Hurstwood Environmental Consulting

FARINGTON CRICKET GROUND

ENERGY STRATEGY

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1.0 SECTION 1 - INTRODUCTION

This draft energy strategy report provides high level guidance on low and zero carbon (LZC) measures considered for this project in order to reduce energy use, and associated carbon dioxide emissions for the proposed Cricket Club development at the Woodcock Estate in Farrington.

Passive and Energy Efficiency measures, outside the scope of this report, can contribute significantly to a building's energy performance and adaptation to future climate change. Current best practice recommends improvements to a building's thermal performance over and above the limiting U-values which have been determined within Part L before considering suitable LZCs. This should be reviewed moving forward.

After reducing the requirement for applied energy in this way, the LZC contributions will represent a larger proportion of the energy used. In fact some LZC solutions perform much better in a well-insulated and airtight building.

The options presented within this report are based upon preliminary calculations considered at the Feasibility / RIBA Stage 2 which use commonly available and proven benchmarks. As a result any final saving is to be based upon detailed calculations performed at the detailed design stage, but these calculations offer suitable guidance for the outline selection of low and zero carbon technologies.

The aim of this report is to present the fundamental principles, to the Client and professional team, of a set of renewable and low carbon technologies for consideration within the context of this project and to identify those which warrant a more detailed feasibility assessment. The recommendations pertain to technical and functional feasibility and will include consideration to lifecycle costs and simple payback.

1.1 Proposed Site

The existing Woodcock Estate site currently contains residential dwellings arranged around open space. The site is bounded by Stanifield Lane to the East, Fowler Lane to the South/West and the A582 to the North (refer to Figure 1).

The redevelopment will include a Cricket Facility comprising 2No. cricket ovals and associated pavilion building, spectator seating, covered cricket nets, access, parking, landscaping and associated works (including temporary event overlay facilities on ticketed match days), realignment of various Public Rights of Way.

Please refer to The Architects Report for the current Accommodation Schedule.

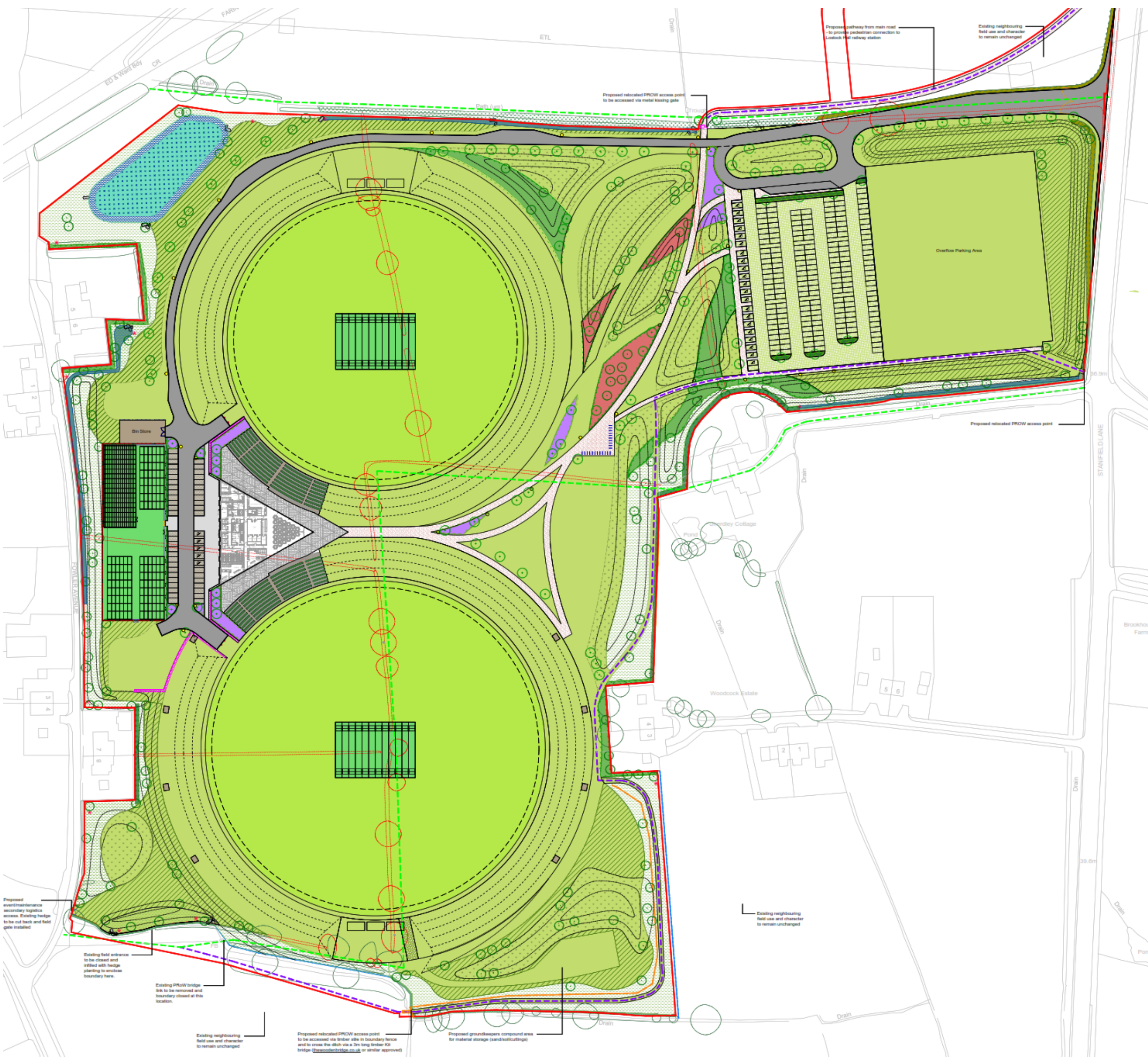


Figure 1.1 – Proposed Development Plan

2.0 SECTION 2 – POLICY CONTEXT

This section of the report provides an overview of the relevant planning policy and guidance regarding sustainability and climate change policies applicable to new non-domestic developments from a national and local perspective.

2.1 UK Sustainable Development Strategy

In 2021, the Government published an updated Heat and Buildings strategy for implementing sustainable development across the UK.

This strategy acts as an overarching document from which a range of specific policies and legislation was derived.

One of the key aims of this strategy is to recognise the threats of climate change and ensure that the UK develops a strategy to mitigate and adapt to this phenomenon. In 2019, the UK became the first major economy to pass laws to reduce its greenhouse gas emissions to net zero by 2050. And in April 2021, the UK enshrined an ambitious target to reduce emissions by 78% by 2035 on 1990 levels into UK law.

The document established a number of key principles that will underpin the national sustainable development strategy:

1. To meet Net Zero virtually all heat in buildings will need to be decarbonised
2. The buildings transition presents huge opportunities for jobs, growth and levelling up
3. Ultimately, Net Zero will mean gradually, but completely, moving away from burning fossil fuels for heating.
4. We will take major strategic decisions on the role of Hydrogen for heat by 2026.
5. We need to act now to develop the market and bring down costs for energy efficient low-carbon heat.
6. The journey to Net Zero buildings starts with better energy performance.

The strategy will be implemented at a national level through the development of more specific strategies at a Government department or sector level. With regards to planning and the built environment, this document sets the basis for the development of plans and policies that promote development that mitigates and adapts to climate change.

2.2 Climate Change Act

The Climate Change Act (2008) sets a legally binding target for reducing UK CO2 emissions by at least 80% on 1990 levels by 2050, however the new sixth Carbon Budget announcement is aiming to achieve almost the same level 15 years earlier.

In line with the recommendation from the independent Climate Change Committee, the sixth Carbon Budget limits the volume of greenhouse gases emitted over a 5-year period from 2033 to 2037, taking the UK more than three-quarters of the way to reaching net zero by 2050. The Carbon Budget will ensure Britain remains on track to end its contribution to climate change while remaining consistent with the Paris Agreement temperature goal to limit global warming to well below 2°C and pursue efforts towards 1.5°C.

2.3 National Planning Policy Framework (NPPF)

National Planning Policy is now provided by the NPPF (July 2021) which sets out the government's planning policies for England and how these are expected to be applied. It also sets out the requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so.

The Government has made clear its expectation that the planning system should positively embrace well-conceived development to deliver the economic growth necessary and the housing we need to create inclusive and mixed communities.

The presumption in favour of sustainable development is a key thread running through national policy for both planning making and decision taking.

The NPPF states that: 'The purpose of the planning system is to contribute to the achievement of sustainable development'.

To satisfy this purpose the Planning System must perform three distinct roles, aligned to the three pillars of sustainability, which must not be taken in isolation and should be pursued jointly:

> ***An economic role*** contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure;
>
> ***A social role*** supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high quality built environment, with accessible local services that reflect the community's needs and support its health, social and cultural well-being; and
>
> ***An environmental role*** contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low Carbon economy

NPPF states that: "The purpose of the planning system is to contribute to the achievement of sustainable development".

The policies referred to in NPPF have been divided into 13 themes;

1. Building a Strong Competitive Economy
2. Ensuring the Vitality of Town Centres
3. Supporting a prosperous rural economy
4. Promoting sustainable transport
5. Supporting high quality communications infrastructure
6. Delivering a wide choice of high quality homes
7. Requiring good design
8. Promoting healthy communities
9. Protecting Green Belt Land
10. Meeting the challenge of climate change, flooding and coastal change
11. Conserving and enhancing the natural environment
12. Conserving and enhancing the historic environment
13. Facilitating the sustainable use of minerals

Should a proposed development demonstrate that it is supporting the relevant policies of the NPPF then it is deemed to be 'Sustainable Development'

2.4 Current Part L Standards

The current Part L energy efficiency standards (UK Government Approved Documents which mandates minimum energy efficiency standards for new and existing buildings across England) were last updated in 2013 (2014 for Wales). Over the last 7 years since their publication, the Building Services industry and the wider construction industry have been working to higher standards of energy efficiency for most buildings being constructed within the UK.

The latest Part L 2013 Building Regulations now require new non-residential buildings to deliver an aggregate 9% reduction in Carbon emissions compared to equivalent 2010 Part L standards. This change aims to strike a balance between the commitment to reducing Carbon emissions and improving energy efficiency and ensuring that the overall effect of regulation upon consumers and businesses does not stifle growth

2.5 Local Planning

Policy 27 of Central Lancashire Core Strategy (2012) requires all non-residential buildings to achieve BREEAM 'Very Good'.

The Core Strategy points to Central Lancashire Design Guide Supplementary Planning Document (SPD) for details on the design standards expected.

3.0 SECTION 3 – SUSTAINABLE & ENVIRONMENTAL ENGINEERING

The design for the new building will be underpinned with a low energy and sustainable ethos/approach to meet brief.

The energy hierarchy proposed for the new building is "Be Lean, Be Clean and Be Green".

3.1 Passive and Carbon Saving Measures – Be Lean

Passive Design Analysis

3.1.1. Site location – The site forms part of the Woodcock Estate in Farington and is largely comprised of open and undeveloped land.

3.1.2. Site weather – the site benefits from a temperate climate which is generally defined as an environment with moderate rainfall spread across the year or portion of the year with sporadic drought, mild to warm summers and cool to cold winters (Simmons, 2015). Large opening glazed door are proposed in the function area to allow occupants to benefit from natural ventilation and cooling when weather conditions permit. Mechanical ventilation systems can be run at night to provide night-purge ventilation and associated free cooling.

3.1.3. Microclimate - Microclimatic conditions depend on such factors as temperature, humidity, wind and turbulence, dew, frost, heat balance, and evaporation. This site is largely exposed (particularity from the South and East). Solar Thermal and Photovoltaic systems would be well suited to this development if there was available roof space.

3.1.4. Building layout – the building is comprised of 2No. Levels. The lower level houses the ground keeping garage/office/store as well as the main plant room and fitness suite. The upper level which sits above the tiered seating is home to the changing areas, meeting rooms, a kitchen and the large multi-function room which has views over both of the proposed cricket pitches.

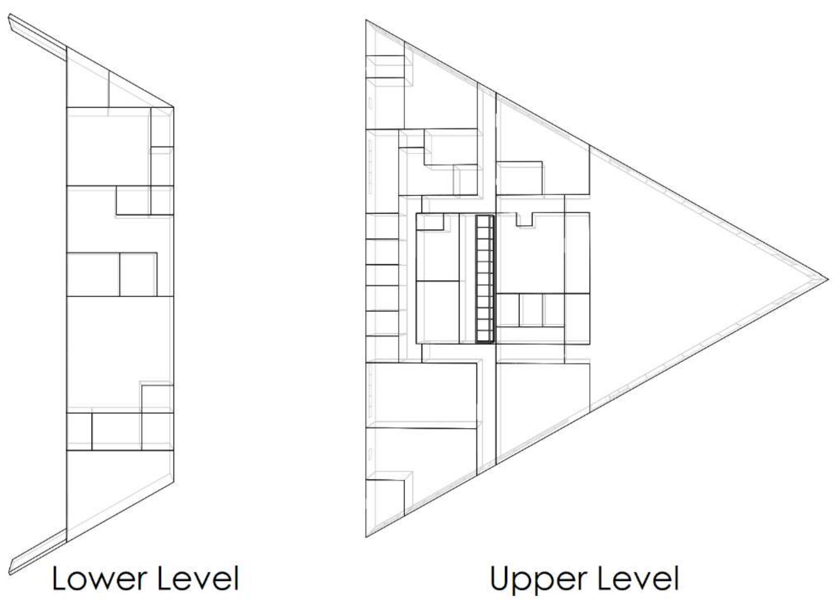


Figure 3.1.4 – Proposed Layout from IES Model

3.1.5. Building orientation – the orientation of the building has been largely determined by the layout of the site and the design choice to have 2No. cricket pitches (one due North of the other) and the pavilion between the two with equal viewing platforms to each pitch.

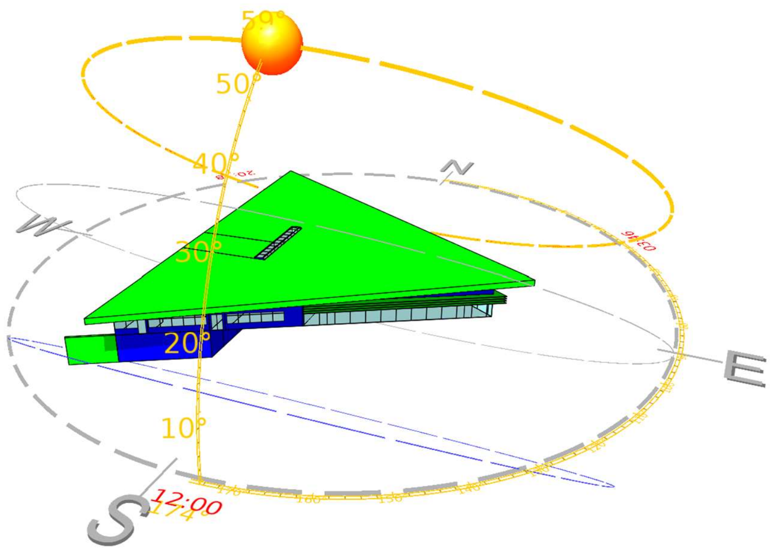


Figure 3.1.5 – Solar Arc showing Solstices and Equinox

3.1.6. Building form – a simple building envelope/plan shape has been chosen to minimise the surface area to volume ratio (minimise fabric heat loss).

3.1.7. Building fabric –

Design Fabric Efficiencies

Building Element	Part L Limit	Proposed Value	
Walls	0.35	0.26	W/m².K
Roof	0.25	0.18	W/m².K
Floor	0.25	0.22	W/m².K
Windows	2.20	1.60	W/m².K
Air Permeability	≤ 10.0	5.00	$m^3/(h.m^2)$ @50Pa

3.1.8. Thermal mass or other fabric thermal storage –

Design Fabric Thermal Mass

Building Element	Cm Thermal Capacity		Thermal Capacity Classification
Walls	21.95	KJ/(m².K)	Very Lightweight
Roof	98.75	KJ/(m².K)	Lightweight
Floor	85.0	KJ/(m².K)	Lightweight

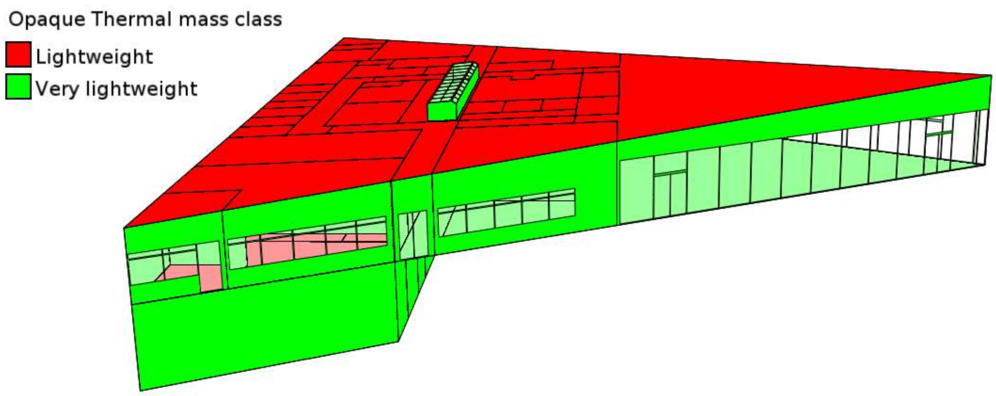


Figure 3.1.8 – Thermal Mass Class

3.1.9. Building occupancy type – the will be occupied throughout the year and at all times during the day. The building will be used more frequently during the cricket season.

3.1.10. Daylighting strategy – external windows have been included to occupied perimeter rooms to maximise daylighting levels within the building. A large rooflight provides daylighting to internal spaces on the upper level,

3.1.11. Ventilation strategy – the building is predominantly mechanically ventilated with Heat Recovery. The main function area is designed to operate on a mixed-mode strategy when external ambient conditions permit.

3.1.12. Adaptation to climate change – the application of design considerations 1-11 above will allow the building to adapt well to climate change. The thermally efficient lightweight envelope combined with low air permeability is complimented by the fast response HVAC system. The Building Management System used to control the HVAC system will be equipped with Weather Compensation to ensure the Heating & Cooling systems are only in operation when it is strictly necessary.

Additional 'active' measures will further enhance the energy efficiency of the development and reduce Carbon emissions including:

- Enhanced daylight and lighting controls which dim down and/or switch off when not required;
- Energy efficient luminaires will be specified throughout with LED lighting to corridor areas
- Mechanical ventilation with heat recovery;

- Reduced heat gains and glare control through by installation of fixed external shading, internal blinds and suitable solar control glazing specification.
- Option to passively cool during the night time with purge ventilation;
- Comprehensive metering strategy interfaced with Building Management System (BMS).

3.2 Active Energy and Carbon Saving Measures – Be Clean

The following active measures will be considered:

- High efficiency space heating and cooling plant.
- Primary flow water temperature from the centralised heating plant which can be adjusted according to the external ambient temperature for high energy efficiency.
- Variable speed pumping of heating water services to take advantage of load diversity throughout the day.
- Variable speed pumping water supply services to reduce annual energy demand and take maximum advantage of diversity of load.
- High efficiency motors incorporated into all building services.
- High efficiency LED / electronic lighting ballasts and high efficacy lamps.
- Passive infra-red and daylight responsive lighting control where possible in common areas.
- Daylight responsive external lighting.
- Power factor correction reducing electrical consumption.
- Energy meters to facilitate feedback, monitoring and control.

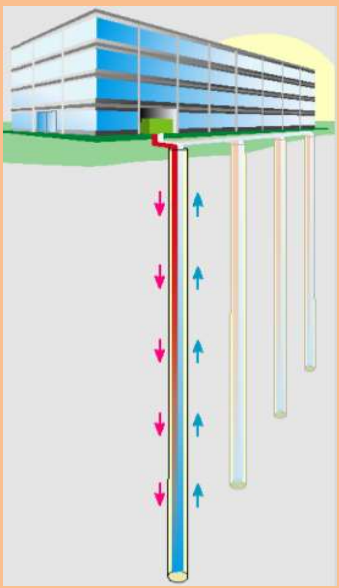
3.3 Renewable Energy Feasibility Study – Be Green

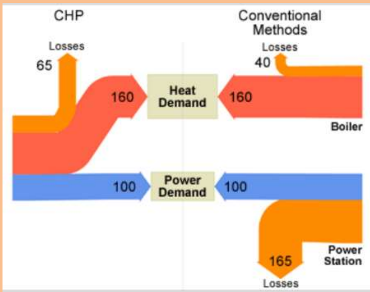
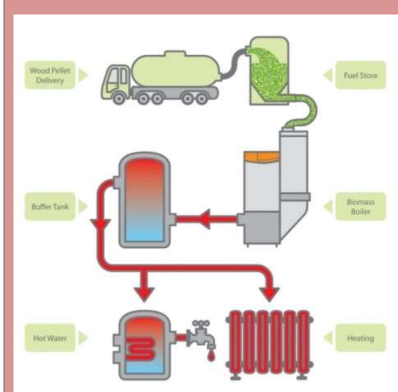
There are various sustainable technologies, such as photovoltaic panels, wind turbines and CHP available. However, not all are feasible due to capital expenditure, pay-back periods, availability, logistics and respective CO_2 emission reduction. It's often not feasible to outlay significant capital expenditure which has high payback periods and will save limited CO_2 emissions. The following section of this report aims to identify potential technologies for more detailed analysis and justify and technologies being excluded at this stage.

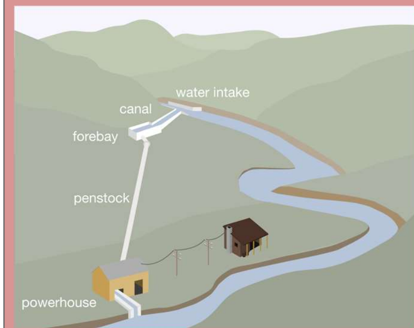
A traffic light system has been adopted to represent the anticipated feasibility of these measures prior to undertaking calculation of the site. The traffic light system should be interpreted as follows:

Red Technology not suitable.
Amber Technology may be suitable depending on building energy demands.
Green Technology may be suitable subject to payback

Renewable Energy Technology	Details, compatibility and feasibility
Solar Photovoltaics 	Photovoltaics could be mounted at roof level or within open fields to generate electricity. The best locations in the northern hemisphere for photovoltaic systems are on buildings with a roof or wall that faces within 45° of south, with systems elevated at 10–15°. PV arrays will also benefit from Feed In Tariffs which will provide income revenue for the building. This is feasible due to a good quantity of roof and external space available, on suitable orientations. ***Typical payback = 6 – 10 years***

Solar thermal hot water 	Similar to PV, a centralised solar hot water system with buffer vessel could be used to generate domestic hot water for this development. SHW can provide renewable energy in the summer months during the peak occupation of the building. Carbon savings are low relative to the costs of installation. The electrical demand of the building is estimated to outweigh demand for hot water, a solar PV array would compete for space on the roof or field. ***Typical payback = 15 – 20 years***
Ground source heat pumps 	Ground Source Heat Pumps utilise a collector located underground to transfer heat stored in the ground to the heat pump. Several configurations of GSHP collector are available; with each drawing energy from the ground in a different manner. The two main configurations are open loop (lake and ground water) and closed loop (rock and surface soil) type systems. Open loop systems extract heat from a body of water such as a lake, river or groundwater using a network of immersed pipes. Open loop systems have been discounted as no lake, river or ground water source is assumed available for this scheme. Closed loop systems continuously circulate brine through an underground network of pipes located in vertical boreholes or shallow horizontal surface soil arrays to absorb energy from the ground. The brine is then passed through the heat pump to convert the low grade heat into high grade heat capable of generating domestic hot water and space heating. A surface soil collector is considered impractical due to the amount of available ground space to site the length of pipe required (several kilometres) and has been discounted. Therefore, all GSHP options presented are based on using vertical borehole collectors Ground works involved also results in high capital costs which would impact viability in relation to the available capital budget. ***Typical payback = 10 - 15 years***
Air Source heat pumps 	Air source heat pumps operate in a similar manner as ground source heat pumps except that the thermal transfer is completed with the external air instead of the ground. Use of air source heat pumps is a feasible and cost effective technology for providing heating and cooling to areas with high heat gains, e.g. server rooms. ***Typical payback = 10 – 15 years***

Combined Heat & Power  	CHP requires a high thermal base load in order to operate efficiently. During the summer months, the DHW load allows the CHP to continue running. Without a large base load, a limit is placed on the size of CHP that could be installed. It is unlikely that a CHP unit would run for significant periods during the warmer months and therefore CO2 emission saving is potentially limited. There is a small DHW load requirement due to the shower facilities. The inclusion of CHP is to be considered at this stage if required to meet Part L. ***Typical payback = 20 years approx***
Wind Turbines 	Wind power can be used to generate electricity, either in parallel with mains supplies or for stand-alone applications with battery back-up. In order to generate worthwhile quantities of electricity, average wind speeds of more than 5–6 m/s are typically required. Wind turbines are highly visible and aesthetically unattractive which can cause planning issues due to the proximity of residential areas. Careful positioning of turbines and good design of rotors is required to ensure that noise from turbines does not affect nearby residential areas. Due to the high cost of installation and maintenance as well as nearby residential developments, we have not considered this technology ***Typical payback = 20 years approx.***
Biomass Heating  	Biomass boilers is not considered appropriate in this instance given the sites location, spatial, operational and maintenance demands of a biomass system. As with CHP the absence of stable yearly base thermal load restricts the effective sizing and runtime of a biomass boiler and is combined with potential fuel sourcing, storage and local air quality impacts. ***Typical payback = 10 – 15 years***

Micro Hydro  	As the site has no established water bodies near the building this technology is not considered feasible and has been discounted. ***Typical payback = Unknown TBC***
Rainwater Harvesting  	Traditionally, rainwater is collected from surfaces such as roofs and goes to drain which in our opinion is a waste of water, especially when a large proportion of each person's daily water needs does not need to be potable. Rainwater harvesting is a process by which this rainwater is collected and stored for re-use within and around the building (e.g. for toilet flushing, vehicle washing) therefore reducing the dependence on infrastructure which in turn reduces water bills. There are two types of rainwater harvesting systems available – above ground and below ground. The type installed is generally determined by the needs of the Client from both a space and aesthetics perspective however the below ground option is best for the prevention of legionella growth as the stored water temperature will generally be kept below 10oC. Other system requirements include pump set and associative filters, valves. Potentially Economically Unfeasible. The building's WC / grey water load profile is unlikely to result in a worthwhile investment, however further investigation required ***Typical payback = Unknown TBC***

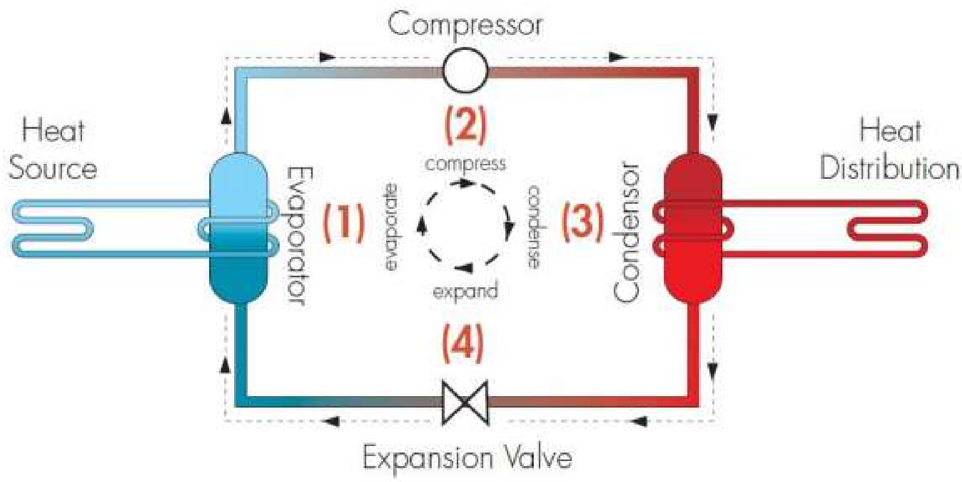
3.4 Water Management

Similar to the energy hierarchy, the water strategy for the new building focuses first on resource reduction, and then considers efficient use and recycling. The approach proposed is described in more detail below.

- Reduction of water demand
    - Metering of water consumption is proposed. This will highlight any abnormal usage patterns and help in the creation and tracking of targets for water use minimisation.
    - Sub metering is proposed for areas of high water consumption such as the kitchens to the catering facilities.
    - A leak detection system is also proposed which would sound an alarm when a leak occurs so that it can be rectified immediately.
- Efficiency
    - Water efficient appliances and fittings are proposed to further minimise water consumption.

3.5 Heat Pump Technology Overview

A heat pump is a device that transfers energy from a source of heat (such as the air or ground) to a heat sink (i.e. an apartment). Heat pumps are able to absorb heat from a cold space and release it to a warmer one typically using a vapour compression cycle with refrigerant as the working fluid. The lower the temperature differential between the heat source and the heat sink the higher the heat pumps coefficient of performance (CoP) will be. CoP's of up to 5 are stated by some manufacturers. A heat pump cycle is shown in the picture below



3.6 High Operating Temperatures vs Low Operating Temperatures

As stated above, the lower the temperature differential between the heat source (i.e. ground or air) and the heat sink (i.e. the building or water storage cylinder) the higher the heat pumps coefficient of performance (CoP) will be.

Therefore, running a heat pump at around 45°C will maximise the systems coefficient of performance whilst providing sufficient heat for a typical residential heating system. However, a primary temperature of 45°C is not sufficient to meet the UK guidance of storing hot water at above 60°C and for hot water to be 60°C at the hot water outlet (blended to a lower temperature where required). *To achieve the required domestic hot water temperatures a gas fired or all-electric top up system is required if the heat pumps efficiency is to be optimised.*

Running a heat pump at 65°C enables both heating and hot water to be generated from the primary ring main. However, the CoP is typically 25% lower and thus running costs may be higher

4.0 SECTION 4 – PROPOSED OPTIONS

This section provides an overview of how each option generates heating and hot water and lists the key features to aid comparison.

Biomass, wind and micro hydro technology has not been considered further within this report due to its operational and fuel storage constraints. Therefore, the report will focus on the different heat pump technologies available as well as an all-gas system.

To aid comparison of the features of each option considered a traditional all-gas system has also been assessed against the same criteria.

Therefore, the following options have been assessed:

1. Centralised Gas Fired Boiler Plant (Baseline option).
2. Centralised Gas Fired Boiler Plant c/w Solar Thermal or CHP for DHW generation
3. Centralised GSHP running at 65°C**
4. Centralised ASHPs running at 65°C**

***Refer to Section 3.6 for summary of key differences between heat pumps operating at low temperature (~45°C) and high temperature (~65°C).*

4.1 Option 1 – Centralised Gas Fired Boiler Plant (Baseline Option)

This option incorporates a centralised cascaded gas fired boiler arrangement circulating Low Temperature Hot Water (LTHW) around the building using Variable and Constant Temperature circuits radiators, underfloor heating and heating coils. The pipework would be located in the corridor ceiling void and distributes to all areas via local vertical risers. Domestic hot water would distribute to hot water outlets respectively via plate heat exchangers or direct gas fired cylinders within the plantroom. This option has the following features:

General Features:

- Centralised plant enables plant size and efficiency to be optimised.
- Supply temperatures up to 85°C. Enables lower flow rates and higher heat exchange rates. Excellent supply temperature for Domestic hot water generation.
- Combustion products produced require routing to a safe location.
- Building requires gas connection and associated equipment.
- Smaller plant room space (for heating and hot water generation equipment only) required compared to heat pumps.
- No external equipment required other than a small gas kiosk at the site boundary.
- Condensing boilers with efficiencies above 96%. Further efficiency gains are possible for centralised heating networks via incorporation of a smart control system such as minibems. *Produces two to four times higher carbon emissions compared to heat pumps*. No option to utilise green fuel sources.

Diagram of typical Boiler arrangement.

Feasibility

This option is based on an all gas generation approach and would not meet the requirements of the policies stated in section 2 of this report alone. Other sustainable technologies would have to be selected to achieve the required CO2 reductions adding additional cost and plant to the project.

This option would also require a new gas supply to the site and albeit possible it would incur an additional cost to upgrade the gas infrastructure in the surrounding area, therefore this option is deemed to have the highest cost risk for the project.

4.2 Option 2 – Centralised Gas Fired Boiler Plant c/w Solar Thermal or CHP

This option incorporates option 1 above c/w 30m^2 solar thermal array and a gas fired CHP boiler to provide space heating and domestic hot water to the building.

General Features:

- As per Option 1

Diagram of Solar Thermal.

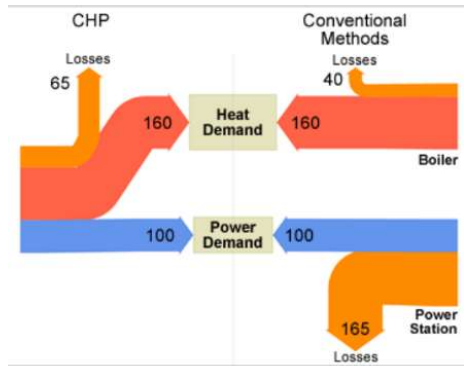


Diagram of CHP Schematic.

Feasibility

This option is based on an all gas generation approach and would likely meet the requirements of the policies stated in section 2 of this report. CHP and Solar Thermal require a high hot water demand all year round to run as efficiently as possible. The nature of this building would seem to suggest that the hot water demand may not be feasible especially during the winter months when the sports facilities will be at its lowest occupational demand.

This option would also require a new gas supply to the site and albeit possible it would incur an additional cost to upgrade the gas infrastructure in the surrounding area, therefore this option is deemed to have the highest cost risk for the project.

4.3 Option 3 – Centralised GSHP running at 65°C

This option incorporates an external vertical borehole collector connected to a centralised Ground Source Heat Pump (GSHP) cascade arrangement located in a suitable plant room. LTHW generated by the GSHP plant is circulated around the building using Variable and Constant Temperature circuits radiators, underfloor heating and heating coils. Domestic hot water would distribute to hot water outlets respectively via plate heat exchangers or indirect cylinders c/w immersion heaters within the plantroom. This option has the following features:

General Features:

- Centralised plant enables plant size and efficiency to be optimised.
- Supply temperatures up to 65°C. Requires medium flow rates, slightly larger pipework. Supply temperatures sufficient to generate Domestic hot water.
- Standard radiators or under floor heating can be utilised.
- Seasonal Coefficient of Performance (SCOP) of approximately 2.5 at 65°C flow temperature.
- No gas connection or associated equipment required.
- No combustion products released. No flue routes and associated coordination issues.
- Increase in electrical load required compared to gas fired system.
- ~70% lower carbon emissions compared to gas fired boilers using standard electricity tariffs. Option to utilise 100% renewable electricity tariffs.
- Improves SAP & SBEM results.
- GSHP have a service life of around 15 years. Approximately 5 years less than boilers.
- Borehole collector service life ~100 years. Minimal maintenance.
- No obtrusive external equipment.

Diagram of typical GSHP Cascade

Feasibility

This option is based on an all-electric approach and would most likely meet the requirements of the policies stated in section 2 of this report.

This option would represent an alternative solution for the project but would require extensive ground works to provide heating and hot water to the building.

4.4 Option 4 – Centralised ASHP running at 65°C (Preferred Option)

This option incorporates an external Air Source Heat Pump (ASHP) cascade arrangement located in a suitable external enclosure. LTHW generated by the ASHP plant is circulated around the building using Variable and Constant Temperature circuits radiators, underfloor heating and heating coils. Domestic hot water would distribute to hot water outlets respectively via plate heat exchangers or indirect cylinders c/w immersion heaters within the plantroom. This option has all the same features as Option 3 (High temperature GSHP) but with the following key differences:

- Seasonal Coefficient of Performance (COP) of around 3.0 at 65°C flow temperature.
- Large external heat pump compound required. Appendix A provides an indication of the scale of ASHP array required for the scheme.
- Potential noise issues relating to external equipment operation.
- Reduced plant room space requirements as the majority of equipment is located within the external compound.
- Improves SAP & SBEM results. Will help meet the policy targets above
- ASHP performance can be affected by outdoor conditions

Diagram of typical ASHP

<u>Feasibility</u>

This option is based on an all-electric approach and would most likely meet the requirements of the policies stated in section 2 of this report.

This option would represent the best solution for the project and would provide the most cost effective solution to provide heating and hot water to the building.

5.0 SECTION 5 – CONCLUSIONS

The Lean and Clean design considerations imperative to the success of the Energy Strategy include:

- Low Fabric U-values (high levels of insulation)
- Low Air Permeability (air tight building envelope)
- Internal blinds to offset solar gains
- Heat recovery on ventilation systems
- LED luminaires
- BMS system

LZC Modelling results:

	BER	TER	% Improvement
Option 1: Gas Baseline	179.6	187.5	4.2
Option 2: Gas CHP + Solar Thermal	143.2	187.5	23.6
Option 3: GSHP DHW + Panel Heaters	113.2	152.8	25.9
Option 4: ASHP DHW + Panel Heaters	118.0	152.8	22.8

The Air Source Heat Pump is the most appropriate heat generating Low to Zero Carbon Energy technology for this site when the groundwork implications of bringing gas to site or digging ground collector trenches are factored in. Otherwise the gas fired CHP + Solar Thermal (Option 2) is preferred.

Option 4: ASHP + Electric Panel Heaters Mechanical Specification Summary:

- VRF Heating and Cooling to First Aid, Scorer Base, Players Dining, Cellar, Comms and Match Room.
- FCU Heating and Cooling to Multifunction Space, Bar, Reception and Gym.
- Electric Panel Heaters to all other heated spaces.
- ASHP to heat Domestic Hot Water.
- Heat Recovery on all ventilation systems.

5.1 Assessment Findings

- Replacing gas fired systems with heat pumps as the primary means of generating hot water will improve the energy efficiency of the building and avoid the significant cost of bringing gas to the building.

- With the current price of gas and electricity at approximately 3.5p/kWh and 14p/kWh respectively, a heat pump CoP of 4 is required to realise equal annual running costs when compared to a traditional gas fired system.

- An increase in electrical load will be required to power the ASHP compared to a gas fired system.