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TEMPLE DINSLEY

M&E FEASIBILITY REPORT





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CONTENTS

1. EXECUTIVE SUMMARY	5
1.1 Mechanical	5
1.2 Electrical	5
2. INTRODUCTION	7
2.1 Site Details	7
2.2 Existing Infrastructure	9
2.3 Data	12
3. SUSTAINABILITY ASPIRATIONS	13
3.1 Minimum Target Requirements	13
3.2 Desired PV Target	13
4. FUEL AND PLANT LOCATION	14
4.1 Appropriate Fuels	14
4.2 Heat Generator Location	15
5. INITIAL LZC REVIEW	16
6. INITIAL PLANT SIZING	19
6.1 Main Building & Teaching Block	19
6.2 New Build Dwellings	20
7. HEAT GENERATOR OPTIONS	21
7.1 Option 1: Low Temperature Air Source Heat Pump (LT ASHP)	21
7.2 Option 2 – Low Temperature Ground Source Heat Pump (LT GSHP)	27
8. FINANCIAL COMPARISON	31
8.1 Main Building & Teaching Block	31
8.2 New Build Dwellings	31
9. ON-SITE GENERATION, STORAGE AND SUPPLY	32
9.1 Electricity Generation	32
9.2 PV Type and Location	32
9.3 Battery Storage	33
9.4 Solar Calculations	34
10. ELECTRICAL INFRASTRUCTURE UPGRADE	37
10.1 Incoming Electrical Supply	37
10.2 LV Distribution & Small Power	38
10.3 Containment/Wiring Strategy	40
10.4 Internal Lighting	41
10.5 External Lighting	43
10.6 Data Network	44
10.7 Fire Alarm System	44



10.8	CCTV	45
10.9	Intruder Alarm	46
10.10	Intercom System	46
10.11	AV	46
10.12	Lightning Protection	46
11.	CONCLUSIONS	48

1. EXECUTIVE SUMMARY

1.1 Mechanical

An analysis of the Temple Dinsley Estate has identified several technologies that are suitable for minimising carbon emissions, providing feasible servicing strategy for the existing and proposed buildings, and meeting the minimum requirements set out by North Herefordshire District Council.

The following technologies were deemed appropriate to the site and detailed assessment carried out:

- Low Temperature Air Source Heat Pump (LT ASHP)
- Low Temperature Ground Source Heat Pump (LT GSHP)
- Solar Photo-voltaic (PV) – PV Panels and PV Slate

The exercise has highlighted the following observations and recommendations.

- Deployment of an ASHP heat network will be significantly cheaper compared to a GSHP equivalent.
- A GSHP heat network will reduce operational costs due to its higher coefficient of performance meaning electricity bills for both the landlord and tenants will be less.
- An ASHP heat network will incur higher distribution losses due to its requirement to be externally sited away from the Main School Building.
- Dedicated ASHPs are the likely solution for the new-build dwellings and stand-alone conversions.
- A district heat network served from a number of commercial-sized ASHPs is the preferred approach to provide heating and hot water to the flats. Each flat would use a Heat Interface Unit (HIU) to supply and meter the final hydronic circuits.
- A combination of PV panels on the car park roofs and PV slate on some of the new dwellings will meet the NHDC's Gold Standard for renewable energy generation with the deployment of an ASHP. To meet the LETI target for small scale housing, a small number of additional PV panels will be required, however if a GSHP is deployed, an excess of electricity will be produced.

1.2 Electrical

This report outlines the current state of electrical services and the proposed strategy for the Main School Building and Teaching Block.

- Incoming Electrical Supply: There is an existing substation located on the main road. A Load Assessment has been carried out, with an estimated usage of 1.6MVA, therefore requiring an upgraded UKPN supply. The new Substation to be located at the site boundary, feeding 43 flats, 26 houses & two existing structures which are being converted into accommodation, all via local Ryefield boards in a purpose-built structure. Separate supplies for communal energy center and EV chargers are proposed.

- LV Distribution & Small Power: The existing condition of services in the listed buildings show signs of aging and wear. The proposed plan for each property is to have a dedicated UKPN supply with a consumer unit feeding all final circuits. Small power provision will be developed to suit furniture arrangement and appliances.
- Data Network: The proposed plan is to replace existing fibre connection with a new connection from a nearby BT base. Fibre to be installed in the same trench as the main power cable.
- CCTV and Security: CCTV provision for external coverage around buildings and gates. Intruder Alarm to each property to have its own system, designed to BS EN 50131 Grade 2.
- Lightning Protection: Existing condition of current system assumed inadequate. The proposed plan is to conduct a strike risk assessment. Install necessary protection systems and surge protection for all distribution boards.



2. INTRODUCTION

The first site visit was undertaken by CBG Consultants on 25th March 2024. All areas of the property were accessed as part of the survey, with the general visual condition of mechanical and electrical services noted. We were engaged to advise on the overall condition of the M&E services and consequently note any specific defects found as part of the report. No intrusive surveys, functional testing or opening up were carried out. A report with our findings was issued on 24th April 2024.

This feasibility report follows on from the above and outlines initial design concepts for the scheme and provides a basis for further design development. This report has now been updated following changes to the initial design intention.

The aim of this report is to propose methods of serving the existing estate with new MEP services, focussing on options for Low and Zero Carbon (LZC) technologies.

The report includes discussion on the preferred method to satisfy the expected demand of the refurbished properties & newly built dwellings.

This report also provides a rough comparison between capital costs of differing LZC technologies, and provides an analysis of the Solar PV panels required to achieve minimum requirements set out by North Hertfordshire District Council.

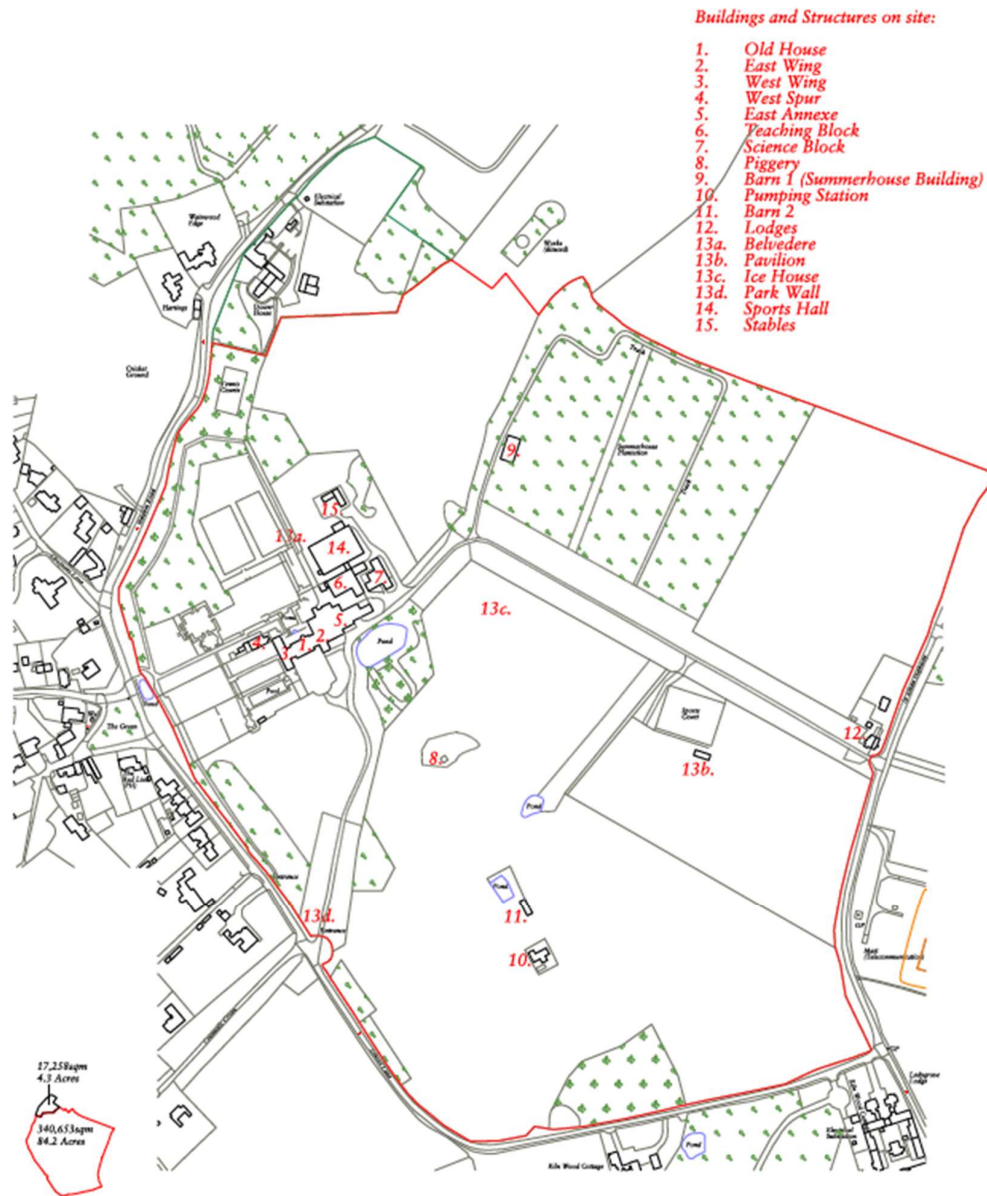
2.1 Site Details

As seen on the site plan below, the following is being proposed:

- The existing Old House, East Wing, West Wing, West Spur, and East Annexe will now be renamed to Main Building and will house 35No. flats.
- The existing Teaching Block will be converted to 8No. flats.
- The existing Sports Hall will be demolished and Sadlier House built in its place (6No. dwellings).
- The existing Science Block will be demolished and Edwin House (4No. dwellings) will be built.
- Barn 1 will be demolished and Summer House (1No. dwelling) created in its place.
- Templars House (2No. dwellings), Harwood House (1No. dwelling) & Violet House (4No. dwellings) will all be newly built dwellings onsite.
- The existing Stables will be demolished, and Ithel House (6No. dwellings) will be built in the same location.
- The existing Pump House (1No. dwelling) and Tank House (1No. dwelling) will be converted to new residences.

In total the site will consist of 69No. dwellings, either new or conversions.

Note: The existing Belvedere & Ice House are deemed to not be part of the proposed site strategy.



Existing site plan

Site Area : 277945 sq.m
(27.8 ha)

Buildings and Structures on site:

1. Main Building
2. Teaching Block
3. Edwin
4. Violet
5. Sadielr
6. Ithel
7. Templar
8. Summer House
9. Harwood House
10. Tank House
11. Pump House
12. Lodge Gate
13. Belvedere
14. Ice House
15. Piggery
16. Park Wall
17. Paved Rose garden
18. Herbaceous Garden
19. Small Herbaceous Garden
20. Rose Garden
21. Magnolia Steps
22. Cricket Pitch
23. North Tennis Court
24. Village Gate
25. Walled Parking Garden
26. Existing Parking
27. Visitor Parking
28. Summer House Plantation
29. East Tennis Court
30. Pergola Garden
31. Permissive Path



Proposed site plan

2.2 Existing Infrastructure

2.2.1 Gas

Both heating and domestic hot water are generated via Gas fired boilers. The teaching block is served via 1No. boiler located in the basement as seen below, whilst the Main Building is served via 4No. gas boilers also located in the basement.



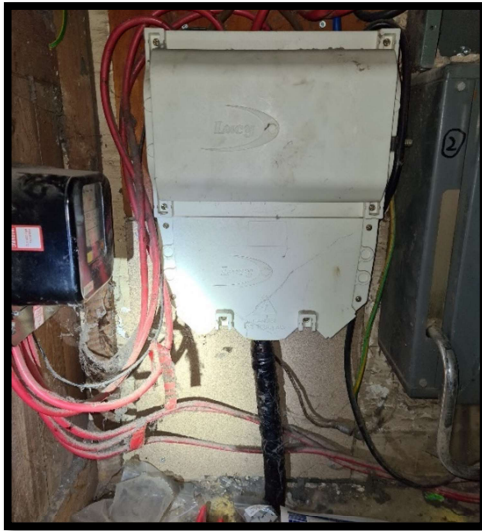
Teaching Block – Basement Gas Fired Boiler



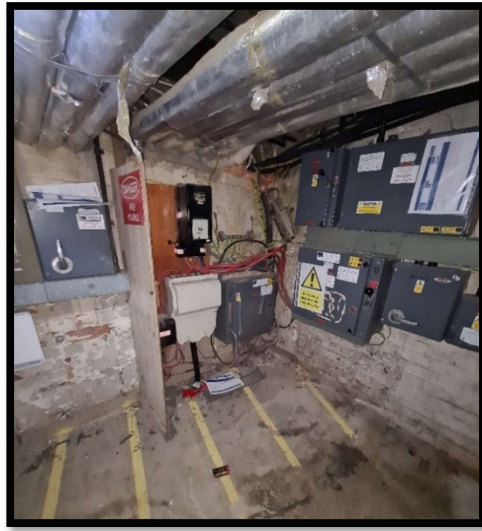
Main Building – Basement Gas Fired Boilers

2.2.2 Electricity

The incoming electrical supply is located within the basement of the Main School Building and rated at 100A 3-phase based on survey information collected. The cut-out for the incoming supply appears to have been subject to overheating, that may have been caused by overloading on the electrical infrastructure, and in turn causing the bitumen to slowly drip out of the cut-out.

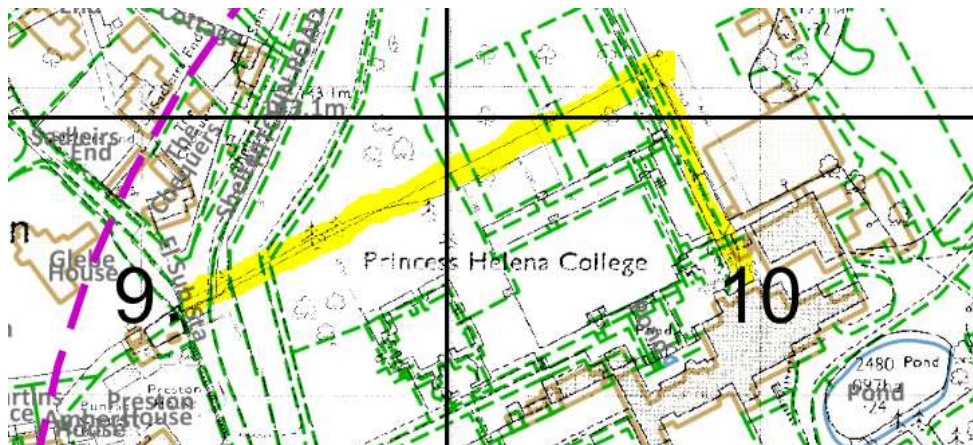


DNO Cut-out



Basement switchgear

The utility plan received from UK Power Network details the existing incoming supply is buried from Preston Sub-station off the main road, as detailed below.



Utility map incoming cable

The substation capacity is unknown, with the information only provided to CBG once an application has been made to UKPN and returned. A load assessment has been carried out and application made to UKPN with a response expected soon.



Substation location of the adjacent main road

2.3 Data

The incoming fibre connection follows the main drive, buried within the ground and appears to rise up the eastern façade of the main building as shown below. This incoming location then feeds all other cabinet/outlets around the main building and site.



Openreach Fibre Map



Fibre on Eastern Facade

3. SUSTAINABILITY ASPIRATIONS

The proposed site plan is to include the refurbishment of the Main Building and Teaching Block into 43No. flats, and the construction of 26No. dwellings.

3.1 Minimum Target Requirements

The minimum target requirements are in line with those stated by North Hertfordshire District Council (NHDC). Within this, the client would like to aim for Silver for the existing (refurbished) buildings, which entails the following:

- Energy Efficiency – Equivalent to Sustainable Traditional Building Alliance (STBA) Whole House Advanced which includes the deployment of a district scheme for renewable energy.
- Energy Generation – A minimum of 25% renewable generation onsite.

For the new dwellings, the NHDC Gold standard is the aspiration, specifically the London Energy Transformation Initiative (LETI) for small scale housing, as below:

- Energy Efficiency – Equivalent to LETI Small Scale Housing with the following targets:
 - Energy Use Intensity (EUI) less than 35 kWh/m².annum
 - Space Heating Demand less than 15 kWh/m².annum
- Energy Generation – NHDC Gold requires a minimum of 50% renewable generation onsite.

3.2 Desired PV Target

For the new dwellings only, there is a client desire to build in accordance with LETI entirely, therefore generation of renewable energy onsite would be 100% compared to NHDC's Gold Standard of 50%. Both of these renewable energy generation targets are considered later in this report.

See the below link for details of the LETI standard in detail:

https://www.leti.uk/files/ugd/252d09_c1ae6c7277c7467ebd4810a02423802e.pdf

4. FUEL AND PLANT LOCATION

4.1 Appropriate Fuels

Below is a summary of primary fuels/energy sources that could be used to provide heating and domestic hot water on the site.

4.1.1 Electricity

To reduce carbon emissions, dwellings that use electricity for heat and hot water generation are becoming increasingly popular. This has the advantage of simplifying utility supplies, and associated technologies are typically very easy to meter and control.

Electricity can be generated using renewable sources such as wind or solar energy. As a result, the UK electricity grid has been significantly decarbonised in recent years from approximately 700gCO₂e/kWh in 1990 to 136gCO₂e/kWh (as used in the latest SAP 10.2 document). The department for Business, Energy & Industrial Strategy (BEIS) predicts that the carbon intensity of the UK electricity grid will fall further to approximately 41gCO₂e/kWh by 2035 meaning that any electrically driven system will further reduce its environmental impact through its lifetime.

The only major disadvantage is the cost to the consumer. Electricity is currently around 3.5 times more expensive than fossil fuel alternatives such as oil which is often beyond the Coefficient of Performance (CoP) of heat pump solutions, meaning heat pump solutions are more expensive to run year-on-year. Recent spikes in energy prices have driven inflation to over 18% over the last 12 months making long-term financial returns more difficult to calculate with a high degree of accuracy.

4.1.2 Hydrogen

Hydrogen is far from a mainstream fuel for heating buildings; though, it has recently received significant funding from the UK government based on its future potential for replacing fossil fuels. There are currently a number of ways to produce hydrogen; many involve the use of fossil fuels (grey hydrogen). However, it is possible to extract hydrogen from water using electricity. Currently this process is only about 80% energy efficient¹ so it is hard to justify the benefits over using direct electric heat.

It is noted that the Committee on Climate Change (CCC) believes that by 2050 only 5% of the UK heat demand will be met through the use of hydrogen fuels suggesting that the infrastructure to support these types of systems will be minimal. Note that the CCC expects 52% of the UK's heating demand to be met via heat pumps.

¹ <https://www.carboncommentary.com/blog/2017/7/5/hydrogen-made-by-the-electrolysis-of-water-is-now-cost-competitive-and-gives-us-another-building-block-for-the-low-carbon-economy>



Until further details become available on the use of hydrogen in the UK, it isn't possible to incorporate it into the decision process as part of the energy strategy.

4.2 Heat Generator Location

The heat generator location can have an impact on overall energy consumption levels due to heat losses to the ground via transmission.

Generally, it is favourable to install heat generators local to the loads being served. This is compatible with ground source heat pumps which can be installed within the dwelling as they do not produce direct emissions. Biomass boilers are typically located a distance away from the occupied buildings due to the nature of the flue effluent and regulatory restrictions. Air source heat pumps are often located mid-distance due to aesthetic and noise issues.

Another positive aspect of installing generators local to the building is a reduction in infrastructure costs through less trenching and materials (pipework). More energy is also required for pumping the heated water as the distance from generator to building increases.

When the buildings on the site are heavily used throughout the year (such as on hotel sites) the distribution losses are much less significant. However, for residential sites (with possible intermittent use) long heat networks can be highly inefficient unless the flow temperatures are kept to a minimum and individual pumps are employed for each circuit.

For this development, we will explore both options of an energy centre and utilising existing plant room rooms for LZC deployment.

5. INITIAL LZC REVIEW

An initial review was conducted to eliminate any LZC technologies that are not deemed viable and highlight which technologies would be suitable for further investigation.

Each of the below technologies is considered generally and specific to the site.

Table 1 – LZC Technologies

LZC Technology	Basic Technical Information	Technical, Environmental & Economic Implications/Considerations	Suited Application	Site Specific Comment	Considered for Detailed Analysis
Solar Thermal	Solar collectors (flat plate or tube) transfer energy into transfer liquid to a closed loop twin coil hot water cylinder	• Could meet a proportion of the DHW demand • Efficiency effected by site factors – shading, orientation, and roof/ground space • Requires considerable hot water demand all year round to be financially beneficial and maintain reliability.	Domestic and commercial applications with high annual hot water load; leisure centres, canteens, washrooms.	Solar Thermal can only be used when a DHW cylinder is present – Hot water demand will be intermittent (individually) and cylinders will be difficult to accommodate in the refurbished flats, therefore solar thermal cannot be deployed.	No
Wind Turbine	Turbine/generator convert wind energy to electrical power.	• Allows on site generation of renewable electricity • Can create structural, vibrations and noise implications • Not suited for urban environments • Costs can be high in relation to the actual amount of electricity generated • Potential for additional planning issues • Generally, payback over 20 years	Large sized turbines in rural areas will be more effective and provide better payback.	Site is located in the area where a wind turbine would unlikely be granted planning permission.	No
Solar Photovoltaic	Converts sunlight to DC electrical power which then using an inverter to convert to DC.	• Allows on site generation of renewable electricity • Generally, payback between 5-10 years with current electricity prices. • Generally, requires comparable base load to installed capacity due to loss of FiT and Export Tariff. • Low maintenance requirements • Efficiency effected by site factors – shading, orientation, and roof/ground space	Wide range of building types of particularly buildings with limited solar shading and south facing or flat roofs. Ground mounted array becoming more popular.	New Dwellings to have pitched roof ideal for deployment and in line with sustainability aspirations. Space for a roof mounted array above proposed car park.	Yes

LZC Technology	Basic Technical Information	Technical, Environmental & Economic Implications/Considerations	Suited Application	Site Specific Comment	Considered for Detailed Analysis
Air Source Heat Pump (ASHP)	ASHPs capture heat from the outside air and transfer the heat directly to the air inside the building or transferring the heat to a liquid medium that can be pumped around the building	• Lower installation cost than ground source heat pump • Can provide heating using low flow temperature heat emitters. Retrofit to existing buildings usually means replacement of emitters and often distribution pipework. • COP is not as good during the heating season when the outside air is often cooler than the ground. Seasonal COP = approx. 2.5. • COP for hot water provision is generally poor	Wide range of building types of particularly buildings designed to have low temperature heat emitters. Often used for stand-alone heating to swimming pools.	The main building and Teaching Block will have a constant heating/DHW load based on a heat network being provided. The new build dwelling will each have a heating and DHW demand ideal for an ASHP.	<u>Yes</u>
Ground Source Heat Pump (GSHP)	GSHPs capture heat from the ground and transfer the heat to a liquid medium that can be pumped around the building	• COP is higher than air source heat pumps; SCOP = approx. 4.0. • High thermal outputs can be achieved. Maintenance is minimal compared to corresponding Biomass. • Requires large area for ground collector array. • High initial capital cost than ASHP. • COP for hot water provision is reduced.	Wide range of building types of particularly buildings designed to have low temperature heat emitters and sufficient space for necessary ground works.	There is sufficient land available for boreholes. A GSHP could be located in the existing Main School House basement, limiting distribution losses.	<u>Yes</u>
Water Source Heat Pump (WSHP)	WSHPs capture heat from a body of water (lake/river) and transfer the heat to a liquid medium that can be pumped around the building	• COP is higher than air source heat pumps; SCOP = approx. 4.0. • High thermal outputs can be achieved. • For a closed loop system requires large area for collector array and min. 1.5m deep if static water body. • Potential issues with local water fauna – requires the Environmental Agency (EA) approval. • High initial capital cost • COP for hot water provision is reduced • Maintenance of open loop system is high	Wide range of building types of particularly buildings designed to have low temperature heat emitters and sufficient water body.	Sufficient body of water is not present to warrant a WSHP.	<u>No</u>

LZC Technology	Basic Technical Information	Technical, Environmental & Economic Implications/Considerations	Suited Application	Site Specific Comment	Considered for Detailed Analysis
Biomass	Uses biomass as a fuel source for space heating and hot water	• Renewable source of heating • Can provide high temperature LTHW meaning existing emitters/distribution can remain. • High energy density. • Can provide DHW directly. • Ongoing maintenance requirements • Requires large fuel storage capacity and frequent fuel deliveries • Requires access for deliveries • Considerations of flue effluent dispersal.	Site with access and storage facilities and a capable maintenance team/infrastructure in place.	Requires a minimum return temperature of 65 DegC meaning a high temp heat network (similar to a gas boiler) would have to be deployed.	<u>No</u>
CHP	Generates both electricity and heat using fossil (or renewable) fuels.	• Efficient use of heat for a wide variety of users • 80-90% efficient (when electric and heat supplies are being used) • Requires consistent base load (heat) to work well. • More gas used than equivalent boiler. • Requires technical considerations with respect to grid connection and managing low heat loads. • Relatively large plant space required	Large project with 24hr base load, typically suits hotels, hospitals and leisure centres. Should be sized for base heat load requirement.	A consistent base load for both heating and hot water in the summer is not present.	<u>No</u>

The initial review of available technologies identifies the following systems being suitable for the deployment of & are assessed further within the report:

- Air Source Heat Pumps (ASHP)
- Ground Source Heat Pump (GSHP)
- Solar Photovoltaic (PV)

6. INITIAL PLANT SIZING

6.1 Main Building & Teaching Block

Both the Main Building and Teaching block have been proposed to be refurbished into a combined total of 43No. flats – 35No. within the Main Building and 8No. within the Teaching Block.

Due to the age of the building, its listed nature and limited fabric improvements being proposed, a rule of thumb approach has been used to determine an approximate peak heating load, and Full Load Equivalent (FLEQ) running hours used to calculate an estimated demand.

A similar approach has been used to determine the DHW demand by assuming the flats are occupied 365 days a year as a worst-case scenario. It is also assumed that hot water priority valve is used.

Based on the size and usage of both buildings, and aspiration to use an LZC heat generator, the deployment of a district heat network is recommended with Heat Interface Units (HIUs) proposed in each flat to provide heating and instantaneous domestic hot water. In line with CIBSE Code of Practice CP1, when designing a heat network, a diversity factor shall be applied to reduce the size of the LZC generator. This is applied on the basis that not all flats will be occupied simultaneously and to reduce primary pipe sizes which in turn reduces distribution losses.

Based on 43No. flats, diversity factors of 63% and 9% have been applied to the peak heating and instantaneous DHW loads respectively. As the HIU operates by prioritising DHW production, the LZC heat generator only needs to be sized to cover the higher of the two loads as opposed to both simultaneously. A summary of the loads is summarised in the table below.

Table 2 – Estimated Heating and Hot Water Demand

End Use	Demand (kWh/Year)	Peak Load (kW)	Diversified Peak Load (kW)
General:			
Space Heating	506,744	386	243 (63%)
Domestic Hot Water	293,825	3513	316 (9%)
	800,569	3513	316

The above assumes that the buildings are heated throughout the heating period and that DHW is required throughout most of the year. Differing heating timing and occupancy schedules will vary the annual energy demand.

6.2 New Build Dwellings

In addition to the flats, there are 26No. new dwellings that have been proposed onsite. In line with the NHDC and aspiration to achieve 'Gold', the predicted heating load will be in the region of 10-15 W/m². Like the flats in the Main Building & Teaching Block, we have assumed they are occupied 365 days a year as a worst-case scenario. It is also assumed that a hot water priority valve is used.

Due to these being individual dwellings and stand-alone buildings, they are not proposed as part of the heat network, and instead will each deploy their own LZC heat generator. A summary of the loads is summarised in the table below.

NB: The Tank House and Pump House will be refurbished buildings changing to residential use. Due to their position on site will likely use stand-alone heat pump technologies similar to the new-build houses.

Table 3 – Estimated Heating and Hot Water Demand

End Use		Heating Demand (kWh/Year)	Domestic Hot Water Demand (kWh/annum):	Peak Load (kW)
Edwin	House 44	1815	1089	1.38
	House 45	1815	1089	1.38
	House 46	1215	729	0.92
	House 47	1605	963	1.22
Violet	House 48	1920	1152	1.46
	House 49	1920	1152	1.46
	House 50	1920	1152	1.46
	House 51	1920	1152	1.46
Templar	House 52	1515	909	1.15
	House 53	2190	1314	1.67
Ithel	House 54	1740	1044	1.32
	House 55	1740	1044	1.32
	House 56	1740	1044	1.32
	House 57	1740	1044	1.32
Sadlier	House 58	1740	1044	1.32
	House 59	1740	1044	1.32
	House 60	1920	1152	1.46
	House 61	2535	1521	1.93
	House 62	1920	1152	1.46
	House 63	1920	1152	1.46
	House 64	2535	1521	1.93
	House 65	1920	1152	1.46
Summer House	House 66	6480	3888	4.93
Summer House 2 - Harwood	House 67	6480	3888	4.93
Tank House	House 68	2100	1260	2.10
Pump House	House 69	1950	1170	1.95

7. HEAT GENERATOR OPTIONS

7.1 Option 1: Low Temperature Air Source Heat Pump (LT ASHP)

7.1.1 Drawing List:

- 11951-CBG-XX-SP-DR-MEP-90001
- 11951-CBG-XX-SP-DR-MEP-90002
- 11951-CBG-XX-SP-DR-MEP-90003
- 11951-CBG-XX-SP-DR-MEP-90004
- 11951-CBG-XX-B2-DR-M-10001
- 11951-CBG-XX-B1-DR-M-10001
- 11951-CBG-XX-00-DR-M-10001
- 11951-CBG-XX-01-DR-M-10001
- 11951-CBG-XX-02-DR-M-10001

7.1.2 Description

An ASHP uses a refrigerant coil running at a lower temperature than the ambient air to transfer the low-grade heat energy from the air into the cycle. The heat pump converts the low-grade heat into usable 'high grade' heat through a compression cycle. Due to the high variability of ambient air temperatures, and the lower energy density of air versus groundwater, ASHP units are bigger than the comparable GSHP unit.

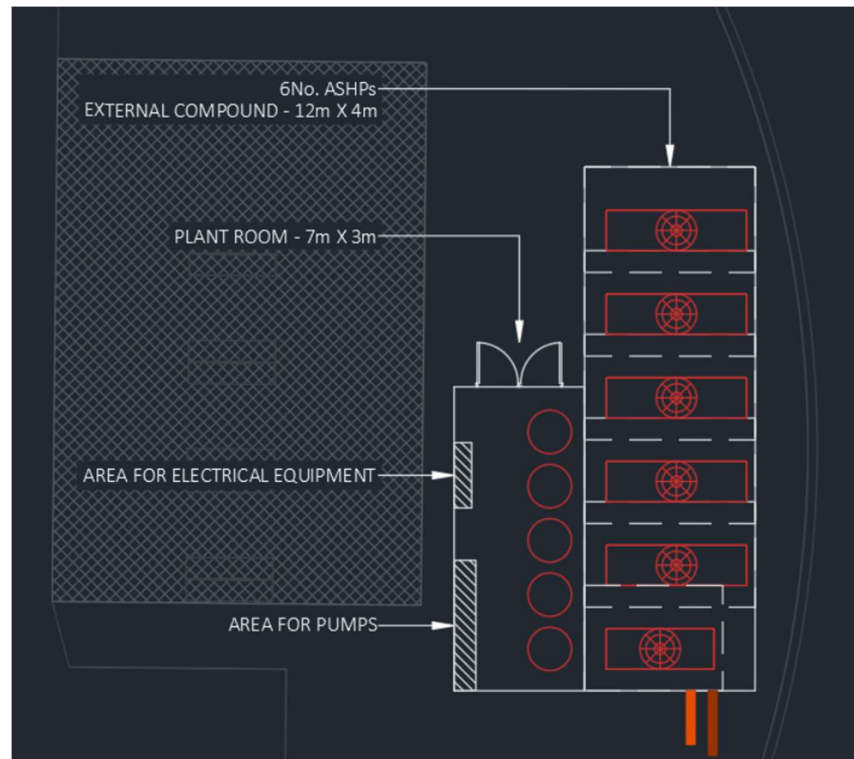
These units have the ability to operate at 55°C flow temperature when there is a demand for DHW whilst operating at lower flow temperatures when only space heating energy is required. This generally allows the heat pump to operate at around 350% efficiency (depending on model, refrigerant, and flow temperatures).

7.1.3 Plant Locations

7.1.3.1 Main Building & Teaching Block

For the heat network, an Energy Centre within the car park is proposed as seen in the figure below. Based on the load calculated above, 6No. commercial ASHPs will be required to meet the diversified load. The energy centre will be approximately 7m x 3m x 2.4m with the external compound requiring a 12m x 4m floorplate.

The primary heating mains from the ASHPs would connect into the Buffer Vessels where they are then distributed in a new 2-pipe system to serve HIUs located within each flat.

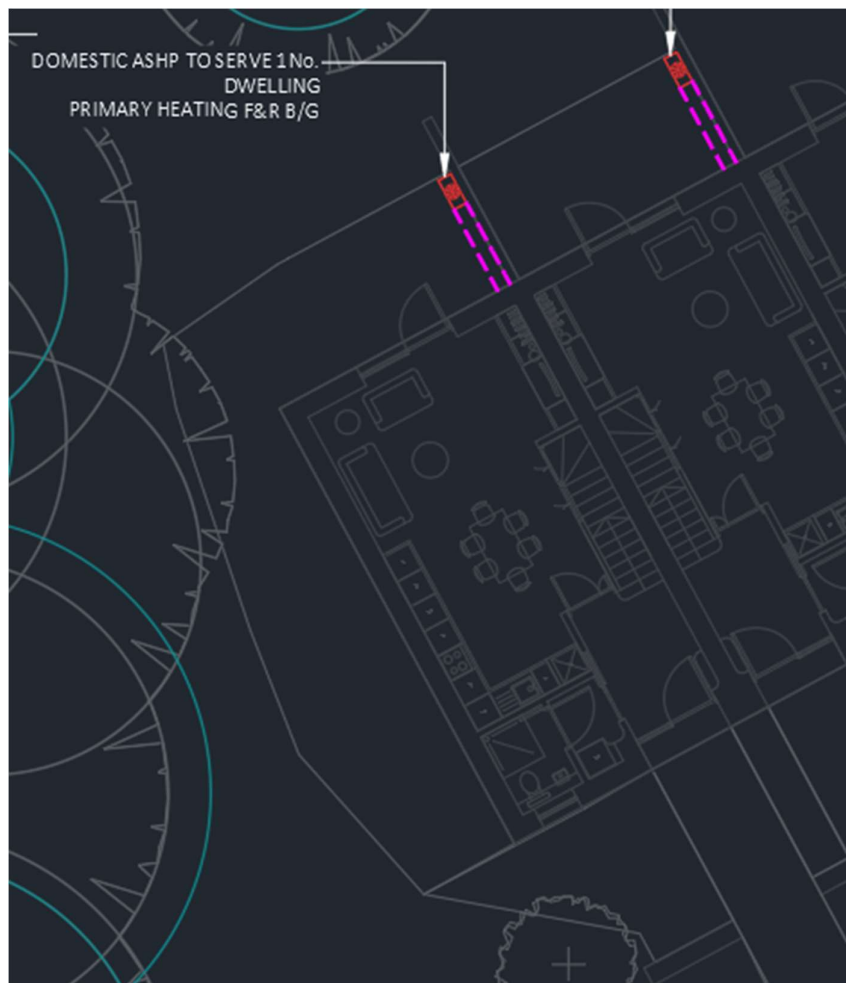


ASHP Energy Centre and external Compound within car park

7.1.3.2 New Build Dwellings

Based on the calculated demand above, each dwelling would require its own ASHP. This would be located within the garden of each property. Each ASHP will be approximately 700 mm(L) x 300mm(D) x 1000mm(H) and must be in open air. An acoustic enclosure could be used to conceal the unit if required.

The primary heating mains will then be buried below ground and trenched to within the dwelling where it will serve a pre-plumbed cylinder. This will provide the dwelling with LTHW heating and DHW. An initial position of the ASHP can be seen for Ithel below, whilst the others can be seen on the drawing.



Domestic ASHP serving 1No. dwelling in Ithel

7.1.4 Emitters

ASHPs generally operate at lower temperatures than oil boilers so convective and radiative heat emitters (e.g. radiators) are often larger when utilising this technology. Larger ASHPs do have the ability to operate at approximately 70°C which can help mitigate this issue however running a heat pump at high temperatures will compromise on its efficiency.

7.1.4.1 Main Building & Teaching Block

For the Main Building and Teaching Block, there are existing emitters which operate off the gas boiler at a higher flow temperature of 80DegC. They will need to be replaced and increased in size (by approximately 50%) to operate at the lower flow temperatures the ASHP requires. Alternatively,

Underfloor Heating (UFH) could be used as the primary emitter, with supplementary radiators used only where needed for particularly high heat loss spaces.

The final hydronic circuits would benefit from using HIUs to serve the space heating and DHW systems. These units are designed to connect to a district heat network, and can provide outputs equivalent to a combi-boiler for heating and DHW. HIUs benefit from being relatively small (600x500x312 HxWxD) and almost silent in operation. They also allow for local and remote billing to each tenant.



Example HIU

7.1.4.2 New Building Dwellings

As this is a new build, in line with Building Regulation Part L, the heating system must be designed with a maximum flow temperature of 55 DegC, therefore an ASHP can be accommodated. Heat emitters could either be radiators or UFH. With mid-terrace dwellings, where heat loss is particularly low, there may also be a case for using a combination of electric panel heaters and heat-pump water heater.

7.1.5 Noise & Visual Impact

7.1.5.1 Main Building & Teaching Block

Due to the size of ASHPs required for the heat network, the noise generated is a key factor in its placement. To avoid disturbance to tenants, the units have been positioned away from the buildings within the car park. A noise assessment will be required during the design stage to ensure sound limit levels are not exceeded, however an ASHP acoustic enclosure could be deployed if required.

Another disadvantage of an ASHP is the size of the unit. The ones shown on the drawing are 3m x 1m x 2m (LxWxH) and based on how they work, they require free flowing air to operate, so they cannot be placed out of sight within a basement like a more traditional gas boiler or GSHP.

7.1.5.2 New Building Dwellings

For a domestic application, the noise generated by the heat pumps must (as a minimum) align with the MCS020 noise calculation. The final location of the ASHPs is to be confirmed, however upon an initial assessment, there should not be any concerns with this failing.

7.1.6 Maintenance

Both the heat network (commercial) and domestic ASHPs utilise R-290 refrigerant internally, so the heat pump itself will require a specialist maintenance engineer with the appropriate F-Gas accreditation. The hydronic distribution circuit can be maintained by the incumbent heating engineer/technician (plumber).

7.1.7 Distribution Losses

7.1.7.1 Main Building & Teaching Block

One disadvantage of a heat network is the constant distribution loss. The ASHPs will provide 55DegC, however, as this heat travels from the Energy Centre to the Main Building and Teaching Block through a heat main buried within the ground, heat is constantly being lost. Overall, there is approximately 950m of primary pipework where this will occur.

Assuming an electricity rate of 24.5p/kWh (current domestic energy price cap as of April 1st 2024) and a heat network consisting of mainly 90mm and 110mm PEX pipes below ground, 110,700 kWh of heat will be lost to the ground. This equates to approximately £27,000/annum. The high losses are partly due to available sizes of pre-insulated heat mains pipework – in this case individual flow and return pipes are required (due to the load), which creates higher loss than if the flow and return are encased in the same jacket (a 'twin' pipe) which only goes up to 63mm.



7.1.7.2 New Building Dwellings

As the ASHPs will be located within close proximity to the dwellings they are serving, the distribution losses are minimal and will not be as noticeable as those on a heat network.

7.2 Option 2 – Low Temperature Ground Source Heat Pump (LT GSHP)

7.2.1 Drawing List:

- 11951-CBG-XX-SP-DR-MEP-90005
- 11951-CBG-XX-SP-DR-MEP-90006
- 11951-CBG-XX-SP-DR-MEP-90007
- 11951-CBG-XX-SP-DR-MEP-90004
- 11951-CBG-XX-B1-DR-M-10002

7.2.2 Description

Ground Source Heat Pumps (GSHP) draw low grade heat from the ground and use electrical energy to convert this to high grade usable heat for heating and domestic hot water production. As the ground temperature is almost always typically warmer than the air in winter, these are often more efficient than Air Source Heat Pumps (ASHP). Generally, for historic buildings and/or those with poor fabric performance GSHPs are preferable over ASHPs due to the improved efficiencies which complement the higher energy consumption of the building(s).

7.2.3 Low Temperature vs High Temperature GSHP

Historically GSHPs have operated with a maximum flow temperature of around 50-55°C however recent development of packaged twin-stage heat pumps now allows flow temperatures up to 73°C. The drawback of producing a higher flow temperature is a loss in equipment efficiency: a LT GSHP operating at 50-55°C can achieve a Seasonal Coefficient of Performance (SCoP) of around 4.0-4.5 whereas the corresponding HT GSHP operating at 65°C will only achieve around 3.1. This has an impact on electricity consumption and hence OPEX. HT GSHPs also command a higher CAPEX due to the twin-stage technology. The benefit of a HT GSHP is the higher flow temperature is usually compatible with existing heat emitters (radiators) whereas a LT GSHP would require increasing the size of radiators or swapping for Under-Floor Heating (UFH).

DHW can also be generated using both systems in a domestic setting and are compatible with HIUs.

7.2.4 Heat Collection Options

There are two main options for GSHP heat collector arrays: boreholes, or horizontal collectors. Boreholes are typically drilled to a depth of 125-150m and thanks to their vertical orientation use much less land area for the same output. The land above boreholes can be resurfaced and/or used for other purposes. Horizontal arrays are installed at a depth of 1.5m and typically take up around 4 times the land area of boreholes, whilst the area above cannot be resurfaced or used for tree planting.

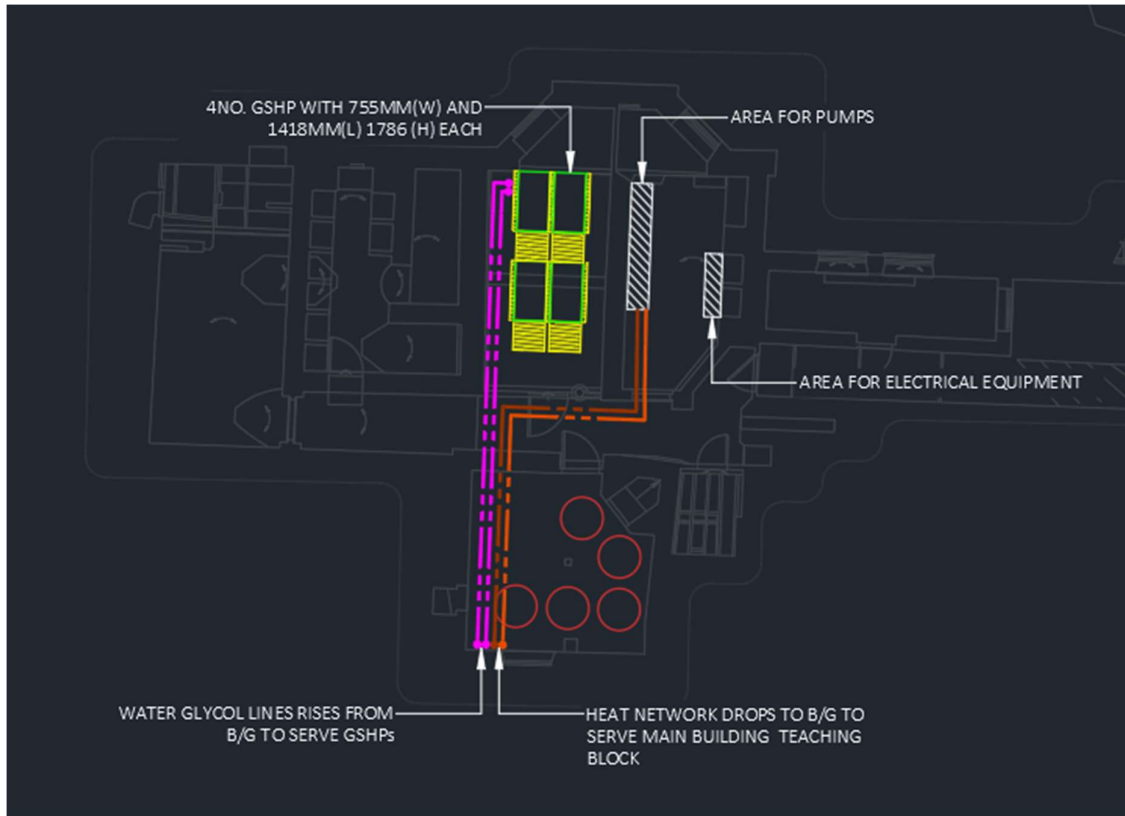


Left: Horizontal Array Trench. Right: Rig Drilling boreholes for Vertical Array

Based on a 330 kW LT GSHP used to serve the Main Building and Teaching Block, 62No. boreholes with a 125m depth would be required, utilising an area of approximately 6200m². The boreholes could be installed in the western field to limit disruption to other areas (see image below). If a horizontal array was opted for, this would require an area of approximately 20,400m². For the purposes of this analysis a borehole collector array has been assumed.

7.2.5 Plant Location

As a GSHP extracts its heat from the ground via boreholes, the heat pump itself does not require free flowing air to operate, hence the existing basement can be used to house the heat pump, buffer vessels and distribution pumps. The only external equipment is the GSHP manifold. There are 3No. rooms within the basement that can be utilised to house the main plant as seen below.



GSHPs, Buffer Vessels and Pumps located within Main Building Basement

The boreholes would be located within the field adjacent to the proposed car park. This area has been chosen due to there being no clashes with the Root Protection Zones (RPZs).



62No. boreholes and GSHP Manifold adjacent to Car Park

7.2.6 Emitters

Similar to the ASHP option, as we are proposing a higher efficiency LT GSHP, radiators in existing buildings will need upgrading, or the use of UFH will be needed. HIUs would be used in the existing buildings.

7.2.7 Noise & Visual Impact

There are no noise concerns from the GSHP as the unit is located internally within the proposed Energy Centre.

7.2.8 Maintenance

The hydronic distribution circuit can be maintained by the incumbent heating engineer/technician. Repair/maintenance of the GSHP unit will require a specialist.

7.2.9 Distribution Losses

7.2.9.1 Main Building & Teaching Block

Like the ASHP heat network, there will be distribution losses. However, as the GSHP is located within the Main Building, the heat network distribution route is reduced from 950m to 650m, therefore distribution losses are 80,000 kWh/annum equating to £18,000/annum (~£10,000/annum less than if an ASHP was to be deployed).

8. FINANCIAL COMPARISON

The capital expenditure for both options of a heat network is covered in the section below. As both systems will require HIUs, replacement of internal distribution pipework and increased emitter sizes, these costs have been removed from the figures below.

Note that the below are high level estimates and are subject to change going forward.

8.1 Main Building & Teaching Block

A 330kW ASHP including installation, trenching, PEX pipework and cost to build an energy centre totals to around £430,000. The equivalent for a GSHP would cost around £1,000,000.

The main reason why a GSHP is more expensive is due to the drilling of boreholes. This alone will cost approximately £300,000. However, as a GSHP has a better COP (4 compared to an ASHPs 3), the electrical consumption will be less meaning the landlord and tenants will benefit from reduced bills.

Another benefit of the GSHP is that the existing basement can be used to house most of the plant therefore an external compound/energy centre will not be required. As this is a listed development, planning permission may arise as an issue, but can be mitigated entirely if a GSHP is chosen.

For the ASHP, an alternative option could be moving the 'Energy Centre' internal to the building (like the GSHP plant room) which will save on CAPEX through construction, however the ASHPs will still be required to remain outside.

Distribution losses for an ASHP are considerably more when directly compared to the GSHP. However, this can be reduced by placing the ASHP external compound and energy centre closer to the Main Building, however this will mean the heat pumps are visible to the tenants. Moving the energy centre into the basement will not reduce the distribution losses any further as LTHW water will still be distributed between the two, however this does encroach on the building GIFA which could be used for other measures.

A significant CAPEX to both proposals is the trenching and pipework for the heat network itself around both buildings which equates to approximately £140,000. Due to the proposed size of the heating mains, it is advised that primary pipework is not routed through one flat to serve another as this may lead to overheating and fire compartmentation issues, hence our preliminary pipework route has been designed to avoid such issues.

8.2 New Build Dwellings

We are proposing the new buildings are only served with an ASHP with LTHW heating and DHW being provided via a pre-plumbed cylinder. This will approximately cost £10,000-£15,000 per dwelling

9. ON-SITE GENERATION, STORAGE AND SUPPLY

9.1 Electricity Generation

Generally, two technologies are available for generating electricity, wind turbines or solar panels. A wind turbine would not be considered appropriate due to the site location. However, Photovoltaic (PV) panels are worthy of further consideration.

Given the desire from the Client to achieve NHDC Silver and Gold Standards, 25% of the Main Building and Teaching Block & 50% of the new dwelling's consumption will have to be offset via renewable generation. However, if LETI is being targeted for the new build dwelling, 100% of the new-build dwellings' consumption will have to be offset.

9.2 PV Type and Location

9.2.1 Car Park

The client has identified the roof of the proposed car park for a slightly inclined (4Deg) roof mounted array. In total, the available area on the roof totals to 1255m² of which 29% will be shaded by neighbouring trees.

Based on the area provided and type of installation, the roof of the car park may have solar PV panels as per below.



Example Carpark Solar PV Array

9.2.2 Dwelling Roofs

To meet the above targets, additional PV may be required on the dwelling roofs. However, as aesthetics is a priority, PV slates are suggested as preferable compared to a traditional PV panel. These panels are designed and sized to look like traditional slate roofs and require no additional planning permission beyond re-slating a roof (see image below). The drawback with this technology is PV Slates are typically twice as expensive and provide approximately 70% of the yield per unit area when compared to 'traditional' PV panels on existing buildings so paybacks are generally longer. As PV is being deployed on new buildings only, finally implications will not be a limiting factor.



PV Slate System

The following roofs have been provisionally selected for further analysis to meet energy offsetting targets which are listed below:

- South facing Roof on Ithel – 187m² on a 50° pitch
- West facing roof on Violet– 128m² on a 50° pitch
- South-east and South-west facing roof on Templar– 180m² on a 50° pitch

9.3 Battery Storage

Battery storage is an emerging technology for use in dwellings. This would enable almost all the electricity generated to be used on site. However, the cost and lifespan of the batteries is currently preventing mainstream usage. Typical warranty periods are 10 years and lifecycles (discharge cycles) typically around 6,000. Not all suppliers allow the energy stored in a battery to be exported back to the grid so any energy stored and not used would generate no revenue in this case.

When considering a large PV Array i.e. one with an output greater than the baseload of an estate, batteries are often not beneficial as the array is providing all the energy needs for the occupants and simultaneously exporting for most of the year.

9.4 Solar Calculations

9.4.1 Consumption Data

The current energy usage for the Main Building and Teaching Block is unknown as it has yet to be repurposed for use as flats, therefore rule-of-thumb demand values from CIBSE Guides have been used for;

- Space heating demand
- Domestic hot water demand
- Small power consumption

An Energy Use Intensity (EUI) of 35kWh/m².a has been assumed for the new dwellings in line with the LETI standards.

Calculations have been carried out assuming 4No. scenarios regarding how much consumption will be offset by solar PV:

- Scenario 1 – ASHP deployment with 25% of existing and 50% of new dwellings in line with NHDC Silver and Gold requirements
- Scenario 2 – ASHP deployment with 25% of existing and 100% of new dwellings in line with Silver and LETI standards
- Scenario 3 – GSHP deployment with 25% of existing and 50% of new dwellings in line with NHDC Silver and Gold requirements
- Scenario 4 – GSHP deployment with 25% of existing and 100% of new dwellings in line with Silver and LETI standards

9.4.2 Electricity Consumption

Using the Microgeneration Certification Scheme (MCS) calculation, the outputs of Scenarios 1-4 are tabularised below.

Table 4 Solar PV Roof Assessment

Calculation Parameters & Outputs	Scenario 1 – ASHP, NHDC Requirement	Scenario 2 – ASHP, LETI Target	Scenario 3 – GSHP, NHDC Requirement	Scenario 4 – GSHP, LETI Target
Total Consumption of Main Building & Teaching Block (kWh/annum) ¹	436,542	436,542	369,828	369,828
Total Consumption of New Dwellings (kWh/annum)	135,415	135,415	135,415	135,415
No. of PV Panels ²	540			
No. PV Slates ³	2,736			
Solar kWp Output	301			
Total Annual Yield (kWh/annum)	244,450			
Minimum Consumption Offset (kWh/annum)	176,843	244,550	160,164	227,872
PV Yield vs Consumption (kWh/annum)	+67,607 (+38%)	0 (+0%)	+84,285 (+53%)	+16,578 (+7%)

¹ Only accounts for internal consumption and not distribution losses within the heat network.

² Based on Sunpower Maxeon 3 430W

³ Based on GB Sol PV Slate – 500x300mm

From the table above, regardless of which LZC heat pump deployed and the consumption offset target, an excess yield will be seen.



9.4.3 Cost

For a roof mounted array, it is estimated this will cost approximately £1,200/kWp of installed PV. Based on a 235kWp array, this equates to £280,000.

As per GB Sol's recommendation, PV slate costs £225/m². Across the 3No. roofs we have assessed for deployment (428m²), this equates to £80,000. However, as these dwellings are yet to be built, they would require a standard slate roof which costs £185/m², which effectively means the extra-over cost for PV Slate is £40/m², equating to an additional £18,000.

10. ELECTRICAL INFRASTRUCTURE UPGRADE

The following section details the existing condition of the electrical services and outlines the proposed strategy for the Main school building and Teaching block. The strategy for the other buildings will follow the same as the main school building, which will be evaluated during the stage 3 design. the remaining buildings are as follows:

- The Sports hall and Stables are to be demolished. Any existing connections to the existing retained buildings will be removed as part of the design.
- The existing shed within the summerhouse plantation will be demolished and a new summerhouse will be built in its place and will require a new full rewire and new supply to meet the design requirements.
- The Tank House & Pumping Station have existing legacy cabling and equipment which are no longer fit for purpose. Both of these buildings are to be re-purposed into new accommodation with new electrical supplies required.
- The Belvedere shall have new heating and lighting which will require a new electrical connection.
- Ice house has no existing electrical connections and is deemed to not be part of the proposed electrical strategy.

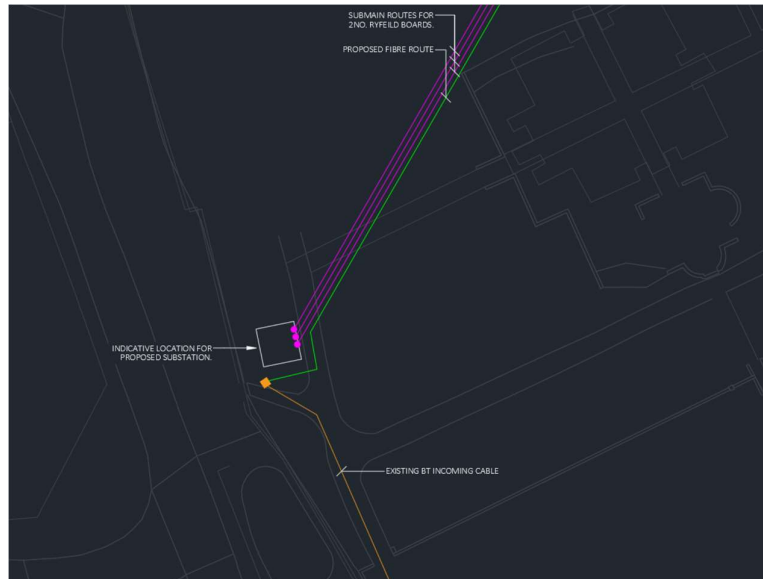
10.1 Incoming Electrical Supply

The existing substation is located on the main road, as detailed in section 2.2.3 of this report. CBG have completed a load assessment based on the estimated electrical usage for the flats, houses, mechanical demand and electric vehicle charges. The estimated figure based on rule of thumb guidance and manufacturers data sheets is 1.6MVA. Due to the electrical loadings required, an upgraded UKPN supply application has been carried out which will include for a new substation to be located on the site boundary supplying covering the required loadings required for the project. The substation dimensions shall be 3m x 3m in a GRP housing. This will require a minimum 500mm ventilation space on all side, with an additional 2m in front for the doors to open fully.

The strategy is to have 3no. Ryfeild boards located near the Sadleir building within a purpose-built structure to feed all 43 flats, 26 houses & 2 re-purposed buildings within the estate. Final location of this building to be agreed at the next stage. Each property will have its own electrical supply and separate meter from the Ryfeild boards, allowing for direct billing from the DNO.

To reduce the amount of the submains and loadings linking to all the new dwellings, its recommended to have separate supplies from the substation for a communal connection for the Energy centre and EV chargers. This connection would be located within mechanical plant room adjacent to the car park.

For all details on the above see drawing 11951-CBG-XX-SP-DR-E-90001 & 11951-CBG-XX-SP-DR-E-90002.



Proposed location of new substation (see drawing 11951-CBG-XX-SP-DR-E-90001)



Indicative Substation

10.2 LV Distribution & Small Power

10.2.1 Existing

The services within the existing listed buildings which will not be demolished as part of the project appear to be showing signs of ageing and wear & tear. All small power and LV distribution shall be stripped out within the retained buildings as the existing electrical infrastructure and cabling does not meet the new requirement nor suit the proposed purpose of the building (from school to dwellings)



Old distribution boards located within the listed building

10.2.2 Proposed

Each property shall be provided with its own dedicated UKPN supply which will be wired from its dedicated Ryefield board as mentioned above. The electrical supply shall either be brought to a meter box enclosure externally outside each property or inside each property. The size of the incoming fuses will be approximately 43.5mm wide, length 100mm & 95.5mm depth in the instance of the supply being single phase. Where the supply is 3-phase the fuse size will approximately be 200mm wide, 100mm length & 95.5mm depth.

A consumer unit shall be provided for each property. This shall feed all final circuits within the property.

Small power provision shall be developed at the next stage but generally shall be provided to suit the furniture arrangement, kitchen appliances and mechanical equipment.

External sockets will be provided at specific locations where required.

Electrical supplies will be provided to suit the sustainable systems and mechanical design, this would include Air source heat pumps, hot water cylinders, PV's etc.

Communal services will be required on landlord DB's, these will be located in various different locations such as electrical & mechanical plant rooms and various different feeder pillars located around the site. These will all be to feed all communal services i.e external gate supply, external store, plant rooms & mechanical plant.

Each property will have its own dedicated EV charger, there are two options for wiring the EV chargers for each dwelling. These are as follows:

- Option 1 - A 11kW 3-phase EV charger shall be provided to each dwelling's car parking space fed from a dedicated 3-phase distribution board located adjacent to the parking spaces within an external storeroom, this shall be programmed by the EV manufacturer for each property to be billed separately.
- Option 2 – A 11kW 1-phase or 3-Phase EV charger shall be wired from each property to its own dedicated parking space.

Option 1 is the preferred because it minimises excavation from each property to the parking spaces and reduces the need for longer cabling distance. However, if option 2 is preferred then this would require either 3-phase within each property or reduced EV charger capacity.

Note: other than 11kW, there is a 7.4kw charger option which will charge the car slower but reduce the electrical demand. 11kW has been suggested in the load assessment, which can be reduced if required due to cost or available capacity.

10.2.2.1 Arc Fault Detection Devices (AFDDs)

The new IET Wiring Regulations 18th Edition recommendation is to use Arc Fault Detection Devices (AFDDs) for certain single-phase circuits, including those serving sleeping accommodation, historic structures, structures that could be fire propagating, chemical/hazardous material stores, woodworking shops, and spaces housing valuable artefacts. Parts of the project fall into at least one of these categories.

AFDDs are designed to prevent electrical arcs from causing fire. These arcs can be caused by many factors, including faulty equipment, loose connections, degraded cabling, and damaged appliance flexes. These arcs are not necessarily detected by conventional circuit breakers, fuses or RCDs. The requirement is that they are provided individually to each final socket circuit.

10.3 Containment/Wiring Strategy

10.3.1 Existing

The wiring within the existing building consists of SWA for submains and a mixture of MICC & LSX throughout. Due to the limited wiring routes internally, its resulted in wiring being installed on the façade of the building which is not aesthetically acceptable. As the building is change of use, its recommended that all cabling is to be stripped out throughout the existing as the scheme.

10.3.2 Proposed

The strategy is to have containment installed within floor and ceiling voids within the existing listed building and within the proposed new builds. The proposal is to have the existing floors lifted to install new insulation that will improve the U-values, which allows an opportunity to installed containment through the affected areas. The routes will be discussed with the architect during stage 3.

To reduce the risk of damaging the fabric of the building, cable routes shall typically follow any existing holes within the floor where possible or existing holes increased in size and supported structurally. Where containment is required, this shall be metal basket or tray depending on the application and shall be mounted directly onto the wall.

All external cables shall be buried underground within trenching and contained in a suitably sized duct which shall be specified on the next stage. Where cabling needs to run through root protection zone to reduce the cable size & length, these areas shall be hand dug and the cables shall be run within steel ducting for protection as this reduces the buried depth and minimise disruption of roots.



Outgoing submains on façade of building

10.4 Internal Lighting

10.4.1 Existing

The existing lighting consists of general linear or flat panel luminaires which tends to be of a more functional nature. These are a mixture of ages, types and condition with some no longer operational and others damaged in places.

Lighting is controlled mostly by traditional switches and emergency lighting is patchy in some areas which should be reviewed with the fire strategy.

With the change of use of the building becoming housing, the existing luminaires in all areas typically do not suit the aesthetics and requirements for the proposed scheme. It is recommended that all existing lighting and wiring shall be stripped out.



Existing luminaires within the school building.

10.4.2 Proposed

The proposed lighting scheme shall be domestic type luminaires within the listed building that are in keeping with the style of the building. The new build houses should also employ domestic type luminaires which are more modern in appearance to suit the fabric of the building.

All luminaires shall be LED for the energy savings and the longevity they can offer. All lighting shall be sourced from reputable manufacturers to avoid colour shift, flickering, humming etc. The lighting system shall be designed with longevity, energy efficiency, vandal resistance and low maintenance in mind.

The locations of light fittings, type and overall scheme will be developed by CBG with the client & architect. A mixture of ceiling pendants, recessed spots, wall fittings/picture light points and 5A wall sockets will be typically provided.

The lighting controls will mostly be basic on/off function with dimmers for the flats and houses and automatic presence detection for the communal corridor and circulation spaces. If required the circulation corridor spaces can have “dim to 10%” function which allows a reduced lighting level for when the occupant walks into the space at night. This is common in more modern housing blocks.

As the scheme consists of a private domestic residence, the properties do not strictly require an emergency lighting system. However, we recommend that emergency lighting is installed adjacent to the distribution board locations throughout the properties as this will aid in situations where power has been isolated.

10.5 External Lighting

10.5.1 Existing

There is currently minimum external lighting within the site, and typically only installed on the facade, along walkways to suit the requirements of the school and security flood lighting. There is no site wide perimeter lighting within the landscaping. Most appear to be outdated, having different colour temperatures and showing signs of integral water damage.

10.5.2 Proposed

A new external lighting scheme will be developed to suit the landscaping, car park, driveways and security requirements. Any new external scheme should comply with Planning requirements for light pollution.

The new scheme shall consist of a wall mounted bulkhead by each entrance door to each property and bollards/column lights along the driveways and car parks. These shall be fed from the local feeder pillars located strategically around site.

The proposed lighting design shall allow for dark areas which can let the wildlife move without being disturbed. Warmer 2700k LED luminaires shall be used to avoid harsh blue/white light and high levels of UV, which can have a negative impact on species.

The site shall be lit to 10 Lux for driveways, enabling suitable light levels for picking up and dropping off. External walkways around the building shall reach a level of 5 Lux. An important aspect around the site boundary is the level shall not exceed 0.5 Lux, 3 meters from the edge of site. This is to prevent possible light intrusion to surrounding wildlife, hedgerows and structures outside of the site boundary. Dark areas shall be maintained at tree level ensuring no light pollution is produced.

All the proposed luminaires shall use cut offs which will reduce the upwards output lighting and skyglow effect, which will be used to minimise the spill of light. Where necessary, luminaires shall use back shields which will further reduce the light intrusion outside of the site boundaries. Luminaires shall be selected for their low glare ratings and direct beam angle.

All Luminaires will produce minimal glare when in the immediate vicinity of the luminaire. Where adjustable optics are used for beam angle, the luminaires shall be fixed to prevent possible movement during adverse weather conditions and future maintenance. The angle shall be at 90 degrees to minimise sky glow, which can brighten up the night sky causing disturbance to wildlife.

current system will no longer be fit for purpose to align with the proposed strategy of the housing. The complete system will need to be stripped out and replaced.

10.7.2 Proposed

Each housing property shall be provided with a fire alarm system to comply with BS 5839-6. This will include main wired fire alarm system with smoke & heat detectors.

Two options that are available for the flats, are as follows:

- **Option 1** - The proposed fire alarm system for the flats under 'Stay put' Policy. A hard-wired fire alarm shall be provided to the building, to BS 5839-6 within the flats. The system shall be powered from the local distribution board using a dedicated MCB.

A 'Stay Put' Policy is an evacuation strategy used in purpose-built blocks of flats. When a 'Stay Put' policy is put into effect, it's to keep people safe when they are not in an area directly affected by the fire. If a fire is not in their flat, they should stay inside with the doors and the windows closed.

- **Option 2** – The fire alarm system is LD1 with a hush button installed in each flat with each housing building linked via the hush button.

The fire alarm Hush system Buttons provide residents with the means to silence false alarms within the flats/houses themselves should they set the fire alarm off accidentally, preventing unnecessary building evacuations or fire service call outs. If however, the occupant is away, the button is not silenced in time or the smoke activates another local detector, then the whole building is to evacuate.

A fire risk assessment will be carried out by the building control/fire officer to determine which option is best and the grade which the fire alarm system will be designed to.

10.8 CCTV

10.8.1 Existing

There was no CCTV identified during CBG's survey which wasn't part of the onsite security team system.

10.8.2 Proposed

Provision will be made for external CCTV camera coverage around the perimeter of the buildings & gate and mounted on purpose-built poles. It's deemed that no CCTV coverage is required within any of the flats/houses or circulations spaces.

The CCTV system will include for provision to remotely access live and recorded footage using a secure website, connecting the head end back to the main data cabinet located in the external electrical room. Details are to be developed with a security specialist.



10.9 Intruder Alarm

10.9.1 Existing

There is an existing intruder alarm system located within the existing school building and teaching building, which is currently maintained by ADT and has a total of 18 zones. The system consists of door contacts and motion detectors located in circulation areas. From the visual survey the system appears to have signs of ageing and wear & tear.

10.9.2 Proposed

Each property will have its own intruder alarm system. The new intruder alarm system shall be designed to comprise of door contacts & motion sensors. Window contacts can also be provided if required by insurers.

The system will be designed to BS EN 50131 Grade 2, the normal standard for domestic properties, unless otherwise advised. The proposed scheme shall have head-end equipment that allows for remote monitoring when the end user is away from the property.

10.10 Intercom System

10.10.1 Existing

No existing intercom system was observed during CBG's survey.

10.10.2 Proposed

The new intercom system shall have a link from the gate to each property and another access control point at each building and property.

10.11 AV

10.11.1 Existing

All of the existing audio/visual equipment has been removed as part of the school removal, with only some legacy cabling left in place. Any existing cabling or equipment located within the buildings will be removed and stripped out.

10.11.2 Proposed

It's been requested that a new Audio/visual system will be required throughout site. The strategy is to be developed with the architect and client and confirmed in the next stage.

10.12 Lightning Protection

10.12.1 Existing



During the visual survey, it was deemed that the lightning protection system is air terminals on the chimney stacks. The condition of the system is unknown due to limited access.

There were no signs of surge protection located within any of the existing distribution boards.

10.12.2 Proposed

The existing lightning protection will be reviewed but is assumed that a lightning protection system will be required at this stage. A strike risk assessment will be undertaken to BS EN 62305, this will determine whether the existing lightning protection system (LPS) is suitable or needs to be upgraded, plus installed of the new buildings.

If required, the systems shall comprise of metal down tapes and tapes along the roof ridges, with air terminals potentially needed on the chimney stacks.

Surge protection will be provided to all distribution boards within each property, as its now a requirement that all submains over the length of 10 meters have surge protection to reduce the risk of a power surge.

11. CONCLUSIONS

A summary of the main findings is contained below:

- For the Main Building and Teaching Block, an ASHP heat network will be significantly cheaper to deploy compared to a GSHP, however the operation cost will be higher due to the differing Coefficients of Performance and differing lengths of heat network distribution.
- One major benefit of the GSHP over the ASHP is its ability to utilise the existing basement to house equipment meaning an Energy Centre and external plant compound to house pumps will not be required. This may be favourable as planning permission to build an Energy Centre would not be necessary. The final decision may depend on available funding for the system.
- To meet the minimum requirements set out by NHDC's Silver and Gold Standards and LETI Standards, a roof mounted PV array on the car park and PV Slate on Ithel, Violet & Templar will be sufficient with an ASHP or GSHP heat network.

There are also some risks to consider for the next design stage, these are as follows:

- The root protection zone causing obstruction for external cable routes, in some cases routes are completely blocked. The solution will be to hand dig in the route protection zones to the amount that permission is granted and run cables in steel ducting within these areas.
- The budget cost for the UKPN incoming electrical substation is £360,000, based on the mechanical proposals, the EV chargers & the electrical demand per dwelling. Confirmation required on the budget allowance by the QS.
- Routing final circuits within listed building will cause restrictions on routes and mounted cables (limited penetration through joists and building fabric). The solution is to re-use or widen existing holes where possible and install cables within raised floors/cavity on the walls.



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