

Energy Statement

Green Park Village School

On behalf of Berkeley Homes (Western) Limited

Revision B

Date: 22nd March 2018



REVISION HISTORY

Revision	Issue Date	Description	Issued By	Checked By
A	13/03/2018	Original Document	RP	WOB
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Calculations contained within this report have been produced based on information supplied by the Client and the design team. Any alterations to the technical specification on which this report is based will invalidate its findings.

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1. EXECUTIVE SUMMARY

This Energy Statement has been produced by Energist UK on behalf of Berkeley Homes (Western) Limited ('the Applicant').

It will set out the measures planned by the Applicant to achieve CO₂ reductions at the proposed development site: Green Park Village School ('the Development') demonstrating compliance with:

- i) National Planning Policy Framework.
- ii) Approved Document Part L of the Building Regulations 2010.
- iii) The local planning policy requirements for Reading Borough Council to meet:
 - *All developments of more than 10 dwellings or 1000m² floorspace incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development;*
 - *All developments reduce mains water use and demonstrate that water conservation measures are incorporated so that predicted per capita consumption does not exceed the appropriate levels set out in the Code for Sustainable Homes or BREEAM Standards.*

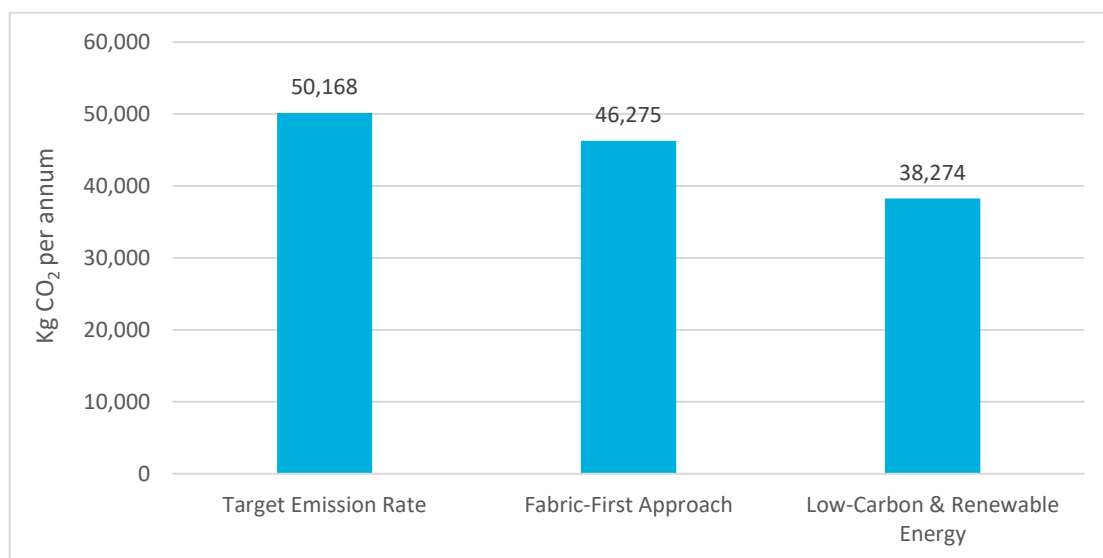
The Energy Statement concludes that the following combination of measures, summarised in Table 1, overleaf, will be incorporated into the Development demonstrating how the energy standard will be delivered by the Applicant.

Table 1: Measures incorporated to deliver the energy standard.

Fabric first: Demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double-glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Efficient-building services including high-efficiency heating systems and mechanical ventilation system. ▪ LED lighting throughout the building. ▪ Occupancy Sensors to WC's. ▪ Heating and lighting sub-metering in line with BREEAM requirements.
Renewable and low-carbon energy technologies	▪ A 15.75kWp PV array (110-126m²) to be installed to a South orientation, at a 30 degree pitch with little or no overshadowing.

The impact of these design measures in terms of how the Applicant delivers the energy standard is illustrated in Figure 1 overleaf.

Figure 1: How the Development meets the energy standard.



The calculated reduction in CO₂ emissions and the percentage reduction in CO₂ over ADL 2010 is demonstrated in Table 2.

Table 2: CO₂ emissions and percentage reduction over ADL 2010.

	CO ₂ emissions	
	Kg/CO ₂ per annum	% reduction
Target Emission Rate: Compliant with ADL 2010	50,168	-
Fabric first: Demand-reduction measures	46,275	7.76%
Low-carbon and renewable energy	38,274	15.95%
Total savings	11,893	23.71%

2. INTRODUCTION

2.1 Site Description

This Energy Statement has been prepared for the non-residential development at Green Park Village. This falls under the jurisdiction of Reading Council.

The Development consists of a residential led mixed use development of 25 hectares. It is centred around a landscaped lake, a primary school, community centre, an extra care home and supporting retail. This report will focus only on the primary school.

The site lies within the boundary of a former gravel works.

Map 1: Site location for Green Park Village School.



Source: Broadway Malyan Site Layout, Drawing number A-2FE-02-100, Feb 2018, revision P2.

2.2 Purpose of the Energy Statement

This Statement sets out how the Applicant intends to meet:

- i) National Planning Policy Framework.
- ii) Approved Document Part L of the Building Regulations 2010.
- iii) The local planning policy requirements for Reading Borough Council to meet:
 - *All developments of more than 10 dwellings or 1000m² floorspace incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development;*
 - *All developments reduce mains water use and demonstrate that water conservation measures are incorporated so that predicted per capita consumption does not exceed the appropriate levels set out in the Code for Sustainable Homes or BREEAM Standards.*

For a detailed overview of the planning policy requirements specific to this development, refer to Appendix 2.

The way in which the Applicant meets the energy standard at Green Park Village School will be set out in this Statement as follows:

- **Baseline energy demand:** The Development's Target Emission Rate (TER) will be calculated to establish the minimum on-site standard for compliance with ADL 2010.
- **Fabric first – reduced energy demand:** The Development's Building Emission Rate (BER) will be calculated to explain how the Applicant's design specification will lead to a reduced energy demand and an improved fabric energy efficiency. The better the design of the building fabric in terms of, for example, insulation, air tightness and orientation to maximise solar gain, the less energy required to heat the dwelling and so the better the fabric energy efficiency.
- **Low-carbon and renewable energy:** Low-carbon and renewable energy technologies will be assessed for their suitability and viability in relation to the Development. Solutions will be put forward for the development and the resulting CO₂ emission savings presented.

2.3 Methods

Energist UK has used SBEM 4.1 e.5 methodology to calculate the energy demand for the non-residential elements of the Development. The whole proposed building at Green Park Village School has been modelled as part of the energy assessment.

3. BASELINE ENERGY DEMAND

3.1 Introduction

In order to measure the effectiveness of demand-reduction measures, it is first necessary to calculate the baseline energy demand and this has been done using SBEM 5.2g methodology. This can also be referred to as the Target Emission Rate (TER.)

The resulting ADL 2010 TER for Green Park Village School has been calculated using Part L model designs which have been applied to the Applicant's Development details. The TER, or baseline energy demand, represents the maximum CO₂ emissions that are permitted for the building in order to comply with ADL 2010.

3.2 The Development Baseline

The resulting TER, representing the total maximum CO₂ emissions permitted for the Development, has been calculated as 50,168 kg/CO₂ per annum. To ensure compliance with ADL 2010, CO₂ emissions should not exceed this figure.

Table 3. Baseline design specification at Green Park Village School.

Element	Baseline Design Specification
Ground Floor U-Value (W/m ² .K)	0.25
External Wall U-Value (W/m ² .K)	0.35
Roof – insulated at ceiling U-Value (W/m ² .K)	0.25
Roof – insulated at slope U-Value (W/m ² .K)	0.25
Roof – flat, U-Value (W/m ² .K)	0.25
Glazing U-Value, including frame (W/m ² .K)	2.2
Door U-Value (W/m ² .K)	2.2
Design Air Permeability	5
Space Heating	91% efficient mains gas boiler
Heating Controls	Standard heating controls
Hot Water	From main heating system
Ventilation	70% efficient heat recovery ventilation system. With a specific fan power of 1.8 w/l/s and terminal unit of 0.3 w/l/s
Low Energy Lighting	Efficiency no lower than 60 lumens per circuit watt throughout. Plus occupant and daylight controls.
Thermal Bridging	Appendix R values

4. FABRIC-FIRST APPROACH - REDUCED ENERGY DEMAND

4.1 Introduction

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

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

Energist UK has considered a fabric-first approach as the priority solution for this Development as it can be shown that a significant reduction in emissions can be achieved through the use of efficient building fabric and building services.

4.2 The Development - Reduced Energy Demand

The Applicant will integrate the following design measures to reduce energy demand:

- Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs.
- High-efficiency double-glazed windows throughout.
- Quality of build will be confirmed by achieving good air-tightness results throughout.
- Efficient-building services including high-efficiency heating systems and mechanical ventilation system.
- LED lighting throughout the building.
- Occupancy Sensors to WC's.
- Heating and lighting sub-metering in line with BREEAM requirements.

The Applicant's design specification and intended demand-reduction measures for the Development have been modelled using the same SBEM 5.2g methodology as before. This allows us to assess the effectiveness of demand-reduction measures as a percentage reduction in CO₂ emissions over the Baseline.

The total calculated CO₂ emissions for Green Park Village School is 46,275 Kg/CO₂ per annum, which is a reduction of 7.76% or 3,893 Kg/CO₂ per annum over the Baseline. Refer to Appendix 3 for a SBEM Results and Table 4 for the fabric-first design specification.

Table 4. The fabric-first design specification at Green Park Village School.

Element	Fabric-First Design Specification
Ground Floor U-Value (W/m ² .K)	0.1
External Wall U-Value (W/m ² .K)	0.15
Roof – Flat U-Value (W/m ² .K)	0.1
Glazing U-Value – including Frame (W/m ² .K)	1.4
Door U-Value (W/m ² .K)	2.2
Design Air Permeability	3
Space Heating	96% Efficient Gas Boiler
Heating Controls	In line with BREEAM requirements
Domestic Hot Water	From main heating system, 300 litre cylinder with standing heat losses of 205MJ/Month
Ventilation	To Kitchen SFP of 1.0W//s To WC's SFP of 0.3W//s
Low Energy Lighting	100% LED lighting
Thermal Bridging	Accredited Construction Details

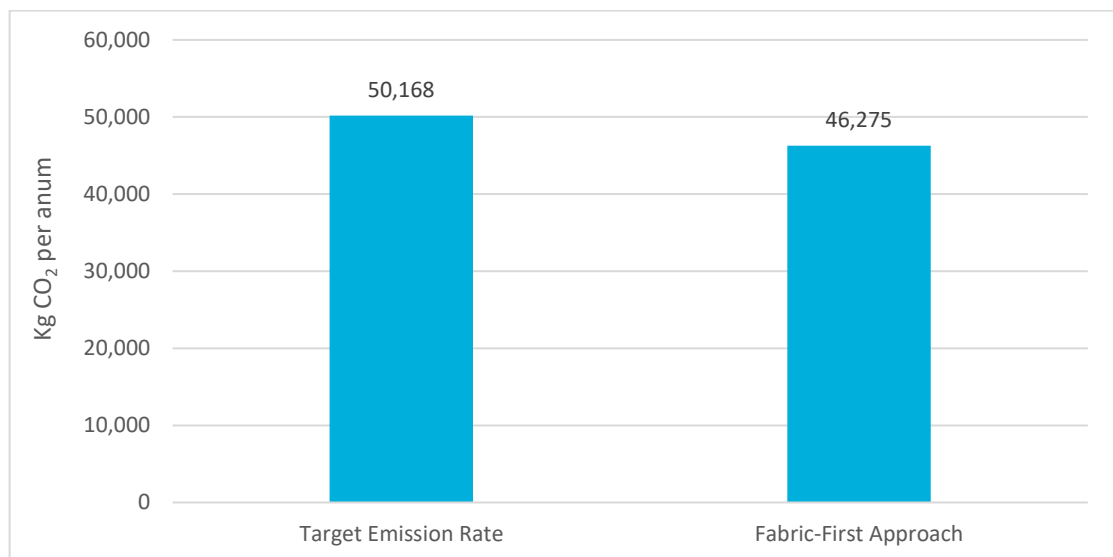
4.3 Conclusion

By incorporating sustainable design and energy-reduction design measures at Green Park Village School, the Applicant will reduce CO₂ emissions by 7.76% over the Baseline for ADL 2010. This is illustrated in Table 5 and in Figure 2 below.

Table 5: The CO₂-emissions baseline and fabric-first, demand-reduction measures.

	CO ₂ emissions	
	Kg/CO ₂ per annum	% reduction
Target Emission Rate: Compliant with ADL 2010	50,168	-
Fabric first: Demand-reduction measures	46,275	7.76%

Figure 2: Baseline and fabric-first CO₂-emissions summary.



5. LOW-CARBON AND RENEWABLE ENERGY

5.1 Introduction

The Applicant adopts a fabric-first approach as the priority solution for this Development and steps have been taken to reduce energy demand through high-quality sustainable design. The planned integration of efficient building fabric and building services has been modelled and is predicted to lead to an enhancement over Part L of the Building Regulations 2010.

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

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

- Wind
- Solar
- Aerothermal
- Geothermal
- Biomass

5.2 Wind 	<i>The ability to generate electricity via a turbine or similar device which harnesses natural wind energy. This could be considered as an onsite solution to reducing carbon emissions (turbines included within the development), or offsite (investing financially into a nearby wind farm).</i>
Installation considerations	▪ Wind turbines come in a variety of sizes and shapes. Turbines of 1 Kw can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical- or horizontal-axis turbines are available. ▪ A roof-mounted 1 kW micro wind system costs up to £3,000. A 2.5 kW pole-mounted system costs between £9,900 and £19,000. A 6 kW pole-mounted system costs between £21,000 and £30,000 (taken from the Energy Saving Trust, TBC by supplier) ▪ Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required. ▪ Noise considerations can be an issue dependent on density and build-up of the surrounding area. ▪ Buildings in the immediate area can disrupt wind speed and reduce performance of the system. ▪ Planning permission will be required along with suitable space to site the turbine, whether ground installed or roof mounted.
Advantages	▪ Generation of clean electricity which can be exported to the grid or used onsite. ▪ Can benefit from the Feed in Tariff, reducing payback costs.
Disadvantages	▪ Planning restrictions and local climate often limit installation opportunities. ▪ Annual maintenance required.

	High initial capital cost. It is usual for an investor to consider a series of turbines to make the investment financially sound.
Development feasibility X	- Installing a large turbine in an area such as this is not considered to be appropriate due to its appearance and physical impact on the built-up environment. Residents' and neighbours' concerns may include the look of the turbine, the hum of the generator and the possibility of stroboscopic shadowing from the blades on homes. - Wind speed has been checked for the development scheme using the NOABL wind map: http://www.rensmart.com/Weather/BERR. The wind speed at ten metres for the development scheme is 4.8 metres per second (m/s) which is below the minimum of 5 m/s and threshold for technical viability. - Typical payback times for a single turbine are expected to be greater than 15 years which means that the cost of installing and maintaining a single wind turbine is not considered a commercially-viable option.

5.3 Solar PV and Solar Thermal

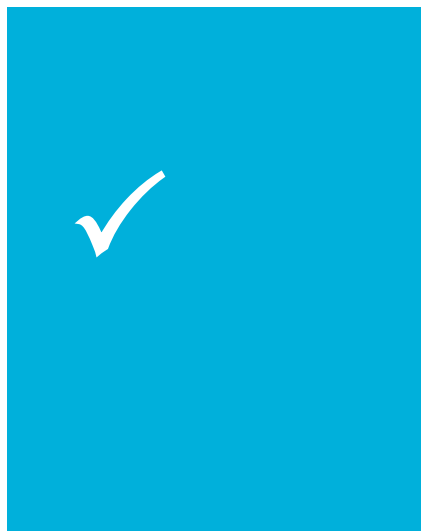


The ability to generate energy (either electricity, hot water or a combination of the two) through harnessing natural solar energy. This could include the use of solar thermal panels, photovoltaic (PV) panels, or a combined solution. PV panels, similarly to turbines, can be considered both on and offsite.

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

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

Installation considerations	▪ Operate most efficiently on a south-facing sloping roof (between 30 and 45-degree pitch.) ▪ Shading must be minimal (one shaded panel can impact the output of the rest of the array.) ▪ Panels must not be laid horizontally on a flat roof as they will not self-clean. Panels will therefore need to be installed at an angle and with appropriate space between them, to avoid over-shading. ▪ Large arrays may require upgrades to substations if exporting electricity to the grid. ▪ Local planning requirements may restrict installation of panels on certain elevations. ▪ Installation must take into account pitch and fall of the roof, along with any additional plant on the roof to ensure there is sufficient room. ▪ The average domestic solar PV system is 4kWp and costs £5,000 - £8,000 (including VAT at 5 per cent) - (taken from the Energy Saving Trust, TBC by supplier.)
Advantages	▪ Relatively straightforward installation, connection to supply and metering. ▪ Linear improvement in performance as more panels are installed. ▪ Maintenance free. ▪ Installation costs are continually reducing. ▪ Can benefit from the Feed in Tariff to improve financial payback.
Disadvantages	▪ Not appropriate for high-rise developments, due to lack of roof space in relation to total floor area. ▪ With Solar Thermal, performance is limited by the hot water demand of the building – system oversizing will lead to overheating.
Development feasibility	▪ The suitability of Solar panels has been considered for this Development and are concluded as a technically-viable option.



- There are potential areas of roof space suitable for the positioning of unshaded Solar PV arrays.
- The Development is not on land which is protected or listed, so it is considered that Solar panels would not have a negative impact on the local historical environment or the aesthetics of the area.
- The occupants may be entitled to claim the Feed-In-Tariff for any energy which is generated. If solar thermal panels were to be used, the occupants would see a reduction in hot water bills.

5.4 Aerothermal

The transfer of latent heat in the atmosphere to a compressed refrigerant gas to warm the water in a heating system. This includes air to water heat pumps and air conditioning systems.

Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water.

They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.

Installation Considerations

- ASHPs operate effectively in buildings with a low energy demand, as they emit low levels of energy suitable for maintaining rather than dramatically increasing internal temperatures. It is therefore vital that the dwelling has a low heating demand to ensure the system can provide appropriate space-heating capability.
- Underfloor heating will give the best performance but oversized radiators can also be used.
- Immersion heater back-up required to ensure appropriate Domestic Hot Water (DHW) temperature in winter months.

	- Noise from the external unit can limit areas for installation. £7,000-£11,000 per dwelling (taken from the Energy Saving Trust, TBC by supplier.)
Advantages	- Air source systems are a good alternative solution to providing heating and hot water to well-insulated, low heat loss dwellings. - They require additional space when compared to a gas boiler. Space for an external unit is needed, as is space for the hot water cylinder and internal pump. - Heat pumps are generally quiet to run, however if a collection of pumps were used, this could generate a noticeable hum while in operation. - Running costs between heat pumps and modern gas boilers are comparable.
Disadvantages	- Occupants need to be made aware of the most efficient way of using a heat pump; as the low flow rates used by such a system means that room temperature cannot be changed as reactively as a conventional gas or oil boiler system. - Will not perform well in homes that are left unoccupied and unheated for a long period of time. - Back-up immersion heating can drastically increase running costs. - Noise and aesthetic considerations limit installation opportunities.
Development feasibility 	- ASHPs are considered a technically-viable option for this development scheme. - The costs of installing an ASHP, compared to the costs of installing an A-rated boiler, are substantially more which means there is a capital-cost implication to consider. For this reason, ASHPs are not considered a commercially-viable option for this development scheme.

5.5 Geothermal



The transfer of latent heat from the ground to a compressed refrigerant gas to warm the water in a heating system. This includes ground source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils.

Ground Source Heat Pumps (GSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the ground) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the ground, either through coils or in bore holes and piles, circulating a mix of water and antifreeze to extract energy from the ground, where the year-round temperature is relatively consistent (approx. 10°C at 4 metres depth). This leads to a reliable source of heat for the building.

Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for GSHPs tend to be higher than those of ASHPs.

Installation considerations

- Require appropriate ground conditions to sink piles/bore holes or excavate for coils (which also require a large area of land.)
- Decision between coils or piles can lead to significant extra cost.
- Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators.
- Similar to ASHPs, perform best in well-insulated buildings with a low heating demand.
- Electric immersion heater required for winter use.
- £11,000-£15,000 per dwelling dependent on the size of the system (taken from the Energy Saving Trust, TBC by supplier.)

Advantages

- Perform well in well-insulated buildings, with limited heating demand.
- More efficient than ASHPs.

Disadvantages

- The coils can be damaged by natural earthworks and by intensive gardening practices – occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit.
- Will not perform well in buildings that are left unoccupied and unheated for a long period of time.
- Back up immersion heating can drastically increase running costs.
- Large area of ground needed for coil installation.

Development feasibility



- GSHPs are not considered a technically-viable option for this development scheme as there are physical constraints in terms of ground conditions and area available for installation.
- The capital installation cost would also be high which leads us to the conclusion that GSHPs would not be a commercially-viable option for this development scheme.

5.6 Biomass



Providing a heating system fuelled by plant based materials such as wood, crops or food waste.

Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.

Installation considerations

- Biomass boilers are larger than conventional gas-fired boilers and also require what can be significant storage space for the fuel source. This

	needs to be considered at planning stage to ensure an appropriate plant room can be provided. ▪ Flue required to expel exhaust gases – design needs to be in line with the requirements of the Building Regulations. ▪ Need to consider whether fuel deliveries will be reliable and consistent to the location of the site (especially relevant in rural areas) and whether the plant room can be easily accessed by the delivery vehicle. ▪ £9,000-£21,000 per dwelling dependent on size (taken from Energy Saving Trust, TBC by Supplier).
Advantages	▪ Considerable reduction in CO₂ emissions.
Disadvantages	▪ Limited reduction in running costs compared to A-rated gas boilers, but at a substantially higher up-front cost. ▪ Plant room space required for boiler and storage. ▪ Dependent on consistent delivery of fuel. ▪ Ongoing maintenance costs (need to be cleaned regularly to remove ash.)
Development Feasibility 	▪ Biomass is not considered a technically-viable option for this development scheme as there are physical constraints on site in terms of installing biomass boilers or storing a sufficient supply. ▪ There are also concerns regarding a sustainable supply of biomass to the site. ▪ The capital installation cost would also be high which leads us to the conclusion that biomass would not be a commercially-viable option for this development scheme.

5.7 Conclusion

The following low-carbon and renewable energy technologies, summarised here in Table 6, are considered potentially-viable options for the non-domestic development scheme at Green Park Village School.

Table 6: Summary of Feasibility for Green Park Village School.

	▪ Solar Thermal ▪ Solar PV
	▪ Aerothermal ▪ Geothermal ▪ Biomass ▪ Wind

6. OVERHEATING AND COOLING

With a continual drive for energy efficiency through both the Building Regulations 2010 and Local Planning Authority requirements, the risk of overheating to buildings in the summer months is becoming more prevalent. Overheating can be a mild discomfort or a hazard to health if managed incorrectly so it is vitally important that overheating risk is mitigated to ensure a building is both energy efficient and comfortable to live in or occupy.

Summer overheating is caused when there is excess build-up of heat within a building. This can occur where there is excessive solar gain and limited means to absorb excess heat into the building fabric or purge this heat through ventilation. Summer overheating can be managed through a variety of measures and the chosen solution will vary from development to development.

6.1 Limiting Solar Gain

- **Glazing g value:** This is a measure of how much solar radiation penetrates the glazing. The lower the g value, the less solar gain that enters a building. Glazing with low g values may have a darker tint to the glazing so aesthetic considerations are also a factor. Lower g values (below 0.5) are often required in apartments with single facades. Specifying g values below 0.2 will increase cost substantially and also limit the number of available suppliers for glazing.
- **External shading:** Windows can be shaded using solar shading or with balconies on the floors above to reduce solar gain in the summer months. If aligned correctly, external shading can reduce solar gain in summer whilst allowing solar gain in the winter when the sun is lower.
- **Internal shading:** Blinds can be used to limit solar gain in a building. They can either be automatic, triggered by the sun's presence on the window, or operated manually. Manual operation requires the occupant to be present so this option is not reliable when trying to mitigate for the risk of overheating.

6.2 Purging Excess Heat Build Up

- **Thermal Mass:** Thermal mass is the measure of a building's ability to absorb energy. A building with a high thermal mass (high proportion of concrete) has the ability to absorb heat during the day which helps to maintain a steady internal temperature. This heat can be released back into the building at night time when the temperature is lower, helping to maintain a consistent internal temperature.
- **Ventilation:** A building can be ventilated to purge excess heat build-up. This can be done through openable windows, especially where cross ventilation is possible. Where ventilation through windows is not possible, due to security, noise or pollution

issues, Mechanical Ventilation can be used. The ventilation rates required to purge a building can often be quite high, requiring oversized systems.

6.3 The Development – Criterion 3 Assessment

The measure of summer overheating used in the SAP calculation is defined in Criterion 3 and recorded here in Appendix 4. The calculation used to assess the risk of summer overheating will take into account all the factors listed above with the exception of mechanical cooling. A building is considered compliant under Criterion 3 if the solar gain limit is not exceeded.

Using the Criterion 3 Assessment, the risk of overheating to the development at Green Park Village School has been mitigated through a combination of measures:

- A g value of 0.4 to North facing windows and 0.32 to all South, East and West facing windows.
- A medium thermal mass which will absorb heat.
- Openable windows allowing an air change rate of 4 to be achieved.
- All spaces within the building have appropriate passive control measures to ensure solar gain limit is not exceeded.

7. INTERNAL-DAYLIGHTING FACTORS

The amount of natural daylight in a room can greatly influence the quality of life enjoyed by the occupant. The amount of natural daylight in a room can be assessed through an Average Daylight Factor (ADF) Calculation. Guidance on good practice for natural daylighting is set out in the *BRE Guidance Note 209: Site Layout Planning for Daylight and Sunlight – A Guide to Good Practice*. This recommends that rooms in schools and education occupied spaces should achieve the following:

- ADF of 2%
- 80% of the room area to comply.

It is also worth noting that the BRE Guide states *“the advice given here is not mandatory and should not be seen as an instrument of planning policy”* and that *“daylight criteria should be interpreted flexibly because natural Daylighting is only one of many factors.”* It is also clear that excessive over glazing of a development can increase the overheating risk, so a careful balance is required.

This development has targeted 6 of the total 6 credits for Hea01 – Visual comfort under the BREEAM scheme, meaning that the rooms are designed to be of a high standard of visual comfort. The following will be achieved on site:

- There will be adequate glare control for building users,
- Adequate daylighting will be achieved
- The design will provide adequate view out for building users
- Internal and external lighting will be specified in accordance with the relevant CIBSE guides and British Standards.

A separate daylighting report will be provided to confirm that the above has been achieved.

8. MAINS-WATER CONSUMPTION

The water consumption of a building has a significant impact on not only direct operational running costs (i.e. water consumption charges), but also indirectly through additional energy usage and the heating of water.

The development is targeting 2 credits in Wat 01 – Water consumption under the BREEAM scheme, this requires a 25% improvement over baseline sanitary fittings. The standard can be met using the following specification as set out in Table 8 below.

Table 8. Water calculations for new dwellings at Green Park Village School.

Element	Performance
Urinals	3 Litres per bowl/hour
Hand basin taps	4.5 Litres per minute
WCs Flush Volume	4.5 Litres (6/4 Dual Flush)
Kitchen Taps	5 Litres per minute
Dishwasher water consumption	13 litres per cycle

9. SUSTAINABLE URBAN DRAINAGE

Policy CS1 requires that developments incorporate sustainable urban drainage facilities and techniques as part of the layout of a development as appropriate and as advised by the Environment Agency, including minimising the size of impermeable areas so that peak run-off and annual water run-off is reduced where possible and in any case is no greater than the original conditions of the site. Particular care will be needed in areas of flood risk where different solutions may be required.

A flood risk assessment has been undertaken which has assessed the site as having low risk of flooding.

In addition to this, the site will meet the BREEAM criteria for peak surface water run-off, run-off volume and attenuation limiting discharge. An appropriate consultant has been appointed to confirm compliance with the following:

- Drainage measures are specified to ensure that peak run-off and run-off volume from the site is no greater for the developed site than it was for the pre-development site, complying with the 1 year and 200-year return period events.
- Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS are in place.
- Calculations include an allowance for climate change in accordance with best practice guidelines.
- Flooding will not occur in the event of a local drainage system failure.
- Any additional predicted volume of run-off for this event is prevented from leaving the site by using infiltration or other Sustainable Drainage System (SuDS) techniques.

For this development, 4 of the 5 credits for Pol03 – Surface water run-off have been targeted to ensure a BREEAM score of 62.5 is achieved as well as compliance with Policy CS1.

10. WASTE MINIMISATION

Policy CS2 requires that development should demonstrate measures to minimise the generation of waste in the construction, use and life of buildings and promote more sustainable approaches to waste management, including the reuse and recycling of construction waste and the promotion of layouts and designs that provide adequate space to facilitate waste storage, reuse, recycling and composting.

The development has targeted 3 of the total 4 credits available for Wst 01 – Construction Waste Management, and one credit for Wst 03 – Operational Waste under the BREEAM scheme. The measures undertaken in order to comply with policy CS2 and the BREEAM scheme are as follows:

- A construction resource management plan has been undertaken.
- At least 70% of non-hazardous waste will be diverted from landfill.
- Provision of suitable, clearly labelled space and facilities to allow for segregation and storage of operational recyclable waste volumes generated by the assessed building, its occupants and activities.
- Static waste compactors or balers specified.
- Vessels for composting suitable organic waste to be provided.

11. CONCLUSIONS AND RECOMMENDATIONS

The Applicant demonstrates commitment to delivering the energy standard at Green Park Village School as follows:

- The Development has been designed to generate a total reduction in CO₂ emissions of 23.71% over the TER ADL 2010.
- The development has been designed to generate a reduction in CO₂ from renewable energy of 15.95% over the TER ADL 2010.

A combination of demand-reduction measures, energy-efficiency measures and low-carbon and renewable energy will deliver the Applicant's target for on-site reduction in CO₂ emissions.

The following measures, summarised here in Table 9, are incorporated in the development proposals.

Table 9. Measures incorporated to deliver the energy standard.

Fabric first: Demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double-glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Efficient-building services including high-efficiency heating systems and mechanical ventilation system. ▪ LED lighting throughout the building. ▪ Occupancy Sensors to WC's. ▪ Heating and lighting sub-metering in line with BREEAM requirements.
Renewable and low-carbon energy technologies	▪ A 15.75kWp PV array (110-126m²) to be installed to a South orientation, at a 30 degree pitch with little or no overshadowing.

The way in which these design measures deliver the Applicant's commitment to the energy standard is illustrated in Figure 3 and Table 10 overleaf.

Figure 3: How the Development delivers the energy standard.

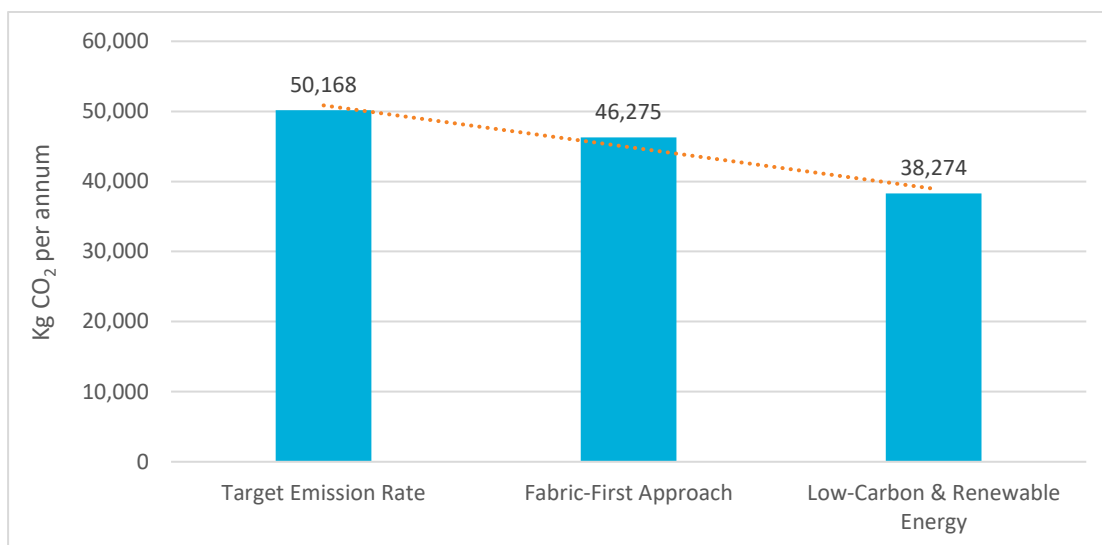


Table 10: How the Development reduces CO₂ emissions.

	CO ₂ emissions	
	Kg/CO ₂ per annum	% reduction
Target Emission Rate: Compliant with ADL 2010	50,168	-
Fabric first: Demand-reduction measures	46,275	7.76%
Low-carbon and renewable energy	38,274	15.95%
Total savings	11,893	23.71%

12. APPENDICES

APPENDIX 1: LIST OF ABBREVIATIONS

ADL 2010	Approved Document Part L of Buildings Regulations 2010
ASHP	Air Source Heat Pump
BER	Building Emission Rate
CHP	Combined Heat & Power
DHN	District Heat Network
ESCO	Energy Services Company
GSHP	Ground Source Heat Pump
LPA	Local Planning Authority
PV	Photovoltaics
SBEM	Simplified Building Energy Model
TER	Target Emission Rate

APPENDIX 2: PLANNING POLICY AND DESIGN GUIDANCE

The Climate Change Act (2008)

Passed in November 2008, the Climate Change Act mandated that the UK would reduce emissions of six key greenhouse gases, including Carbon Dioxide, by 80% by 2050.

As a consequence, the reduction of carbon dioxide emissions is at the forefront of National, Regional and Local Planning Policy, along with continuing step changes in performance introduced by the Building Regulations Approved Document L (2013).

Approved Document L (2013)

This development is subject to the requirements of Approved Document L (2013). ADL 2013 represented an approximate reduction of 6% in the Target Emission Rate (Kg/CO₂/sqm per annum) over the requirements of Approved Document L (2010) for residential development and an aggregate 9% reduction for non-residential development. ADL (2013) also sees the introduction of a Fabric Energy Efficiency Target, a measure of heating demand (kW hrs/sqm per annum) to ensure new-build dwellings with low-carbon heating systems still meet satisfactory energy-efficiency standards.

National Policy

The National Planning Policy Framework encourages Local Planning Authorities to “Have a positive strategy to promote energy from renewable and low-carbon sources” (NPPF paragraph 97), whilst “Ensuring that the adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts”. This suggests that although LPAs should encourage renewable technology, the merits of such should be assessed on a site-by-site basis.

The NPPF also requires that policy-making and planning obligations do not threaten the viability of a development, by maintaining competitive returns for developers and landowners alike. In this respect flexibility is encouraged by LPAs to ensure sustainability standards can be met without incurring unreasonable development costs.

Reading Borough Council Core strategy (January 2008)

Policy CS1

Policy CS1: Sustainable Construction and Design

Proposals for new development, including the construction of new buildings and the redevelopment and refurbishment of existing building stock, will be acceptable where the design of buildings and site layouts use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and take account of the effects of climate change.

To meet these requirements:

- All new housing is required to meet the most up to date Eco-Homes 'Very Good' as a minimum standard, and all new commercial developments are required to meet the most up to date BREEAM 'Very Good' as a minimum standard;*
- On larger developments of more than 10 dwellings or 1,000 m² of floorspace, ensure that 50% of the provision meets the most up to date Eco-Homes and BREEAM 'Excellent' standards;*
- All new developments maximise the use of energy efficiency and energy conservation measures in their design, layout and orientation to reduce overall energy demand;*
- All developments of more than 10 dwellings or 1000m² floorspace incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development;*
- All developments reduce mains water use and demonstrate that water conservation measures are incorporated so that predicted per capita consumption does not exceed the appropriate levels set out in the Code for Sustainable Homes or BREEAM Standards*
- Developments incorporate sustainable urban drainage facilities and techniques as part of the layout of a development as appropriate and as advised by the Environment Agency, including minimising the size of impermeable areas so that peak run-off and annual water run-off is reduced where possible and in any case is no greater than the original conditions of the site. Particular care will be needed in areas of flood risk where different solutions may be required.*

The Housing Standards Review and implications on Local Planning Policy

On March 25th 2015 the Government confirmed its policy to limit energy-efficiency targets that can be imposed on a development as a result of the Housing Standards Review. New developments should not be conditioned to achieve a reduction in Carbon Emissions exceeding a 19% improvement over the requirements of Approved Document L (2013) – the equivalent energy performance of a Code for Sustainable Homes Level 4 dwelling.

In addition the Government confirmed that the Code for Sustainable Homes is no longer an applicable standard for planning permissions granted on or after March 26th 2015. If a Local Planning Authority has an existing policy requirement for the CSH it may still condition the Ene 1 and Wat 1 requirements for CSH Level 4, but cannot require assessment against the remaining categories and full CSH Certification.

Sites with planning permission granted prior to March 25th 2015 can still be assessed and certified against the Code for Sustainable Homes, where there is a requirement to do so (known as legacy sites).

A CSH requirement can also apply where a previously approved Outline Planning Permission has been granted prior to March 25th 2015.

APPENDIX 3: SBEM RESULTS – No LZC

BRUKL Output Document



Compliance with England and Wales Building Regulations Part L 2010

Project name

Green Park School

As designed

Date: Mon Mar 12 13:51:59 2018

Administrative information

Building Details

Address: Green Park Village School, Longwater Avenue,
READING, RG2

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.e.5

Interface to calculation engine: Design Database

Interface to calculation engine version: v25.05

BRUKL compliance check version: v4.1.e.5

Owner Details

Name: Berkley Homes (Western) Ltd

Telephone number: na

Address: 200 Longwater Avenue, Reading, RG2 6GB

Certifier details

Name: Steve Hull

Telephone number: 08458 386 387

Address: Energist UK, College Farm, Tetbury Road,
Cirencester, GL7 6PY

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	23.2
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.2
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	21.4
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	U _{o-Limit}	U _{o-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	CIRC FF Wall 1
Floor	0.25	0.1	0.1	CIRC1 GF Exposed Floor 1
Roof	0.25	0.1	0.1	CIRC FF Exposed Roof 1
Windows***, roof windows, and rooflights	2.2	1.4	1.4	CIRC FF Window 1
Personnel doors	2.2	2.2	2.2	CIRC FF Door 1 (Personnel Door)
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _{o-Limit} = Limiting area-weighted average U-values [W/(m ² K)] U _{o-Calc} = Calculated area-weighted average U-values [W/(m ² K)] U _{i-Calc} = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** 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. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 1

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.96	-	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

1- Default DHW

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
Hot water provided by HVAC system	0

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
KITCHEN	-	-	1
WC ACC FF	-	-	0.3
WC ACC GF	-	-	0.3
WC CHANGE	-	-	0.3
WC1 FF	-	-	0.3
WC1 GF	-	-	0.3
WC2 FF	-	-	0.3
WC2 GF	-	-	0.3
WC3 FF	-	-	0.3
WC3 GF	-	-	0.3
WC4 GF	-	-	0.3

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
CIRC FF	750	-
CIRC1 GF	250	-
CIRC2 GF	190	-
CIRC3 GF	270	-
CIRC4 GF	120	-
CIRC5 GF	210	-
CIRC6 GF	90	-
CLASS1 FF	320	-
CLASS1 GF	320	-
CLASS2 FF	320	-
CLASS2 GF	320	-
CLASS3 FF	320	-
CLASS3 GF	320	-
CLASS4 FF	320	-
CLASS4 GF	320	-
CLASS5 FF	320	-
CLASS5 GF	320	-
CLASS6 FF	320	-
CLASS6 GF	310	-
CLASS7 FF	320	-

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
CLASS8 FF	320	-
CLEANER	10	-
CLEANER2	10	-
CLEANER3	10	-
COATS1 FF	50	-
COATS1 GF	20	-
COATS2 FF	60	-
COATS2 GF	20	-
COATS3 FF	30	-
COATS3 GF	20	-
COATS4 FF	70	-
COATS4 GF	30	-
COPIER	50	-
FOOD DT	140	-
GP RM FF	50	-
GP RM GF	50	-
GP RM2 FF	50	-
HALL	910	-
HEAD	80	-
HYGIENE	40	-
INTERVIEW	30	-
KITCHEN	310	-
LRC	170	-
NURSERY	270	-
NURSERY GP	40	-
OFFICE	130	-
SEN GP	60	-
SERVER	30	-
SICK BAY	20	-
ST	20	-
ST APP	10	-
ST CARE	20	-
ST CHAIRS	70	-
ST KIT	10	-
ST PE	90	-
ST SPEC	20	-
ST STAGE	10	-
STAFF WORK	60	-
STAFF1	50	-
STAFF2	60	-
STAFF3	200	-
STOCK RM	30	-
STUDIO	270	-
WC ACC FF	20	-
WC ACC GF	20	-
WC CHANGE	350	-
WC1 FF	80	-

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
WC1 GF	60	-
WC2 FF	20	-
WC2 GF	60	-
WC3 FF	60	-
WC3 GF	70	-
WC4 GF	80	-

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
CLASS1 FF	NO (-62.9%)	NO
CLASS1 GF	NO (-64.2%)	NO
CLASS2 FF	NO (-68.1%)	NO
CLASS2 GF	NO (-62.7%)	NO
CLASS3 FF	NO (-62.9%)	NO
CLASS3 GF	NO (-71.4%)	NO
CLASS4 FF	NO (-67.8%)	NO
CLASS4 GF	NO (-82.2%)	NO
CLASS5 FF	NO (-72%)	NO
CLASS5 GF	NO (-70.4%)	NO
CLASS6 FF	NO (-69.4%)	NO
CLASS6 GF	NO (-80.1%)	NO
CLASS7 FF	NO (-80.2%)	NO
CLASS8 FF	NO (-81.7%)	NO
COPIER	N/A	N/A
FOOD DT	NO (-76.5%)	NO
GP RM FF	NO (-48.4%)	NO
GP RM GF	NO (-76%)	NO
GP RM2 FF	NO (-60.1%)	NO
HALL	NO (-12.5%)	NO
HEAD	NO (-78.2%)	NO
HYGIENE	N/A	N/A
INTERVIEW	N/A	N/A
LRC	NO (-80%)	NO
NURSERY	NO (-53.3%)	NO
NURSERY GP	NO (-84.9%)	NO
OFFICE	NO (-74.5%)	NO
SEN GP	NO (-82.6%)	NO
SERVER	N/A	N/A
SICK BAY	N/A	N/A
STAFF WORK	NO (-78.5%)	NO
STAFF1	NO (-53%)	NO
STAFF2	NO (-81.4%)	NO
STAFF3	NO (-74.5%)	NO
STUDIO	NO (-86.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	2162.4	2162.4		A1/A2 Retail/Financial and Professional services
External area [m ²]	3830.3	3830.3		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	SWI	SWI		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	5	5		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	1113.92	1482.3		B8 Storage or Distribution
Average U-value [W/m ² K]	0.29	0.39		C1 Hotels
Alpha value* [%]	21.64	14.41		C2 Residential Inst.: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				C2 Residential Inst.: Residential schools
				C2 Residential Inst.: Universities and colleges
				C2A Secure Residential Inst.
				Residential spaces
				D1 Non-residential Inst.: Community/Day Centre
				D1 Non-residential Inst.: Libraries, Museums, and Galleries
			100	D1 Non-residential Inst.: Education
				D1 Non-residential Inst.: Primary Health Care Building
				D1 Non-residential Inst.: Crown and County Courts
				D2 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	21.66	27.7
Cooling	0	0
Auxiliary	1.07	0.98
Lighting	10.77	10.61
Hot water	55.49	60.15
Equipment*	15.67	15.67
TOTAL**	88.99	99.44

* Energy used by equipment does not count towards the total for 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	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m ²]	130.81	141.64
Primary energy* [kWh/m ²]	113.28	122.61
Total emissions [kg/m ²]	21.4	23.2

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

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	70.3	60.5	21.7	0	1.1	0.9	0	0.96	0
Notional	79.6	62.1	27.7	0	1	0.79 / 0.81	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.15	CIRC FF Wall 1
Floor	0.2	0.1	CIRC1 GF Exposed Floor 1
Roof	0.15	0.1	CIRC FF Exposed Roof 1
Windows, roof windows, and rooflights	1.5	1.4	CIRC FF Window 1
Personnel doors	1.5	2.2	CIRC FF Door 1 (Personnel Door)
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Thermal bridges

There is at least one junction in the project whose linear thermal transmittance has been defined as having been calculated following a quality-assured accredited construction details approach in accordance with a scheme approved by the Secretary of State.

APPENDIX 4: SBEM RESULTS –LZC

BRUKL Output Document



Compliance with England and Wales Building Regulations Part L 2010

Project name

Green Park School

As designed

Date: Wed Mar 07 13:22:38 2018

Administrative information

Building Details

Address: Green Park Village School, Longwater Avenue,
READING, RG2

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.e.5

Interface to calculation engine: Design Database

Interface to calculation engine version: v25.05

BRUKL compliance check version: v4.1.e.5

Owner Details

Name: Berkley Homes (Western) Ltd

Telephone number: na

Address: 200 Longwater Avenue, Reading, RG2 6GB

Certifier details

Name: Steve Hull

Telephone number: 08458 386 387

Address: Energist UK, College Farm, Tetbury Road,
Cirencester, GL7 6PY

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	23.2
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.2
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	17.7
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	U _{s-Limit}	U _{s-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	CIRC FF Wall 1
Floor	0.25	0.1	0.1	CIRC1 GF Exposed Floor 1
Roof	0.25	0.1	0.1	CIRC FF Exposed Roof 1
Windows***, roof windows, and rooflights	2.2	1.4	1.4	CIRC FF Window 1
Personnel doors	2.2	2.2	2.2	CIRC FF Door 1 (Personnel Door)
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_{s-Limit} = Limiting area-weighted average U-values [W/(m²K)]
U_{s-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** 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.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 1

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.96	-	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

1- Default DHW

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
	0
Hot water provided by HVAC system	

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
KITCHEN	-	-	1
WC ACC FF	-	-	0.3
WC ACC GF	-	-	0.3
WC CHANGE	-	-	0.3
WC1 FF	-	-	0.3
WC1 GF	-	-	0.3
WC2 FF	-	-	0.3
WC2 GF	-	-	0.3
WC3 FF	-	-	0.3
WC3 GF	-	-	0.3
WC4 GF	-	-	0.3

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
CIRC FF	750	-
CIRC1 GF	250	-
CIRC2 GF	190	-
CIRC3 GF	270	-
CIRC4 GF	120	-
CIRC5 GF	210	-
CIRC6 GF	90	-
CLASS1 FF	320	-
CLASS1 GF	320	-
CLASS2 FF	320	-
CLASS2 GF	320	-
CLASS3 FF	320	-
CLASS3 GF	320	-
CLASS4 FF	320	-
CLASS4 GF	320	-
CLASS5 FF	320	-
CLASS5 GF	320	-
CLASS6 FF	320	-
CLASS6 GF	310	-
CLASS7 FF	320	-

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
CLASS8 FF	320	-
CLEANER	10	-
CLEANER2	10	-
CLEANER3	10	-
COATS1 FF	50	-
COATS1 GF	20	-
COATS2 FF	60	-
COATS2 GF	20	-
COATS3 FF	30	-
COATS3 GF	20	-
COATS4 FF	70	-
COATS4 GF	30	-
COPIER	50	-
FOOD DT	140	-
GP RM FF	50	-
GP RM GF	50	-
GP RM2 FF	50	-
HALL	910	-
HEAD	80	-
HYGIENE	40	-
INTERVIEW	30	-
KITCHEN	310	-
LRC	170	-
NURSERY	270	-
NURSERY GP	40	-
OFFICE	130	-
SEN GP	60	-
SERVER	30	-
SICK BAY	20	-
ST	20	-
ST APP	10	-
ST CARE	20	-
ST CHAIRS	70	-
ST KIT	10	-
ST PE	90	-
ST SPEC	20	-
ST STAGE	10	-
STAFF WORK	60	-
STAFF1	50	-
STAFF2	60	-
STAFF3	200	-
STOCK RM	30	-
STUDIO	270	-
WC ACC FF	20	-
WC ACC GF	20	-
WC CHANGE	350	-
WC1 FF	80	-

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
WC1 GF	60	-
WC2 FF	20	-
WC2 GF	60	-
WC3 FF	60	-
WC3 GF	70	-
WC4 GF	80	-

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
CLASS1 FF	NO (-62.9%)	NO
CLASS1 GF	NO (-64.2%)	NO
CLASS2 FF	NO (-68.1%)	NO
CLASS2 GF	NO (-62.7%)	NO
CLASS3 FF	NO (-62.9%)	NO
CLASS3 GF	NO (-71.4%)	NO
CLASS4 FF	NO (-67.8%)	NO
CLASS4 GF	NO (-82.2%)	NO
CLASS5 FF	NO (-72%)	NO
CLASS5 GF	NO (-70.4%)	NO
CLASS6 FF	NO (-69.4%)	NO
CLASS6 GF	NO (-80.1%)	NO
CLASS7 FF	NO (-80.2%)	NO
CLASS8 FF	NO (-81.7%)	NO
COPIER	N/A	N/A
FOOD DT	NO (-76.5%)	NO
GP RM FF	NO (-48.4%)	NO
GP RM GF	NO (-76%)	NO
GP RM2 FF	NO (-60.1%)	NO
HALL	NO (-12.5%)	NO
HEAD	NO (-78.2%)	NO
HYGIENE	N/A	N/A
INTERVIEW	N/A	N/A
LRC	NO (-80%)	NO
NURSERY	NO (-53.3%)	NO
NURSERY GP	NO (-84.9%)	NO
OFFICE	NO (-74.5%)	NO
SEN GP	NO (-82.6%)	NO
SERVER	N/A	N/A
SICK BAY	N/A	N/A
STAFF WORK	NO (-78.5%)	NO
STAFF1	NO (-53%)	NO
STAFF2	NO (-81.4%)	NO
STAFF3	NO (-74.5%)	NO
STUDIO	NO (-86.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	2162.4	2162.4		A1/A2 Retail/Financial and Professional services
External area [m ²]	3830.3	3830.3		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	SWI	SWI		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	5	5		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	1113.92	1482.3		B8 Storage or Distribution
Average U-value [W/m ² K]	0.29	0.39		C1 Hotels
Alpha value* [%]	21.64	14.41		C2 Residential Inst.: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				C2 Residential Inst.: Residential schools
				C2 Residential Inst.: Universities and colleges
				C2A Secure Residential Inst.
				Residential spaces
				D1 Non-residential Inst.: Community/Day Centre
				D1 Non-residential Inst.: Libraries, Museums, and Galleries
			100	D1 Non-residential Inst.: Education
				D1 Non-residential Inst.: Primary Health Care Building
				D1 Non-residential Inst.: Crown and County Courts
				D2 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	21.66	27.7
Cooling	0	0
Auxiliary	1.07	0.98
Lighting	10.77	10.61
Hot water	55.49	60.15
Equipment*	15.67	15.67
TOTAL**	88.99	99.44

* Energy used by equipment does not count towards the total for 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	6.93	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m ²]	130.81	141.64
Primary energy* [kWh/m ²]	113.28	122.61
Total emissions [kg/m ²]	17.7	23.2

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

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	70.3	60.5	21.7	0	1.1	0.9	0	0.96	0
Notional	79.6	62.1	27.7	0	1	0.79 / 0.81	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{typ}	U _{min}	Surface where the minimum value occurs*
Wall	0.23	0.15	CIRC FF Wall 1
Floor	0.2	0.1	CIRC1 GF Exposed Floor 1
Roof	0.15	0.1	CIRC FF Exposed Roof 1
Windows, roof windows, and rooflights	1.5	1.4	CIRC FF Window 1
Personnel doors	1.5	2.2	CIRC FF Door 1 (Personnel Door)
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{typ} = Typical individual element U-values [W/(m²K)] U _{min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Thermal bridges

There is at least one junction in the project whose linear thermal transmittance has been defined as having been calculated following a quality-assured accredited construction details approach in accordance with a scheme approved by the Secretary of State.