



north east &
yorkshire
ENERGY HUB

North East & Yorkshire Net Zero Hub

Heat Decarbonisation Plan and Feasibility Study Anytown House

Report

Report produced in March 2026



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Association for Public Service Excellence
3rd floor Trafford House
Chester Road, Old Trafford
Manchester, M32 0RS
Telephone: 0161 772 1810
fax: 0161 772 1811
Email: enquiries@apse.org.uk
Web: www.apse.org.uk

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1 Executive Summary

The North East and Yorkshire Net Zero Energy Hub wish to gain a further understanding of the viability of installing low and zero carbon technologies to reduce the energy consumption and carbon emissions at Anytown House.

APSE Energy were appointed to visit the site and undertake a survey of the existing installed mechanical and electrical plant and equipment and recommend energy saving opportunities. This is a feasibility study and options appraisal for the concept design (RIBA Stage 2) of decarbonisation measures. The site was visited in February 2026. The survey consisted of visual inspections of the installed plant and equipment; no operational or performance testing was undertaken. The service and breakdown history documentation were not reviewed.

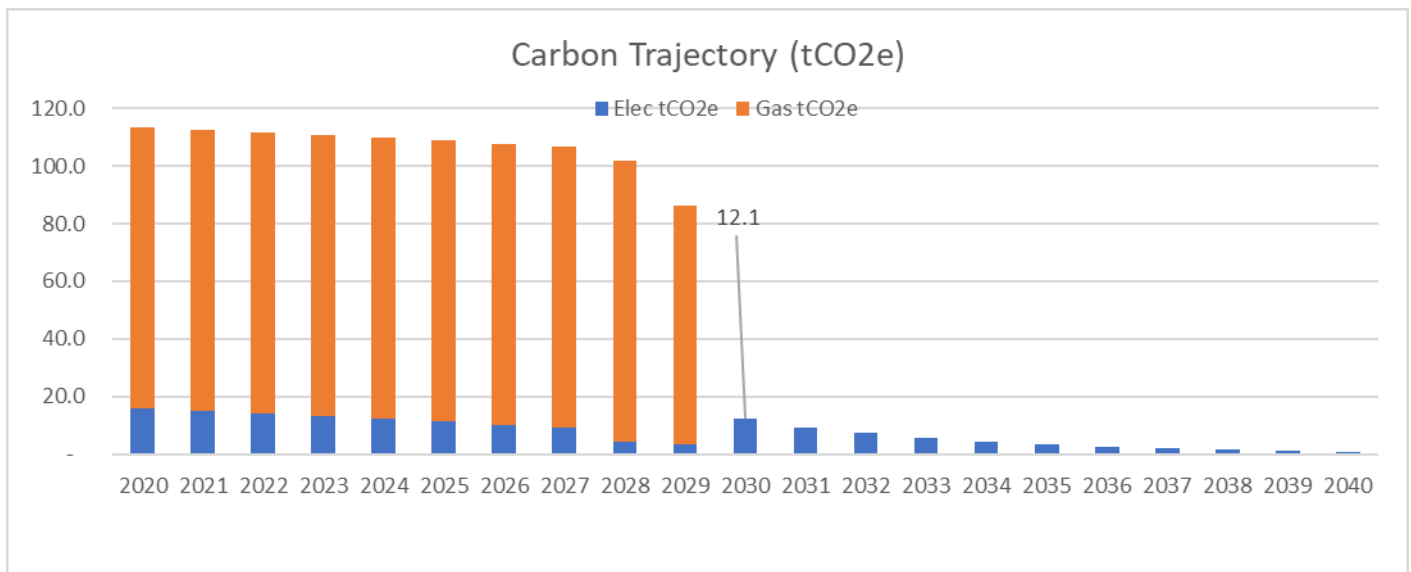
The table below summarises the costs of the works and professional fees associated with the core carbon reduction recommendations. These proposals offer the potential for achieving significant carbon and financial savings.

Table 1: Energy Saving Measures

Item	Recommendation	Annual Electricity Savings (kWh)	Annual gas Savings (kWh)	Annual Saving (£)	Capital Cost (£)	Payback in Years	Carbon Saving (tCO ₂) per year
1	Double Glazing Replacement	-	11,913	£607	£235,500	N/A	2.2
2	Cavity Wall Insulation	-	70,128	£3,573	£73,100	20.5	12.8
3a	Air Source Heat Pump for Space Heating	-59,512	330,850	£1,026	£675,550	N/A	50.0
3b	Air Source Heat Pump & Electric Boiler for Domestic Hot Water	-42,918	119,871	-£4,837	As Above	As Above	13.9
4a	Solar Panels (32.4 kWp) Own Use	17,400	-	£4,628	£41,500	7.4	3.1
4b	Solar Panels (32.4 kWp) Export	8,263	-	£992	As Above	As Above	1.5
5	LED Lighting Replacement	6,837	-	£2,298	£13,300	5.8	1.2
	Total	-69,931	532,762	£8,288	£1,038,950	N/A	84.7

To achieve the site's decarbonisation, and comply with net-zero objectives, it would be necessary to decommission all existing gas-fired equipment by 2030. The figure below shows the carbon trajectory if all recommended projects are completed.

Figure 1: Buildings Carbon Trajectory - Recommended Proposals



Main Recommendations and Next Steps

1. Heating and DHW Decarbonisation:

- Full decarbonisation requires decommissioning all gas-fired boilers by 2030.
- It is recommended to replace them with 2no. ASHP, providing 35°C LPHW to new heating distribution pipework and radiators to provide the building with space heating.
- The DHW will be provided by a dedicated ASHP and electric boiler. The new ASHPs are connected to a new preheat vessel, the existing hot water cylinders, and an 80 kW electric boiler to provide efficient, low-carbon DHW without requiring high-temperature heat pumps.
- The DHW distribution pipework should be retained.

2. Install additional heating circuits

- When installing the new heating distribution pipework, it is recommended to design more secondary heating circuits to replace the existing single circuit. When installed alongside more complex controls (Building Management System) it will help to reduce the significant waste currently caused by standing losses in the heating system due to the single heating circuit.

3. Building Fabric upgrades

- The Council should consider installing new cavity wall insulation to improve the building's thermal performance.
- It is recommended to investigate the status of the wall cavity to confirm it is suitable for the installation of cavity wall insulation.
- The existing double glazing installed in 2000 should be replaced with modern equivalents.

- Thermal modelling should be undertaken to better understand the energy and financial implications of installing cavity wall insulation. It will also help the Council understand the heat loss and required sizing of electrical heating equipment, which could change depending on the status of the cavity and loft space.

4. Electrical Infrastructure and Supply Upgrade:

- An electrical supply upgrade (**estimated £50,000**) will likely be required, subject to confirmation from the District Network Operator (DNO).
- This cost is not fixed and represents a key financial risk and should be explored early in project development by early engagement with the DNO.

5. Solar PV & LED Lighting

- Replace the existing fluorescent lighting with LED equivalents.
- Consider installing PIR (Passive Infrared Sensor) in corridors to reduce unnecessary lighting and energy waste.
- Retain existing LED lighting and replace fittings like-for-like as they fail.
- Consider installing solar PV array on the buildings' roofs for significant carbon savings and a good return on investment. A loan from the Public Works Loan Board could fund these installations.

6. Energy Procurement and Monitoring

- Review utility supply contracts to secure advantageous export tariffs for PV-generated electricity.
- Introduce heat sub-metering to monitor key consumers, including each flat. This will enable more accurate billing and inform future billing strategy.
- Implement a comprehensive metering and energy monitoring scheme to track electricity, heating, and renewable generation, providing valuable data for energy management and ongoing optimisation.

7. Small Equipment Energy Efficiency

- Retain and replace existing electric split units as needed, as these are already decarbonised.
- The Council should consider installing an electricity sub-meter to monitor the electrical consumption in the Laundry. If significant, the council should consider replacing the equipment with modern versions to utilise energy savings.

8. Modelling:

- Perform detailed thermal and DHW modelling to confirm both heating loads, volume and timings of DHW consumption and system sizing.

2 Survey and Observations

2.1 General

Anytown House is located at Anytown.

The building is used as private accommodation for elderly people and contains 32 private flats that are rented from the council as a social landlord rather than council accommodation.

A site plan is presented below.

Figure 2: Ground Floor Plan

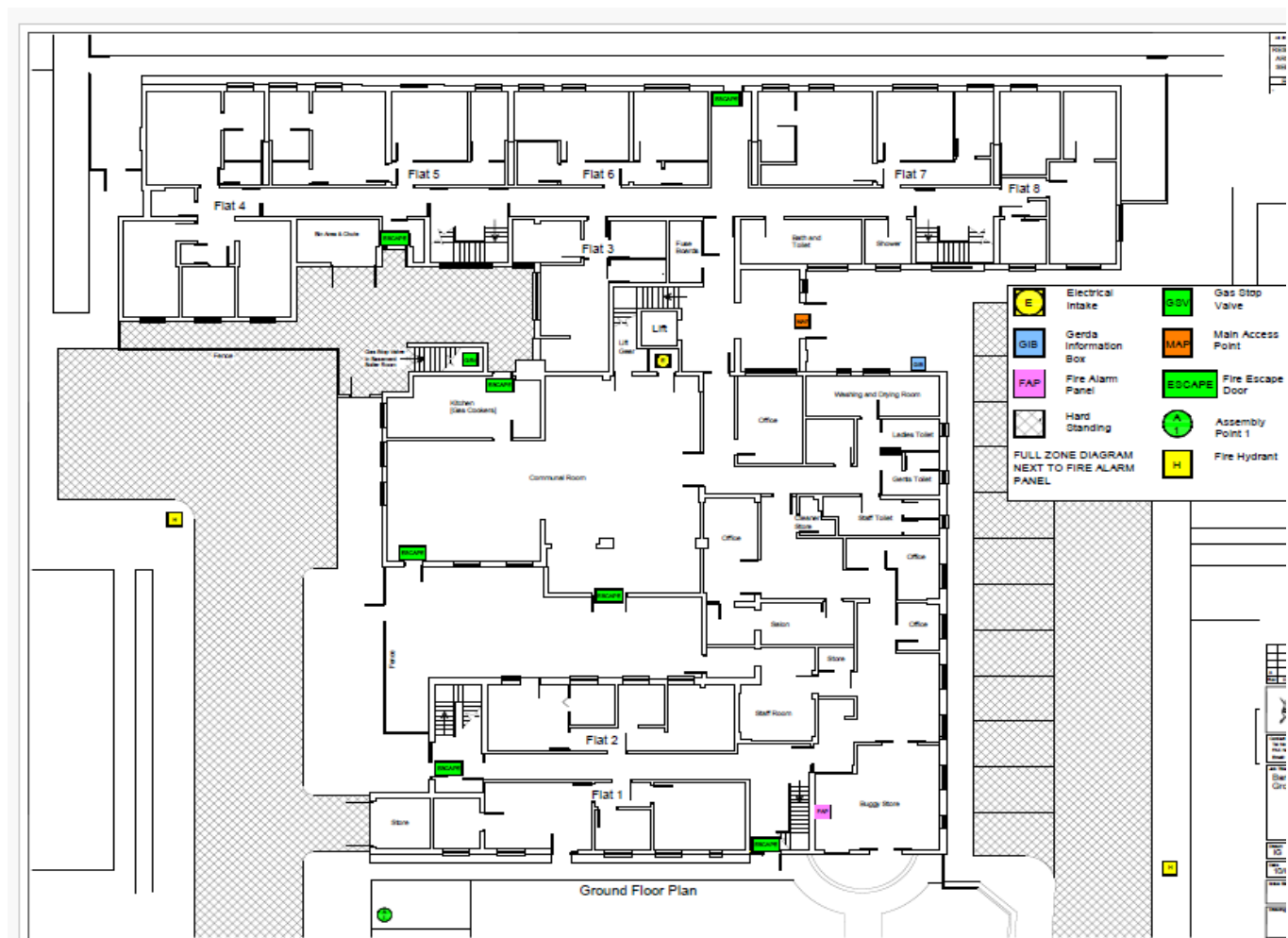


Figure 3: First Floor Plan



Figure 4: Second Floor Plan



The survey of the building was carried out on 18th February 2026, with daily high temperature of 6°C and low of -1°C. The survey was non-invasive, excluding any intrusive assessments that would involve a detailed examination of the condition of the installed plant and equipment.

2.2 Building Fabric

The U-value quantifies the ease with which heat can pass through a material, such as a wall or window. Lower U-values signify better insulation and heat retention within a building, while higher U-values indicate greater heat loss. No architectural details were provided, so the U-values have been assumed to meet the relevant building regulations at the time of construction.

The building was originally constructed in 1960 but was renovated extensively in 1999. During the renovation, the building's original glazing was replaced with PVC double glazing.

The exterior wall was measured at 300mm and is a block and brickwork cavity wall. It is not known if the cavity is filled but given the age of the building (1960) and the lack of marks on the existing exterior brickwork it is currently assumed it is unfilled.

The roof has a slight pitch with a loft space that is insulated. There is an estimated 150mm of loft insulation that covers the entire loft space.

Figure 5: 150mm of Loft Insulation



Figure 6: Anytown House Elevation, Building Fabric & Glazing





Table 2: Assumed U-Values of different construction elements of the based historic U-values and the building regulations at the time of 1960 & 1999

Construction element	Construction type	U-Value (W/m ² K)
Ground floor	Concrete	0.35
External walls	Brick and blockwork with unfilled cavity	1.50
Windows (D.G PVC) (1999)	Double glazed PVC frame	2.40
Roof (150mm Insulation)	Pitched	0.30
Exterior doors (PVC) (1999)	-	3.00

2.3 Lighting

The lighting was observed to have a mixture of LED and fluorescent lighting installed. They were predominantly operated by manual switches.

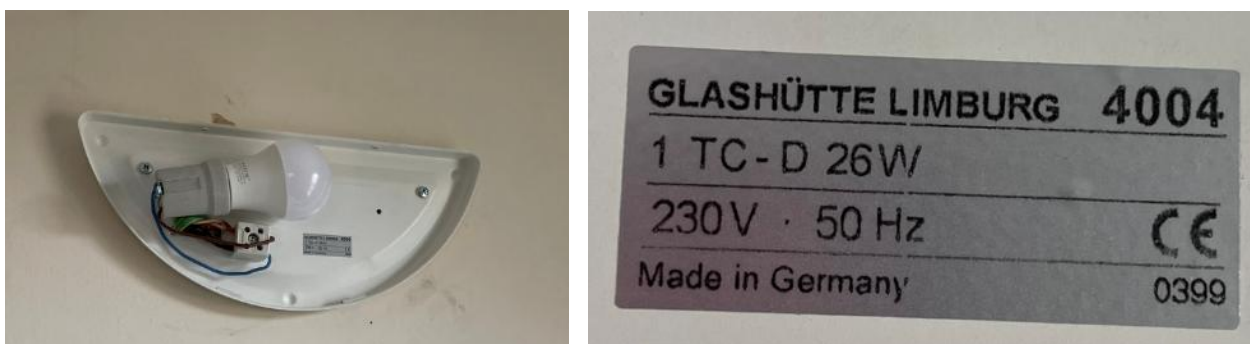
The table below shows the number and type of existing lighting that could be upgraded to LED. The existing lighting that is already LED should be retained.

It was stated that the corridor lighting was on 24/7, and a key was required to turn them off and on in sections of the building. This was primarily a safety feature for the elderly tenants that occupy the building. Installing PIR sensors would prevent unnecessary lighting and could significantly reduce energy consumption of the lighting in this area.

Table 3 Non-LED Lighting Fixture Inventory

Location	Lighting Fixture	Count
	Uplighter with twin DULUX L 2x36W/840 lamps	7
	1163mm (4ft) T5 twin 2x28W batten	1
	1500mm (5ft) T8 single 58W batten	2
	1800mm (6ft) T8 single 70W batten	3
	2D 28W surface mounted bulkhead	5
	CFL 26W	41
Total		59

Figure 7: Retrofitted Wall Hung Corridor Light Fitting with LED & Original CFL Nameplate



The corridor was lit by a number of wall mounted fixtures. It was not possible to identify the specific lamp in each fixture, but it was likely a mixture of the LED bulb pictured and the original 26W CFLs. It was not practical to investigate during the survey what percentage of the light fixtures in the corridor were original. For the purposes of the report, it has been assumed that 35% of the corridor light fixtures were the original CFLs.

2.4 Heating and Hot Water Services

2.4.1 Heating plant

Table 4: Table summarising existing heating plant in the building

Heating/cooling Element	Fuel Type	Capacity	Gross efficiency (%)	Year Installed
Space Heating				
1 no. Potterton Commercial NXR3/37	Gas	210 kW (heat)	88.9	2000
1 no. Potterton Commercial NXR3i/7	Gas	230 kW (heat)	90.9	2015
DHW				
Lapesa GX500R/PSS (Connected to STOKVIS Plate Heat Exchanger of unknown size)	Indirect gas	484 litres 166 kW	Served via boilers	2021
Split Units				
Mitsubishi Electric MUZ-HR35VF (Serving office at edge of building)	Electricity	3.4 kW (Cooling) 3.6 kW (Heating)	280% (Cooling) 369% (Heating)	2023
Midea MA-12N8D0-XO	Electricity	3.5 kW (Cooling) 3.8 kW (Heating)	Unknown	Unknown

A Zip Hydropoint electric water heater was found in the community kitchen.

There were also two split units found across the building. They are fuelled by electricity and are already decarbonised; it is recommended that they are retained and replaced as and when they fail. The two split units

provide two of the offices in the building with cooling. They can provide heating as well, but staff reported that they were mainly used for cooling.

This was even the case during the site visit, despite it being February. This highlighted the control issues at the building given the main heating was also on.

Figure 8: 1no. Potterton Commercial NXR3/37 (2000)



Figure 9: 1no. Potterton Commercial NXR3i/7 (2015)

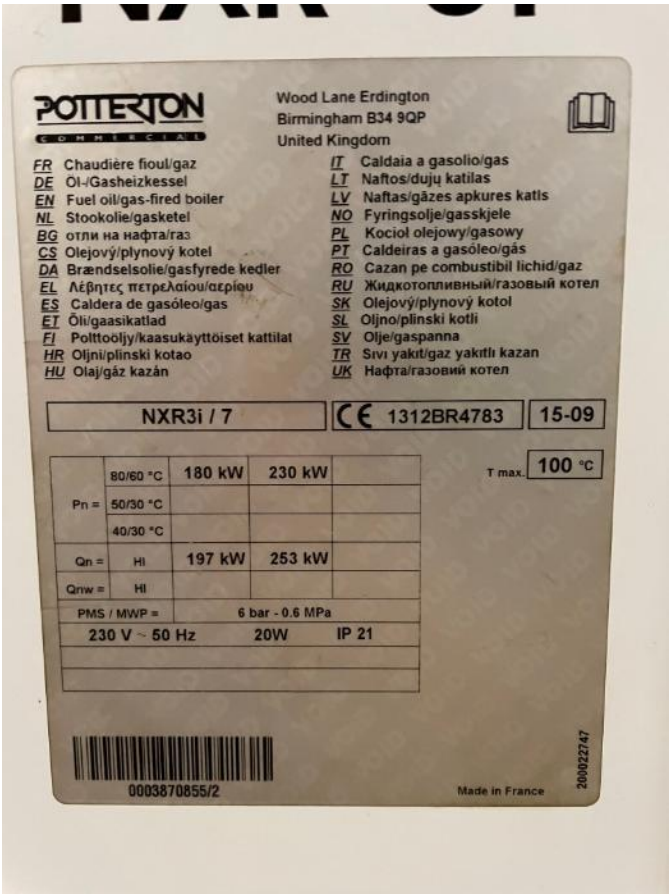
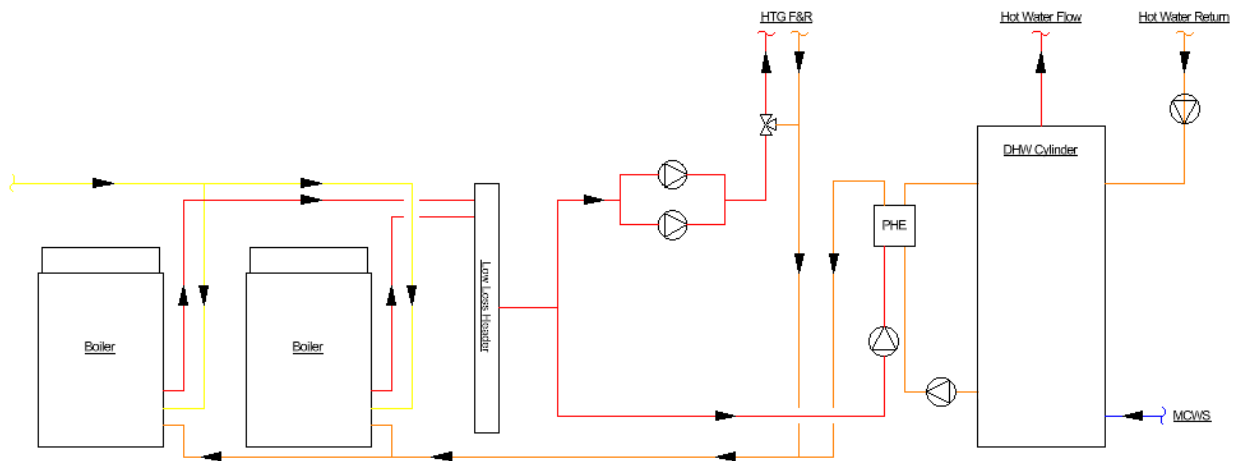


Figure 10: 2no. Split Units



Figure 11: Existing Heating Schematic



2.4.2 Heating distribution

The main boilers (with a total heating capacity of 440 kW) served a low loss header that provided LPHW to 2no. secondary circuits. These were the following:

- VT Heating circuit. Two single head pumps in parallel operation provide LPHW to radiators and fan convectors throughout the building. The circuit splits into 3 in the plant room (assumed 1 per floor).
- Circuit to feed plate heat exchanger connected to the DHW cylinder.

Due to the single heating circuit, there is insufficient control across the building due to the lack of zoning.

The LPHW is distributed across the building to LST radiators, the majority had TRVs (Thermostatic Radiator Valve). There were also fan convectors with TRVs but these were only located in stairwells.

Figure 12: Radiators and Fan Convectors



2.4.3 Domestic hot water

The Domestic Hot Water (DHW) across the building is served via the Lapesa GX500R/PSS indirect water cylinder (Connected to STOKVIS Plate Heat Exchanger of unknown size). It was served by the main boilers and had a DHW return pump. It serves communal areas as well as individual flats.

The example flat that was seen during the site survey had an electric shower installed. Staff have since clarified that the flats have a mixture of electric showers and thermostatic showers fed from the main DHW cylinder. The breakdown of the numbers was not provided.

Figure 13: Electric shower in one of the Flats



2.4.4 Automatic Controls and Control Issues

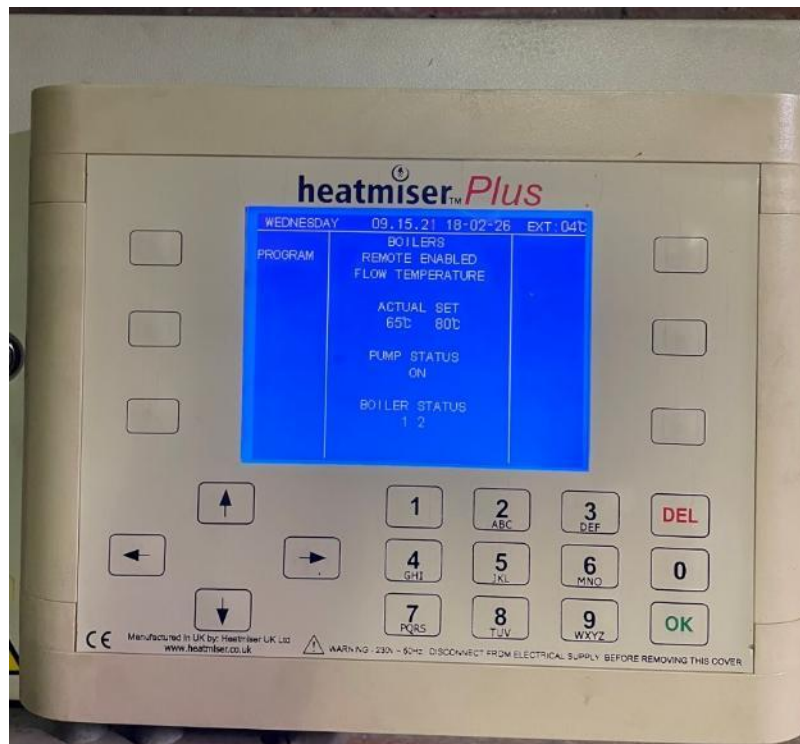
In the central heating plant room, a Satchwell control panel has been installed and linked to a Heatmiser Plus controller, which appears to have been fitted during the 1999 refurbishment. The controller was not investigated as part of the survey; however, given the heating circuit arrangement—consisting of a single secondary circuit that later splits—the system provides limited controllability.

The Heatmiser Plus offers basic heating and timing control for the circuit, but the lack of heat zoning across the building remains a significant constraint. This has contributed to ongoing operational issues. For example, staff noted during the survey that certain areas of the building are prone to overheating. Tenants have frequently complained of the building being too cold, particularly around the perimeter where heat loss through the fabric is greater. To compensate, the building's heating setpoint has been raised to 24°C to achieve acceptable temperatures at the colder edges. It was not confirmed what the nighttime set back temperature was programmed to.

However, because the entire building is heated from a single circuit, this elevated setpoint causes overheating in more central areas. Staff also reported that the building becomes excessively hot during summer, leading to the installation of split cooling units in both staff offices.

As a result, the building frequently experiences simultaneous heating and cooling. During the February site visit, with outdoor temperatures at 4°C, the heating system was active while the office cooling units were also in use.

Figure 14: Heatmiser Plus Controller



2.5 Kitchens

Each flat is fitted with a small kitchen for residents to remain independent. These kitchens only have electric appliances fitted. In addition, there is a main communal kitchen located next to the main communal space on the ground floor.

This kitchen used to have a gas connection but has since been disconnected. Electrical kitchen appliances have been installed as an alternative as they are safer.

Figure 15: Electrical Kitchen Equipment, Flat (Left), Communal (Right)



2.6 Incoming Gas Connection

The main gas incomer at the site is located at basement level in the plantroom. The main site meter is located there and was installed in 2011. It has a Elster IN-Z6 pulse output module attached which enables AMR (Automated Meter Readings) when working in conjunction with a data logger. It is assumed that it is an AMR meter.

Table 5: Installed Gas Meter

Area served	Meter Number	MPRN	Location
Whole Site	MO65K0521011D6	17958503	Basement Plant Room



2.7 Incoming Electrical Supplies

The building has a main landlord supply and has sub metered all of the 32 flats on 100 Amp single phase meters.

Table 6: *Installed Electrical Meter*

Area served	Meter Number	MPAN	Location	Maximum Demand (kW)
Whole Site	E17ML09897	17958503	Electrical Incomer Cupboard	12.1

The main meter is 3-phase, 400 Volt and assumed to be a 100 Amp supply, although it was not labelled. The main incoming supply is assumed to be 100 Amp rated given it has a direct connection to the 100 Amp main meter and is not CT metered.

Staff mentioned that the tenants in the flats are billed on their specific electricity consumption. It is unknown how they bill the tenants for the gas consumption.

Figure 16: Electrical Incomer and Meter



2.8 Renewable Technologies

There are two split units that are installed in the building to serve offices with cooling. They can also provide heating in the winter should they need it. They provide cooling and heating at high efficiencies and are supplied by electricity.

Figure 17: Mitsubishi Split Unit (Air Conditioner)



3 Energy Saving & Decarbonisation Proposals

3.1 Options Appraisal and Discounted Technologies

3.1.1 Solar Thermal

While a solar thermal array installed on the roof could contribute to domestic hot water generation, this option has been excluded as the space would be better utilised by solar photovoltaic panels. Another factor that was considered is that a portion of some of the existing flats have electric showers already installed.

If there was a lower electricity demand at the site, it could have been a good option to consider as a smaller PV system could offer roof space for solar thermal panels.

3.1.2 Ground Source Heat Pumps (Space Heating)

Ground source heat pumps (GSHPs) can provide a more efficient alternative to air source heat pumps (ASHPs) and have a steady year-round efficiency (Coefficient of Performance – COP) of approximately 4.0. This means that typically for every 1.0 kW of electricity used, 4.0 kW of heat is generated. The efficiency of the air source heat pumps varies over the year with the outside air temperature but could have a seasonal COP (SCOP) of 3.2.

However, the capital cost of GSHPs can be significantly greater relative to ASHPs due to the extensive groundworks associated with the installation of the underground piping, known as the ground loop, a crucial component of the GSHP system.

GSHPs can operate with two types of ground pipework arrays: horizontal pipework installation or vertical borehole installation.

As a general guideline, a borehole in loose stones produces approximately 20 W of heat per meter depth (known as the heat/energy extraction rate), while one in granite has an extraction rate of 55 to 70 W/m. For an installation with multiple boreholes, a minimum spacing of 12 m between borehole centres is typically required. However, this spacing can vary depending on whether the system is designed for heat extraction and rejection (i.e., providing heating and cooling).

The site could have available space where boreholes could be viable to be installed but given the significant capital expense compared to alternative low carbon heating systems, it has been discounted at this stage.

3.1.3 Building Fabric – External Wall and Loft Insulation

The building was originally constructed in 1960 but was later refurbished in 2000, with new double glazing installed. There are no planning documents that indicate that the external walls cavity has been filled. In addition, there are no markings on the walls to indicate it has retrospectively been filled.

Due to this, it will be more cost beneficial to install cavity wall insulation rather than the more expensive external wall insulation when considering the energy savings that each solution would offer.

In addition, during the site survey it was discovered that the building has a decent amount of loft insulation installed.

Figure 18: Existing Loft Insulation (~150mm)



The table below shows different levels of insulations U-values. The first 100mm of insulation can improve the U-value by 83%. The next 100mm only improves the U-value by an additional 8%. This means that adding to existing loft insulation does not result in a significant improvement in the thermal properties. As such, it is recommended that the existing loft insulation be retained and adding any additional insulation be discounted.

Table 7: Loft Insulation Thickness to U-value relationship

Insulation thickness at joists (mm)	Assumed roof U-value (W/m ² K)	Improvement from no insulation
None	2.3	
12	1.5	35%
25	1	57%
50	0.68	70%
75	0.5	78%
100	0.4	83%
150	0.3	87%
200	0.21	91%
250	0.17	93%
270	0.16	93%
300	0.14	94%
350	0.12	95%
>= 400	0.11	95%

3.1.4 District Heating

Currently, there are four district heat networks planned to be developed in York and the surrounding area according to the governments heat network database. (Gov.UK)¹ However, none of these heat networks are in close proximity to the building.

It is unlikely that in the near future that the building will be able to connect up to a district heat network. None are listed as in development.

3.2 Building Fabric: Double Glazing & Cavity Wall Insulation

To improve the buildings fabric, it is proposed to:

- Install new double glazing to replace the existing glazing across the building.
- Install Cavity Wall Insulation within the vacant cavity

Table 8: Improved U-Values across the building

Construction element	Construction type	U-Value (W/m ² K)	Proposed U-Value (W/m ² K)
Ground floor	Concrete	0.35	0.35
External walls	Brick and blockwork with unfilled cavity	1.50	0.38
Windows (D.G PVC) (1999)	Double glazed PVC frame	2.40	1.60
Roof (150mm Insulation)	Pitched	0.30	0.30
Exterior doors (PVC) (1999)	-	3.00	3.00

NOTE: Items without retrofit U-values are not recommended for improvement and should be retained unless there are existing defects that need addressing.

While installing the new double glazing will improve the building's fabric and energy efficiency, it is not the most cost effective energy saving measure. It is advised to undertake detailed investigations to confirm the thermal performance of the existing building fabric, complete thermal modelling to estimate the actual heat loss improvement from fabric improvement proposals, obtain quotes from multiple sources and conduct a cost-benefit analysis.

¹ www.data.gov.uk/dataset/8a5139b3-e49b-47bd-abba-d0199b624d8a/heat-networks-planning-database

3.2.1.1 Fabric Improvements Cost Breakdown

The total associated budgetary cost for the proposed fabric improvements is **£308,600** and is broken down as follows:

Table 9: Fabric Cost Breakdown

Item	Description	Cost
1	Preliminaries	£5,800
2	Double Glazing	£190,800
3	Cavity Wall Insulation & 'Conservatory roofing'	£59,300
4	Scaffolding	£38,000
5	Contingency Sum	£14,700
6	Total	£308,600

The existing cavity wall is assumed to be uninsulated. It is recommended to confirm the condition of the cavity by conducting a borescope test to assess its suitability for retrofitting insulation.

The 'conservatory roofing' refers to the replacement of the glazed extension to the common area pictured below.

Figure 19: Glazed extension to the building



3.3 Proposed Building Loads

At this stage, the Salix Heating Load V2 calculation tool has been employed instead of conducting in-depth thermal modelling to estimate the required space heating heat demand within the building. This calculation relies on assumptions regarding the U-values of building fabric elements, as outlined in section 2.2, along with estimates of their associated surface areas.

The Table below indicates the current installed heating capacity, alongside the calculated peak heat loss (kW). The total useful floor area of the building, as per the measured floor plans is approximately 2,475m².

Table 10: Peak Heat Loss Summary

Existing Heat Capacity (Boilers) (kW)	Existing W/m2	Existing DHW Capacity (kW)	Calculated Existing Peak Heat Loss (kW)	Calculated Existing W/m2	Calculated Post Fabric Improvements Peak Heat Loss (kW)	Proposed New Heating W/m2	Approximate Calculation of DHW load (kW)
440*	177	166	172	70	120	48.5	90

*The total 440 kW capacity of the boilers provides the supply for the 166kW PHE for DHW as well as space heating. Allows for 274 kW for space heating if the plate heat exchanger demands the full 166kW.

The total calculated peak heat loss in the building after the proposed fabric improvements is 120 kW. This does not include the load for the DHW. The approximate calculation for the DHW load is based upon the building's use, the number of flats, showers, baths and wash hand basins. This calculation is also corroborated by using the DHW load section of the Salix Peak Heat Loss tool. It is important to highlight that this is an estimation based upon a number of assumptions (e.g. split of flats with electric showers). It is highly recommended to monitor DHW consumption to gain a more comprehensive understanding of the DHW usage profile and load.

The total load after fabric improvements is 210 kW

- Space Heating Peak Heat Loss: 120 kW
- Approximate calculation of DHW Demand: 90 kW
- **120 kW + 90 kW = 210 kW**

Oversizing heat-generating equipment is a common issue in engineering design, leading to excessive system cycling — frequent equipment start and stop — which lowers system efficiencies. Therefore, detailed thermal modelling is highly recommended during the detailed design stage, considering factors such as the building envelope, indoor comfort setpoints, occupancy patterns, and local climate conditions. This would confirm the building's design heat loads and guide in determining the optimal size and configuration for the heating system, ensuring optimal performance, energy efficiency and occupant comfort.

3.4 Plant Replacement

3.4.1 Air Source Heat Pumps

To fully transition from fossil fuel plant and to align with the Council's goal of achieving their 2030 net-zero carbon emission targets, the currently installed gas fired boilers that provide the site with space heating and DHW would need to be decommissioned, disconnected, and removed from the site. In its place, we propose:

- Installing an Air Source Heat Pump (ASHP) system to produce Low-Pressure Hot Water (LPHW) to meet space heating requirements. This would require replacing the existing heating distribution and could enable the installation of multiple heating circuits and zones.
- Installing a dedicated DHW heat pump and electric boiler to work in combination produce water at temperatures suitable for DHW.

Currently, there is only one secondary heating circuit that serves the entire building and all the flats. As detailed in Section 2.4.4 this means that there is limited potential when it comes to controls that can be implemented and that currently a lot of energy is wasted.

By installing an ASHP that operates at lower flow temperatures, it will mean that replacing the older heating distribution pipework and radiators is required. This is due to the fact that they were designed to operate at higher flow temperatures and will likely not be able to provide adequate heating to the building when lower temperature water from ASHPs are passed through it.

However, in replacing the old distribution pipework and radiators, it offers an opportunity to install more secondary circuits and more sophisticated control systems to better heat the building and lower the significant waste that currently occurs. It would also provide the opportunity to install heat metering across the building, to enable more accurate billing.

For optimal performance, ASHP's require unrestricted airflow around the unit. Consequently, the current enclosed plant room is not ideal for ASHP installation. Therefore, we recommend installing the ASHP system externally on a level surface and providing a secure perimeter for access control and protection against vandalism.

The locations are presumed to offer good airflow, essential for the optimal performance of the ASHP unit. The final location of the proposed installation will be determined during the detailed design stage, considering existing infrastructure, such as mains water supply and incoming electrical supply, *spatial* requirements of the installation, and optimisation of associated costs of distribution pipework to the plant rooms.

Figure 20: Proposed Location of ASHP Compound (Blue Hatch)

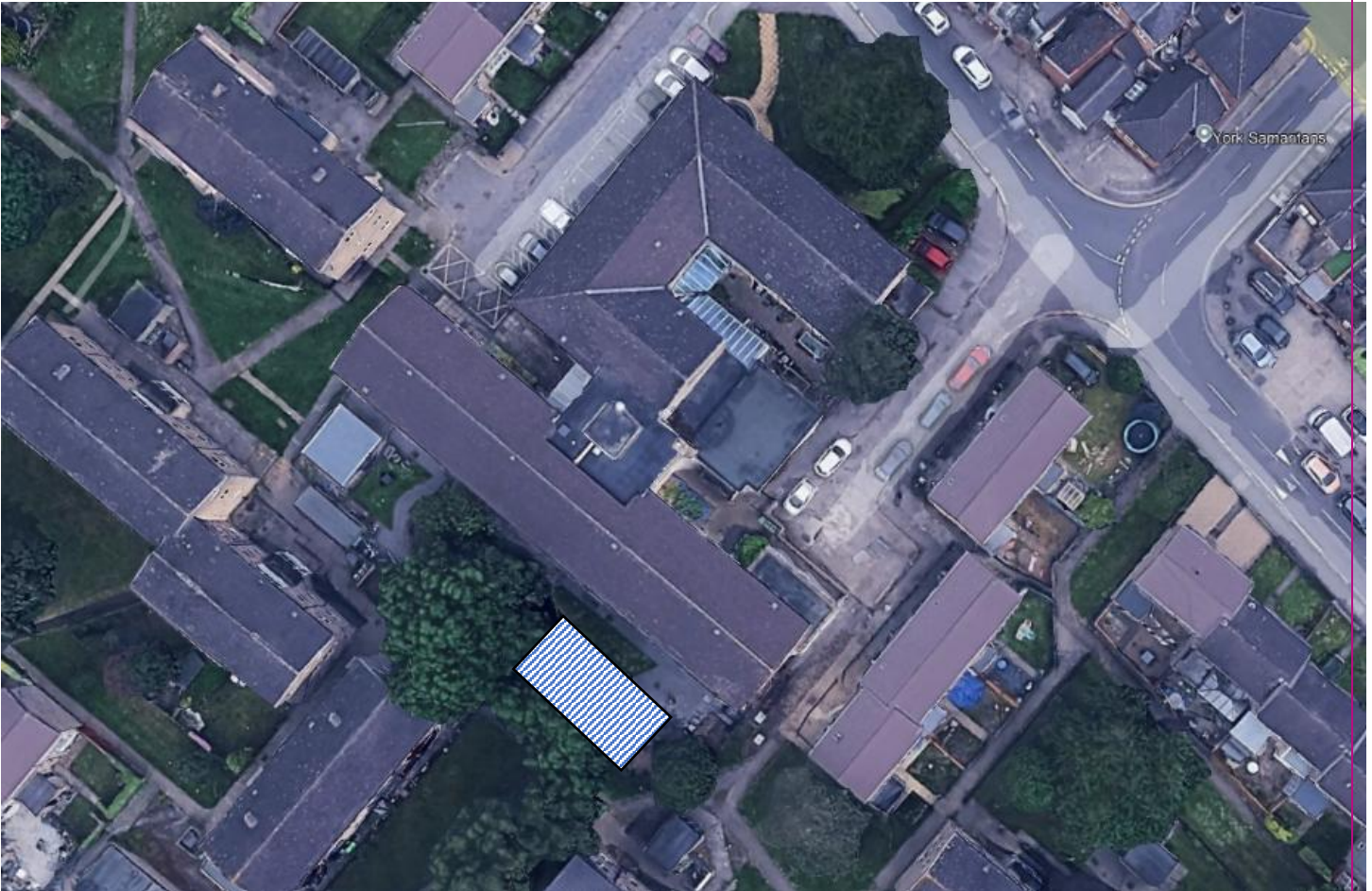
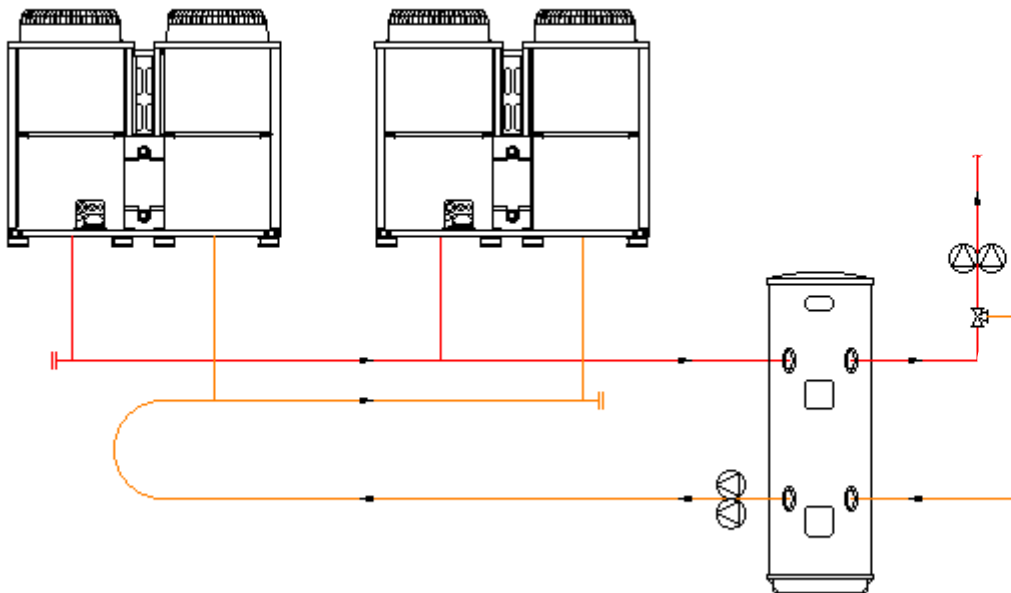


Table 11: Proposed Space Heating & DHW Equipment

Space Heating or DHW	Equipment	Total Proposed Capacity (kW)	SCOP	Flow temperature (°C)	Heat Emitter Replacement
Space Heating	2 x Daikin EWYT090CZNBA2	137	4.00	35	Yes
Domestic Hot Water	1 x Daikin EWYT090CZNBA2	60	2.89 2.51 (Combined with Elec Boiler)	55	N/A
Domestic Hot Water	Adveco Ardent S80	80	1.00	70	N/A

Figure 21: Typical Proposed ASHP Space Heating Schematic



The site's DHW is currently provided via the plate heat exchanger (fed by gas boilers) on the existing DHW cylinder. The plate heat exchanger is rated to 166kW based on the datasheet of the model but is unlikely that the building requires this capacity.

Due to a lack of submetering, it is not possible to confirm the exact requirements of DHW in the building. However, based on the number of flats and through approximated calculations based on the Salix Peak Heating Load tool, it is assumed that a capacity of 90kW will suffice.

During the detailed design stage, the DHW consumption should be metered and recorded to gain a better understanding of the current demand and usage patterns. The peak demand is likely to be significantly higher than the baseload.

It is proposed that a dedicated ASHP for DHW production be installed to work in conjunction with an electric boiler, which will 'top up' the temperature supplied by the ASHP to 65°C which is a temperature suitable for DHW storage. The ASHP would feed a pre-heat vessel which in turn will feed 2no. indirect cylinders. The existing plate heat exchanger and indirect cylinder can be retained for use in this system, alongside an additional new indirect cylinder. The electric boiler would supply each of these indirect cylinders in parallel.

By adopting this approach, the high-cost installation of a high-temperature ASHP can be avoided, while still achieving efficient DHW production. The preheat vessels allow for the utilisation of LPHW to raise the temperature of incoming water, minimising the energy required for DHW heating. The electric boilers provide a supplementary heating source to ensure that the DHW temperature meets the desired level in the building. The additional storage also ensures that the peak DHW demand can be met and allows the installation of a smaller ASHP to lower the cost.

It is proposed that the AHSP would produce a flow temperature of 55°C and the existing DHW distribution pipework will be retained across the site.

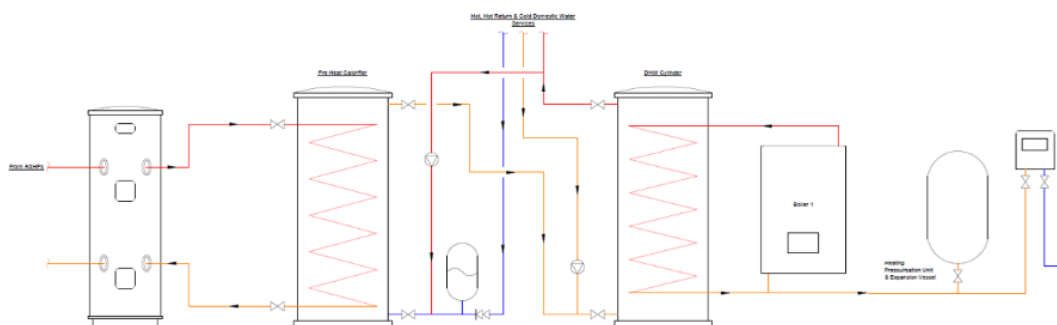
By utilising the ASHPs to preheat the water entering the indirect cylinder, the efficiency of the overall DHW system can be increased to:

- 251% when the ASHP is run at 55°C;
- 220% when the ASHP is run at 35°C.

Due to this, it is proposed to run the DHW ASHP at 55°C as it offers better efficiencies when working with the electric boiler.

To ensure optimal system performance and efficiency, avoiding oversizing the DHW storage cylinder is crucial. This helps prevent extensive re-heat times which can negatively impact energy consumption. Proper sizing of DHW equipment should be based on a comprehensive understanding of the DHW usage profile, considering factors such as daily demands, peak hot water flow requirements and the time period between peak demands. This should be investigated during the detailed design stage.

Figure 22: Proposed DHW Schematic



3.4.1.1 Budget Cost Estimate

The budgetary estimate for implementing the proposed ASHP heating system and dedicated DHW ASHP and electric boiler is approximately **£675,550** and is broken down as:

Table 12: ASHP System for Space Heating and DHW Cost

Item	Description	Costs
1	Preliminaries	£10,200
2	Space Heating ASHP and Equipment	
2a	Air Source Heat Pump	£65,700
2b	Construction of External Compound	£24,000
2c	Heating Secondary Pump(s)	£14,700

2e	Pressurisation Unit(s) & Expansion Vessel(s)	£1,700
2f	Plant Room Pipework, Valves, & Ancillaries	£13,600
2g	Buffer Vessel	£1,500
2h	Automatic Controls	£37,200
2i	Electrical Works	£10,200
2j	Interconnecting Pipework (ASHP to Plant Room)	£1,600
2k	Glycol Antifreeze	£1,600
2l	Builders' Work	£10,300
3	DHW and Equipment	
3a	Preheat Vessel	£1,700
3b	DHW Pump(s)	£1,500
3c	Air Source Heat Pump for DHW	£36,200
3d	New DHW indirect cylinder	£1,700
3e	Electric Boiler	£7,900
3f	DHW Return Pump	£250
4	HEATING DISTRIBUTION	
4a	Removal of Existing Building Plant & Equipment	£5,000
4b	Heat Emitters	£111,400
4c	Distribution Pipework	£89,100
4d	Builders' Work	£17,400
4e	BMS, Flow Balancing, ASHPs	£1,500
5	Upgrading Main Incoming Electrical Supply	£50,000
6a	Testing & Commissioning	£500
6b	Demonstration & Training	£500
6c	Record Information	£500
7	Contingency Sum	£77,700
8	Works Budget Total	£595,150
9a	Design Fees	£53,600
9b	Project Management Fees	£26,800
10	Project Budget Total	£675,550

The costs outlined above are exclusive of VAT and are based on the assumption that a mechanical contractor will be appointed as the Principal Contractor, with specialist work elements being subcontracted. These costs do not account for overhead; profit associated with further contracting or framework fees.

This estimate is based on the assumption that the existing DHW distribution pipework is retained and is suitable for the operation of the proposed systems.

3.4.2 Boiler Like for Like Replacement Cost Breakdown

The table below shows a comparable estimate to replace the space heating boilers like-for-like:

Table 13: Gas Fired Boiler Like for Like Replacement

Item	Estimated Cost
Removal of Existing Equipment	£1,000
Main Equipment	£21,800
Plinth, Pipework Connections, Insulation	£2,200
Installation	£5,500
Commission	£1,000
Total	£31,500

3.4.3 Electrical Capacity

When incorporating electrically powered low-carbon heating systems in a building, it is crucial to acknowledge the increased electrical load. Thus, evaluating the site's current electrical capacity and determining any additional capacity requirements is essential.

The building has a main landlord supply and has sub metered all of the 32 flats on 100 Amp single phase meters.

The main meter is 3-phase, 400 Volt and assumed to be a 100 Amp supply, although it was not labelled. The main incoming supply is assumed to be 100 Amp rated given it has a direct connection to the 100 Amp main meter and is not CT metered.

Staff mentioned that the tenants in the flats are billed on their specific electricity consumption. It is unknown how they bill the tenants for the gas consumption.

Table 14: Electrical Capacity Requirements

Maximum Import Capacity (kVA)	Current Max Demand (kVA)	Space Heating ASHP Electrical Demand (kVA)	DHW ASHP & Electric Boiler Electric Demand (kVA)	Resultant Spare Capacity (kW)
69	13	115	112	-161

The maximum demand was taken from the main meter in the absence of half-hourly electrical data provided by the Council. The resultant spare capacity after the proposed low carbon electrically powered equipment is installed is

approximately **-161 kW**. The maximum import capacity was taken from cycling through the settings on the main meter. It is not clear for what period of time the maximum demand is recorded from.

It is recommended that the Council liaise with the DNO ahead of 2030 when the proposed electrical equipment is installed to ascertain if this is possible or if they will have to fund electrical infrastructure upgrades.

The installation of the new low carbon heating equipment requires the site to upgrade the electrical capacity. The costs of this are often unknown and can be significant. We have associated a cost of **£50,000** for these upgrades at this stage.

This is a high-risk item as the cost to upgrade the electrical infrastructure can be significant and vary significantly.

Electrically powered low-carbon heat sources such as heat pumps typically contain variable speed drives (VSDs), which could contribute to harmonic disturbances within the electricity network. Where issues persist, it could lead to a decision by the network operator to disconnect the supply to the site until it is rectified.

Therefore, we recommend that a harmonics assessment be carried out at the site in line with EREC G5/5, which would provide evidence of compliance with the harmonic's limits set by the network operator. We have also allowed for the cost of harmonic filtration equipment, if required, within the contingency in the ASHP cost table. The applicable cost would be confirmed during the detailed design stage following equipment selection.

3.5 Lighting Replacement

3.5.1 Lighting Installation

It is recommended to replace all existing fluorescent lighting with more energy efficient LED luminaires. The quantity of fluorescent lighting is shown in **Section 2.3**.

Incorporating lighting control systems with absence detection and daylight dimming features can contribute to additional energy and carbon emission reductions. The extent of these savings could vary, depending on the existing and proposed configurations. For this case, we have assumed a saving of 15%, considering that sensors would be fitted to 10% of the new LED light fixtures. It is important to note that implementing comprehensive lighting control across all areas could necessitate significant rewiring of the lighting power and switch circuits.

An area of the building that could significantly benefit is the corridors. There are no easily accessible manual wall switches to the lights and there are no PIR sensors. Staff reported that they are on 24/7 as a safety feature. Installing PIR sensors could help save significant energy.

The energy savings from implementing LED luminaires have been approximated based on the methodology of replacing the existing light fittings with LED alternatives based on luminance output. However, this is not ideal as it could result in mismatched lux levels compared to recommendations.

Consequently, we recommend considering conducting a comprehensive lighting design study. This would aim to model and implement lighting levels aligned with recommended guidelines. Such an approach can yield multiple advantages, including potential energy and cost savings, the assurance of appropriate lighting levels, optimal distribution of fixtures and a comprehensive assessment of the retrofit's impact on the environment and users. Additionally, the study can assist in identifying the most suitable LED lights and their optimal installation orientations to maximise benefits and assess any potential limitations or issues related to the existing electrical system.

To optimise visual perception for all users, the lighting design will consider factors such as recommended colour index, lighting levels and avoidance of light spill and glare. Further energy savings could be realised across the entire facility if all utilised spaces are matched to the recommended lux levels with the implementation of lighting controls.

All new lighting would be designed to meet the requirements of the applicable CIBSE Lighting Guide.

3.5.2 Budget Cost Estimate

The budgetary estimate for replacing fluorescent lighting with LED fittings is as follows:

Table 15: Lighting Replacement Cost Breakdown

Item	Description	Cost
1	Prelims	£500
2a	Access for works	£100
2b	Installation	£2,500
2c	Removal and Disposal	£700
3a	Lighting	£4,000
3b	Controls	£1,000
3c	Emergency	£900
4a	Record Information	£500
4b	Testing & Commissioning	£200
5	Contingency costs	£1,100
6	Works Budget Total	£11,500
7a	Design and Engineering Fee	£1,200
7b	Project Management Fee	£600
8	Total Project Costs	£13,300

The cost estimate includes all non-LED luminaires identified during the site survey.

3.6 Solar Photovoltaics

3.6.1 System Installation

The building has available roof space which could be a good location for the installation of solar panels for on-site renewable energy generation. At the detailed design stage, a survey will need to be carried out to understand if the selected roofs have the capacity to support an array of this size and weight.

A desktop study was carried out which involved 3D modelling of the site to evaluate the suitability of the space for solar panel installation and to identify the optimal placement of the PV modules to maximise energy yield. The heights of surrounding objects have been estimated utilising Google Earth, these measurements alongside the buildings' geometry were used to produce a shading analysis. However, it should be noted that a higher degree of precision in the PV simulation could be achieved through detailed and exact measurements.

The modelling was based on monthly electricity consumption data from the April 2024 to February 2025 for Meter No: E17ML09897.

Figure 23 Proposed 32 kWp PV System

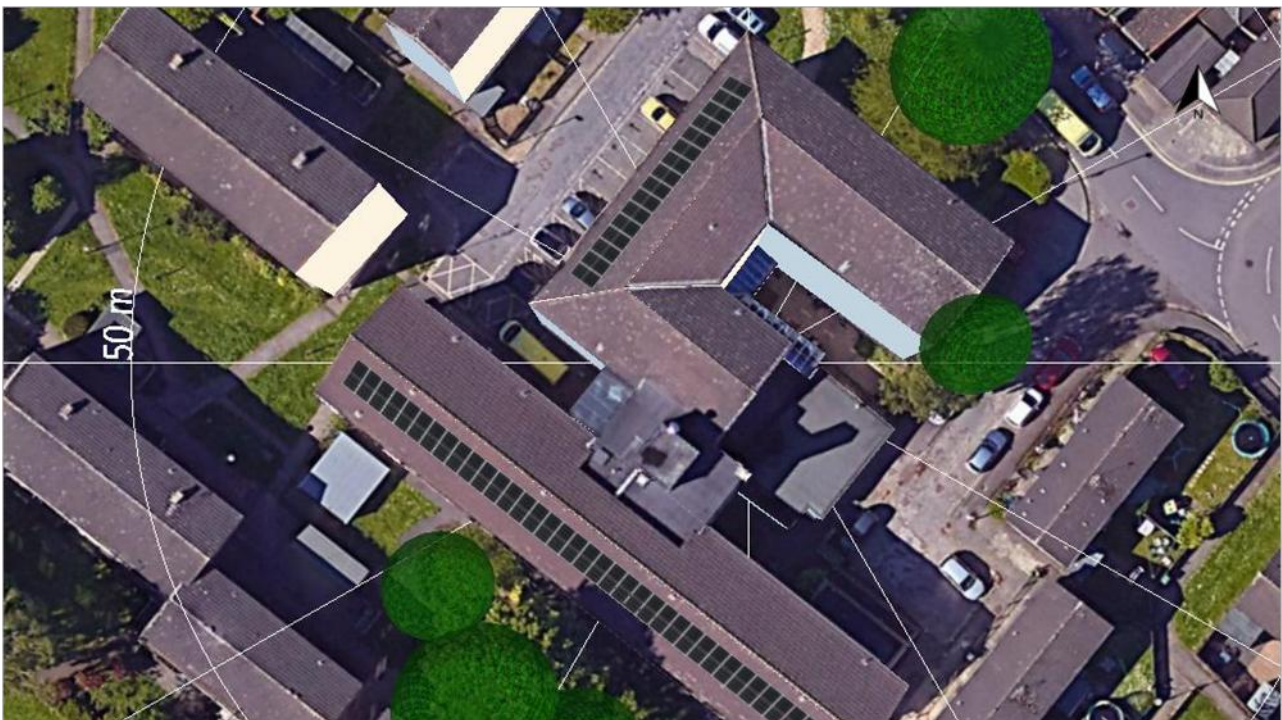


Figure 23 visualises the proposed PV installation on the building. Additional investigations involving the structural integrity of the roof with respect to the additional weight of the PV installation and wind loading would be required and are subject to product manufacturer and installation contractor recommendations. PV design options would be investigated during the detailed design stage and may have an effect on the budgetary estimate provided in **Table 17**.

The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Table 16: 32 kWp PV System Performance

PV Generator Output	32.40	kWp
Number of Panels	54	
Spec. Annual Yield	792.01	kWh/kWp
Performance Ratio (PR)	81.04	%

Yield Reduction due to Shading	13.8	%
PV Generator Energy (AC grid)	25,664	kWh/Year
Own Consumption	17,400	kWh/Year
Clipping at Feed-in Point	0	kWh/Year
Grid Export	8,263	kWh/Year
Own Power Consumption	67.8	%
Level of Self-sufficiency	18.6	%

The charts below show the proportion of the PV generated electricity to the electrical consumption of the building.

Figure 24: PV System Output Split by End Use

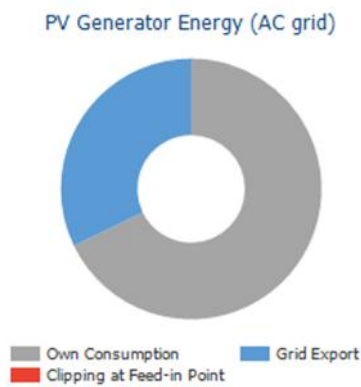


Figure 25: Building Consumption by Energy Source

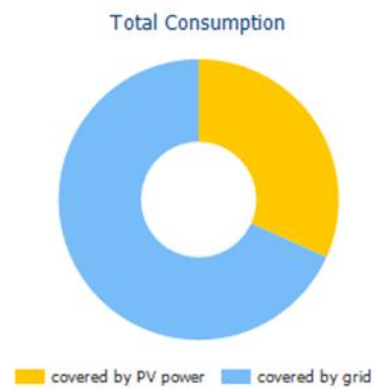
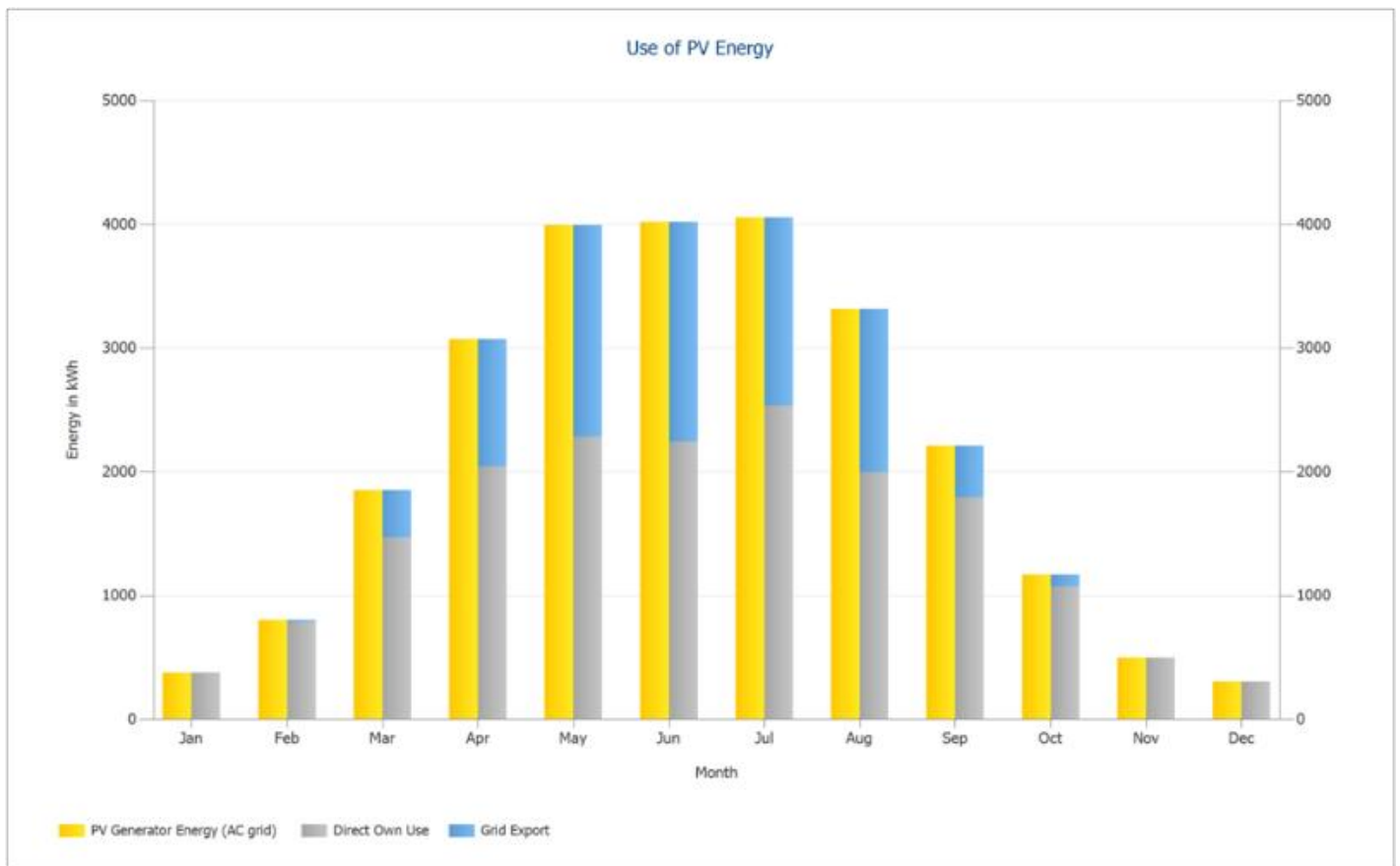


Figure 26: PV Generator Output Allocation by Month



3.6.2 Budget Cost Estimate

The associated budgetary cost for the proposed 32 kWp PV installation is **£41,500** and is broken down as follows:

Table 17: 32 kWp PV System Cost Breakdown

Item	Description	Cost
1	Preliminaries	£1,700
2a	Photovoltaic Array	£6,200
2b	Inverters	£2,000
2c	Electrical Connections	£9,300
3a	Builders' Work & Frame	£6,200
3b	Access/ Scaffolding	£7,700
4a	Testing & Commissioning	£500
4b	Record Information	£500
5	Contingency Sum	£3,500
6	Works Budget Total	£37,600
7a	Design Fee	£2,700
7b	Project Management Fee	£1,200
8	Project Budget Total	£41,500

3.6.3 Surplus PV Generation

The majority of surplus PV generation is observed during summer, as illustrated in the figures above. Under the current modelling parameters for the PV system, the amount of surplus energy - when the PV system produces more electricity than the buildings use is 8,263 kWh/year.

It is advised that the surplus electricity be exported to the grid; cost savings calculations assume that this is sold to the grid at a rate of 12p/kWh. We have assumed this as it is currently an available export tariff from different providers that any generator has access to, even if they are not a customer of said energy supplier.

However, there are better value tariffs available that would make any exported energy to the grid even more valuable to the Council and could help to save even more money. The Council should investigate what export tariffs are available to them to come to a more considered final solution to the sizing of the array. It could be the case the Council would have to switch energy provider to gain access to certain tariffs.

The Council should also engage with the local District Network Operator (DNO) to understand any export limitations that might be in place in the area to prevent overloading the network.

The building's electrical demand is expected to increase after the implementation of electrically powered heating systems, which could impact the estimated electrical peak load. However, it is worth noting that peak PV generation coincides with the summer months when space heating demands are minimal or non-existent.

A comprehensive PV feasibility study and load modelling, factoring in the forecast electricity usage after the implementation of low-carbon heating solutions, would assist in determining the facility's demand per half-hour throughout the year, optimal PV system size and the feasibility of battery storage for surplus PV generation.

3.7 Efficiencies through Small Power

Switching to energy-efficient appliances can result in substantial long-term power savings. By gradually replacing outdated appliances such as the electric point of use water heater in the kitchen or the old washing machines and dryers in the laundry, costs can be distributed more evenly over time as they reach the end of their service life. This approach makes the expense more manageable.

The laundry was supplied with the following equipment:

- 3no. Washing machines;
- 2no. Dryers;
- Extract fan for ventilation.

All the equipment was over 10 years old. Given it is powered by electricity it is not recommended to be replaced as part of energy saving and decarbonisation measures. However, modern equivalents can use up to 70% less electricity for dryers and 30% for washing machines.

It is recommended that in the short term before the majority of energy efficiency improvements take place, that a sub meter or load monitoring equipment are installed to enable a better understanding of the electrical consumption of the equipment in the laundry. If it is substantial, then it could be beneficial to replace the existing equipment with modern alternatives.

Figure 27: Existing Washing machines installed in the Laundry



4 Energy and Carbon Savings

4.1 Energy Consumption

The table below presents a summary of the energy usage at the site. The data provided by the Council is not direct consumption data but is based of invoices for their gas and electricity over a 12 month period.

The electricity data has been provided is the monthly consumption from April 2024 to March 2025. The gas data, from March 2024 to February 2025

Invoices for the electricity nor the gas has not been provided. The electricity tariff rate of 0.27 £/kWh and gas rate of 0.05 £/kWh have been calculated from the total summed cost compared to total kWh consumed (with CCL rate added where appropriate). The gas rates exclude any other additional charges. It is unclear what additional charges were included in the total cost of electricity provided.

It is important to note that higher rates lead to increased operational costs and quicker paybacks, which further reinforces the business case for delivering energy efficiency projects.

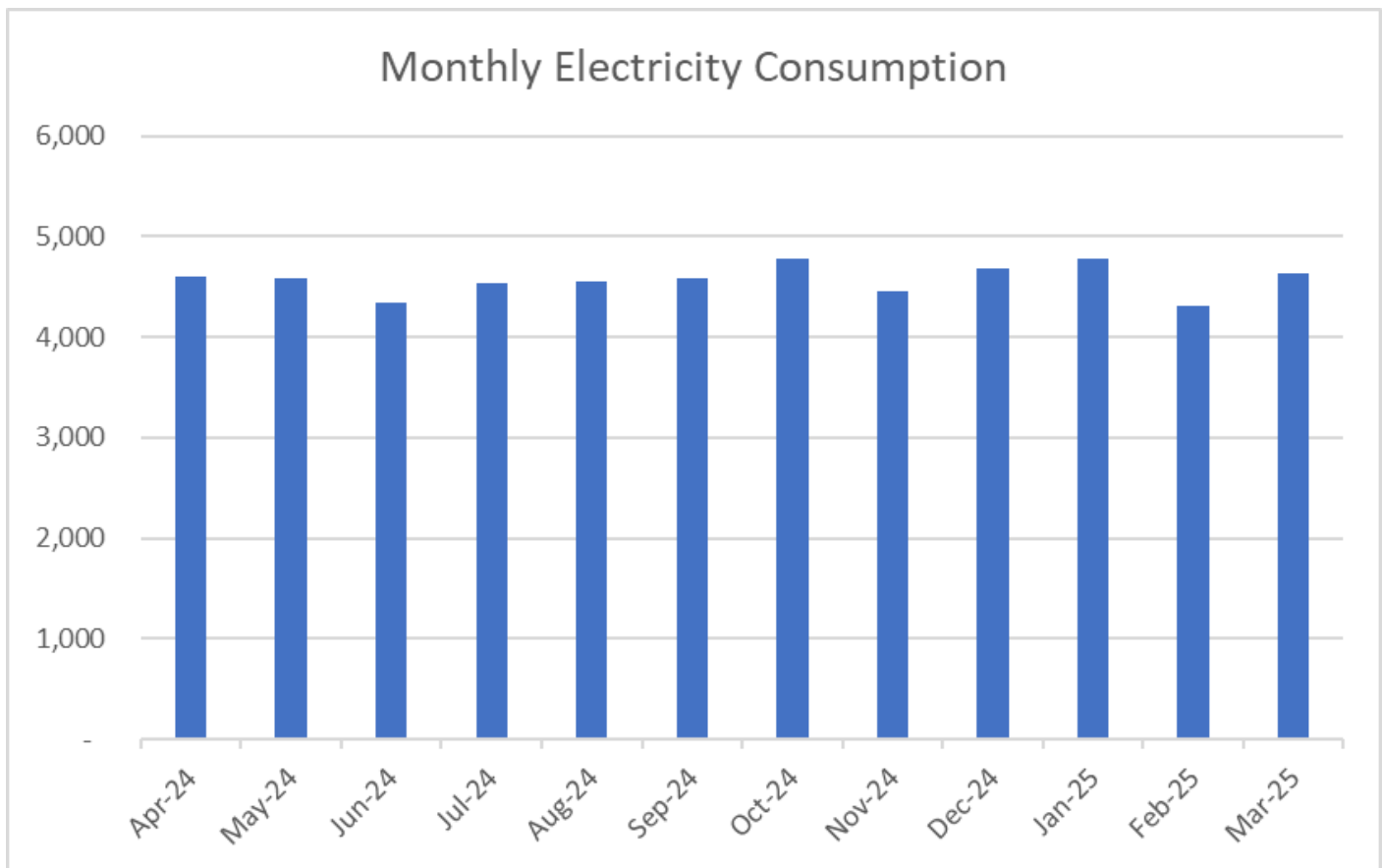
Large spark gaps (the difference between the cost of electricity and gas) mean that equipment such as ASHPs payback will be less favourable. If installing electrical heating equipment, it would be worth reviewing the Council's utilities contract and go to the market. There could be more favourable rates available for electricity.

Carbon emissions have been calculated using the 2025 UK Government emission conversion factors for greenhouse gas (GHG) reporting published by the Department for Energy Security and Net Zero (DESNZ).

Table 18: Building Energy Consumption: Cost and Carbon Emissions

Energy Source	Annual Energy Consumption (kWh)	Cost	CO ₂ e (tonnes)	Unit Rate (£/kWh)	Energy Benchmarking Typical Consumption (kWh)
Electricity	54,842	£14,588	9.7	0.27	56,776
Gas	534,056	£27,210	98	0.05	167,912
Total	588,898	£41,798	108		

Figure 28: Electrical Consumption April 24– March 25



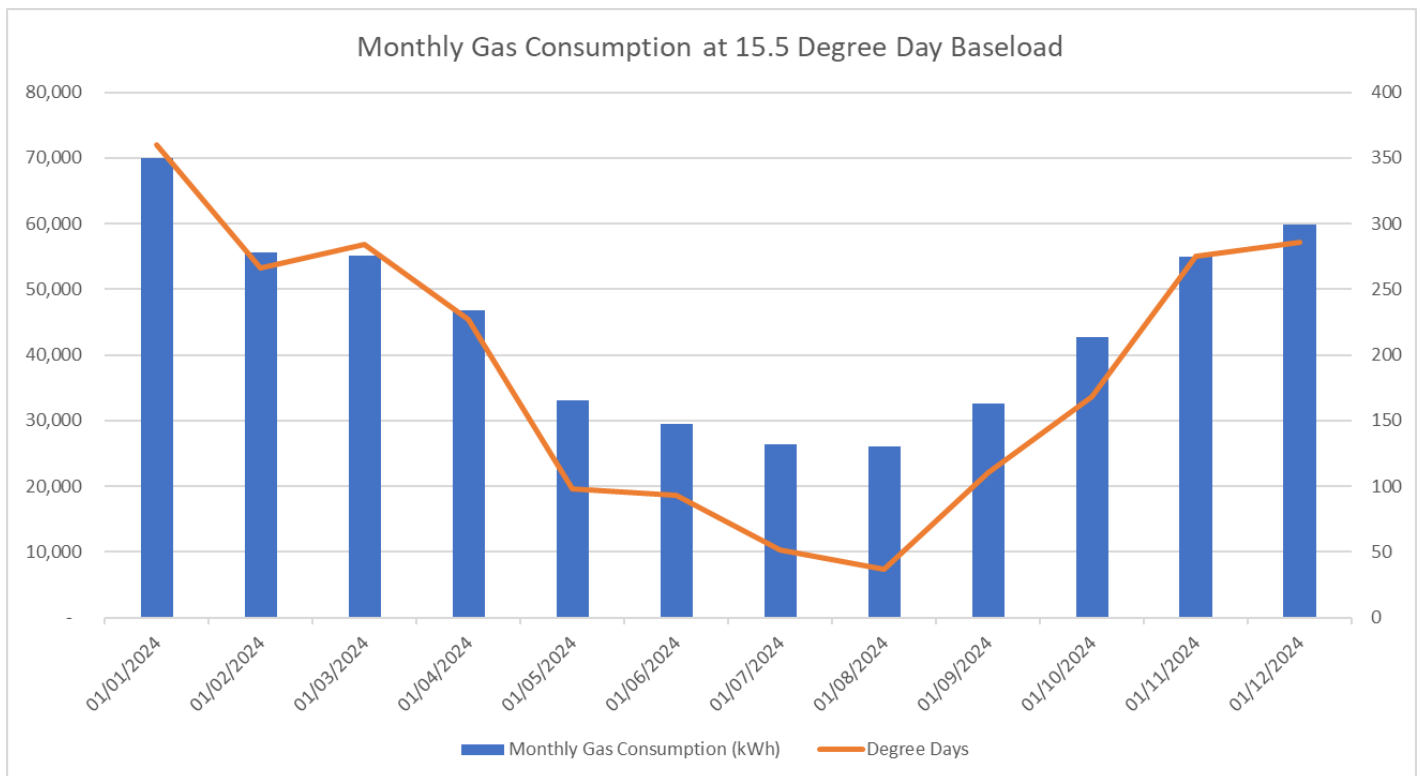
The Figure above shows that the monthly electrical consumption has remained fairly consistent throughout the year regardless of season. It does however highlight that the electrical consumption of the air conditioning installed in the offices has not significantly increased electrical consumption in the building over the summer.

However, this could also suggest that as the staff mentioned, due to the high temperature set points that are required to keep the elderly residents comfortable, the air conditioning is used frequently over the entire year.

The figure below showcases the relationship between the monthly gas consumption and the degree day data of a baseload of 15.5 Celsius. Degree day data is used to showcase when building's heating systems should be in operation, i.e. when the external temperature drops below 15.5°C .

Regression analysis was undertaken using the building's monthly gas consumption data to identify the baseload gas consumption and the best baseline temperature to compare with. The regression analysis indicated that the gas consumption used for space heating correlated the highest when the outside temperature reached 15.5°C and below. In practice this is when the difference between the internal and external temperature is large enough for the building to lose heat at a rate that the boilers need to supply the heating circuit to maintain the internal setpoint of 24°C.

Figure 29: Gas Consumption v Degree Day data



As expected, the gas consumption at the site is more varied throughout the year due to the falling temperatures in the winter. It largely follows the expected trend seen with gas consumption over the year. However, a distinct pattern shown in the data is the persistently elevated gas consumption during the summer period (May–August), despite very low levels of heating degree days.

While HDD (Heating Degree Day) values fall to minimal levels (reflecting little to no space-heating requirement), the building continues to consume between 25,000–30,000 kWh per month.

This demonstrates that:

- A substantial portion of the gas use is not driven by the external temperature;
- Baseline loads such as DHW production, distribution losses, and continuous circulation, as well as system inefficiencies, contribute significantly to annual gas consumption;
- Even with minimal heating requirement, the building's gas demand does not fall proportionally, confirming a large non-heating component.

Regression analysis using degree day data at the 15.5°C base temperature indicates that the baseload gas consumption throughout the year, i.e. the gas load that is not associated with the external weather (DHW and waste/losses) totals approximately 18,976 kWh each month. Over the year, this comes to 227,608 kWh.

A care home or residential home is expected to associate approximately 23% of its total gas consumption to DHW. Using this we can deduce that the approximate gas use split in the building is as follows:

- Space Heating: 305,154 kWh (57%);
- DHW: 119,871 kWh (23%);
- Waste/Losses: 107,737 kWh (20%).

The following reasons support why the building has such high projected waste:

- The building has a single secondary heating circuit, meaning that the whole system and building is heated regardless of where the heating demand is. This leads to continuous circulation and standing losses;
- The staff reported overheating in central/core areas of the building;
- Lack of zoning leads to unnecessary yearly distribution losses.

This observation supports the regression-derived estimate that 22.5% of total gas use is DHW and 20.2% is classified as avoidable waste (system losses, overheating, and inefficiencies).

This potential saving is included in the calculations of the energy savings from the installation of the ASHP for space heating, which includes BMS (building management systems) and the installation of new distribution pipework and additional secondary circuits.

It is important to note that this is based on the observations and information from staff that there is no gas consuming kitchen equipment.

Due to the lack of submetering data, these estimates are based on assumptions. Further clarification is required to ascertain the exact breakdown of energy consumption within the site. Obtaining accurate and comprehensive data regarding gas consumption is crucial for monitoring energy usage and assessing the performance of energy efficiency programmes. It is recommended that a submetering programme be implemented to account for all key end-uses in the interim to obtain a comprehensive understanding of usage and benchmarking baseline for future comparisons.

The gas use from domestic hot water (DHW) demand would be particularly useful. This can be calculated by installing heat metering across the flow and return of the LPHW connection to the plate heat exchanger connected to the DHW indirect cylinder. Using this data alongside the efficiency of the gas boilers can be used to calculate the gas consumption due to DHW demand.

As a result of the absence of submetering data, we have used the energy end-use breakdowns from the Building Energy Efficiency Survey (BEES)² and insights from observations during the site survey for the relevant non-domestic sector in estimating how electricity and gas consumption is divided across the building.

² [Building Energy Efficiency Survey \(BEES\) - GOV.UK \(www.gov.uk\)](https://www.gov.uk/building-energy-efficiency-survey)

4.2 Energy Savings

The table below shows the energy and carbon savings from the recommended projects. This represents the comparison of the sites current operation in 2025 compared with 2030.

Table 19: Recommended Decarbonisation Projects: Energy, Cost and Carbon Saving

Item	Recommendation	Annual Electricity Savings (kWh)	Annual gas Savings (kWh)	Annual Saving (£)	Capital Cost (£)	Payback in Years	Carbon Saving (tCO ₂) per year
1	Double Glazing Replacement	-	11,913	£607	£235,500	N/A	2.2
2	Cavity Wall Insulation	-	70,128	£3,573	£73,100	20.5	12.8
3a	Air Source Heat Pump for Space Heating	-59,512	330,850	£1,026	£675,550	N/A	50.0
3b	Air Source Heat Pump & Electric Boiler for Domestic Hot Water	-42,918	119,871	-£4,837	As Above	As Above	13.9
4a	Solar Panels (32.4 kWp) Own Use	17,400	-	£4,628	£41,500	7.4	3.1
4b	Solar Panels (32.4 kWp) Export	8,263	-	£992	As Above	As Above	1.5
5	LED Lighting Replacement	6,837	-	£2,298	£13,300	5.8	1.2
Total		-69,931	532,762	£8,288	£1,038,950	N/A	84.7

The solutions, systems and equipment detailed within this report are provided to demonstrate a method for reducing the onsite carbon emissions, when considering the existing installed systems, site operation and constraints and financial viability to maximise the opportunity for funding support. The proposed projects are based on specific technologies and manufacturer information. However, other systems and technologies or combination of technologies may prove to be more favourable during the detailed design stage and completion of thermal modelling to confirm the building heating load.

The annual carbon and cost savings are based on the same carbon emission factors and energy tariff rates as described in Section 4.1. The presented carbon and cost savings above do not consider future cost increases or decarbonisation of the grid.

The electricity savings for Items 3a and 3b are negative, indicating the expected increase in electricity consumption at the site from transitioning to electrically powered low-carbon solutions. However, the cost savings are influenced by the interplay between the improved performance of the proposed low carbon systems and the Council's current energy tariffs.

The low-carbon alternatives notably outperform traditional systems in terms of efficiency, and as mentioned the electricity tariff rates used in the modelling are approximately 5 times higher than gas rates. However, it is anticipated that the cost of fossil fuels will increase much faster than electricity in the future making the low-carbon solutions comparably more cost-effective in the long run.

Implementing the proposed PV system and LED lighting installation within the site presents the Council with the greatest electrical energy and cost savings, accompanied by a short payback period. The Council should opt to proceed with this initiative in the very near term.

4.3 Carbon Trajectory

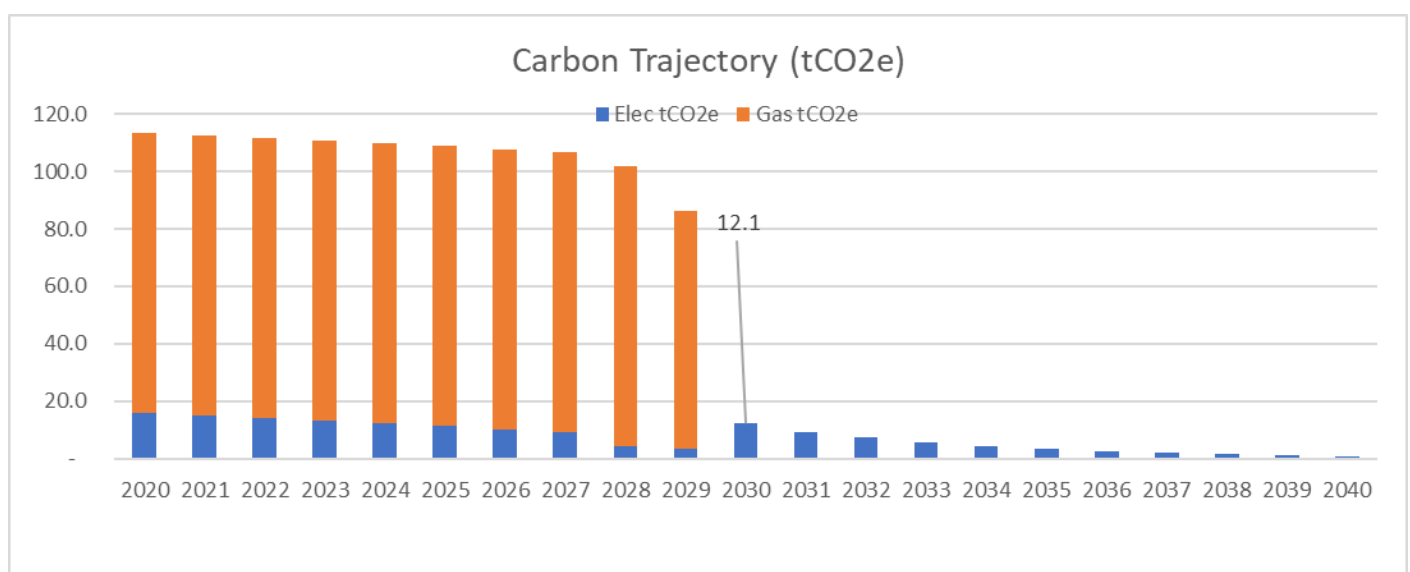
The use of gas at the site will need to cease and all gas-fired equipment will need to be decommissioned to decarbonise the site and align with the Councils set net-zero targets in 2030.

The assessment of future emissions considers that the electricity grid will decarbonise much faster than the traditional gas. Therefore, replacing gas-fired equipment with electrically powered low-carbon heating equipment results in a high carbon savings in the future.

The suggested programme of works is:

- 2027: Installation PV solar array and LED Lighting.
- 2028: Install new double glazing and cavity wall insulation.
- 2029: Decommissioning of gas fired equipment and the Installation of ASHPs for space heating and Electric Boiler for DHW contribution.

Figure 30 Carbon Trajectory – Recommended Projects



The trajectory shows what the emissions would be if gas-fired equipment is removed from site and the proposed heating system alongside all energy-efficiency programmes are implemented before the Council's net-zero target of 2030.

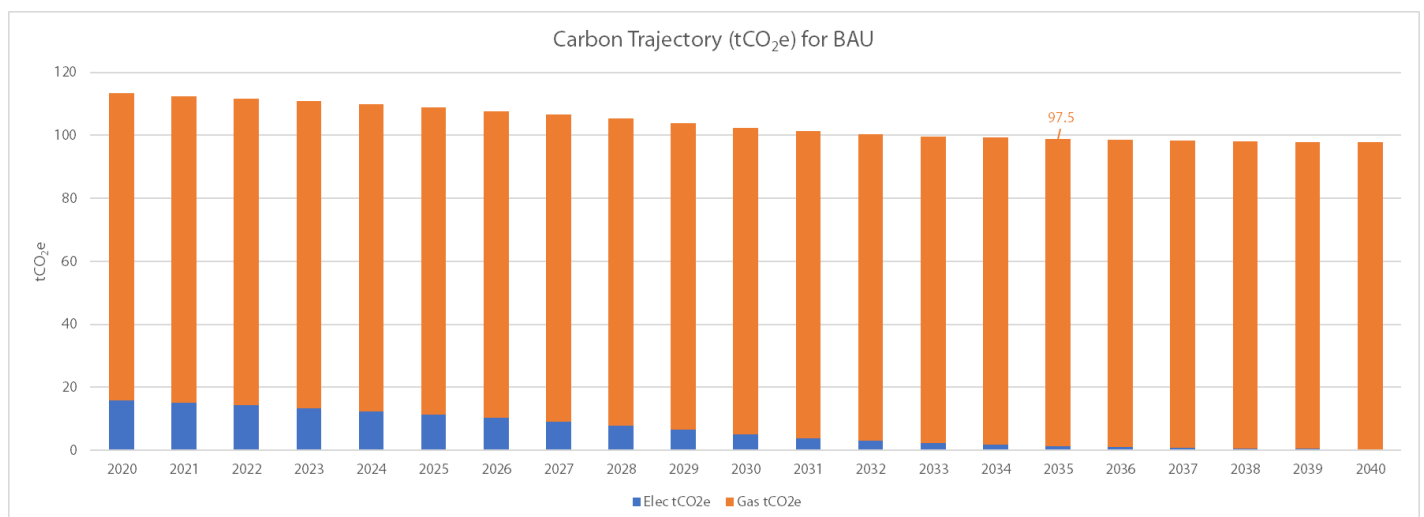
Achieving net-zero carbon emissions requires a strategy that focuses on reducing emissions as much as possible through energy efficiency/conservation measures and low-carbon projects, alongside generating energy onsite from renewable sources. After these carbon reduction initiatives, the remaining emissions are often hard to mitigate and require offsetting strategies to reach a net-zero carbon footprint. Consistent with the Council's net-zero objectives, some plausible strategies to fully offset these hard-to-reduce emissions (12.1 tCO₂e) by the year 2030 and in the years following include:

- Investing in renewable energy projects to replace fossil fuel energy.
- Planting trees or other vegetation to absorb carbon dioxide through photosynthesis.
- Supporting projects that reduce emissions in other sectors, such as the production of low-carbon products.
- Purchasing carbon credits from verified carbon offset programmes.

The electricity usage within the site is modelled as being static after the projects have been delivered. However, related CO₂e emissions continue to fall as the electricity grid continues to decarbonise.

Figure 31 visualises the carbon trajectory where no projects are implemented to reduce energy usage or carbon emissions at the site. In this scenario, business continues as usual and the energy consumption at the site is modelled as being constant through the years.

Figure 31: Business as Usual (BAU) Carbon Trajectory



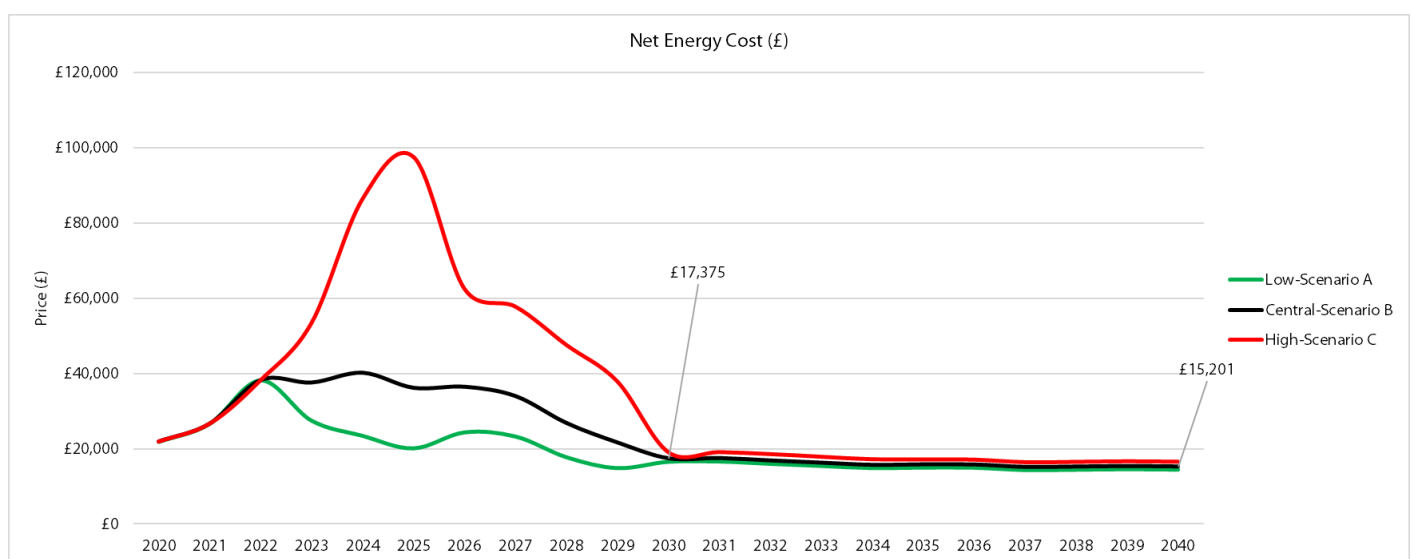
4.4 Forecast Energy Costs

The future retail fuel prices have been adopted and utilised in forecasting associated running costs following the implementation of decarbonisation proposals under the following parameters:

- Modelling central electricity retail prices.

This was done to account for uncertainties surrounding energy prices at present using the best available data from DESNZ. Further guidance about the various scenarios and methodologies involved in forecasting long-run price trend is available from DESNZ.

Figure 32 Year to Year Net Energy Running Costs



The annual operating costs by 2030 for the proposed low-carbon heating solutions, in conjunction with the recommended energy efficiency projects, has been highlighted.

The energy cost modelling in the scenarios is aimed at providing the Council with insight into how fluctuations in energy prices may affect running costs, a form of sensitivity analysis. However, from experience and historic markets, we anticipate that energy prices will increase higher than DESNZ are suggesting.

5 Recommendations

To achieve the site's decarbonisation, and comply with net-zero objectives, it would be necessary to decommission all existing gas-fired equipment by 2030.

The main decarbonisation recommendations in this report centre around the installation of ASHPs in 2029 to meet the net zero carbon goal of 2030.

The existing gas-fired boilers that provide LPHW (Low Pressure Hot Water) for space heating and DHW water demand should be decommissioned and removed from site in 2029. It is also proposed that the existing heating pipework and heat emitters be decommissioned and removed from site, with new pipework consisting of multiple secondary heating circuits and heat emitters with larger surface areas to operate at lower temperatures installed.

It is recommended that at the detailed design stage careful consideration is given to identifying the optimum zoning areas throughout the building to inform the design of multiple secondary heating circuits. This will help resolve

current issues with the buildings overheating in central areas and underheating in areas near the perimeter of the building caused by the single secondary heating circuit currently in place.

It is also recommended to make the most of the opportunity of installing new heating distribution pipework and to install heat metering across the different flats to ensure accurate heat billing to tenants.

It is proposed that in its place, two Air Source Heat Pumps (ASHPs) and the associated auxiliary equipment are installed to provide 35°C Low Pressure Hot Water (LPHW) to the new heating distribution system and higher surface area heat emitters.

In the case of Domestic Hot Water (DHW), it is proposed that a dedicated ASHP and electric boiler be installed to provide DHW. This ASHP and the associated auxiliary equipment would be installed to provide 55°C LPHW to a new preheat vessel. The preheat vessel would work in conjunction with the existing indirect cylinder and an additional indirect cylinder, provided there is enough space.

The water from the preheat vessels would serve the indirect cylinders, where the water temperature would be heated to temperatures appropriate for DHW storage ~ 60°C by the electric boiler. This allows for a greater efficiency DHW system without the need to specify an individual high temperature heat pump.

It is recommended that the existing indirect hot water cylinder and plate heat exchanger that uses LPHW from the existing gas boilers to provide the site with DHW is retained. The cylinder was only installed in 2021 so has a number of years of its lifespan to go.

The electric boiler will feed the existing plate heat exchanger to heat the water to temperature. It is recommended that the existing DHW distribution pipework and pump will be retained. A detailed assessment of the DHW consumption profile is highly recommended to aid in the design of a suitably sized DHW system for the site.

The Council should consider installing the fabric improvement proposals at the site. Including:

- New double glazing to replace the 2000 installed glazing;
- Installing cavity wall insulation.

However, before insulating the cavity walls the Council should investigate the cavity to clarify the standard of the existing cavity or if there is any cavity insulation already in place. This would be done by conducting a borescope test to assess its suitability for retrofitting insulation. Depending on the size and condition of the cavity, the energy savings of filling the cavity with insulation could change significantly, so confirming the status of the cavity is important.

Undertaking detailed thermal modelling is highly recommended, considering factors such as the building envelope heat loss, indoor comfort setpoints, occupancy patterns and local climate conditions. This would confirm the building's design heat loads and guide in determining the optimal size and configuration for the heating systems, ensuring optimal performance, energy efficiency and occupant comfort.

Improving fabric efficiency improves air tightness and could affect natural ventilation within the buildings. Therefore, it is advised that a ventilation assessment be carried out and adequate measures be implemented to ensure that the fabric improvements do not negatively impact the building post-retrofit.

Consideration should be given to installing LED lighting and solar PV on the roof. These measures offer significant carbon savings and a good return on investment and procuring a loan from the Public Works Loan Board to fund the installation could be a viable option.

Given the proposals to move the building towards electric heating and the installation of a solar PV array, it is highly recommended that the Council reviews its utilities contracts and consider if switching energy supplier could be advantageous. For example, as well as paying less for electricity there could be the opportunity to gain access to a favourable export tariff to benefit from any installed PV arrays exported electricity.

As the electric showers, point of use water heater and the two split units are fuelled by electricity and are already decarbonised, it is recommended that they are retained and replaced as and when they fail.

All the equipment in the laundry was over 10 years old. Given it is powered by electricity it is not recommended to be replaced as part of energy saving and decarbonisation measures. However, modern equivalents can use up to 70% less electricity for dryers and 30% for washing machines.

It is recommended that in the short term before the majority of energy efficiency improvements take place, that a sub meter or load monitoring equipment are installed to enable a better understanding of the electrical consumption of the equipment in the laundry. If it is substantial, then it could be beneficial to replace the existing equipment with modern alternatives.

The electricity usage on site will increase if proceeding with installing a low carbon electric heating system. The building will require its electrical supply to be upgraded to install and operate this equipment. The Council should liaise with the District Network Operator to get a better estimate of this cost asap if proceeding with proposals to install electrically powered heating equipment. At this stage, the estimated cost for the upgrade is **£50,000**, but costs can vary significantly. **Due to the unknown costs, this is a high risk item.**

Incorporation of a smart building controls and monitoring energy use across the site is encouraged. Ther proposed ASHP cost includes the upgrade of the building management system (BMS). This will enable data-driven decisions for reducing energy consumption and associated costs. An annual review of the building controls is recommended to ensure continued optimisation.

6 Appendix A

NOTE

Local authorities should undertake their own due diligence where appropriate rather than relying on this report. This is a feasibility study and detailed design is required prior to undertaking any works. APSE does not provide financial or investment advice and is not registered with the Financial Conduct Authority.

The options and recommendations contained within this report provide a reasonable forecast for the pre-tender capital cost and cost/carbon savings for selected projects. Further detailed design is required to determine more cost certainty and to ensure that appropriate systems are installed that optimise energy usage and provide a healthy working environment.

Products referred to in this report do not constitute a recommendation. They are for example purposes only and alternatives are available unless stated.

The current military situation impacting the supply of oil and gas from the Middle East has not been taken into account within this report. Although it is likely to have a short term impact on fuel prices the extent of this is unknown and cannot be accurately predicted.

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