



# **North East & Yorkshire Net Zero Hub**

## **Heat Decarbonisation Plan and Feasibility Study Anytown Town Hall**

Report

Report produced in April 2026



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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 Town Hall.

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**

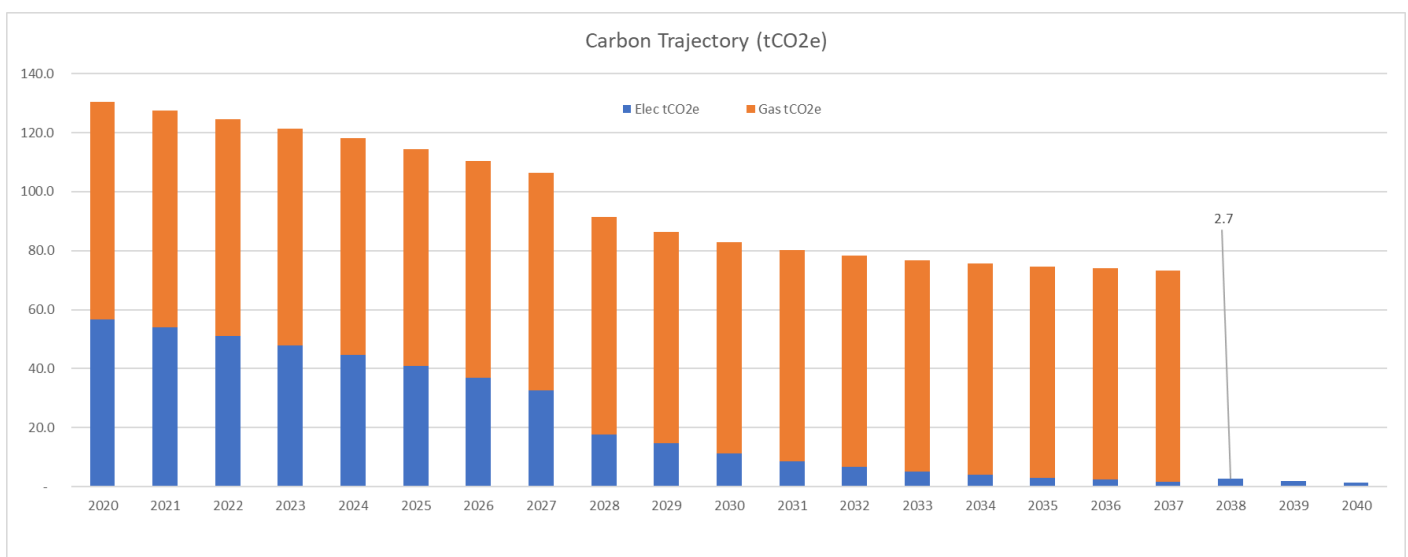
| Item         | Recommendation                                          | Annual Electricity Savings (kWh) | Annual Gas Savings (kWh) | Annual Saving (£) | Capital Cost (£) | Payback in Years | Carbon Saving (tCO <sub>2</sub> ) per year |
|--------------|---------------------------------------------------------|----------------------------------|--------------------------|-------------------|------------------|------------------|--------------------------------------------|
| 1            | Secondary Glazing Installation                          | -                                | 10,785                   | £539              | £77,000          | N/A              | 2.0                                        |
| 2a           | High temperature air source heat pump for Space Heating | -96,572                          | 355,931                  | -£10,872          | £699,900         | N/A              | 48.0                                       |
| 3a           | Solar Panels (59 kWp) Own Use                           | 43,627                           | -                        | £11,343           | £62,000          | 5.2              | 7.7                                        |
| 3b           | Solar Panels (59 kWp) Export                            | 5,251                            | -                        | £630              | As Above         | As Above         | 0.9                                        |
| 4            | LED Lighting Replacement                                | 29,463                           | -                        | £8,624            | £39,600          | 4.6              | 5.2                                        |
| 5            | Kitchen Equipment Replacement                           | -21,346                          | 35,577                   |                   | Unknown          | N/A              |                                            |
| <b>Total</b> |                                                         | <b>-39,578</b>                   | <b>402,293</b>           | <b>£10,265</b>    | <b>£878,500</b>  | <b>N/A</b>       | <b>63.9</b>                                |

**Table 2: Alternative Option for Heating Decarbonisation**

| Option | Proposals            | Annual Electricity Savings (kWh) | Annual Gas Savings (kWh) | Annual Saving (£) | Capital Cost (£) | Payback in Years | Carbon Saving (tCO <sub>2</sub> ) per year |
|--------|----------------------|----------------------------------|--------------------------|-------------------|------------------|------------------|--------------------------------------------|
| 2b     | Electric Boiler (SH) | -266,539                         | 355,931                  | -£55,063          | £334,000         | N/A              | 17.9                                       |

To achieve the site's decarbonisation, and comply with net-zero objectives, it would be necessary to decommission all existing gas-fired equipment by 2038. The figure below shows the carbon trajectory if all recommended projects are completed.

**Figure 1: Buildings Carbon Trajectory - Recommended Proposals**



## **Main Recommendations**

### **Main Recommendations and Next Steps**

#### **1. Heating and DHW Decarbonisation:**

- Full decarbonisation requires decommissioning all gas-fired boilers by 2038.
- It is recommended to replace them with 5no. ASHP, providing 65°C LPHW to the existing heating distribution pipework and radiators to provide the building with space heating.
- An external compound could be constructed in the green space to the northeast of the building to house the ASHPs. Would need to be approved from Historic England and the local planning authority.

- In the short term the Council should lower the flow temperatures of the boilers to see what the lowest temperature they can provide to the existing heating distribution that still effectively heats the building. This will allow the Council to operate the ASHP at the highest efficiency possible once installed to lower operating costs. The carbon savings and operating costs in this report are based on the assumption the ASHPs will produce water at 65°C.
- The existing Domestic Hot Water (DHW) is provided by electric point of use water heaters and should be retained.

## **2. Consider opportunity to upgrade the existing heating distribution**

- The Council should commission a conditions survey to look at the existing heating distribution pipework.
- If it reveals that the distribution pipework will need replacement in the near future, the Council should consider it an opportunity to potentially install a distribution pipework system designed to operate at lower flow temperatures. This would allow them to use a ASHP operating at a higher efficiency to lower operational costs.

## **3. Updating Building Management System**

- The Council should investigate the current settings of the BMS to ensure that it is aligned with the current use of the building (heating schedule, etc).
- The method that changes are implemented into the BMS should be streamlined to avoid instances of energy wastage and allow staff working in the building to implement changes easily.
- Implement a comprehensive metering and energy monitoring scheme to track electricity, heating, and renewable generation, providing valuable data for energy management and ongoing optimisation.

## **4. Building Fabric upgrades**

- The Council should install secondary glazing in the existing single glazed windows in the theatre and reception/meeting room.
- Some areas of loft insulation were displaced, leaving areas uninsulated. The displaced insulation should be moved back to ensure full coverage.
- Thermal modelling should be undertaken to better understand the energy and financial implications of installing the fabric measures. It will also help the Council understand the heat loss and required sizing of electrical heating equipment.

## **5. Electrical Infrastructure and Supply Upgrade:**

- An electrical supply upgrade (**estimated £150,000**) will 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.

## **6. 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.
- Review utility supply contracts to secure advantageous export tariffs for PV-generated electricity.
- Engage early with local planning and Historic England to make them aware of plans to install solar panels on the building's roof.

## **7. Small Equipment Energy Efficiency, Kitchen Equipment & AHU**

- Retain and replace existing electric split units as needed, as these are already decarbonised.
- Replace the existing gas fired kitchen equipment with electric equivalents before 2038.
- 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.
- The existing AHU was currently faulty but was in the process of being repaired. If working with lower temperatures to the heating coil, then the Council will have to install a heating coil with higher surface area to achieve the same heating capacity. The condition as the internal was not investigated.

## **2 Survey and Observations**

### **2.1 General**

Anytown Town Hall is located at Anytown.

The building is a Grade II listed Victorian hall and was constructed in 1889 at the reported cost of £40,000 - £50,000. The town hall houses offices for council workers, a 700 concert hall that regularly puts on productions, function and meeting rooms and an old court room.

The court room was retired in the late 1980s but was previously used to convict the Yorkshire ripper Peter Sutcliffe in 1981, who was housed in the cells following his arrest.

In more recent times, the courts have been used in television productions by the BBC and ITV. And rooms and the hall are available for hire, including for large events such as weddings.

The building is generally in use from 06:00 – 19:00 Monday to Friday.

When events are taking place and over the weekend, the building is in use from 06:00 – 24:00.

Events such as weddings and productions are not on a fixed schedule, but staff reported that the building is often busy for much of the year.

The building is Grade II listed, and the reason for this is the buildings architectural and historical interest. Historic England list the following reasons for the buildings Grade II status:

- A highly impressive town hall in a key location at the head of the historic marketplace in Anytown, with main elevations to Market Place and Anytown Road featuring a grand entrance portico and tower (to Market Place) and French-style pavilion roofs.
- For its opulent interiors, including ornate plaster ceilings, carved stonework, oak panelling and joinery, mosaic floors and painted- and stained-glass windows, and incorporating the civic symbolism of the Anytown Sea.
- As an excellent example of a town hall with a combined function as municipal offices and departments, borough court, police station and main hall, embodying the emergence of well-organised local government in the C19.
- It is one of the best works of the notable local architects' firm of Holtom and Fox, who have several listed buildings to their name.

A site plan is presented below.

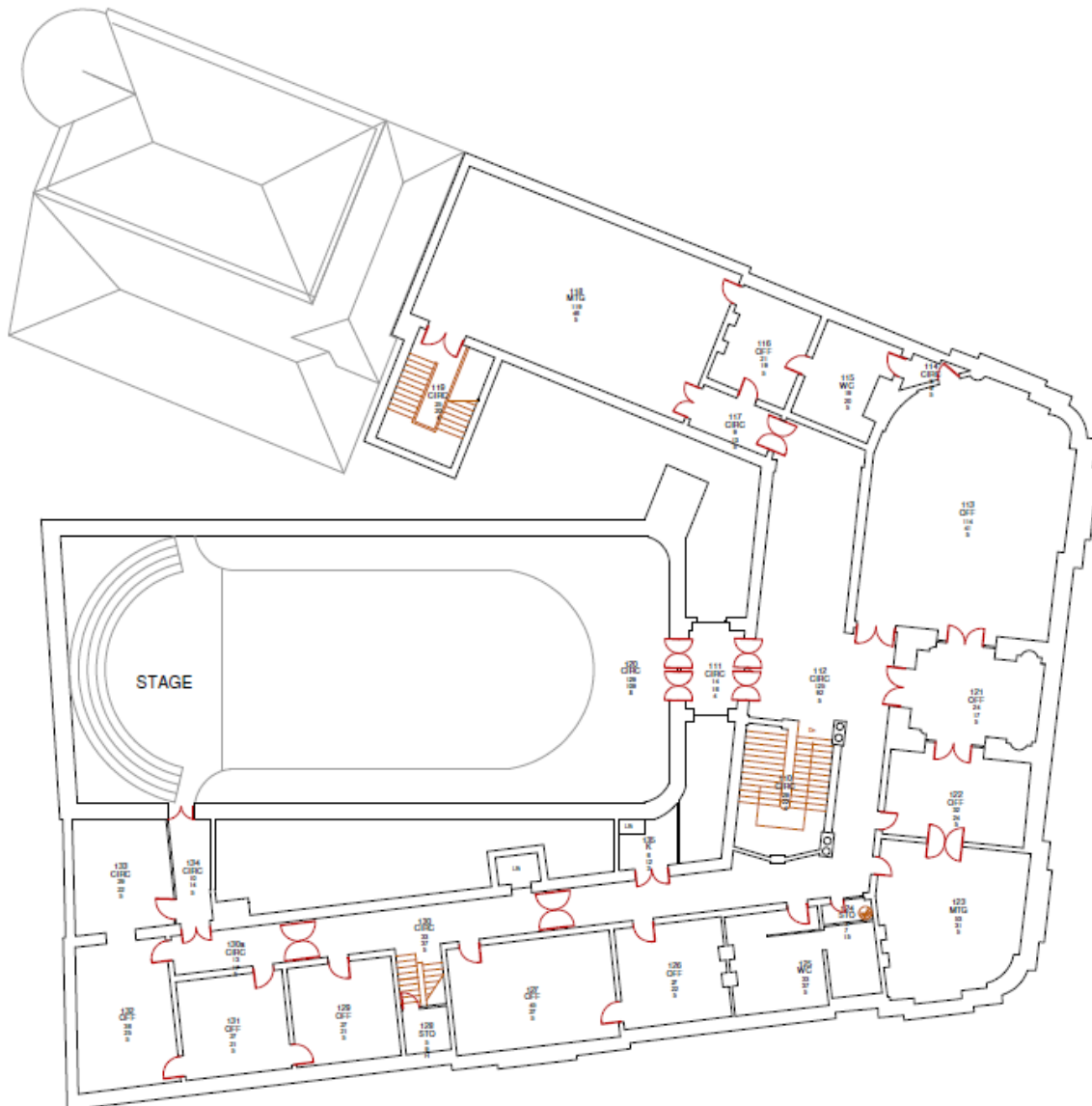
**Figure 2:** Ground Floor Plan



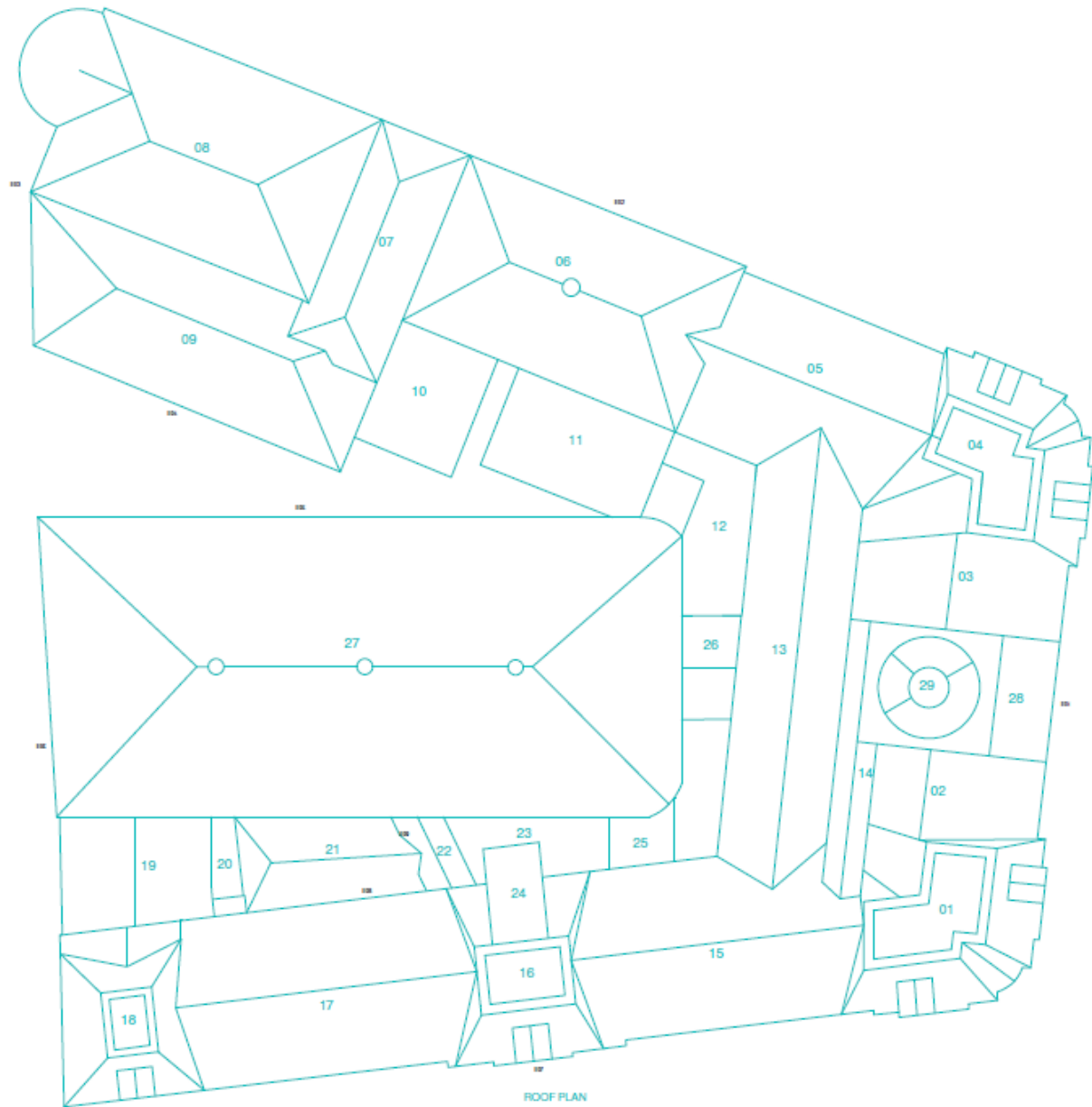
**Figure 3: First Floor Plan**



**Figure 4:** Second Floor Plan



**Figure 5: Roof Plan**



**Figure 6:** Site Plan

The survey of the building was carried out on 17<sup>th</sup> February 2026, with daily high temperature of 13°C and low of 6°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 Town Hall was opened in 1889 and was constructed using ashlar sandstone with a solid wall construction that was measured at 500mm during the site survey.

The roof is a timber frame with slate roofs.

The building has original single glazing throughout but has since installed secondary glazing to the majority of the windows in the building.

**Figure 7:** Anytown Town Hall Elevation & Building Fabric





**Table 3:** Assumed U-Values of different construction elements of the building based on historic U-values

| Construction element | Construction type        | U-Value (W/m <sup>2</sup> K) |
|----------------------|--------------------------|------------------------------|
| Ground floor         | Concrete                 | 1.20                         |
| External walls       | Solid Stone Wall (500mm) | 1.10                         |
| Windows              | Secondary Glazing        | 2.20                         |
| Windows              | Single Glazing           | 5.70                         |
| Roof                 | Pitched (Loft Insulated) | 0.40                         |
| Exterior doors       | -                        | 3.00                         |

## 2.3 Lighting

The lighting was observed to have a mixture of LED and fluorescent lighting installed. They were all predominantly operated by manual switches, though some areas such as bathrooms did utilise PIR (Passive Infrared Sensors).

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.

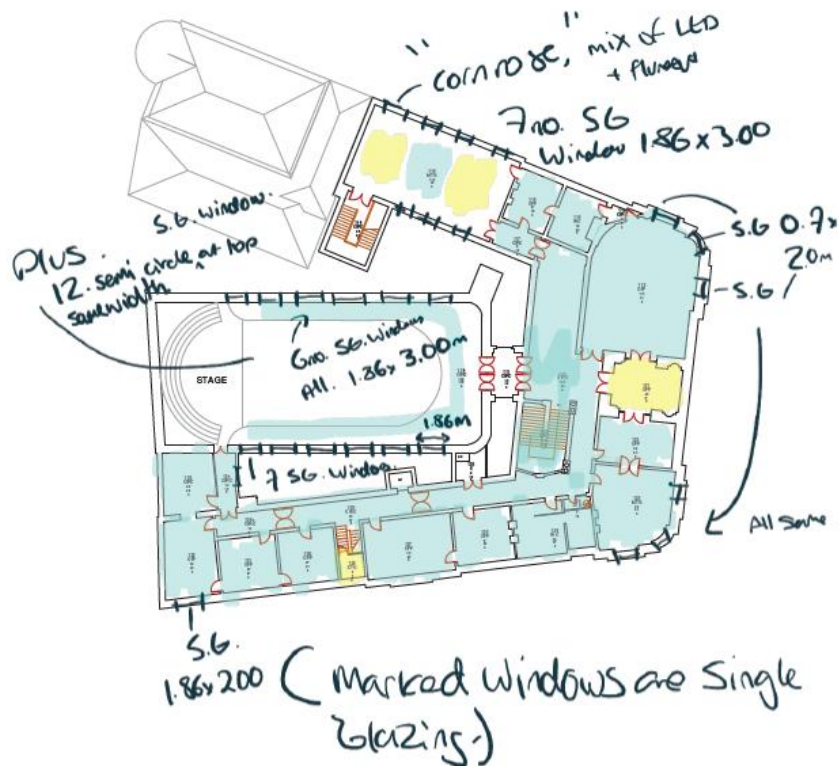
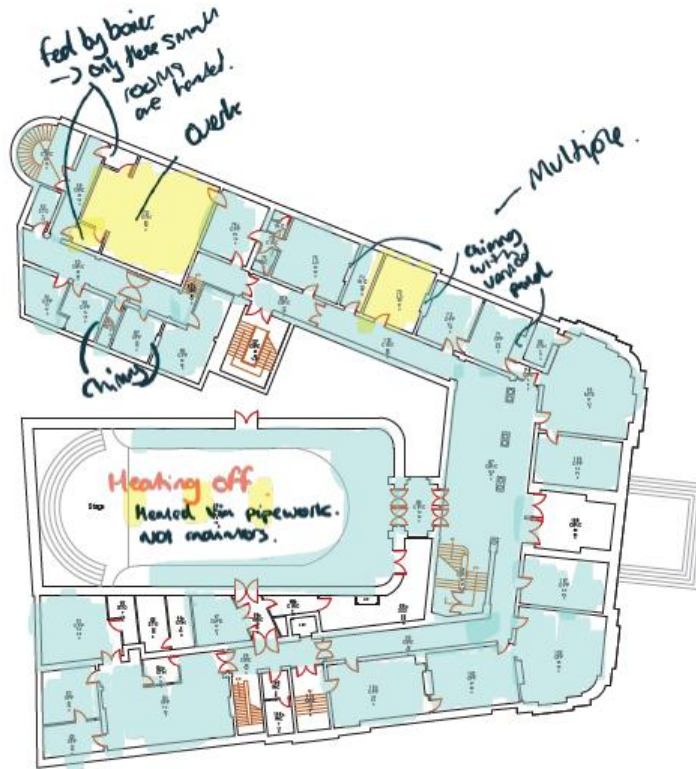
**Table 4** *Non-LED Lighting Fixture Inventory*

| Location          | Lighting Fixture                          | Count      |
|-------------------|-------------------------------------------|------------|
| Various Locations | Uplighter with single CFL 26W 4000k lamps | 42         |
| Various Locations | 1163mm (4ft) T5 single 28W batten         | 1          |
| Various Locations | 1463mm (5ft) T5 twin 2x35W batten         | 2          |
| Various Locations | 1500mm (5ft) T8 single 58W batten         | 26         |
| Various Locations | 1800mm (6ft) T8 twin 2x70W batten         | 15         |
| Various Locations | 2D 38W surface mounted bulkhead           | 53         |
| Various Locations | 600x600 T5 4 tubes recessed               | 6          |
| Various Locations | 600x600 T8 4 tubes recessed               | 10         |
|                   |                                           |            |
| <b>Total</b>      |                                           | <b>155</b> |

The attached diagrams show the marked up site plans, showing the areas of the building that were served by LED and fluorescent light fixtures. **Blue** indicates LED, **Yellow** indicates fluorescent fittings.

Figure 8: Diagrams of Lighting Locations





## 2.4 Heating and Hot Water Services

### 2.4.1 Heating plant

**Table 5:** Table summarising existing heating plant in the building

| Heating/cooling Element                         | Fuel Type | Total Capacity (kW)       | Gross efficiency (%)                    | Year Installed |
|-------------------------------------------------|-----------|---------------------------|-----------------------------------------|----------------|
| 2no. Ideal Evomod 500 Boilers                   | Gas       | 930 (heat)                | 88.1                                    | 2020 (Serial)  |
| 1no. Fujitsu AOYG9OLRLA (Serving AHU)           | Elec      | 27 (heat)<br>22 (cooling) | 350 (heat) (est)<br>300 (cooling) (est) | 2021           |
| 1no. Daikin RY45DB7UI (Serving indoor cassette) | Elec      | 1.5 (cooling)             | 300 (cooling) (est)                     | 2000           |
| 1no. Daikin RY35DB7UI (Serving indoor cassette) | Elec      | 2.1 (cooling)             | 300 (cooling) (est)                     | 2001           |

The Domestic Hot Water (DHW) across the building is served via point of use electric water heaters, rather than the DHW being generated in the main plant room. Given this is already decarbonised, it is recommended that the Council retain these and replace them as and when they fail.

There were also three 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 Daikin split units provide two of the offices to the front of the building with cooling. They were noted to be in poor condition during the survey.

A secondary heating circuit served LPHW to an AHU, which was located on the roof above the plant room. This was also where the 3no. split units were located. The AHU was being repaired at the time of the survey.

| AHU            | Area Serving              | Total Capacity (kW)                | Heating and/or Cooling                                                                                      | Heat Recovery | Volume flow rate (m3/s) | Year Installed |
|----------------|---------------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------|-------------------------|----------------|
| ABBEUGA-21-210 | Law Offices & Circulation | Unknown +27 (heat)<br>22 (cooling) | LPHW from boilers for heating<br><br>Dx coil from Fujitsu AOYG9OLRLA serving cooling & Heating as required. | No            | Unknown                 | 2000           |

**Figure 9:** AHU served by LPHW and split unit. Provides conditioned air to law offices. Currently being repaired



**Figure 10:** 2no. Ideal Evomod 500 Boilers



# EVOMOD 500

CONDENSING BOILER MODULE

ABC 20678900000162 1910 19/03/07

P I No 86CL183

230V ~ 50Hz

POWER CONSUMPTION 678W MAX

I.P. 20.

CAT. I<sub>2H</sub> (EN437) NATURAL GAS ONLY

BOILER TYPE: B<sub>23</sub>

OPERATING WATER PRESSURE PMS:

1.0 bar MIN 6.0 bar MAX

NOX CLASS 5.

BOILER TO BE INSTALLED WITH A  
GOVERNED METER.

GAS SUPPLY PRESSURE 20mbar.

2H - G20 - 20mbar

FOR NATURAL GAS ONLY.

COUNTRIES OF DESTINATION: GB, IE.

MADE IN THE UK BY IDEAL BOILERS LTD,  
PO BOX 103, NATIONAL AVENUE, HULL,  
EAST YORKSHIRE, HU5 4JN

**ideal**

CE 0086

## BURNER & HEATING DATA

### HEAT INPUT "Q" =

|     | NET               | GROSS             |
|-----|-------------------|-------------------|
|     | kW (Btu/h)        | kW (Btu/h)        |
| MAX | 476.0 (1,624,112) | 528.2 (1,802,218) |
| MIN | 47.6 (162,411)    | 52.8 (180,256)    |

### HEAT OUTPUT "P" =

|     | CONDENSING        | NON - COND'G      |
|-----|-------------------|-------------------|
|     | kW (Btu/h)        | kW (Btu/h)        |
| MAX | 505.0 (1,723,060) | 465.0 (1,586,724) |
| MIN | 51.4 (175,404)    | 46.7 (159,325)    |

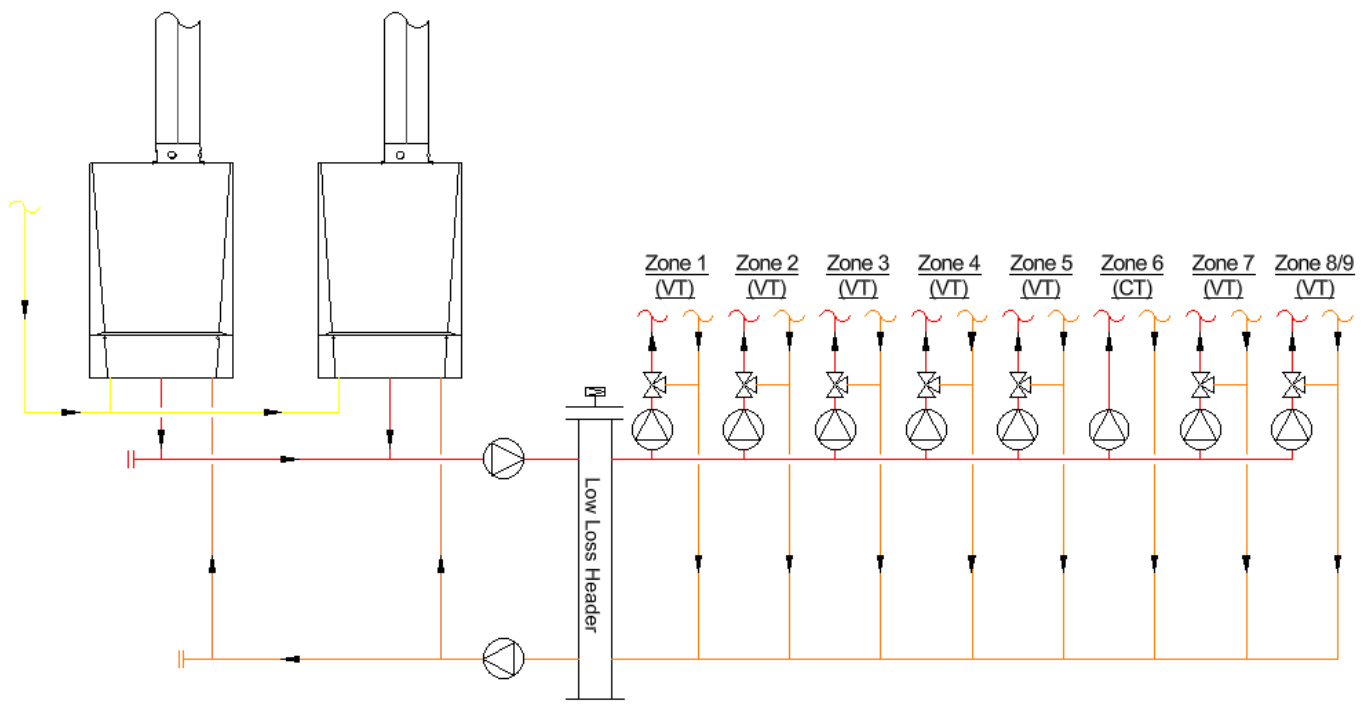


\*ABC206789000001621910\*

**Figure 11:** 2no. Daikin Split Units in Poor Condition



**Figure 12:** Existing Heating Schematic



### 2.4.2 Heating distribution

The main boilers (with a total heating capacity of 930 kW) served eight secondary circuits. Seven of these secondary circuits provided LPHW for radiators across the building, with the final secondary circuit serving an AHU.

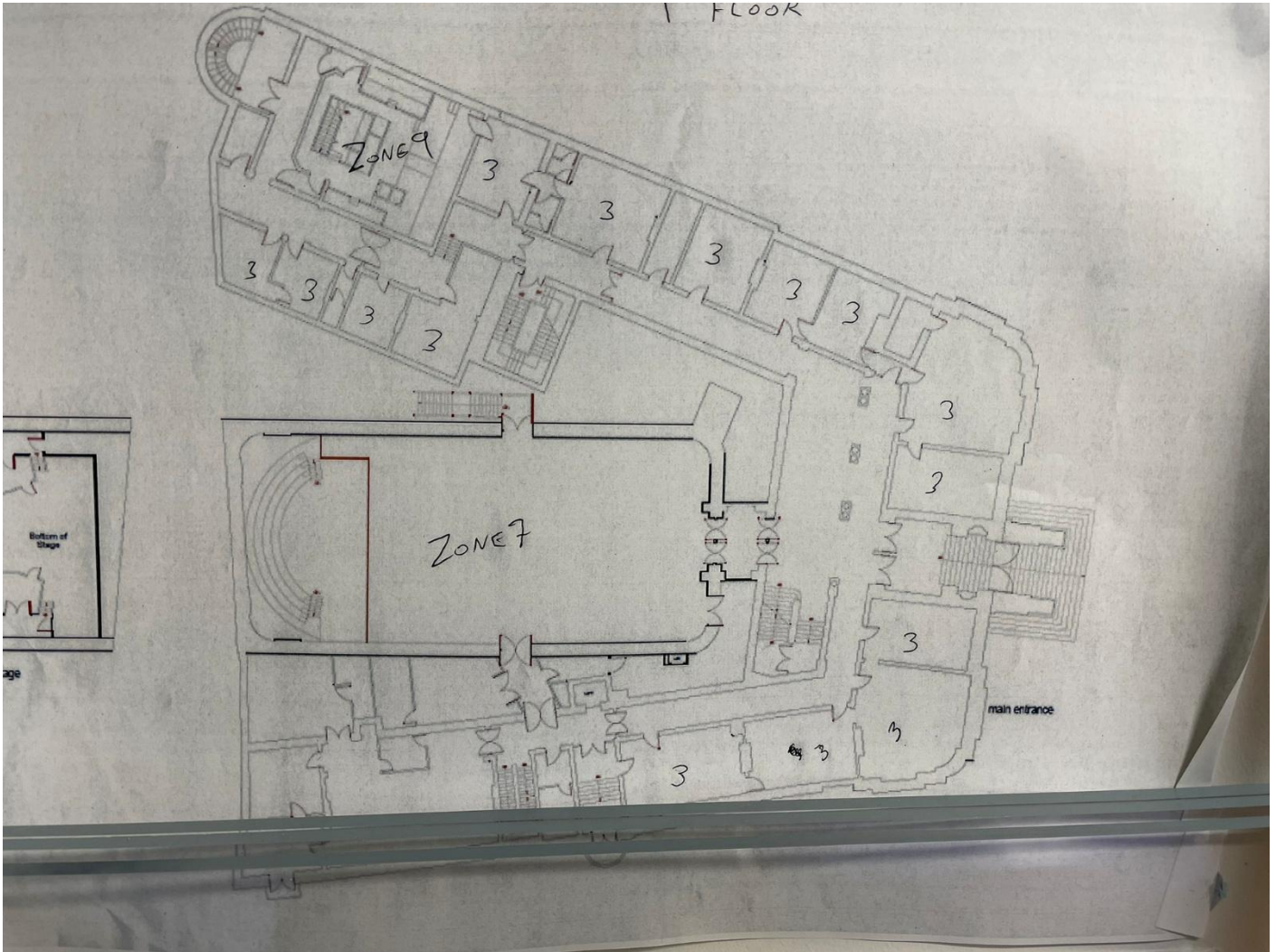
They were labelled as the following:

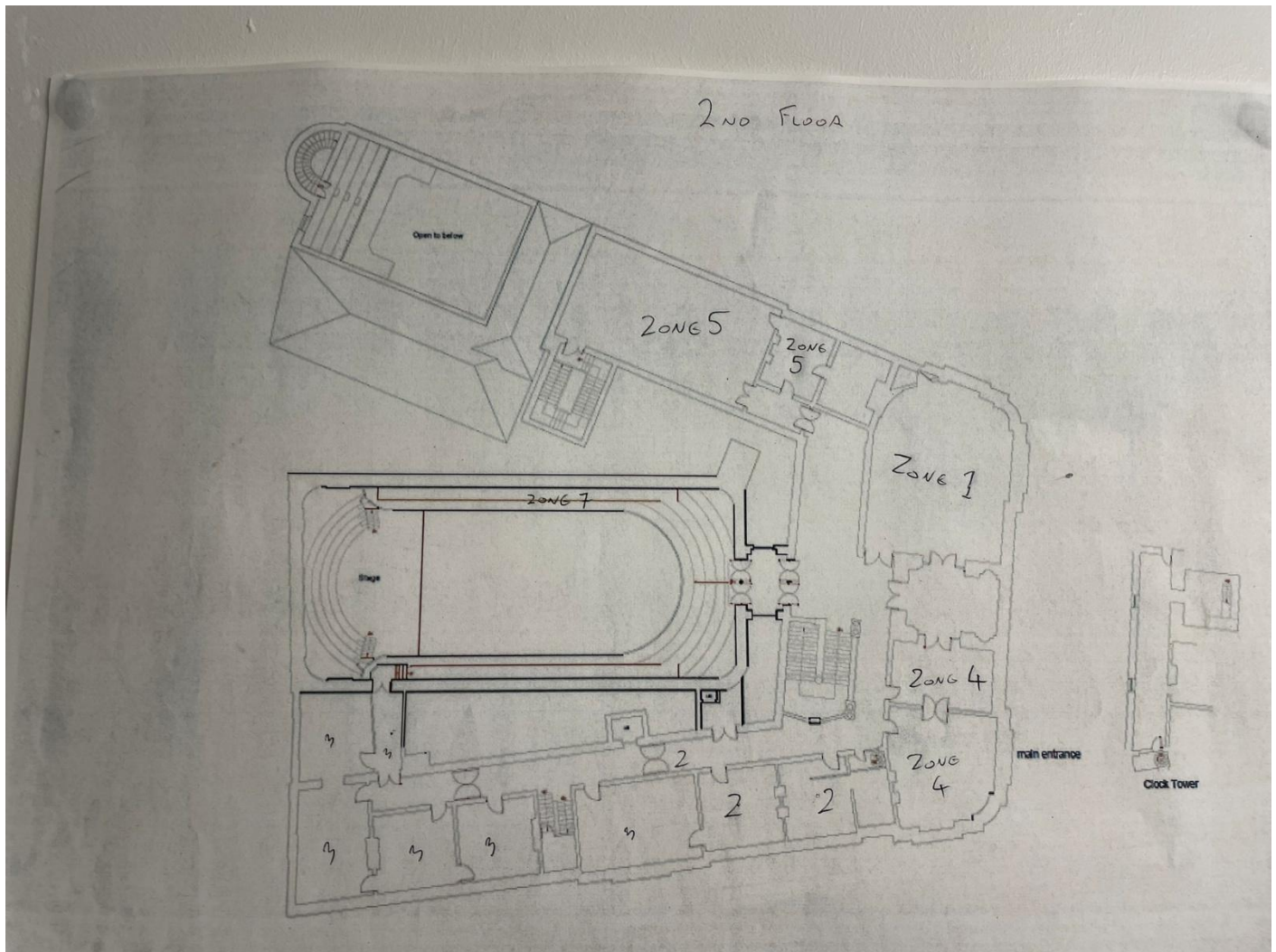
- Zone 1 (VT): Mayors Reception Room
- Zone 2 (VT): Corridors & WCs
- Zone 3 (VT): Offices
- Zone 4 (VT): Ceremonial Rooms
- Zone 5 (VT): Council Chambers
- Zone 6 (CT): AHU supply
- Zone 7 (VT): Victoria Hall – TURNED OFF – leak in the process of being fixed.
- Zone 8 (VT): Court (Also labelled as Zone 9)

All circuits had twin head pumps. The diagram below shows a marked up plan with the heating zones labelled.

**Figure 13:** Marked Up Plans Showing Heat Zones







The majority of space heating across Anytown Town Hall is provided via wall hung radiators of varying age, condition and level of control. There were varies types of radiators of different ages across the building. Some had no TRV controls and some did not work altogether. The figures below showcase the number of different types of radiator in the building.

**Figure 14:** Different Radiator Types in the Building





In addition, Victoria Hall was heated via large pipework that spanned the perimeter of the room under seating. This space was not heated during the visit due to a leak. The interior of the building is named as a contributing factor to the Grade II listed status with Historic England, so it is strongly unlikely that any improvements or replacements to the heating distribution would be approved, unless as part of necessary maintenance.

**Figure 15:** Heating Pipework in Victoria Hall





### 2.4.3 Domestic hot water

The Domestic Hot Water (DHW) across the building is served via point of use electric water heaters, rather than the DHW being generated in the main plant room. Given this is already decarbonised, it is recommended that the Council retain these and replace them as and when they fail.

*Figure 16: Point of Use Water Heater*

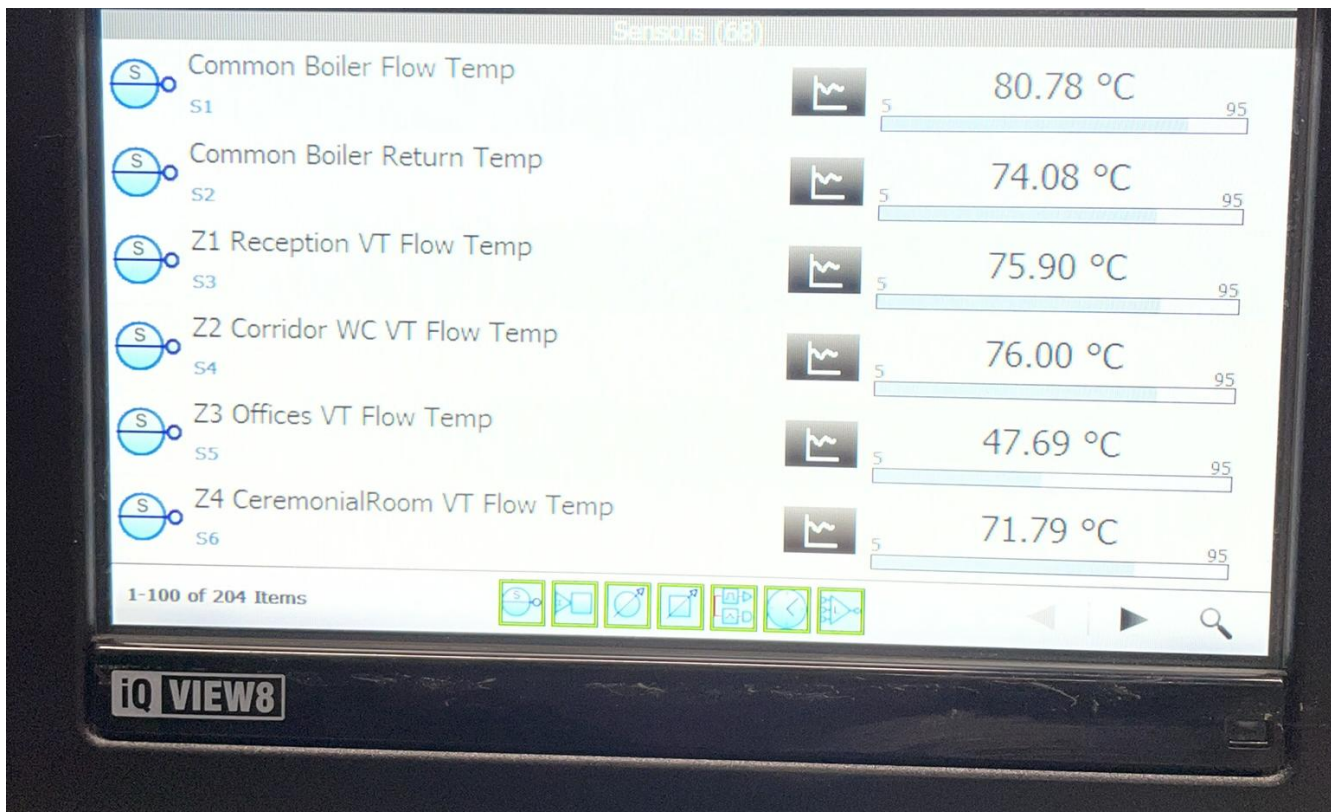


### 2.4.4 Automatic controls

In the central heating plant room, a control panel with TREND iQ View 8 interface was installed. During the site survey, it was not possible to fully interrogate the BMS settings, including zone temperature setpoints, operational time schedules, or detailed flow and return temperature data, as the interface did not respond when attempting to navigate beyond the initial display screens. It was likely just taking an excessive amount of time to load the data, but it is worth the Council checking it is operational and not a fault. The page displayed at the time showed flow temperatures for several heating circuits, with reasonable variation observed between circuits.

In addition, on the control panel there were switches that indicated the controls were linked to the BMS but were also set to 'Winter' mode.

**Figure 17:** Trend IQ View 8 interface



However, when visiting the court room there were two closed off entrances that were excessively heated by large radiators without TRVs. It appeared that there were also no thermostats on the walls and a lack of control overall with the space heating.

In addition, given the space was not in use it supported the view that the BMS is not correctly set up to reflect the zones across the building and the time in which they are in use. The Control panel had the court zoning set to 'Auto' and linked to the BMS, yet it was excessively heating the space during a time it was not in use.

During the survey of the court room, two enclosed entrance areas were found to be excessively heated. These spaces were served by large radiators without thermostatic radiator valves (TRVs), and there were no visible wall-mounted thermostats or space temperature sensors. There was limited local temperature control within these areas, with heat output likely governed solely by central plant operation and time schedules rather than real-time space conditions.

At the time of the visit, the court room was not in use; however, the space was being actively heated, despite the BMS zone for this area being shown as set to 'Auto' and linked to the central system. This observation suggests that the current BMS zoning, control schedules or demand logic may not reflect actual occupancy patterns or periods of use across the building. In particular, it indicates that intermittent-use areas may be receiving heat unnecessarily outside of occupied hours, leading to avoidable energy consumption and risk of overheating.

It is highly recommended that the Council investigate the current settings on the BMS to ensure it is optimised to the current use of the building as the observations during the site survey suggested that it is not currently. The review of the BMS settings should include:

- Heating zone definitions and plant enable logic;
- Time schedules for occupied and unoccupied periods;

- Space and flow temperature setpoints;
- Seasonal changeover and override functions.

It is also recommended that the building's staff are educated on how to input changes where necessary to the BMS settings, or to at least communicate with the correct person at the Council who can remotely make these changes.

The existing BMS does not need replacement but could require modifications if the Council opt to make any of the suggested changes to the building's heating system.

*Figure 18: Control Panel showing 'Winter Mode'*



## 2.5 Kitchens

There was a commercial kitchen on the first floor of the building. It had a number of different electrical equipment appliances in the kitchen but also had a gas hob installed.

**Figure 19:** Gas Hob in Kitchen



## 2.6 Incoming Gas

**Table 6:** Installed Gas Meter

| Area served | Meter Number   | MPRN    | Location                            |
|-------------|----------------|---------|-------------------------------------|
| Whole Site  | M0100E011814R0 | 6839001 | Exterior Cupboard next to plantroom |

## 2.7 Incoming Electrical Supplies

*Table 7: Installed Electrical Meter*

| Area served | Meter Number | MPAN          | Location               | Maximum Demand (kW) |
|-------------|--------------|---------------|------------------------|---------------------|
| Whole Site  | NG17K00937   | 2356550370011 | Electrical Intake Room | 65.1*               |

The main electrical meter had a CT ratio of 400:5 and was installed in 2017.

The MPAN was provided by the Council via the electrical Half-Hourly data.

The main intake and distribution panel indicated that the supply was rated at 400 Amps.

**\*The maximum demand was calculated based on half hourly electrical data provided by the Council.**

## 2.8 Renewable Technologies

Other than the split units providing air conditioning to offices and to the AHU, there are currently no direct renewable technologies installed at Anytown Town Hall.

Another strategy currently being utilised is the conversion of chimney stacks being converted into natural ventilation stacks with sliding ducts.

## 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 limited space not clearly seen from the ground would be better utilised by solar photovoltaic panels. In addition, given the building's DHW is supplied by point of use water heaters, it is already decarbonised.

#### 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).

There is very limited space at the site, and any boreholes would be extremely expensive and disruptive. It could be worth considering if the planning authority and Historic England rule out an external compound for ASHPs, but at this stage has been discounted.

### **3.1.3 Building Fabric (External Wall Insulation, Loft Insulation)**

The building was constructed in 1889 and has significant historical significance to the county and the surrounding area. As a result, it is a Grade II listed building. The alterations to the fabric that have low impact to the character and appearance of the building, such as installing secondary glazing and loft insulation have already been installed.

As a result, the building fabric improvements that are available that would pass through planning and would make meaningful energy savings are severely limited.

For example, the large single glazed windows in the theatre hall could have secondary glazing installed. However, the fact secondary glazing was not installed here when it was throughout the rest of the building raises the question that perhaps Historic England objected. A query has been made with Historic England to check this factor, but currently it is assumed that it would be possible to install secondary glazing.

If it isn't possible, then at the very least draught proofing the windows can be done to limit air leakage and heat loss.

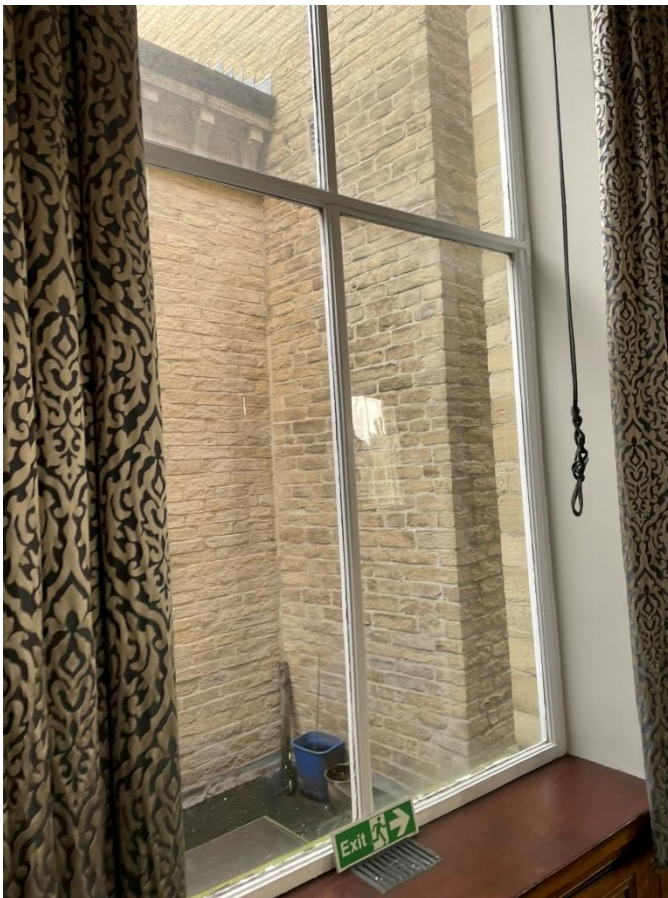
It is worth noting that there were some areas of loft insulation that were displaced. Overall, no new insulation needs to be installed, but the displaced insulation should be moved to ensure it covers any empty spaces.

Given the works already completed and the restrictions due to the building's character, improving the building's fabric, other than installing more secondary glazing, has been discounted.

**Figure 20:** Building Facade



**Figure 21:** Large Single Glazing & disturbed insulation



### 3.1.4 District Heating

Anytown Council are involved with the development of district heat networks in the area surrounding Anytown. Key developments includes:

- Anytown District Energy Heat Network;
- Anytown Housing (Anytown).

Anytown DEHN is a significant new heat network in development in Anytown, which has just gone to market<sup>1</sup> for early engagement. The published cabinet <sup>2</sup> meeting in 2021 indicated that the heat network would be focused in and around Anytown town centre and not extend into Anytown. This means that this building will not be able to connect to the heat network.

<sup>1</sup> <https://www.find-tender.service.gov.uk/Notice/022193-2025>

<sup>2</sup> chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://democracy.anytown.gov.uk/documents/s39756/Hudds%20Heat%20Network%20-%20FINAL.pdf

**Figure 22:** Diagram Published by Anytown Council, 2018 Feasibility study proposed heat network route map

In Anytown there are existing district heating networks such as Anytown Housing. However, these are domestic and used to provide heating to a number of council homes. It is not suitable for connection due to the size of the existing equipment and the distance from the Town Hall. In addition, it uses biomass and gas boilers as the heat source so would not decarbonise the heating at the Town Hall even if connection was possible.<sup>3</sup>

At this stage, there is not a suitable heat network in the area or in development that has a viable connection to the Town Hall.

Future developments of a DHN would not entirely be in the Council's control. There is no guarantee a connection could be possible or what heat source it would use. It could be powered by fossil fuels, meaning it would not decarbonise the building. Operational costs are a relative unknown, subject to change and significant standing charges that are not fixed.

For these reasons it is not wise or plausible to rely on connection to a DHN to decarbonise the heating at the Town Hall. However, due to the Council's net zero goal of 2038, it is recommended that the Council monitor the situation and if there are larger plans to construct a district heat network in the centre of Anytown, that the Town Hall is considered a key consumer in the area.

However, in the immediate future, the Council should look to other measures to decarbonise the building's space heating.

### 3.2 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 buildings. 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 all the buildings, as measured from the provided floor plans is approximately 4300m<sup>2</sup>.

**Table 8:** Peak Heat Loss Summary

| Existing Heat Capacity (Boilers) (kW) | Existing W/m2 | Existing DHW Capacity (kW) | Calculated Existing Peak Heat Loss (kW) | Calculated Existing Peak Heat Loss Post Fabric Changes (kW) | Proposed New Heating W/m2 |
|---------------------------------------|---------------|----------------------------|-----------------------------------------|-------------------------------------------------------------|---------------------------|
| 930                                   | 216           | Point of Use               | 399                                     | 392                                                         | 92                        |

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

<sup>3</sup> chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ruralenergy.co.uk/sites/default/files/Anytown%20Case%20Study.pdf

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.

### 3.3 Fabric Replacement (Secondary Glazing)

Given the building is Grade II listed with Historic England, installing fabric improvements is very difficult as each proposal will come under scrutiny to ensure it doesn't take away from the building's historic character. Installing secondary glazing is generally accepted as a measure to improve the fabric efficiency in listed buildings, so it is proposed that the existing single glazing in the theatre hall and reception/meeting room has secondary glazing installed.

It is worth noting that there were some areas of loft insulation that were displaced. Overall, no new insulation needs to be installed, but the displaced insulation should be moved to ensure it covers any empty spaces.

**Table 9: Proposed Fabric Improvements**

| Construction element | Construction type           | U-Value (W/m <sup>2</sup> K) | Improved U-Value (W/m <sup>2</sup> K) |
|----------------------|-----------------------------|------------------------------|---------------------------------------|
| Ground floor         | Concrete                    | 1.20                         | 1.20                                  |
| External walls       | Solid Stone Wall (500mm)    | 1.10                         | 1.10                                  |
| Windows              | Secondary Glazing           | 2.20                         | 2.20                                  |
| Windows              | Single Glazing to Secondary | 5.70                         | <b>1.80</b>                           |
| Roof                 | Pitched (Loft Insulated)    | 0.40                         | 0.40                                  |
| Exterior doors       | -                           | 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.

The table below shows the budgetary capital costs for the proposed fabric improvements. No allowances have been made for handling deleterious/hazardous materials (i.e. asbestos), where present, or for improvement works to the existing building structure before retrofitting. It is recommended that further investigations and design be conducted prior to the proposed works to ensure that the proposals are suitable for the building and that any existing structural/fabric issues are identified and remedied.

#### 3.3.1 Budget Cost Estimate

The following table breaks down the proposed fabric improvements and the cost.

**Table 10: Fabric Costs Breakdown**

| Item | Description   | Cost   |
|------|---------------|--------|
| 1    | Preliminaries | £1,500 |

|   |                   |                |
|---|-------------------|----------------|
|   |                   |                |
| 2 | Secondary Glazing | £71,800        |
|   |                   |                |
| 3 | Contingency Sum   | £3,700         |
|   |                   |                |
| 4 | <b>Total</b>      | <b>£77,000</b> |
|   |                   |                |

All other potential fabric improvement works have been discounted given the buildings Grade II listed status and the assumption that any improvements would not be approved by planning or Historic England.

### 3.4 Plant Replacement

#### 3.4.1 Heating Decarbonisation Options Appraisal

To fully transition from fossil fuel plant and to align with the Council's goal of achieving their 2038 net-zero carbon emission targets, the currently installed gas fired boilers for space heating that provide the site with LPHW for space heating would need to be decommissioned, disconnected and removed from the site.

There are a lot of factors to consider when proposing the best method to decarbonise the building. The current limiting factors for the different options are as follows:

##### Air Source Heat Pumps

- An external compound would need to be constructed at the rear of the building for this to enable installation. It is thought the green space to the building's northeast might be suitable.
- There is an existing leak in the Victoria Hall + Dressing room secondary heating circuit. Ideally, we would replace the whole heating distribution as it appears to be in poor condition. However, given the building's historic listed Grade II status, specifically with the interior listed, it is assumed that it is not possible to replace the existing heating distribution in its entirety. Due to this, a higher temperature ASHP would likely be required.

##### Electric Boilers

- While the boiler itself is relatively cheap and would enable the existing heating distribution to be retained, there would likely be a significant cost required to upgrade the building's electrical infrastructure to be able to power it.
- As its efficiency is limited to 100% (Compared to an ASHP efficiency of approximately 350%) the operational costs would be extortionate.

##### Connection to District Heat Network (DHN)

- Connection to an available DHN could be ideal as it could enable the existing heating infrastructure to be retained, high efficiency, no external plant required, subtle connections.
- However, the development of a DHN would not entirely be in the Council's control. There is no guarantee a connection could be possible, or what heat source it would use. It could be powered by fossil fuels, meaning it would not decarbonise the building.

- Operational costs are a relative unknown, subject to change and significant standing charges that are not fixed.
- Further research shows that a future connection is not currently plausible.

The table below gives an indication of the possible routes to decarbonisation of the building's heating systems. It highlights the pros, cons and limitations of each option.

The cost has been summarised in a ranking of 1 – 5.

**Key:**

£££££ = High Cost

£ = Low Cost

**Table 11: Heating Decarbonisation Options Summary**

| Option                                        | Capital Cost  | Operating Costs | Existing Heating Distribution Replacement | Disturbance | External Compound Required | Reliant on third parties. |
|-----------------------------------------------|---------------|-----------------|-------------------------------------------|-------------|----------------------------|---------------------------|
| Baseline (Existing Plant)                     | <b>None</b>   | <b>££</b>       | N/A                                       | None        | No                         | No                        |
| Low Temperature ASHP                          | <b>££££££</b> | <b>££</b>       | Yes                                       | Very High   | Yes                        | No                        |
| High Temperature ASHP                         | <b>££££</b>   | <b>£££</b>      | No                                        | Reasonable  | Yes                        | No                        |
| Electric Boiler                               | <b>££</b>     | <b>££££££</b>   | No                                        | Minimal     | No                         | No                        |
| Connection to future District Heating Network | <b>££</b>     | <b>Unknown</b>  | No                                        | Minimal     | No                         | Yes                       |

Initially In the draft version of this report, we recommend the installation of an electric boiler due to the following reasons:

- It is not confirmed if the existing heating distribution could be removed;
- It is not confirmed that building an external storage space/plant to the rear of the building is possible;
- It is not possible to map out connections to heat networks at this stage and it isn't a guarantee that a connection will be possible.

However, although not confirmed, further research showed there is greater potential for a possible ASHP installation using an external compound than first thought. Because of this, we have compared the two major options available to the Council to decarbonise the building's heating.

At this stage, we are assuming that it is not possible to replace the existing heating distribution in the building due to its Grade II status and the disruption that it would cause to the building's interior. As a result, the only viable options for decarbonisation are either the installation of a high temperature ASHP or an electric boiler that can work with the existing heating distribution.

### 3.4.2 Option 1: Electric Boiler

Installing an electric boiler would not involve significant works and would require the connection of the electric boiler to the existing heating distribution system. It would however involve the upgrade of the existing electrical infrastructure capacity which would likely come at significant cost.

This is an unknown cost at this stage and would involve an application with the local district network operator (DNO) to better understand the works that would be required and the costs associated with them.

All other works would be contained within the plant room.

The budgetary estimate for implementing an electric boiler heating system to serve the building is approximately **£334,000** and is broken down as:

**Table 12: Electric Boiler Cost Breakdown**

| Item     | Description                                  | Cost            |
|----------|----------------------------------------------|-----------------|
| 1        | Preliminaries                                | £5,300          |
| 2        | Plant Room(s)                                |                 |
| 2a       | Electric Boiler(s)                           | £39,200         |
| 2b       | Heating Primary Pump(s)                      | £4,600          |
| 2c       | Pressurisation Unit(s) & Expansion Vessel(s) | £3,300          |
| 2d       | Plant Room Pipework, Valves, & Ancillaries   | £8,000          |
| 2e       | Automatic Controls, Control Panel & BMS      | £15,000         |
| 2f       | Electrical Works                             | £30,100         |
| 2g       | Glycol Antifreeze                            | £3,000          |
| 2h       | Civil Works                                  | £2,000          |
| 2i       | Builders' Work                               | £4,400          |
| 3        | Electrical Infrastructure Upgrade            | £150,000        |
| 4a       | Testing & Commissioning                      | £1,000          |
| 4b       | Demonstration & Training                     | £1,000          |
| 4c       | Record Information                           | £500            |
| 5        | Contingency Sum                              | £26,800         |
| <b>6</b> | <b>Works Budget Total</b>                    | <b>£294,200</b> |

|    |                             |                 |
|----|-----------------------------|-----------------|
|    |                             |                 |
| 7a | Design Fees                 | £26,500         |
| 7b | Project Management Fees     | £13,300         |
|    |                             |                 |
| 8  | <b>Project Budget Total</b> | <b>£334,000</b> |
|    |                             |                 |

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.

It also assumed that the existing heating distribution and existing pumps will be retained, with minor modifications to the existing BMS.

### 3.4.3 Option 2: High Temperature Air Source Heat Pump

Installing a High Temperature Air Source Heat Pump (HT-ASHP) would require more capital investment and works to install the equipment. However, it would see the benefit of a substantially better efficiency compared to an electric boiler, meaning the operational costs would be lower for the Council once the equipment was installed.

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.

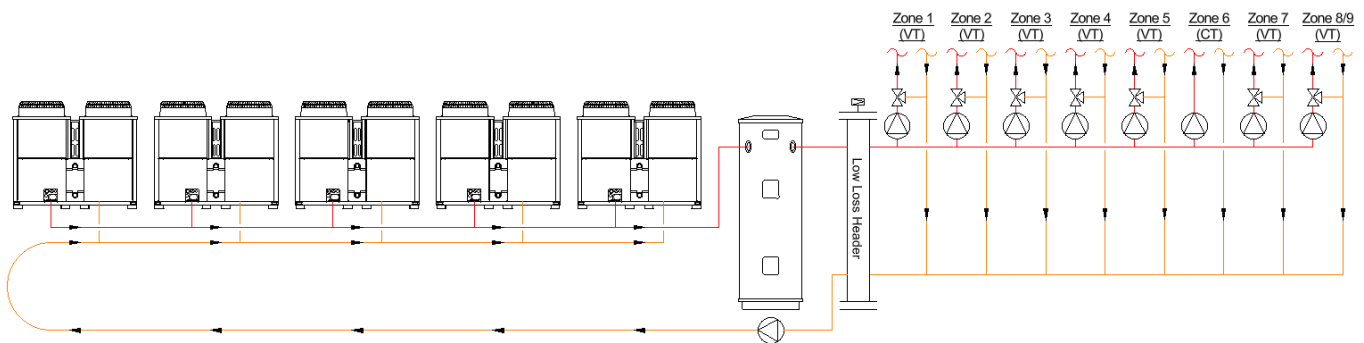
The proposed location is presumed to offer good airflow, essential for the optimal performance of the ASHP unit. The final location of the proposed installation will be determined during the detailed design stage and subject to approval from local planning and Historic England. Considerations include but are not limited to retaining the character of the building, 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 23: Proposed Location of ASHP Compound (Blue Hatch)*

*Table 13: Proposed Space Heating Equipment*

| Space Heating or DHW | Equipment                   | Total Proposed Capacity (kW) | SCOP | Flow temperature (°C) | Heat Emitter Replacement |
|----------------------|-----------------------------|------------------------------|------|-----------------------|--------------------------|
| Space Heating        | 5 × Lochinvar LAHP-88HTR290 | 440                          | 2.76 | 65                    | No                       |

**Figure 24: Typical Proposed ASHP Space Heating Schematic**



The budgetary estimate for implementing a high temperature air source heat pump heating system to serve the building is approximately **£699,900** and is broken down as:

**Table 14: HT-ASHP Cost Breakdown**

| Item | Description                                   | Costs    |
|------|-----------------------------------------------|----------|
| 1    | Preliminaries                                 | £11,000  |
| 2    | <b>Heat Pump(s) and Plant Room</b>            |          |
| 2a   | Construction of External Compound             | £36,700  |
| 2b   | Air Source Heat Pump(s) (ASHP)                | £191,100 |
| 2c   | Pressurisation Unit(s) & Expansion Vessel(s)  | £1,600   |
| 2d   | Plant Room Pipework, Valves, & Ancillaries    | £44,000  |
| 2e   | Buffer Vessel                                 | £3,300   |
| 2f   | Automatic Controls                            | £15,000  |
| 2g   | Electrical Works                              | £33,000  |
| 2h   | Interconnecting Pipework (ASHP to Plant Room) | £44,000  |
| 2i   | Glycol Antifreeze                             | £5,000   |
| 2j   | Builders' Work                                | £22,800  |
| 3    | Upgrading Main Incoming Electrical Supply     | £150,000 |
| 4a   | Testing & Commissioning                       | £1,500   |
| 4b   | Demonstration & Training                      | £1,000   |
| 4c   | Record Information                            | £500     |
| 5    | Contingency Sum                               | £56,100  |

|          |                             |                 |
|----------|-----------------------------|-----------------|
|          |                             |                 |
| <b>6</b> | <b>Works Budget Total</b>   | <b>£616,600</b> |
|          |                             |                 |
| 7a       | Design Fees                 | £55,500         |
| 7b       | Project Management Fees     | £27,800         |
|          |                             |                 |
| <b>8</b> | <b>Project Budget Total</b> | <b>£699,900</b> |
|          |                             |                 |

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.

It also assumes that the existing heating distribution and existing pumps will be retained, with minor modifications to the existing BMS.

### 3.4.4 Electric Boiler v High Temperature Cost and Energy Comparison

For the purposes of understanding the implications of each heating system option for the Town Hall, an electric boiler and HT-ASHP systems have been compared to see both the financial and carbon implications. The following systems were compared.

#### An Electric Boiler System:

- Four electric boilers would be installed in the existing plant room to replace the existing gas fired boilers.
- A Seasonal Coefficient of Performance (SCOP) of 1.00 for production of space heating LPHW at 65-80°C.
- Connected up to the existing heating distribution.
- Would require significant electrical infrastructure upgrades, potentially high cost.

#### A High Temperature ASHP system:

- 5no. HT-ASHPs would be installed in a new external compound to the northeast of the building.
- Trenching required for connection to existing plant room.
- A SCOP for space heating of 2.76 to provide space heating LPHW at 65-70°C.
- Connected up to the existing heating distribution.
- Would require electrical infrastructure upgrades, potentially high cost.

The following Tables and Figures showcase the different systems performance in year 1 and over a 20 year period, with the assumption that both systems were installed from 2027 for a better comparison of their performance.

**Table 15:** *Electric Boiler v HT-ASHP Performance Year One*

| System | Capital Cost | Space Heating Electricity use (kWh) | Carbon Saving (TC)2e) | Cost Saving Year 1 (£) |
|--------|--------------|-------------------------------------|-----------------------|------------------------|
|--------|--------------|-------------------------------------|-----------------------|------------------------|

|                        |          |         |    |         |
|------------------------|----------|---------|----|---------|
| <b>Electric Boiler</b> | £334,000 | 266,539 | 18 | -55,000 |
| <b>HT-ASHP</b>         | £699,900 | 96,572  | 48 | -10,872 |

The above table showcases that the operational cost of the ASHP system is significantly lower than the electric boiler. This is because the overall efficiency of the HT-ASHP is greater (2.76 times greater), and it uses significantly less electricity than the electric boiler.

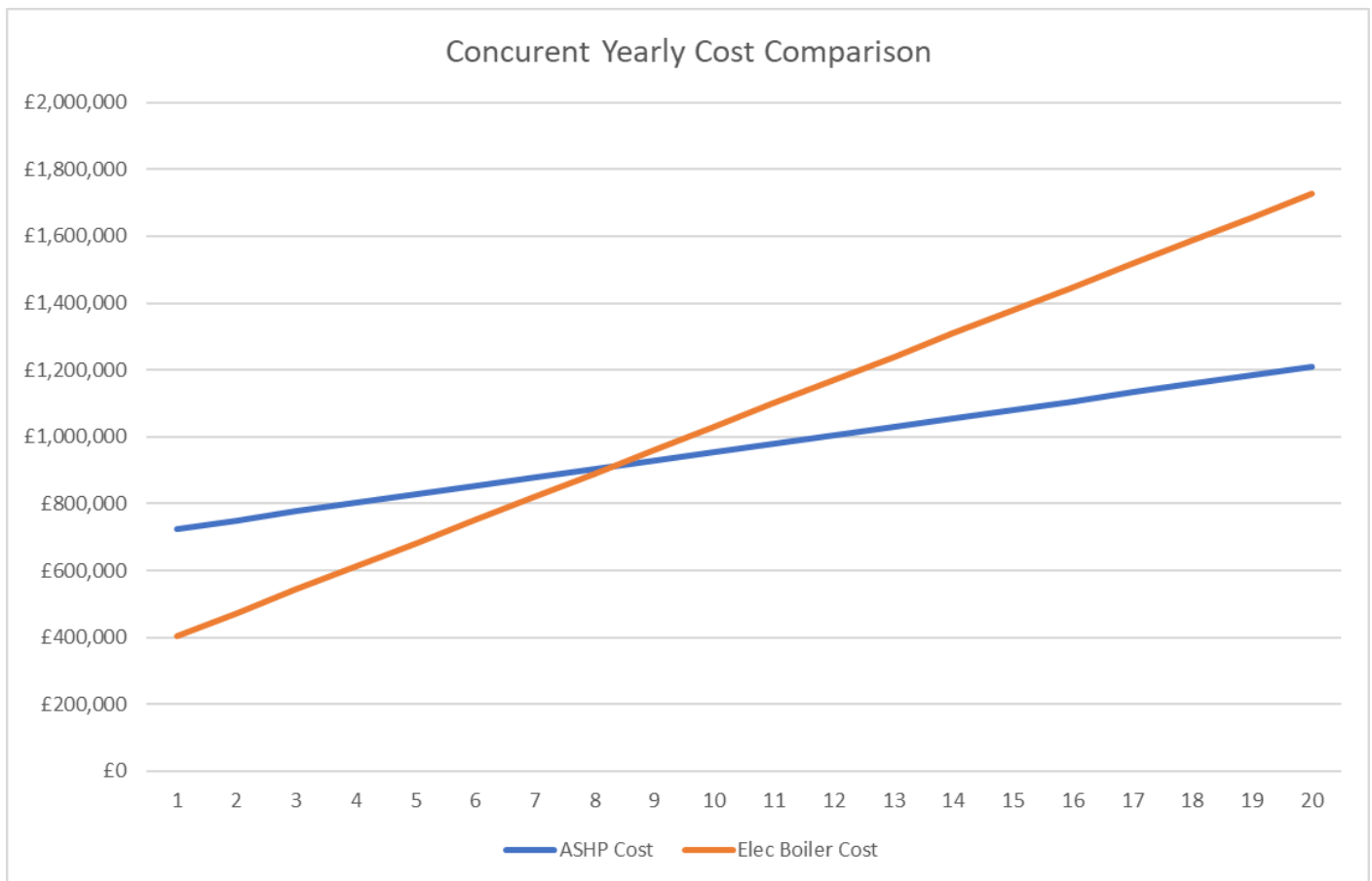
However, the initial capital costs of the electric boiler system are significantly cheaper than the HT-ASHP system, mainly due to the higher equipment and external compound costs that are required for the HT-ASHP. Despite this however, over a 20 year period, the HT-ASHP system would cost the Council less money when taking into account both systems operational costs over this period. The below table showcases the costs and performance of the two systems, with comparison to the existing set up in the building.

**Table 16: Financials and Carbon over 20 Year Period**

| <b>System</b>               | <b>Capital Cost</b> | <b>20 Year Operational Cost (£)</b> | <b>Total Cost After Installation &amp; 20 Years of Operation (£)</b> | <b>Carbon Emissions over 20 Years (TCO2e)</b> |
|-----------------------------|---------------------|-------------------------------------|----------------------------------------------------------------------|-----------------------------------------------|
| <b>Existing Gas Boilers</b> | £0                  | £321,834                            | £321,834                                                             | 1472.1                                        |
| <b>Electric Boiler</b>      | £334,000            | £1,386,004                          | £1,720,004                                                           | 943.5                                         |
| <b>HT-ASHP</b>              | £699,900            | £502,175                            | £1,202,075                                                           | 341.9                                         |

Please note that the above figures are a simple projection, using the Council's current tariff rates for both electricity and gas over the whole 20 year period. It also assumes that the building use does not change and the existing heating load is consistent over the 20 year period.

**Figure 25: 20 Year Cost Comparison**



The figure above shows the comparison of the ongoing costs of the two systems over a 20 year period, taking into account the Council's initial capital expenditure. It shows that due to the significantly lower costs to operate the HT-ASHP each year compared to the electric boiler system, that in year 8, the HT-ASHP becomes a better financial decision and is the cheaper option to the Council. This saving increases with each year thereafter, eventually resulting in a scenario where the HT-ASHP system would have cost the Council approximately £518,000 less over the 20 years of operation when compared to the electric boilers.

As well as this, the HT-ASHP produces less carbon emissions over the 20 year period than the electric boiler system. The electric boiler system produces 944 TCO<sub>2</sub>e while the HT-ASHP produces 342 TCO<sub>2</sub>e, approximately 602 TCO<sub>2</sub>e less than the electric boiler over the same period.

This shows that the HT-ASHP is a better option for the Council, both financially and in reducing the Council's carbon emissions. However, it would require significantly more initial capital investment and would cause more disruption to the building's normal activities.

Due to the high likelihood that planning would object to the requirements when replacing the existing heating distribution system, we have not costed or estimated energy savings of installing a lower temperature air source heat pump. However, the existing heating distribution is likely in poor condition, given the leak on one of the secondary heating circuits at the time of the site survey. It is a possibility that the Council would have to replace the existing distribution as part of the maintenance of the building anyway over the next few years.

This, combined with the fact that the Council has until 2038 until their net zero carbon goal, means that it is worth having the conversation with Historic England in the short term about possibly installing a new lower design temperature heating distribution system if significant and disruptive repairs to the heating distribution would be required due to maintenance regardless.

It is strongly recommended that the Council commission a condition survey of the current heating distribution pipework and radiators to understand their remaining lifespan. If the result of this is that they are only to last another 15 years or less for example, it is highly recommended that the Council wait to decarbonise the building's heating system until a time that they can combine the work with the heating distribution replacement.

This would allow them to utilise air source heat pumps that operate at lower temperatures and higher efficiency, which would lower their operational costs.

Alternatively, if they needed to replace the heating distribution after installing the proposed Lochinvar HT-ASHPs, they could simply change the operating temperature of the heat pumps to lower temperatures to significantly improve the efficiency and Seasonal Coefficient of Performance (SCOP) of the system.

- SCOP of Lochinvar LAHP-88HTR290 at 65°C: 2.76
- SCOP of Lochinvar LAHP-88HTR290 at 35°C: 3.95

*Figure 26: Pros and Cons of the Different Options*

| System          | Capital Cost Contribution | Carbon Saving | Operational Cost | Need to replace Heating Distribution System |
|-----------------|---------------------------|---------------|------------------|---------------------------------------------|
| Electric Boiler | Medium                    | Medium        | Very High        | No                                          |
| HT-ASHP         | High                      | High          | Medium           | No                                          |

Currently, we would recommend opting with the HT-ASHP over the electric boiler as it offers the best carbon and cost savings over the 20 year period and could be utilised at higher efficiency if the opportunity arose.

If installing the external compound that is required for the heat pumps is not possible, then the only realistic measure for decarbonising the space heating at Town Hall is by installing the electric boiler system.

Alternatively, if the Council concludes that replacing the current heating distribution and radiators is feasible in the near future, then we would recommend the Council commission an energy audit or decarbonisation study nearer the time they plan to replace the heating distribution, as the market could have significantly changed over this time.

### 3.4.5 Domestic Hot Water (DHW)

The Domestic Hot Water (DHW) across the building is served via point of use electric water heaters, rather than the DHW being generated in the main plant room. Given this is already decarbonised, it is recommended that the Council retain these and replace them as and when they fail.

### 3.4.6 Boiler Like for Like Replacement Cost Breakdown

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

**Table 17: Space Heating Boiler Like for Like Replacement**

| Item                                     | Estimated Cost |
|------------------------------------------|----------------|
| Removal of Existing Equipment            | £1,000         |
| Main Equipment                           | £50,400        |
| Plinth, Pipework Connections, Insulation | £5,100         |
| Installation                             | £12,600        |
| Commission                               | £500           |
|                                          |                |
| <b>Total</b>                             | <b>£69,600</b> |
|                                          |                |

### 3.4.7 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 main meter is 3-phase, 400 Volts with a 400 Amp supply, although it was not clearly labelled. The main incoming supply is assumed to be 400 Amp rated given it has a direct connection to the 400 Amp main meter and the distribution panel is rated at 400 Amps.

**Table 18: Electrical Capacity Requirements**

| Maximum Import Capacity (kVA) | Current Max Demand (kVA) | ASHP Electrical Demand (kVA) | Boiler Electric Demand (kVA) | Resultant Spare Capacity (ASHP) (kW) | Resultant Spare Capacity (Electric Boiler) (kW) |
|-------------------------------|--------------------------|------------------------------|------------------------------|--------------------------------------|-------------------------------------------------|
| 277                           | 69                       | 273                          | 421                          | -56                                  | -197                                            |

The maximum demand was calculated from half-hourly electrical data provided by the Council. It was also not confirmed if there is an existing agreement with a DNO to provide a lower capacity to the building as no electricity bill was provided.

The resultant spare capacity after the proposed low carbon electrically powered equipment is installed is approximately **-56 kW** if installing ASHPs, and **-197 kW** if installing the electric boilers. 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 2038 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 **£150,000** for these upgrades at this stage for both the ASHP and electric boiler option as regardless of whichever option is available to decarbonise the building's heating (with exception to connection to a district heat network) the building's existing electrical infrastructure will need to be upgraded.

**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.

The energy savings from implementing LED luminaries 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 19: Lighting Replacement Cost Breakdown**

| Item     | Description                | Cost           |
|----------|----------------------------|----------------|
| 1        | Prelims                    | £1,500         |
| 2a       | Access for works           | £300           |
| 2b       | Installation               | £6,400         |
| 2c       | Removal and Disposal       | £1,800         |
| 3a       | Lighting                   | £16,000        |
| 3b       | Controls                   | £2,000         |
| 3c       | Emergency                  | £2,200         |
| 4a       | Record Information         | £500           |
| 4b       | Testing & Commissioning    | £400           |
| 5        | Contingency costs          | £3,200         |
| <b>6</b> | <b>Works Budget Total</b>  | <b>£34,300</b> |
| 7a       | Design and Engineering Fee | £3,500         |
| 7b       | Project Management Fee     | £1,800         |
| <b>8</b> | <b>Total Project Costs</b> | <b>£39,600</b> |

The cost estimate includes all non-LED luminaires identified during the site survey excluding the lighting in the loft space and clock tower.

Given these fixtures low use, it is recommended that they be replaced as of when they fail as they are not as cost efficient to replace as the energy savings will be minimal.

## 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. However, the building is Grade II listed by Historic England. This means that any proposals will come under increased scrutiny and is more difficult to get approved.

There is precedent for listed buildings to have solar PV installed, so it is a possibility. The proposed PV at Anytown hall is on the roof of the Theatre Hall so it is not visible from the main façade at the front of the building.

At the detailed design stage, a survey will need to be carried out to understand if the roof has 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 the annual electricity consumption data provided by the Council. Half hourly electrical data or monthly would be more useful to predict when the PV system would export electricity. However, given the current systems export is minimal, this isn't a significant issue.

*Figure 27 Proposed 59 kWp PV System*



**Figure 27** visualises the proposed PV installation on the building's roof. 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 21**.

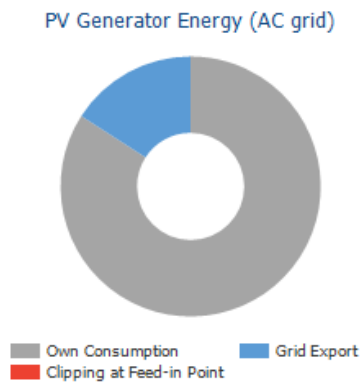
The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter and other factors.

**Table 20:** 59 kWp PV System Performance

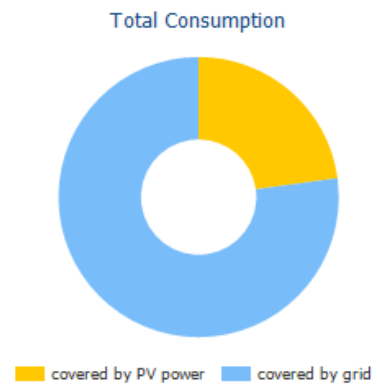
| <b>PV Generator Output</b>       | <b>59</b>   | <b>kWp</b> |
|----------------------------------|-------------|------------|
|                                  |             |            |
| Spec. Annual Yield               | 831.05      | kWh/kWp    |
| Performance Ratio (PR)           | 88.73       | %          |
| Yield Reduction due to Shading   | 7.1         | %          |
|                                  |             |            |
| PV Generator Energy (AC grid)    | 48,877      | kWh/Year   |
| Own Consumption                  | 43,627      | kWh/Year   |
| Clipping at Feed-in Point        | 0           | kWh/Year   |
| Grid Export                      | 5,251       | kWh/Year   |
|                                  |             |            |
| Own Power Consumption            | 89.3        | %          |
|                                  |             |            |
| <b>Level of Self-sufficiency</b> | <b>22.1</b> | <b>%</b>   |
|                                  |             |            |

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

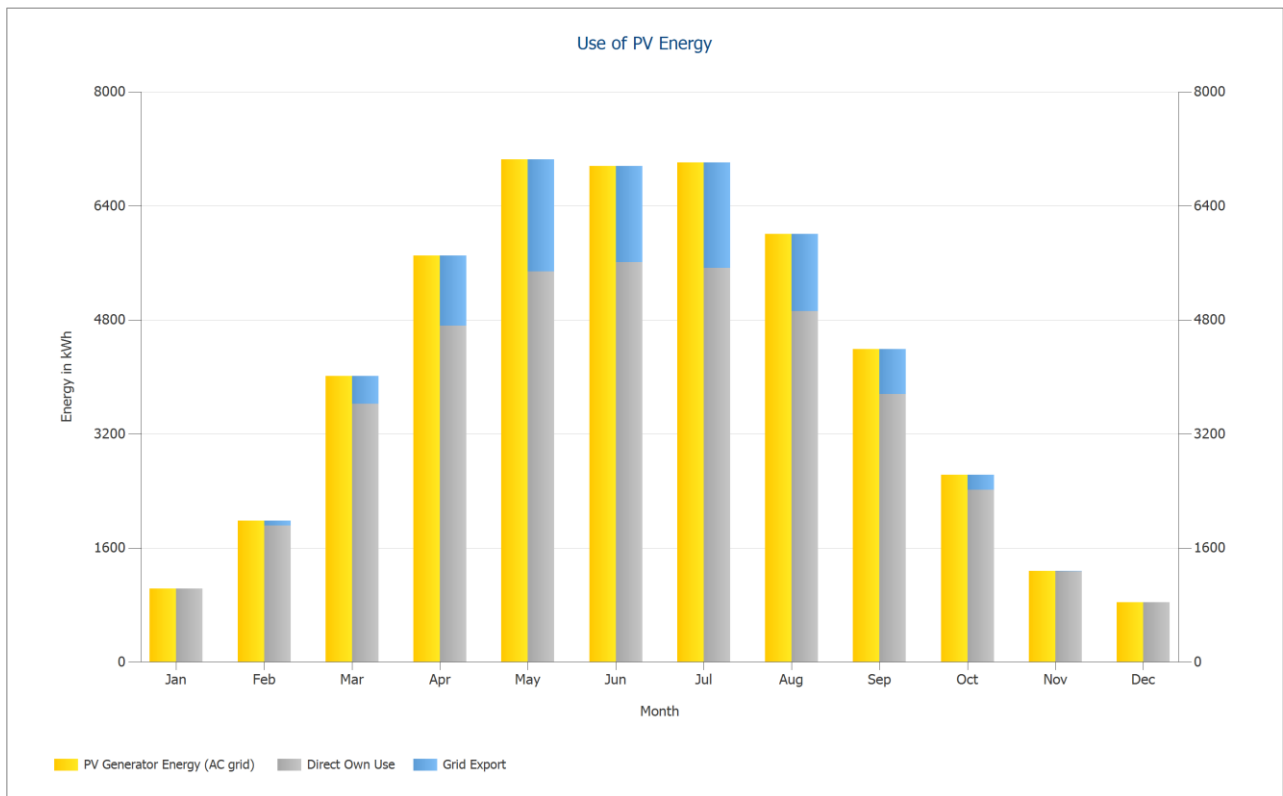
**Figure 28: PV System Output Split by End Use**



**Figure 29: Building Consumption by Energy Source**



**Figure 30: PV Generator Output Allocation by Month**



### 3.6.2 Budget Cost Estimate

The associated budgetary cost for the proposed 59 kWp PV installation is **£62,000** and is broken down as follows:

**Table 21: 59 kWp PV System Cost Breakdown**

| Item     | Description                 | Cost           |
|----------|-----------------------------|----------------|
| 1        | Preliminaries               | £2,500         |
| 2a       | Photovoltaic Array          | £11,300        |
| 2b       | Inverters                   | £2,500         |
| 2c       | Electrical Connections      | £17,000        |
| 3a       | Builders' Work & Frame      | £9,300         |
| 3b       | Access/ Scaffolding         | £7,500         |
| 4a       | Testing & Commissioning     | £500           |
| 4c       | Record Information          | £500           |
| 5        | Contingency Sum             | £5,200         |
| <b>6</b> | <b>Works Budget Total</b>   | <b>£56,300</b> |
| 7a       | Design Fee                  | £4,000         |
| 7b       | Project Management Fee      | £1,700         |
| <b>8</b> | <b>Project Budget Total</b> | <b>£62,000</b> |

### 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 building uses, is 5,251 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 tariff's 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 hand dryers, costs can be distributed more evenly over time as they reach the end of their service life. This approach makes the expense more manageable.

### **3.8 Catering Equipment**

To fully eliminate the use of fossil fuels at the site, replacing all gas-fired cooking appliances with electric equivalents is recommended. By switching to energy-efficient commercial catering appliances, substantial energy savings can be achieved. Rational<sup>4</sup>, an established commercial catering equipment manufacturer, estimates potential energy savings of 40% by switching to these energy-efficient appliances.

The gas consumption associated with catering equipment is 35,577 kWh. The cost of the cooking appliances is unknown as this is specialist equipment.

## **4 Energy and Carbon Savings**

### **4.1 Energy Consumption**

The table below presents a summary of the energy usage at the site. Both the gas and electricity were originally provided by the Council as an annual figure, but at a later date electrical half-hourly data over a period of a year and monthly gas invoices were provided.

Gas AMR data was available, but staff reported that it was not calibrated correctly. It is highly recommended that the Council get in contact with their supplier to try and resolve this.

The energy prices are based on tariff rates provided by the Council. No invoices have been provided directly, so in this instance it is assumed that CCL is included within the provided tariff rates.

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.

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).

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<sup>4</sup> [iVario Pro. In the restaurant. The Game Changer. | RATIONAL AG \(rational-online.com\)](https://www.rational-online.com)

**Table 22: Building Energy Consumption: Cost and Carbon Emissions**

| Energy Source | Annual Energy Consumption (kWh) | Cost           | CO <sub>2</sub> e (tonnes) | Unit Rate (£/kWh) | Energy Benchmarking Typical Consumption (kWh) |
|---------------|---------------------------------|----------------|----------------------------|-------------------|-----------------------------------------------|
| Electricity   | 197,136                         | £51,255        | 34.9                       | 0.26              | 365,500                                       |
| Gas           | 402,293                         | £16,092        | 73.6                       | 0.04              | 567,600                                       |
| <b>Total</b>  | <b>599,429</b>                  | <b>£67,347</b> | <b>108.5</b>               |                   |                                               |

The “Energy Benchmarking” figures provide a means to compare the building’s energy usage to similar building types. The benchmarking figures are based on the “typical” energy usage for the building type as obtained from the CIBSE Energy Benchmarking Dashboard<sup>5</sup> and a measured floor area from provided plans of 4,300m<sup>2</sup>.

The energy benchmarking figures suggest that the building is performing significantly better than typical town halls (gas-heated) properties. For example, gas usage where it is at just 70% of typical consumption of a building of its size (m<sup>2</sup>) and type. This is also the case for electrical consumption; the building is consuming just 54% of what would typically be expected.

An Energy Performance Certificate (EPC) is currently the best available indicator of the energy efficiency rating (relating to running costs) within buildings that are sold or rented out and in which energy is used to condition the indoor climate. The energy rating from the most recent EPC is as follows:

|                      |                    |
|----------------------|--------------------|
|                      | <b>, ANYTOWN,</b>  |
| <b>Source</b>        |                    |
| <b>Energy rating</b> | <b>A (Expired)</b> |
| <b>Score</b>         | <b>8</b>           |

The EPC rating is heavily dictated by the building’s energy consumption when compared to its use. The latest EPC suggests that the Town Hall has the following annual consumption:

- Electricity: 31,459 kWh
- Gas: 78,973 kWh

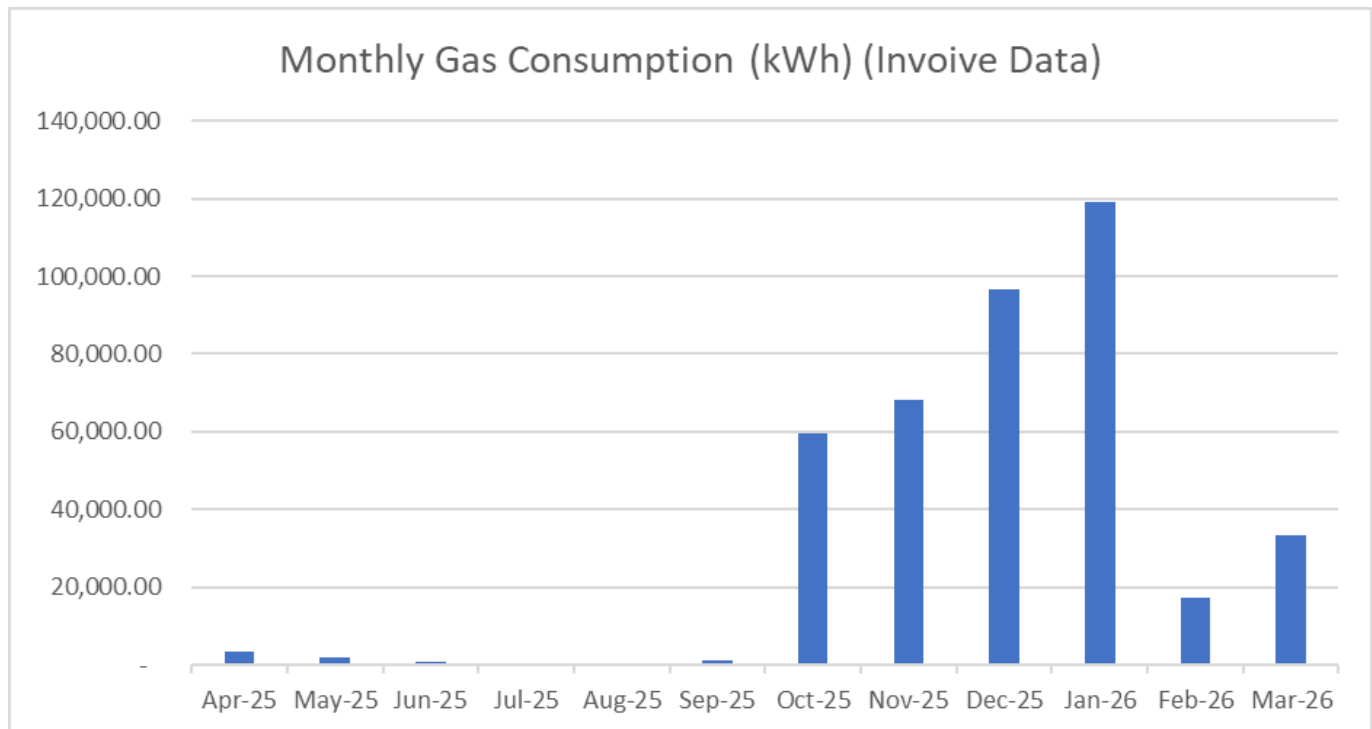
This, combined with the incredibly good score of 8 is highly unlikely to be an accurate representation of the Town Hall. The data that the Council has provided is significantly higher than the data presented in the EPC. This trend is seen in the previous EPC’s too, and none of them are a fair representation of the building’s energy performance. It is recommended that when the Town Hall next receives an EPC assessment that the Council provide the assessor with accurate consumption data.

It is highly recommended the Council investigate the issue with the gas AMR. This will enable them to be able to properly record gas consumption data. Gas invoices are not always representative of true monthly consumption.

<sup>5</sup> [Energy Benchmarking Dashboard](#)

For example, the below graph is a plot of the gas consumption data provided from invoices over the last 12 months. March 2026 has been taken as an average, as only 11 months was provided.

**Figure 31:** Gas Invoice Consumption Data



The data is unlikely to be an accurate representation of the building's gas consumption; the total annual consumption is just split between half of the year. The fact that the building has a gas hob in the kitchen means that even in the summer they will be consuming gas.

Further clarification is required to ascertain the exact breakdown of energy consumption within the site. Obtaining accurate and comprehensive data regarding both electricity and 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.

As a result of the absence of submetering data, we have used the energy end-use breakdowns from the Building Energy Efficiency Survey (BEES)<sup>6</sup> 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 site and the three main buildings.

## 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 2038.

<sup>6</sup> [Building Energy Efficiency Survey \(BEES\) - GOV.UK \(www.gov.uk\)](https://www.gov.uk/building-energy-efficiency-survey-bees)

**Table 23:** 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 <sub>2</sub> ) per year |
|--------------|---------------------------------------------------------|----------------------------------|--------------------------|-------------------|------------------|------------------|--------------------------------------------|
| 1            | Secondary Glazing Installation                          | -                                | 10,785                   | £539              | £77,000          | N/A              | 2.0                                        |
| 2a           | High temperature air source heat pump for Space Heating | -96,572                          | 355,931                  | -£10,872          | £699,900         | N/A              | 48.0                                       |
| 3a           | Solar Panels (59 kWp) Own Use                           | 43,627                           | -                        | £11,343           | £62,000          | 5.2              | 7.7                                        |
| 3b           | Solar Panels (59 kWp) Export                            | 5,251                            | -                        | £630              | As Above         | As Above         | 0.9                                        |
| 4            | LED Lighting Replacement                                | 29,463                           | -                        | £8,624            | £39,600          | 4.6              | 5.2                                        |
| 5            | Kitchen Equipment Replacement                           | -21,346                          | 35,577                   |                   | Unknown          | N/A              |                                            |
| <b>Total</b> |                                                         | <b>-39,578</b>                   | <b>402,293</b>           | <b>£10,265</b>    | <b>£878,500</b>  | <b>N/A</b>       | <b>63.9</b>                                |

The Table below showcases energy and carbon savings from the alternative option for the decarbonisation of the building's space heating. This represents the comparison of the sites current operation in 2026 compared with 2038.

**Table 24:** Carbon & Energy Savings - Alternative Option

| Option | Proposals            | Annual Electricity Savings (kWh) | Annual Gas Savings (kWh) | Annual Saving (£) | Capital Cost (£) | Payback in Years | Carbon Saving (tCO <sub>2</sub> ) per year |
|--------|----------------------|----------------------------------|--------------------------|-------------------|------------------|------------------|--------------------------------------------|
| 2b     | Electric Boiler (SH) | -266,539                         | 355,931                  | -£55,063          | £334,000         | N/A              | 17.9                                       |

|  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|

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 Item 2a, 5 and 2b 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 6 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 LED lighting and PV system 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

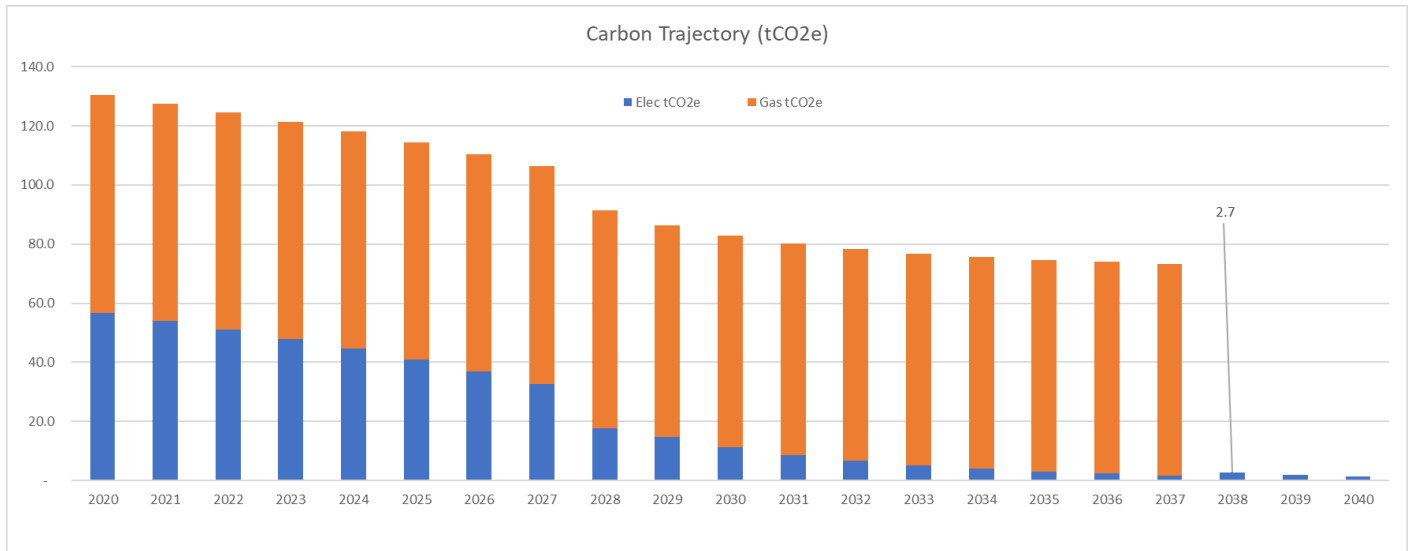
The use of gas at the site will need to cease and all gas-fired equipment will need to be decommissioned to decarbonise the site and align with the Council's set net-zero targets in 2038.

The assessment of future emissions considers that the electricity grid will decarbonise much faster than the traditional gas grid. 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 of PV solar array and LED lighting.
- 2028: Installation of additional secondary glazing in the theatre hall and reception/meeting room.
- 2037: Decommissioning of gas fired equipment (Including kitchen equipment) and the installation of high temperature air source heat pump for space heating.

**Figure 32** Carbon Trajectory – Recommended Projects



The trajectory shows what the emissions would be if the site transitioned to electricity before the Council’s net-zero target of 2038.

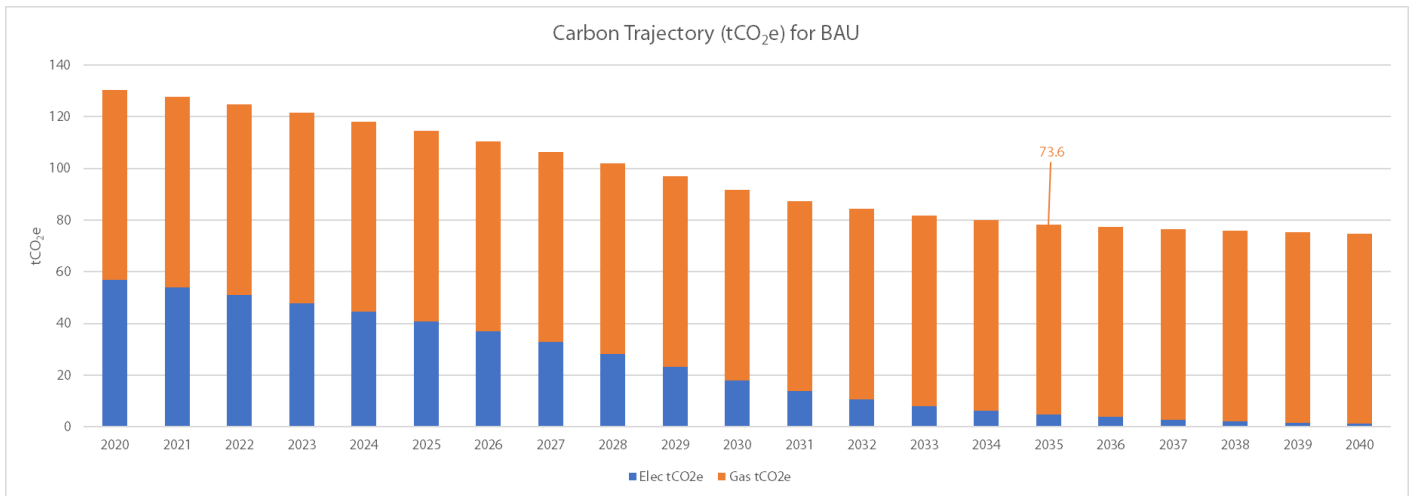
Achieving net-zero carbon emissions requires a strategy that focuses on reducing emissions as much as possible through energy efficiency/conservation measures and low-carbon projects, alongside generating energy onsite from renewable sources. After these carbon reduction initiatives, the remaining emissions 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 (2.7 tCO<sub>2</sub>e) by the year 2038 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 CO<sub>2</sub>e emissions continue to fall as the electricity grid continues to decarbonise.

**Figure 33** 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 33: Business as Usual (BAU) Carbon Trajectory**



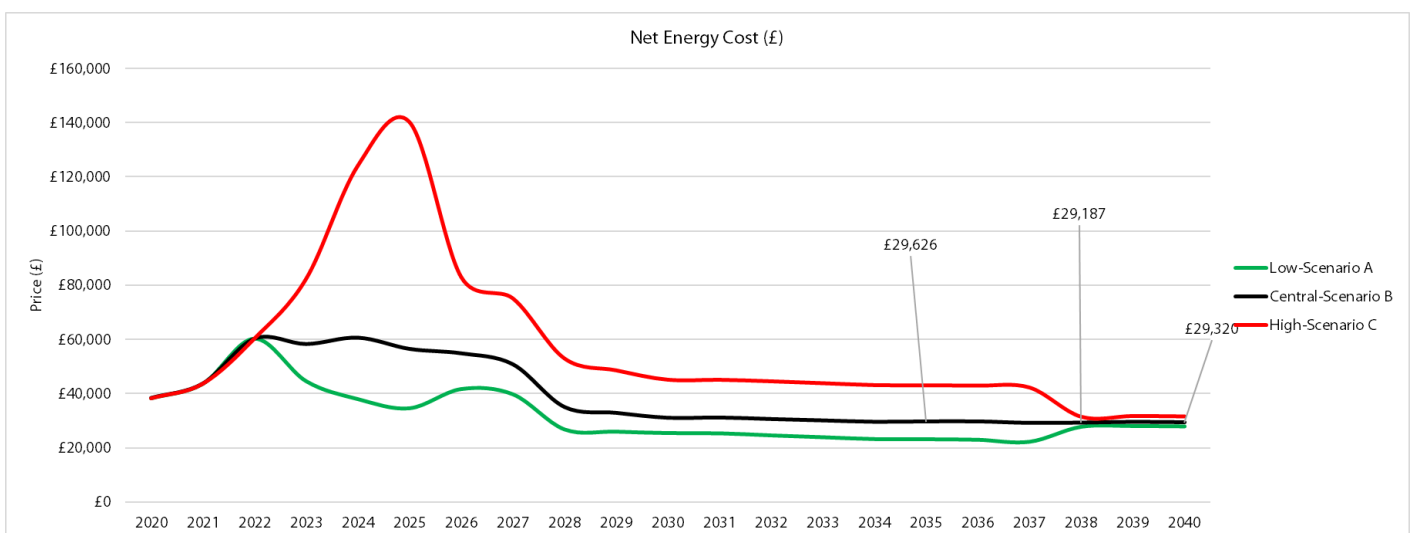
## 4.4 Forecast Energy Costs

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 34 Year to Year Net Energy Running Costs**



The annual operating costs by 2038 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 2038.

Originally, we recommended the installation of an electric boiler if the Council wanted to fully decarbonise the building in the draft version of this report. This was due to the following reasons:

- It is not confirmed if the existing heating distribution could be removed.
- It is not confirmed that building an external storage space/plant to the northeast of the building is possible.
- It is not possible to map out connections to heat networks at this stage and it isn't a guarantee that a connection will be possible.

Although not confirmed, further research showed there is greater potential for a possible ASHP installation using an external compound than first thought. Because of this, we have compared the two major options available to the Council to decarbonise the building's heating over a 20 year period.

Based on the comparison, it is recommended that the Council decommission the existing gas boilers that provide the main building's space heating demand and remove them from site. It is proposed that in its place, five High Temperature Air Source Heat Pumps (HT-ASHPs) alongside the auxiliary equipment are installed to provide 65°C Low Pressure Hot Water (LPHW) to the existing heating distribution system. By removing the existing boilers there should be sufficient space in the existing plant room for the new buffer vessel.

It is also recommended that the Council lower the flow temperatures of the boilers to see what the lowest temperature they can provide to the existing heating distribution that still effectively heats the building. This will allow the Council to operate the ASHP at the highest efficiency possible once installed to lower operating costs.

Due to the high likelihood that planning would object to the requirements when replacing the existing heating distribution system in the building, we have not costed or estimated energy savings of installing a lower temperature air source heat pump. However, the existing heating distribution is likely in poor condition, given the leak on one of the secondary heating circuits at the time of the site survey. It is a possibility that the Council would have to replace the existing distribution as part of the maintenance of the building anyway over the next few years.

Anytown Council's net zero carbon goal of 2038 means that it is worth having the conversation with Historic England in the short term about possibly installing a new lower design temperature heating distribution system if significant and disruptive repairs to the heating distribution would be required due to maintenance.

It is strongly recommended that the Council commission a condition survey of the current heating distribution pipework and radiators to understand their remaining lifespan. If the result of this is that they are only to last another 15 years or less for example, it is highly recommended that the Council wait to decarbonise the building's heating system until a time that they can combine the work with the heating distribution replacement.

It is highly recommended that the Council investigate the current settings on the BMS to ensure it is optimised to the current use of the building as the observations during the site survey suggested that it is not currently. The review of the BMS settings should include:

- Heating zone definitions and plant enable logic;

- Time schedules for occupied and unoccupied periods;
- Space and flow temperature setpoints for each zone;
- Seasonal changeover and override functions.

It is also recommended that the buildings' staff are educated on how to input changes where necessary to the BMS settings, or to at least communicate with the correct person at the Council who can remotely make these changes.

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.

Planning could be a potential issue but there is precedent for listed buildings to have solar PV installed. It is recommended that the Council engage with their local planning department to see what could be possible. The proposed PV at Anytown Town Hall has been designed to be located on the roof of the Theatre Hall so it is not visible from the main façade at the front of the building with this under consideration.

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.

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 installed electrical infrastructure at the sub-station suggest that it should be possible to negotiate with the DNO to increase this allowance. 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 **£150,000**, but costs can vary significantly. **Due to the unknown costs, this is a high risk item.**

The Domestic Hot Water (DHW) across the building is served via point of use electric water heaters, rather than the DHW being generated in the main plant room. Given this is already decarbonised, it is recommended that the Council retain these and replace them as and when they fail.

As 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.

It is recommended to implement a metering scheme where sub-meters are installed to track the electricity and heating consumption as well as special uses and renewable energy generation. Energy monitoring can result in immediate savings while providing a baseline for comparing operational energy usage in the future.

It is recommended that the Council install new secondary glazing in both the theatre and the meeting/reception room on the second floor to the southeast of the building. If the Council are quoted extortionate amounts by contractors to complete these works, then it is recommended for the Council to consider if the works are cost beneficial as the energy saved from the works is not hugely significant when compared to the ASHP installation.

It is worth noting that there were some areas of loft insulation that were displaced. Overall, no new insulation needs to be installed, but the displaced insulation should be moved to ensure it covers any empty spaces where excessive heat loss could occur.

At the detailed design stage, 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.

The existing AHU was currently faulty but was in the process of being repaired. If working with lower temperatures to the heating coil, then the Council will have to install a heating coil with higher surface area to achieve the same heating capacity. The condition of the internal was not investigated.

It is recommended that the Council replace the existing gas fired kitchen equipment with electrical equivalents, either when the existing equipment fails or before their net zero carbon target of 2038.

## 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 recommendation. They are for alternatives are available unless

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do not constitute a example purposes only and 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.