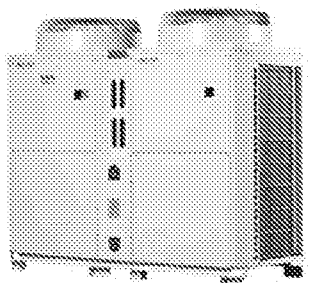


Figure 3.2 – Air Source Heat Pump (Image Source: [www.mitsubishielectric.co.uk](http://www.mitsubishielectric.co.uk))

The fuel source for ASHPs is electricity, which, given the recent decarbonisation of the electricity grid, aligns with the UK shift away from source of fossil fuel burning technologies.

This technology could be a potential option for the Vahnea Student Residences development.

### Fuel Cells

Fuel cell technology utilising hydrogen produced from LZC technologies is at an early stage of development with the cost and limited availability of plant being the major limiting factor. Fuel cells will therefore not be considered further.

### Photovoltaics

Photovoltaics have been identified as an appropriate technology for application to this scheme. There is a large roof area available for the mounting of PV panels, and there are likely to be consistent daytime electrical loads to utilise the generated electricity.

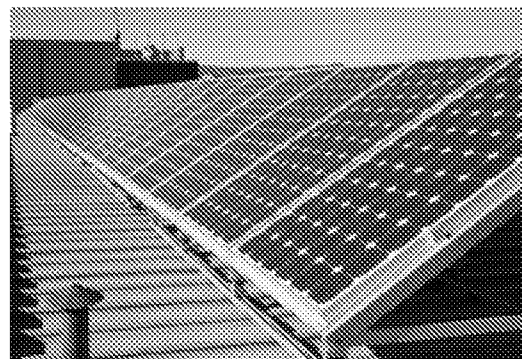


Figure 3.3 – PV Array (Image Source: [www.segen.co.uk](http://www.segen.co.uk))

Notably, a PV array is also a feature of the notional building in the revised version of Part L (2021). This does not mean that it will be compulsory for a PV array to be installed, but as the notional building informs the TER it means that if it is not specified an improvement would need to be made elsewhere in the building specification to compensate in order to achieve compliance with the TER.

This technology could be a potential option for the Vahnea Student Residences development.

### Solar Thermal

Solar thermal technology could be adopted in the scheme to utilise solar energy to contribute to the domestic hot water loads on the scheme. This technology would require an area of roof to house the solar thermal array. Experience on previous schemes has demonstrated that significant carbon emission savings cannot be demonstrated through the implementation of this form of technology, relative to the impact that can be demonstrated with other forms of LZC technology. Therefore, at this stage this technology shall not be considered further.

### Decentralised Energy Network

A decentralised energy network is a network in which energy is generated in the vicinity of where it is to be used – rather than at a large centralised plant where it is then distributed through the national grid.

Decentralised energy generation may be via combined heat and power (CHP), solar energy, geothermal or biomass. The generation of energy locally can reduce transmission losses and carbon emissions from energy generation.

The Association for Decentralised Energy (ade) have produced an online District Heating Installation map. This map can be used to find decentralized energy systems in the vicinity of new developments, and categorizes them into residential/commercial, university and hospital systems.



Figure 3.4 – District Heating Installation Map (Source: www.adc.co.uk)

This database has been accessed for the purposes of this energy strategy review. Figure 3.4 shows the area in the vicinity of the development site. The closest established network is shown to be the Graylingwell Park District Heating Scheme (blue marker in Figure 3.4), with no networks located at present in Bognor Regis. Given the significant distance from this network to the development site – it is not considered to be a feasible potential connection.

CHP

A CHP engine generates electricity and heat in a single process from a single fuel (typically natural gas). This cogeneration process has historically facilitated greater fuel efficiencies being achieved and reduces transmission losses. This is illustrated in Figure 3.5, below.

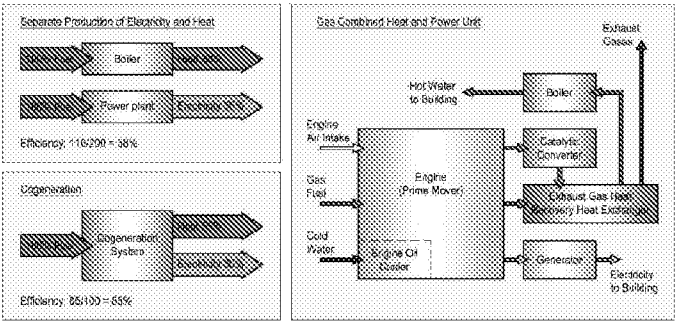


Figure 3.5 – Illustrative CHP Schematic

With the decarbonisation of the national grid, which is to be reflected by upcoming changes to the Part L emission factor for electricity, the regulated CO<sub>2</sub> emissions savings associated with the implementation of a CHP installation are anticipated to be significantly reduced.

As the decarbonisation of the grid has reduced the feasibility of implementing CHP installations, this technology will not be considered further for this scheme.

Proposed LZC Technologies

An electrically fed ASHP is proposed to meet the thermal loads of the scheme. The make/model of ASHP will be established at detailed design stage, but at this stage it is anticipated that the Seasonal Coefficient of Performance (SCOP) of the heat pump will be  $\geq 3$ .

A roof mounted PV array is proposed as a green means of on-site electricity production. It is proposed for a 30kWp PV array to be installed.

3.5. Energy Monitoring

3.5.1. Overview

It is recognised that in order to achieve truly carbon efficient buildings, there will be a need to monitor and understand operational energy use on occupation and work towards minimising the performance gap – i.e. the difference between predicted energy usage at design stage and the actual energy use on occupation.

3.5.2. Monitoring and Metering

A Building Energy Monitoring System (BEMS) is proposed for the scheme to control and monitor the building services systems that are to be installed. This system will facilitate remote monitoring of system performance – with alarms for faults and remote meter reading capability.

Individual heat meters will be installed to the heating circuit and to the domestic hot water circuit. All heat meters will be equipped with M-bus (/equivalent) to allow for remote monitoring.

A utility meter is to be installed for the electricity supply to the new halls of residence. Electricity sub metering will also be installed at the below locations as a minimum:

- Mechanical services plant;
- Lifts;
- PV arrays; and
- Split distribution boards for lighting and small power.

All electricity sub meters will be equipped with Mod-bus (/equivalent) to allow for remote monitoring.

The metering/ sub-metering strategy for the scheme will be developed further at detailed design stage. The comprehensive metering provision will allow full remote monitoring capabilities for the energy usage on site, which will facilitate the performance monitoring of the systems.

3.5.3. Building Services Controls Systems

An automatic controls system will be specified at detailed design stage to operate, control and monitor all central plant. It is anticipated that its performance will exceed the requirements of Part L and will optimise energy use. A controls interface will be allowed for which will allow monitoring and logging of the building's energy use via sub-metering systems.

## 4. ENERGY PERFORMANCE

### 4.1. Overview

An initial assessment of regulated energy usage has been undertaken for the proposed development, based on the preliminary energy strategy that has been set out for the scheme in Section 3.

It is the intention that this energy modelling will demonstrate the following:

- Compliance with Part L of the Building Regulations; and
- Demonstrate that 10% of the building energy requirements for the scheme will be met from renewable or low carbon sources.

### 4.2. Part L Compliance

In order to demonstrate the impact of the proposed energy efficiency measures for the scheme, an energy model has been built for the scheme using iSBEM v6.1.a.

This software is an approved Simplified Building Energy Model (SBEM) interface - approved by Communities and Local Government to produce Energy Performance Certificates for non-domestic buildings and to check compliance with Part L of the building regulations. This version of iSBEM software assesses compliance against Part L 2021 of the Building Regulations.

The BRUKL output document from the undertaken SBEM model is included in Appendix 1. The BRUKL output document demonstrates:

1. Building Emission Rate (BER) < Target Emission Rate (TER)
2. Building Primary Energy Rate (BPER) < Target Primary Energy Rate (TPER)

When the detailed design and construction programme for the scheme is established, the Part L compliance strategy will need to be revisited by the design team to ensure compliance of the detailed design proposals with the relevant version of Part L of the Building Regulations.

### 4.3. Contribution from Renewable or Low Carbon Energy Sources

Two forms of LZC technology are proposed for the scheme – an ASHP to meet the thermal loads of the scheme and a solar PV array to contribute to the electrical energy demands of the scheme.

The SBEM compliance calculation undertaken for the scheme has demonstrated the following:

- PV array produces 22% of annual, regulated energy consumption; and
- ASHP produces 33% of annual, regulated energy consumption.

It is therefore demonstrated that significantly more than 10% of the annual, regulated energy consumption of the building will be met by LZC technologies.

## 5. WIDER SUSTAINABILITY ISSUES

### 5.1. Overview

The focus of this report is to set out the energy and carbon efficiency strategy for the development site. A BREEAM pre-assessment has been undertaken for the development and is available under separate cover. A BREEAM assessment covers a myriad of sustainability issues in addition to addressing energy carbon intensity. A targeted score of BREEAM Excellent has been set for the scheme.

This section of the report will provide an overview of the wider sustainability considerations that have been taken into account for the scheme, with reference to the BREEAM pre assessment that is available under separate cover, where relevant.

### 5.2. Health and Wellbeing

The health and wellbeing of future building occupants has become an increasingly important consideration in recent years. To recognise this, the design team have taken steps to incorporate design measures that will enhance the comfort experienced by future building users.

#### 5.2.1. Thermal Comfort

The BREEAM assessment that has been undertaken for the scheme has targeted 2 no. credits under the issue of Hea04 Thermal Comfort to ensure that appropriate thermal comfort levels are achieved through design, and controls are selected to maintain a thermally comfortable environment for occupants within the building.

A number of design measures have been incorporated into the building proposals to aid in mitigating overheating risk. Some of the key proposed measures are set out below:

- Excessive areas of glazing are not proposed;
- Solar control glazing is proposed;
- Student bedrooms to be provided with openable windows and acoustically treated louvres to facilitate natural ventilation; and
- Mechanical ventilation systems to provide some supplementary dissipation of internal heat gains.

As the design progresses, a dynamic thermal simulation modelling exercise will be undertaken on the proposed building to verify that the proposed strategy accords with the requirements of CIBSE TM59. Amendments will be made as necessary in order for the requirements of this standard to be met. In the first instance, additional passive options will be reviewed – and in the second instance, more active means of meeting the criteria will be explored.

#### 5.2.2. Air Quality

In order to facilitate a healthy internal environment appropriate ventilation, equipment and finishes are to be specified for the scheme. Targeted credits under the BREEAM category of Hea02 will aid in enabling this through the following works:

- An Indoor Air Quality (IAQ) plan is to be produced, with the objective of facilitating a process that leads to design, specification and installation decisions and actions that minimise indoor air pollution for during the occupation period of the building.
- Paints, varnishes and other high-risk materials will be specified in compliance with the BREEAM Volatile Organic Compound (VOC) criteria, which will aid in reducing the VOCs emitted in the occupied spaces during early occupation.

-VOC level testing is to be undertaken prior to building occupation. If BREEAM target levels aren't achieved, contingent measures set out in the IAQ are to be followed to reduce VOC concentrations in the building.

To facilitate fresh air provision to the future occupants of the building, openable windows and attenuated louvres have been allowed for in the building façade. Furthermore, MVHR ventilation systems are proposed in the student clusters to provide a means of fresh air provision in the winter condition whilst mitigating heat losses.

#### 5.2.3. Acoustics

An acoustician has been engaged, ION Acoustics, to provide preliminary guidance on the acoustic design of the proposed student accommodation. Noise levels on the site were established to be generally low, however, a noise source was identified to be the loading bay on Bedford Street which is used by the Wilko store. ION Acoustics have advised the required acoustic performance for windows and ventilators that will need to be met in order to mitigate the acoustics impacts on the future residents of the site.

### 5.3. Water

The World Economic Forum's Global Risks Report 2021 listed natural resource crises (encompassing water and food security) as one of the top five global risks in terms of impact. Therefore, the importance of reducing water consumption is becoming an increasingly critical priority.

It is proposed for the new halls of residence to be fitted with a water meter on the incoming mains supply. This meter is to have a pulsed output or an equivalent open protocol communication output to enable a connection to an appropriate utility monitoring/ management system. This will aid to facilitate active water consumption management and alert the building owner/ manager to potential leakages.

It is also proposed for the demand for potable water to be reduced through the provision of efficient sanitary fittings – such as dual flush toilets and low flow taps & shower fittings (/flow restrictors).

### 5.4. Materials

Materials have an inherent impact on the environment throughout their lifecycle – whether it's where they are produced or sourced from, how they are transported to construction sites or how the finished elements are protected to ensure longevity.

At detailed design stage, the construction materials for the scheme will be selected with reference to the BRE Green Guide to Specification. This guide is a free to use, comprehensive online tool providing guidance for designers on the relative environmental impacts for a range of different building elemental specifications.

It is also proposed for all materials to be sourced in accordance with a Sustainable Procurement Plan. This plan will set out a clear framework for the responsible sourcing of materials to guide procurement throughout the project.

### 5.5. Pollution

Pollution from a development can arise from a variety of sources. NO<sub>x</sub> emissions are a common source of air pollutant associated with the operation of buildings associated with combustion plant – such as gas fired boilers. No combustion plant is currently proposed for this development.

To mitigate night time light pollution, the external lighting strategy will be designed in accordance with Table 2 of the ILP Guidance notes for reduction of obtrusive light.

## 6. CONCLUSION

When reviewing the energy and sustainability strategy for this development, careful consideration has been given to the context of the site, local planning policy and Part L of the Building Regulations.

The approach taken for the proposed energy strategy for the development has followed the guidance of the Arun Local Plan 2011-2031. A sequential approach has been adopted in line with the Energy Hierarchy - assessing in turn the feasibility of reducing the energy demand of the building, using energy more efficiently, applying LZC technologies and using the remaining fossil fuels cleanly.

A number of passive design measures have been implemented including optimising the thermal performance of the building envelope beyond the minimum U value and air infiltration standards set out in Part L of the Building Regulations, providing a sensible glazing façade ratio and utilising solar control glazing to reduce the risk of overheating.

Energy efficient building servicing systems are proposed for the development to reduce the energy loads of the development on occupation. Key measures that are proposed for the scheme to reduce regulated energy usage are factory applied insulation on domestic hot water stores, heat recovery ventilation systems, high efficiency lighting installations with occupancy and photocell controls where appropriate and an intelligent automatic controls system to optimise system performance. Additionally, in line with BREEAM guidance on the control of unregulated loads it is proposed for key energy efficiency measures to be incorporated into the design of the lift systems and for plug in and white goods to be sourced in accordance with the energy performance requirements set out in BREEAM issue ENE08.

A feasibility assessment has been undertaken evaluating the applicability of a number of renewable and clean technologies to the Vahnea Student Residences development. The technologies identified as being the most appropriate for application to the site were ASHPs and PV.

It is proposed that this energy strategy for the scheme will be implemented to:

- Abide by the Arun energy hierarchy.
- Meet the energy performance requirements of Part L of the Building Regulations; and
- Meet the 10% renewable target set out in the Arun Local Plan 2011-2031.

Wider sustainability measures for the site are primarily addressed in the BREEAM Pre Assessment Report that has been undertaken by Ridge & Partners LLP and is submitted under separate cover. A brief overview of some key sustainability measures proposed for the scheme is included in Section 5 of this report and sets out a strategy for enhanced occupant health and wellbeing, sustainable water usage, resource efficiency and pollution mitigation.

APPENDIX 1 – BRUKL OUTPUT DOCUMENT

# BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

Vahnea Student Residences

As designed

Date: Mon Jan 31 13:52:13 2022

## Administrative information

### Building Details

Address: Bognor Regis.

### Certification tool

Calculation engine: SBEM

Calculation engine version: v8.1.a.0

Interface to calculation engine: SBEM

Interface to calculation engine version: v8.1.a

BRUKL compliance check version: v8.1.a.0

### Certifier details

Name: Ridge & Partners LLP

Telephone number: 01902 834400

Address: Partnership House, Moorside Road, Winchester, SO18 7RX

Foundation area (m²): 870.25

## The CO<sub>2</sub> emission and primary energy rates of the building must not exceed the targets

|                                                                                        |                          |
|----------------------------------------------------------------------------------------|--------------------------|
| Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> /annum   | 4.13                     |
| Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> /annum | 3.68                     |
| Target primary energy rate (TPER), kWh/m <sup>2</sup> /annum                           | 44.15                    |
| Building primary energy rate (BPER), kWh/m <sup>2</sup> /annum                         | 42.27                    |
| 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 <sub>value</sub> | U <sub>class</sub> | U <sub>class</sub> | First surface with maximum value      |
|--------------------------------------|--------------------|--------------------|--------------------|---------------------------------------|
| Walls*                               | 0.28               | 0.18               | 0.18               | 1.3 Bedrooms/line                     |
| Floors                               | 0.18               | 0.15               | 0.15               | 1.2 Ensuite/1                         |
| Pitched roofs                        | 0.18               | 0.15               | 0.15               | 1.11 Ensuite/s/c                      |
| Flat roofs                           | 0.18               | 0.15               | 0.15               | 1.9 Bedrooms/c                        |
| Windows** and roof windows           | 1.6                | 1.3                | 1.3                | 1.3 Bedrooms/ineig                    |
| Rooflights***                        | 2.2                | -                  | -                  | No external rooflights                |
| Personnel doors†                     | 1.8                | 1.8                | 1.8                | First Floor Corridor Door             |
| Vehicle access & similar large doors | 1.3                | -                  | -                  | No external vehicle access doors      |
| High usage entrance doors            | 2                  | -                  | -                  | No external high usage entrance doors |

U<sub>value</sub> = U-value area-weighted average U-values (W/m<sup>2</sup>/K)  
U<sub>class</sub> = Calculated area-weighted average U-values (W/m<sup>2</sup>/K)  
\* Automatic U-value check by the tool does not apply to curtain walls whose U-value is similar to that for windows.  
\*\* Double windows and similar glazing are excluded from the U-value check. \*\*\* Values for rooflights refer to the horizontal position.  
† For the door, U-value is 1.4 W/m<sup>2</sup>/K  
N.B.: Neither roof ventilators (inc. double vents) nor swimming pool basins are assessed or checked against the U-value standards by the tool.

| Air permeability   | Limiting standard | This building |
|--------------------|-------------------|---------------|
| m³/(h.m²) at 50 Pa | 8                 | 1             |

RIDGE

