CALDECOTE FARM

NEWPORT PAGNELL · MILTON KEYNES

SUPPORTING DOCUMENTS

SUSTAINABILITY STATEMENT

BY COUCH PERRY WILKES

JULY 2021

newlands developments

SUSTAINABILITY STATEMENT

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SUSTAINABILITY STATEMENT

1.0 INTRODUCTION

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In accordance with the Milton Keynes Council (MKC) Local Plan, Plan:MK, Couch Perry Wilkes (CPW) has produced a Sustainability Statement on behalf of Newlands Developments to support an outline planning application for the proposed erection of two storage and distribution units (Class B8) with associated facilities on land at Caldecote Farm, Newport Pagnell.

1.1 PLANNING POLICY

Relevant local (Plan:MK) and national planning policy pertaining to sustainability and energy have been considered in the preparation of this report.

The National Planning Policy Framework (NPPF) document was revised in February 2019 and sets out the overarching policies for development in England. At the heart of the NPPF is a presumption in favour of sustainable development encompassing three interdependent areas of planning policy: social, economic and environmental.

The NPPF supports a reduction in greenhouse gas emissions and the delivery of renewable and low carbon energy. To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so by adopting nationally described standards.

In determining planning applications, local planning authorities should expect new development to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

The document also makes it clear that good design is a key aspect of sustainable development.

1.2 APPROACH TO ADDRESSING PLANNING POLICY REQUIREMENTS

With reference to the key requirements of Plan:MK Policy SC1, this sustainability statement serves to demonstrate how the proposed scheme will:

- Incorporate energy efficiency measures and best practice design to reduce the inherent energy demand of the scheme and achieve a 19% carbon dioxide (CO_2) reduction against Building Regulations Part L 2013 standards.
- Incorporate Low and Zero Carbon (LZC) technology solutions to decarbonise the energy supply and provide a further 20% CO_2 reduction.
- Incorporate recycled materials and materials with low embodied energy impact.
- Incorporate water efficiency measures and Sustainable Drainage Systems (SuDS).
- Incorporate measures to reduce waste.
- Incorporate measures to encourage sustainable transport

The planned new development on land adjacent to Caldecote Farm off Willen Road in Newport Pagnell is identified as part of a strategic site allocation within Policy SD12 of Plan:MK. This policy envisages a comprehensive new residential and employment development within a new sustainable urban extension. This planning application forms part of the employment element of the development. An indicative site layout is shown below.

Figure 1. Indicative Site Layout

With the current emphasis placed on energy conservation and the use of LZC technologies, the applicant is keen to maximise the development's sustainability credentials.

To this end, the proposed design shall promote reduced CO2 emissions from delivered energy consumption by minimising operational energy demand through passive and best-practice measures.

LZC technologies will be incorporated into the design, as deemed appropriate, as part of an integrated services strategy as opposed to a 'bolt-on' approach.

A combination of the aforementioned CO2 reduction techniques will limit the carbon offset payment to the MKC carbon offset fund for developments that are not 'Carbon Neutral'.

This report has been compiled to address the adopted Milton Keynes Council planning policy requirements in terms of demonstrating an exemplar sustainability strategy for the proposed development.

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2.0 ENERGY BENCHMARKING

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2.0 ENERGY BENCHMARKING

2.1 ESTIMATED ENERGY DEMANDS AND CO2 EMISSIONS

In order to benchmark the proposed new development, estimated energy demands and CO^2 emissions data have been calculated. These estimated energy consumptions are indicative only at this stage. They will, however, be used as a guideline to assess the percentage of the building's total energy consumption and CO2 emissions that could be reduced or offset by applying best practice energy efficiency measures and/or LZC technology solutions.

For the purposes of BREEAM, it is prudent for this report to reflect the benchmark data derived from approved Dynamic Simulation Model (DSM) software which uses government and industry agreed National Calculation Method (NCM) room templates containing standard operating conditions. This is due to the fact that BRE Global will only accept results from the approved models when verifying the percentage reduction in CO2 emissions from the building for credits Ene 1 and Ene 4 (BREEAM 2014).

To assist with the formulation of an energy strategy, the estimated **regulated notional** energy consumption and CO2 emissions for the development have been derived from approved DSM software (IES):

Unit 1 = 44,153m2

The total predicted regulated notional energy consumption is: **914,735kWhr per year**
The total predicted regulated notional CO2 emissions are: **463,961kgCO2 per year**

Unit 2 = 34,286m2

The total predicted regulated notional energy consumption is: **641,939kWhr per year**
The total predicted regulated notional CO2 emissions are: **325,885kgCO2 per year**

2.2 CARBON OFFSET PAYMENT

Milton Keynes Council expect all new developments to be 'Carbon Neutral'. Where this is not technically feasible, the calculated increase in CO2 emissions arising from a new development is expected to be balanced by making a cash in lieu payment into a carbon offset fund. This one-off contribution payment is currently levied at 200 per tonne of estimated regulated and unregulated CO2 emissions over the course of one year.

To assist with the above calculation, the estimated regulated and unregulated energy consumption and CO2 emissions for the development have been derived from approved DSM software (IES). This data can be used later in the process when the applicant has discussed the extent of any contribution with Milton Keynes Council.

Note 1 CO2 emission factors of 0.216 for Gas and 0.519 for Electricity have been used to calculate the above and are taken from Building Regulations Approved Documents.

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3.0 ENERGY EFFICIENCY, WATER CONSERVATION AND MATERIALS OF CONSTRUCTION

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3.0 ENERGY EFFICIENCY, WATER CONSERVATION AND MATERIALS OF CONSTRUCTION

In order to deliver environmentally responsible building stock, an exemplar approach is being proposed based on low energy design principles. In summary, this approach involves energy demand minimisation through effective building form and orientation, good envelope design and proficient use of services; such that the buildings themselves are being used as the primary environmental modifier.

Long term energy benefits are best realised by reducing the inherent energy demand of the buildings in the first instance before considering deployment of appropriate renewable technologies to decarbonise the development's energy supply.

To further reduce the environmental impact of the design, and in accordance with the requirements of the SPD, the intension is to incorporate water conservation measures, Sustainable Drainage Systems (SuDS) and materials with low embodied energy/high recycled content.

These benefits are described and quantified as follows:

3.1 BUILDING DESIGN – ENERGY EFFICIENCY

The general construction design standards to be adopted must exceed the requirements of the current (2013 Edition) Part L Building Regulations which stipulate an improvement on the CO2 emissions of an aggregated 9% against 2010 standards.

The building envelope will be designed to ensure that the fabric and form of the office and warehouse spaces encompass low energy sustainability principles.

The following table (Table 1) describes the proposed minimum building envelope thermal performance criteria.

Element	Part L 2013 Building Regulations U-Value (W/m2K)	Target U-Value (W/m2K)	Notes
General Glazing (including frame)	U = 2.20	U = 1.50	Glass to achieve a total light transmission of 0.36 (g = 0.38)
Roof Lights (including frame)	U = 2.20	U = 1.30	Glass to achieve a total light transmission of 0.58 (g = 0.55)
External Walls	U = 0.35	U = 0.35	
Roof	U = 0.25	U = 0.23	
Ground Floor	U = 0.25	U = 0.22	
Thermal Bridging ψ Value	-	0.01W/mK	

Table 1. Summary of Building Envelope Thermal Performance Criteria

In accordance with the requirements of a low energy building, the air tightness characteristics will be addressed. With robust design, the target proposed for the buildings is 2.5m3/m2/hr @ 50Pa. This compares to the current Part L Building Regulations standard of 10m3/m2/hr @ 50Pa and hence represents an improvement of 75%.

High levels of natural daylight will be provided, wherever possible, through effective window design and 12% roof lights to the warehouse areas. The glazing specifications for the new buildings will be optimised to ensure that the glazed elements provide excellent thermal performance combined with optimum solar reflectance to minimise summer solar heat gains along with high daylight transmittance factors to maximise daylight factors. Encouraging the correct quality and quantity of daylight to penetrate the buildings is key to reducing the amount of light required from artificial sources and hence energy requirements.

It is imperative that the lighting design philosophy provides the correct quality of lighting with minimum energy input and hence reduce internal heat gains. In the buildings, energy efficient lighting (including LEDs with an efficacy of 80 lumens per circuit Watt,) will be deployed throughout and lighting schemes will be appropriately zoned to allow control of luminaires via switches/absence detection and daylight sensors. Output performance or Light Output Ratios (LORs) will exceed 80%.

To complement the significant improvements in envelope design and lighting provision, the building services heating and ventilation systems being proposed will also drastically reduce the inherent energy consumption of the site.

The provision of an effective control and metering philosophy is fundamental to the efficient operation of the building's environmental services. The following provides an overview of the plant efficiency and control measures that are proposed:

- Air-source heat pump (ASHP) heating/cooling (VRV/VRF) to office/meeting room areas.
- High efficiency hybrid heat recovery ventilation with automatic control strategy to the office spaces.
- Zoning of mechanical ventilation systems.
- Modular open architecture controls systems and associated network.
- High efficiency low energy motors to be used to drive mechanical ventilation systems.
- Variable speed pumps and fans to be used to promote lower operating costs and help match energy usage with the operating profile and occupancy of the building.
- Sub-metering to be provided such that approximately 90% of the input energy from each utility service may be accounted for at end use. The Building Management System (BMS) will be interfaced to provide automatic monitoring and targeting of all sub-meters to promote energy management and deliver lower consumption.

It has been shown via accredited computer modelling that incorporating the above best practice energy efficiency measures alone, reduces the inherent energy demand of Unit 1 by c. 23.1% and the CO2 emissions by c. 21.1% compared to the notional building, resulting in the following:

The total predicted regulated energy consumption is: **702,778kWhr per year**
The total predicted regulated CO2 emissions are: **366,285kgCO2 per year**

It has been shown via accredited computer modelling that incorporating the above best practice energy efficiency measures alone, reduces the inherent energy demand of Unit 2 by c. 21.0% and the CO2 emissions by c. 19.4% compared to the notional building, resulting in the following:

The total predicted regulated energy consumption is: **507,327kWhr per year**
The total predicted regulated CO2 emissions are: **262,230kgCO2 per year**

3.2 BUILDING DESIGN – UNREGULATED ENERGY

Unregulated energy refers to that energy associated with equipment/appliances used within the building and/or unique equipment processes taking place within the building. It is important to recognise that the proportion of unregulated energy making up a building's total energy demand can vary drastically between building types; from c. 20% for simple buildings with limited appliance and ICT loads, to as much as c. 80% for complex buildings with significant process loads.

The final tenant must take responsibility for the unregulated energy within the building and procure the most energy efficient equipment and appliances, as well as refining any energy hungry processes.

3.3 BUILDING DESIGN – WATER CONSERVATION AND SUSTAINABLE DRAINAGE SYSTEMS (SUDS)

In order to reduce the environmental impact on water resources as a result of the development, it is proposed that all toilets will be low water capacity, taps will be push button type and water consumption will be tightly monitored. Sanitary supply shut-off control could also be incorporated into the design. These measures will be supplemented by the incorporation of rainwater harvesting to supply the office accommodation. Rainwater harvesting does provide a means of conserving water and is a recognised SuDS measure to provide for the disposal of surface water.

A green roof has been considered, but it is not advisable to incorporate this with a rainwater harvesting system, so will not be taken further.

Permeable surface treatments to the car park and service areas will be encouraged to facilitate attenuation within the sub-structure; leading to an increase in the time of entry for the overflow into the carrier network. Infiltration techniques will be highly dependent upon the soil characteristics and the level of the water table. The flow and run-off from soft landscaped areas can be reduced through strategic planting of locally occurring species of bushes and trees.

3.4 BUILDING DESIGN – MATERIALS OF CONSTRUCTION

The design intention is to use locally sourced A and A+ rated construction materials (as defined by the Green Guide to Specification), wherever possible, with associated low embodied carbon impact. Timber will be from certified and renewable FSC approved sources.

Construction product efficiency (off-site pre-fabrication) will be promoted along with the utilisation of a local workforce to reduce the environmental impact over the construction life cycle.

Opportunities to mitigate embodied carbon emissions on new build projects should concentrate on appropriate selection of materials of construction, not least for the concrete substructure that can account for over 40% of the total 'cradle-to-grave' emissions. The design could allow for the specification of concrete with up to 30 - 40% Pulverised Fuel Ash (PFA) or Ground Granulated Blast Furnace Slag (GGBS) content which can reduce the embodied carbon impact of concrete by as much as 80% when compared to that containing 100% Portland Cement.

A further environmental benefit of using PFA or GGBS is that they are both derived from waste streams and readily available in the UK at little or no cost uplift.

3.5 BUILDING DESIGN – OPERATIONAL WASTE MANAGEMENT

The final tenant will be encouraged to provide dedicated storage facilities for the building's operational related recyclable waste streams, so that waste can be diverted from landfill or incineration. The waste management strategy will be dependent on the tenant's business activities, but may include for e.g. compactors or balers to deal with large amounts of packaging, or vessels for composting suitable organic waste. Facilities should be clearly labelled to assist with the segregation, storage and collection of the recyclable waste streams.

3.6 LANDSCAPE AND SUSTAINABLE GROUNDWORKS

The design strategy is to assimilate the proposed development within the site landscape and topology with particular attention given to the groundworks and earth modelling. Wherever possible, materials from site will be recycled and reused in the formation of the new landscaped areas. The reprofiling works will be designed to achieve an earthworks cut to fill balance, thus minimising the need for offsite disposal and import of materials. This has the added benefit of reducing HGV movements to and from the site. Where materials are required to be imported, the intention is to utilise recycled aggregates and soils sourced locally.

3.7 SUSTAINABLE TRANSPORT

A green travel plan will be developed as part of the process to consider all types of travel relevant to the building users; encouraging the reduction of user reliance on forms of travel that have the highest environmental impact.

The green travel plan could include measures to minimise car-based travel patterns:

- Providing parking priority spaces for car sharers
- Providing electric vehicle (EV) charging infrastructure and conveniently located EV charging stations
- Providing dedicated and convenient cycle storage and changing facilities
- Lighting, landscaping and shelter to make pedestrian and public transport waiting areas accessible
- Negotiating improved bus services, i.e. altering bus routes or offering discounts
- Providing lobby areas where information about public transport or car sharing can be made available
- Providing a pedestrian and cycle friendly site through the provision of e.g. cycle lanes and safe crossing points

The plan will be further tailored to minimise the impacts of operational related transport e.g. deliveries of supplies, equipment and support services to and from the site.

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4.0 APPRAISAL OF RENEWABLE AND LOW CARBON TECHNOLOGY ENERGY OPTIONS

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4.0 APPRAISAL OF RENEWABLE AND LOW CARBON TECHNOLOGY ENERGY OPTIONS

The technical feasibility and economic viability of installing each LZC technology at the Caldecote Farm development have been assessed in order to discount any unsuitable options at an early stage. A summary of the feasibility process is tabulated below and an overview of each viable technology is given subsequently.

Technology	Brief Description	Benefits	Issues/Limitations	Feasible for site
Solar Photovoltaic	Solar photovoltaic panels convert solar radiation into electrical energy through semiconductor cells. They are not to be confused with solar panels which use the sun's energy to heat water (or air) for water and space heating.	Low maintenance/no moving parts Easily integrated into building design	Any overshadowing reduces panel performance Panels ideally inclined at 30 to the horizontal facing a southerly direction	Yes
Solar Thermal	Solar thermal energy can be used to contribute towards space heating and hot water requirements. The two commonest forms of collector are panel and evacuated tube.	Low maintenance Little/no ongoing costs	Must be sized for the building hot water requirements Panels ideally inclined at 30 to the horizontal facing a southerly direction	Yes
Ground Source Heat Pump (GSHP)	GSHP systems tap into the earth's considerable energy store to provide both heating and cooling to buildings. A number of installation methods are possible including horizontal trench, vertical boreholes, piled foundations (energy piles) or plates/pipe work submerged in a large body of water. The design, installation and operation of GSHPs is well established.	Minimal maintenance Unobtrusive technology Flexible installation options to meet available site footprint	Large area required for horizontal pipes Full ground survey required to determine geology More beneficial to the development if cooling is required Integration with piled foundations must be done at an early stage	No, prohibitively expensive installation costs
Air Source Heat Pump	Electric or gas driven air source heat pumps extract thermal energy from the surrounding air and transfer it to the working fluid (air or water).	Efficient use of fuel Relatively low capital costs	Specialist maintenance More beneficial to the development if cooling is required Requires defrost cycle in extreme conditions Some additional plant space required	Yes

Technology	Brief Description	Benefits	Issues/Limitations	Feasible for site
Wind Turbine (Stand-alone column mounted)	Wind generation equipment operates on the basis of wind turning a propeller, which is used to drive an alternator to generate electricity. Small scale (1kW – 15kW) wind turbines can be pole or roof mounted.	Low maintenance/ ongoing costs Minimum wind speed available Excess electricity can be exported to the grid	Planning issues Aesthetic impact and background noise Space limitations on site Wind survey to be undertaken o verify 'local' viability	No, not suitable on this site
Wind Turbine (Roof Mounted)	As above	Low maintenance/ ongoing costs Minimum wind speed available Excess electricity can be exported to the grid	Planning issues Aesthetic impact and background noise Structural/vibration impact on building to be assessed Proximity of other buildings raises issues with downstream turbulence Wind survey to be undertaken to verify 'local' viability	No, not suitable on this site
Gas Fired Combined Heat and Power	A Combined Heat and Power (CHP) installation is effectively a mini on-site power plant providing both electrical power and useful heat. CHP is strictly an energy efficiency measure rather than a renewable energy technology.	Potential high CO2 saving available Efficient use of fuel Excess electricity can be exported to the grid Benefits from being part of an energy centre/district heating scheme	Maintenance intensive Sufficient base thermal and electrical demand required Some additional plant space required	No, limited domestic hot water requirements

Technology	Brief Description	Benefits	Issues/Limitations	Feasible for site
Bio-fuel Fired Combined Heat and Power	As above.	Potential high CO_2 saving available Efficient use of fuel Excess electricity can be exported back to the grid Benefits from being part of an energy centre/district heating scheme	Maintenance intensive Sufficient base thermal and electrical demand required Significant plant space required Biomass fuelled systems are at early stages of commercialisation Large area needed for fuel delivery and storage Reliable biomass fuel supply chain required	No, not suitable on this site
Bio-Renewable Energy Sources (Automated feed – woodfuel boiler plant)	Modern wood-fuel boilers are highly efficient, clean and almost carbon neutral (the tree growing process effectively absorbs the CO_2 that is emitted during combustion). Automated systems require mechanical fuel handling and a large storage silo.	Stable long term running costs Potential good CO_2 saving	Large area needed for fuel delivery and storage Reliable fuel supply chain required Regular maintenance required Significant plant space required	No, not suitable on this site
Fuel Cells and Fuel Cell Combined Heat and Power	Fuel cells convert the energy of a controlled chemical reaction, typically involving hydrogen and oxygen, into electricity, heat and water vapour. Fuel cell stacks operate in the temperature range 65 C – 800 C providing co-generation opportunities in the form of Combined Heat and Power (CHP) solutions.	Zero CO_2 emissions if fired on pure hydrogen and low CO_2 emissions if fired on other hydrocarbon fuels Virtually silent operation since no moving parts High electrical efficiency Excess electricity can be exported back to the grid Benefits from being part of an energy centre/district heating scheme	Expensive Pure hydrogen fuel supply and distribution infrastructure limited in the UK Sufficient base thermal and electrical demand required Some additional plant space required Reforming process, used to extract hydrogen from alternative fuels, requires energy; lowering overall system efficiency	No, expensive, emerging technology

Table 2. Summary of Renewable and Low Carbon Technology Energy Options

4.1 SOLAR PHOTOVOLTAIC (PV) PANELS

Solar photovoltaic panels convert solar radiation into electrical energy through semiconductor cells. They are not to be confused with solar panels which use the sun's energy to heat water (or air) for water and space heating.

Figure 2. Solar PV Installation

Photovoltaic panels are available in a number of forms including monocrystalline, polycrystalline, amorphous silicon (thin film) or hybrid panels. Polycrystalline products offer the best combination of performance and cost at present. They are fixed or integrated into a building's un-shaded south facing facade or pitched roof.

Distribution centre roofs provide an ideal location for the installation of PV panels.

It is essential that the panels remain un-shaded, as even a small shadow can significantly reduce output. This is not an issue on warehouse projects due to the uncluttered nature of the roof. The individual modules are connected to an inverter to convert their direct current (DC) into alternating current (AC) which is usable in buildings.

Photovoltaic technology may be feasibly incorporated into the building design with little/no maintenance or on-going costs. Installations are scaleable in terms of active area; size being restricted only by available fa ade and/or roof space.

A particular advantage of solar PV is that running costs are very low (requires no fossil fuel for operation) and, since there are no moving parts, very little maintenance is required.

It should be noted that the installation and connection of embedded generation equipment to the mains electrical utility grid (National Grid), including solar PV panels rated at more than 16A per phase, is subject to technical approval by the District Network Operator (DNO). This takes the form of a G99 agreement. The G99 is the regulation surrounding the connection of any form of generator device to run 'in parallel' or 'synchronised' with the grid.

The DNO are required (under the Connection and Use of System Code) to make a request for a Statement of Works (SoW) to National Grid Electricity Transmission plc (NGET) in relation to the potential impact of connection of embedded generation on the National Electricity Transmission System (NETS). As such, there is no guarantee that approval for the connection of embedded generation equipment will be granted.

4.1.1 SMART GRID – SOLAR PV, BATTERY STORAGE AND ELECTRIC VEHICLE (EV) CHARGING

The UK electricity infrastructure is gradually moving from a traditional top down power flow model with predictable loads, to a more complex nodal model characterised by intermittent distributed generation (PV/wind) and irregular loads (electric vehicles/heat pumps), often located at the very extremities of the network.

The current infrastructure is showing signs of strain due to the increase in complexity and technical challenges associated with balancing supply and demand across the power transmission and distribution system, whilst maintaining power quality.

Given the size and nature of the development, opportunities exist to maximise the site's overall efficiency by adopting a 'smart grid' approach. This is where the intermittent generation of energy from renewable sources (in this case solar PV) is paired with an energy storage and management system before being re-distributed at times of high energy demand and/or to provide e.g. dedicated electric vehicle charging.

This arrangement requires the installation of a large scale on-site battery array. At present, lithiumion based Battery Energy Storage Systems (BESS) are commercially available from e.g. Tesla, and can be located above or below ground.

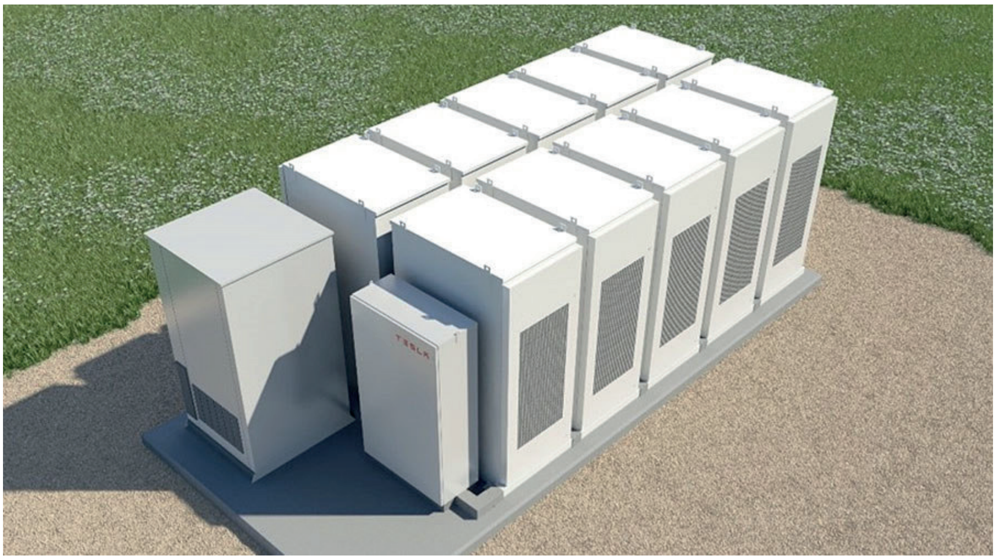

Figure 3. Battery Energy Storage System (BESS)

The BESS can be used to balance the site energy requirements through mechanisms known as renewable firming, load shifting and peak shaving, thereby modulating the use of grid electricity and, in turn, reducing costs. In addition, external grid services, procured through an aggregator from the National Grid in the form of Demand Side Response (DSR) participation, can be exploited to generate revenue.

With the current scheme, it would be prudent to consider using the BESS to provide electric vehicle (EV) charging infrastructure, as this can place a heavy burden on the power demands of the site during business hours. The exact number of EV charging stations is not known at this point, but with fast AC chargers rated at 7kW or above, the total load across the site could be significant and would have to be carefully managed. The most efficient way of recharging an EV is to use power generated locally and this is where the BESS paired with solar PV comes into play.

Figure 4. EV Battery Charging Stations

On-site transportation will form a major role in the delivery and uplift of goods to and from each unit. The use of electric transportation is a viable proposition with the use of e.g. open trailer configurations to facilitate palletised deliveries and uplifts using forklift trucks. The transportation and goods handling vehicles could be charged using their own dedicated charging network.

4.2 SOLAR THERMAL

Solar thermal energy can be used to contribute towards space heating and hot water requirements. In the UK, most applications focus on hot water installation as the solar availability during the space heating season is limited.

Figure 5. CPW Solar Thermal Evacuated Tube Systems: William Brookes School (above left) and Police Federation Headquarters (above right)

The use of solar water heating installations is widespread throughout Europe. The systems use a heat collector, generally located at roof level on support frames, orientated in a southerly direction to maximise solar heat absorption.

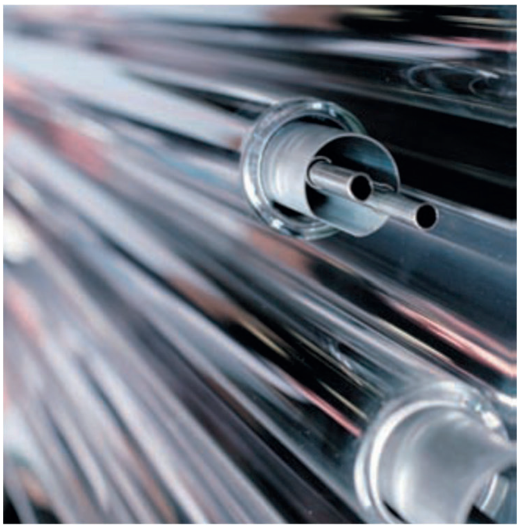

Figure 6. Evacuated Tube Type Collectors

A working fluid is used to heat water that is stored in either a separate hot water cylinder or more commonly a twin coil hot water cylinder with the second coil providing top-up heating from a conventional boiler.

The two commonest forms of collector are panel and evacuated tube.

The panel type collectors are generally more robust and reliable while manufacturers claim that the evacuated tube versions offer better winter all-round performance.

The design of the flat plate panels is relatively straightforward; consisting of water tubes arranged behind solar glass and an absorber plate. The absorber plate absorbs the sun's rays and transfers energy to the water flowing through the tubes. In contrast, the evacuated tube type collectors are more complicated consisting of double wall glass tubes with a space in the centre containing a heat pipe and a liquid.

Coatings on the inner glass ensure that around 93% of the absorbed heat is retained within the system and the vacuum prevents loss of heat through conduction and convection. The circular design helps maximise the potential to collect solar energy all year round when the sun is at different angles.

The heat pipes are connected to a manifold containing circulating water. The liquid in the heat pipe is evaporated by the suns energy and rises to a heat exchanger within the manifold where it condenses and gives up its latent heat energy to the water. This heated water is then pumped to a coil in the hot water cylinder sized to meet the demand of the installation. Evacuated tube systems deliver higher temperature water than flat plate types, with little decrease in efficiency, making them more effective with thermal storage solutions.

As a general rule, the evacuated tube collectors can deliver around 700kWhr/m2/yr when in optimum orientation (inclined at 30 to the horizontal facing a southerly direction). This compares to around 580kWhr/m2/yr for the flat plate collectors under similar conditions.

Solar thermal installations can be designed to fit the available roof space and/or building fa ade. Each evacuated tube is approximately 2m in length with an external diameter of 58mm. They weigh around 2kg each and can be spaced from 10mm to 500mm apart in an array. A typical panel array, 2.1m x 1.0m, will provide around 1.33m2 of absorber area and weigh approximately 45kg. Bespoke mounting frames can be fashioned to provide the ideal inclination of 30 to the horizontal facing a southerly direction. Access to the roof mounted solar collectors will be necessary for occasional cleaning of the active tubes.

For the current development, any solar thermal system should be sized to meet the domestic hot water demands of the building to prevent the risk of overheating during the summer months.

Given the above, a solar thermal installation could be accommodated given the size and envisaged load profiles of the Units.

Solar thermal systems generally come with a 10-year warranty. Very little maintenance is required and a check by a professional installer of pumps, valves and anti-freeze mixture every 3 – 5 years is usually sufficient.

4.3 AIR SOURCE HEAT PUMPS

Electric driven air source heat pumps extract thermal energy from the surrounding air and transfer it to the working fluid (air or water). Like GSHPs they can provide both heating and cooling to buildings and have an associated Coefficient of Performance (COP). This is typically around 3 to 4 for heat pumps driven by compressors powered by electric motors and incorporating Variable Refrigerant Flow (VRF) technology. With VRF technology, there is an opportunity to heat and cool separate spaces and recover the heat between them.

Figure 7. Air Source Heat Pumps

Care should be taken when mounting the units to avoid any acoustic problems associated with operating the fans. The outdoor units normally operate with sound levels typically in the range 55 - 60dB(A).

A downside of electric driven air source heat pumps is that they require a defrost cycle in extreme conditions which impacts on the system efficiency. Heating capacity also falls off as the ambient temperature drops below 5 C but still maintains 80% capacity at -5 C.

Air source heat pump systems are scaleable to meet the specific demands of the development and have the potential to offer good CO2 reduction as the grid electricity supply is decarbonised. For this study, assume that the office areas are being targeted.

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5.0 BREEAM ASSESSMENT

5.0 BREEAM ASSESSMENT

A BREEAM 2014 pre-assessment of the new development has been undertaken by a qualified BREEAM Accredited Professional (AP) against the New Construction criteria at Design and Procurement stage. It should be noted that both Unit 1 and Unit 2 have been registered under BREEAM 2014. The Caldecote Farm Unit 1 development currently achieves a score of 62.03% which translates into an overall BREEAM rating of 'Very Good'. The table below shows a breakdown of the BREEAM score:

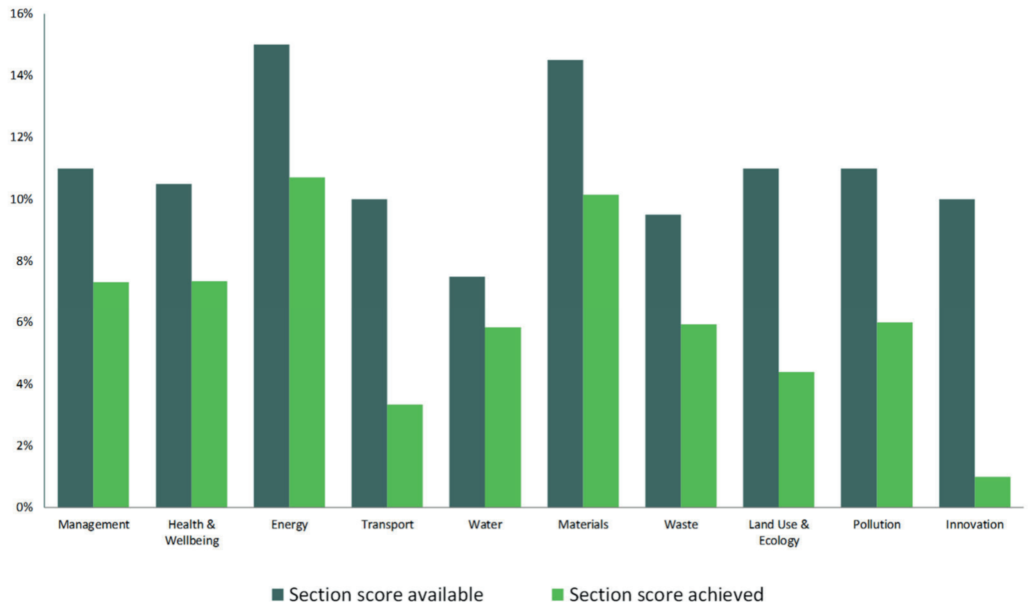
BREEAM UK New Construction 2014 Assessment Report: Rating & Key Performance Indicators

BREEAM® UK

Overall Building Performance

Building name	Unit 1 Caldecote Farm
BREEAM rating	Very Good
Total Score	62.03%
Min. standards level achieved	Outstanding level

Building Performance by Environment Section



Environmental Section	No. credits available	No. credits Achieved	% credits achieved	Section Weighting	Section Score
Management	18	12	66.67%	11.00%	7.33%
Health & Wellbeing	10	7	70.00%	10.50%	7.35%
Energy	21	15	71.43%	15.00%	10.71%
Transport	9	3	33.33%	10.00%	3.33%
Water	9	7	77.78%	7.50%	5.83%
Materials	10	7	70.00%	14.50%	10.15%
Waste	8	5	62.50%	9.50%	5.93%
Land Use & Ecology	10	4	40.00%	11.00%	4.40%
Pollution	11	6	54.55%	11.00%	6.00%
Innovation	10	1	10.00%	10.00%	1.00%

Table 3. Summary of BREEAM 2014 Assessment (Unit 1)

CALDECOTE FARM

NEWPORT PAGNELL · MILTON KEYNES

SUPPORTING DOCUMENTS

SUSTAINABILITY STATEMENT

6.0 SUMMARY AND CONCLUSIONS

newlands developments

6.0 SUMMARY AND CONCLUSIONS

A Sustainability Statement has been produced for the proposed Caldecote Farm development to address the requirements of Policy SC1 of the Milton Keynes Council Local Plan, Plan:MK.

In order to deliver environmentally responsible building stock, an exemplar approach is being proposed based on low energy design principles. In summary, this approach involves energy demand minimisation through effective building form and orientation to promote high levels of daylight, good envelope design and proficient use of building services such that the buildings themselves are being used as the primary environmental modifier.

Long term energy benefits are best realised by reducing the inherent energy demand of the buildings in the first instance before considering deployment of appropriate renewable technologies to decarbonise the development's energy supply.

It has been shown via accredited computer modelling that incorporating best practice energy efficiency measures alone, reduces the inherent energy demand of Unit 1 by c. 23.1% and the CO2 emissions by c. 21.1% compared to the notional building, in line with Plan:MK Policy SC1.

It has been shown via accredited computer modelling that incorporating best practice energy efficiency measures alone, reduces the inherent energy demand of Unit 2 by c. 21.0% and the CO2 emissions by c. 19.4% compared to the notional building, in line with Plan:MK Policy SC1.

To further reduce the environmental impact of the design, the intension is to incorporate water conservation measures, SuDS and materials with low embodied energy/high recycled content that are locally sourced, wherever possible. Careful consideration will be given to the groundworks to assimilate the proposed development within the site landscape and topology with a view to achieving an earthworks cut to fill balance and thus minimise waste and HGV transportation.

A green travel plan will be developed as part of the process to consider all types of travel relevant to the building users; encouraging the reduction of user reliance on forms of travel that have the highest environmental impact.

The final tenant will be encouraged to provide dedicated storage facilities for the building's operational related recyclable waste streams, so that waste can be diverted from landfill or incineration.

To further quantify the positive impact of the proposed sustainability measures, a BREEAM 2014 Design and Procurement pre-assessment has been undertaken by a qualified BREEAM Accredited Professional (AP) against the New Construction criteria. Unit 1 currently achieves a score of 62.03% which translates into an overall BREEAM rating of 'Very Good'.

Having reviewed the feasibility of installing each LZC technology solution, the following is proposed for inclusion on the scheme, at this stage, in order to reduce CO2 emission by a further 20% in line with Plan:MK Policy SC1:

Unit 1

- Air Source Heat Pump installation to Office Areas.
- 1,550m2 (150kWp) Solar Photovoltaic Panel installation (c. 20.0% CO2 reduction).
- 20m2 Solar Thermal Evacuated Tube Installation (c. 0.5% CO2 reduction).

Unit 2

- Air Source Heat Pump installation to Office Areas.
- 1,150m2 (110kWp) Solar Photovoltaic Panel installation (c. 20.0% CO2 reduction).
- 14m2 Solar Thermal Evacuated Tube Installation (c. 0.5% CO2 reduction).