

Project: Chippenham Town Hall and Neeld Hall
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REPORT

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TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	BRIEF AND SCOPE.....	1
1.2	THE BUILDINGS	1
1.3	CONTEXT	1
1.3.1	Chippenham Council's Sustainability Commitments	1
1.3.2	E3's Sustainability Commitments.....	1
1.4	NET ZERO CARBON	2
2	CHIPPENHAM TOWN HALL'S ENERGY USAGE	3
2.1	METERED DATA	3
2.2	BENCHMARKING.....	4
2.2.1	Town Hall.....	4
2.2.2	Neeld Hall	4
3	THE TOWN HALL: FABRIC AND SERVICES.....	5
3.1	FABRIC	5
3.2	HEATING	5
3.3	VENTILATION AND COOLING.....	6
3.4	DOMESTIC HOT WATER	6
3.5	ELECTRICAL INFRASTRUCTURE	7
4	NEELD HALL: FABRIC AND SERVICES	8
4.1	FABRIC	8
4.2	HEATING AND COOLING.....	9
4.2.1	Gas fired heating system.....	9
4.2.2	DX/VRF Fan coil units.....	10
4.2.3	Electric heaters.....	10

4.3	VENTILATION	11
4.4	DOMESTIC HOT WATER	11
4.5	ELECTRICAL INFRASTRUCTURE	12
5	DECARBONISATION OPTIONS.....	13
5.1	TOWN HALL.....	13
5.1.1	Option 1 – Direct electric heating: high level radiant panels	13
5.1.2	Option 2 – Direct electric heating: low level electric heaters.....	14
5.1.3	Option 3 – Air to air heat pump – fan coil units	15
5.1.4	Option 4 – Air to air heat pump – air handling unit.....	16
5.1.5	Other options.....	16
5.2	THE NEELD HALL	17
5.2.1	Overall Strategy	17
5.2.2	Air to water heat pump.....	17
6	REVIEW OF QUOTATIONS RECEIVED	18
6.1	TOWN HALL.....	18
6.2	NEELD HALL	18
7	HEALTH AND SAFETY	19
8	BUILDING REGULATIONS	19
9	PLANNING/LISTED BUILDING CONSENT	19
10	OTHER CONSULTANT INPUT.....	19
11	CONCLUSIONS/NEXT STEPS	19
	APPENDIX A – E3 EXISTING SERVICES SKETCHES	20

1 INTRODUCTION

1.1 BRIEF AND SCOPE

E3 Consulting Engineers has been appointed by Chippenham Town Council (CTC) to carry out a feasibility study into options for decarbonising the heating systems for the Town Hall and The Neeld, in the centre of Chippenham. The primary aim of project is to remove the gas supply to both buildings and electrify the heating systems in both buildings. Funding has been secured to carry out some works from April 2025 onwards.

Before appointing E3, CTC had taken the initiative to approach a number of contractors and suppliers to gather ideas and costed options for each building. CTC thereafter decided to engage E3 to assess the buildings, the systems and the options proposed, to give an independent appraisal of the options and propose next steps.

The aim of this report is to present the work carried out to date, and explain the options available.

Information has been gathered from a number of sources:

- Emails from CTC to E3 containing the manufacturers quotes, energy bills, and drawings of the building.
- An online meeting held with CTC and E3 on 22nd November 2024.
- A site visit by Isabel Barham and Hugh Griffiths of E3 on 6th December 2024. The scope of our visit was to view the buildings, the services and to understand the operation of the buildings and system. We also viewed paper records held in the Town Hall relating to both buildings.

1.2 THE BUILDINGS

Chippenham Town Hall is a Grade II listed building on the High Street in Chippenham. It was completed in 1834 and built in Ashlar stone. The Council Hall is at first floor level and is a double height space overlooking the high street. At ground floor there are vaulted stone ceilings to the entrance and reception area. On the west side of the building there are 4 storeys of office accommodation. There are some basement areas.

The Neeld is a masonry building constructed to the rear of the Town Hall between 1848 and 1850 and is also Grade II listed. The main hall is a double height space with a pitched roof and it is surrounded by several adjoined structures housing supporting spaces and toilets. There was a foyer and bar extension added in 1996 and this area was recently refurbished in 2023. The Neeld is used as a multipurpose community venue and has a stage and retractable bleacher seating.

1.3 CONTEXT

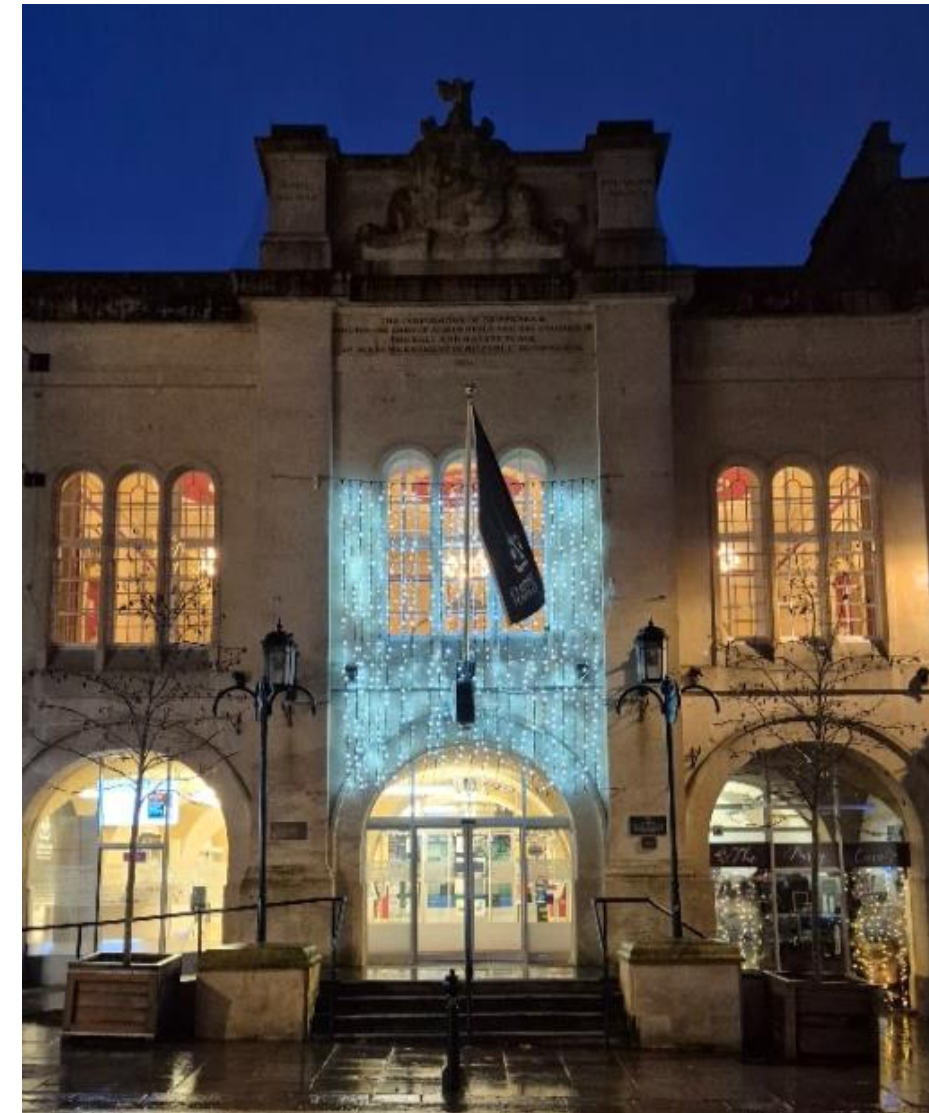
1.3.1 Chippenham Council's Sustainability Commitments

In 2019 Chippenham Town Council declared a climate emergency, acknowledging that "the consequences of global temperature rising above 1.5°C are so severe that preventing this from happening must be humanity's number one priority" and made a commitment to work towards a net zero. Chippenham Town Hall is the primary civic building in Chippenham and should therefore set an exemplar approach, underpinning the Council's commitments.

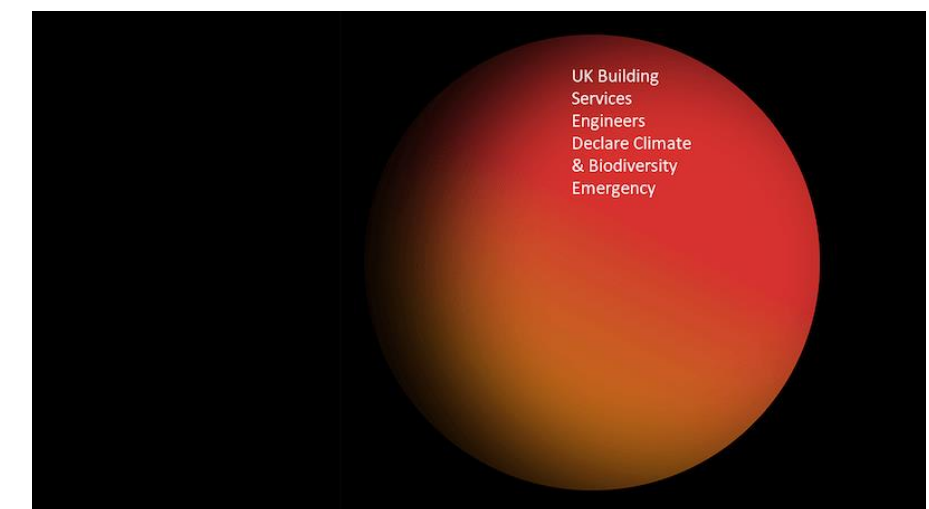
Chippenham Town Council has committed to becoming net zero carbon by 2030 and maintaining net zero thereafter.

1.3.2 E3's Sustainability Commitments

As a signatory of Building Services Engineers Declare Climate & Biodiversity Emergency, E3 is committed to raising awareness, advocating for faster change, accelerating the shift to low energy in all we do, and providing building services engineering design that achieves the standard of net zero.



Chippenham Town Hall



UK Building Services Engineers Declare Climate & Biodiversity Emergency

1.4 NET ZERO CARBON

Over recent years there's been a lack of consistency and clarity when it comes to defining and implementing the concept of 'net zero' in the UK construction industry.

In September 2024, the UK Net Zero Carbon Buildings (UKNZCB) Standard was launched creating a unified definition for 'Net Zero Carbon Buildings Aligned' in the UK, underpinned by an evidence-based reporting methodology. We recommend this is the industry standard that the town hall should now move towards.

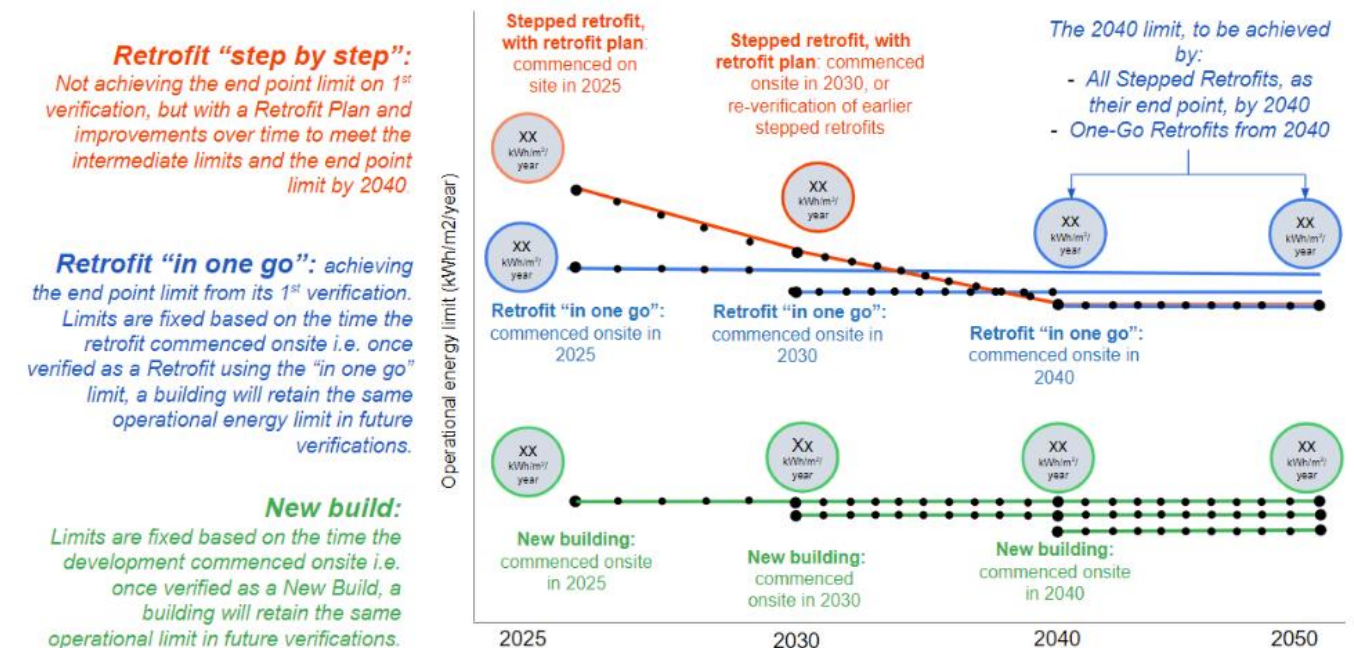
CTC could consider targeting UKNZB standard for the project. As the Neeld and Town Hall are existing buildings they would need to meet the following simplified requirements set out in the UKNZCB Standard:

- Ongoing metering to monitor and record operational energy. Energy use intensity (EUI) targets are set within the standard, in kWh/m².
- The embodied carbon of ongoing works would need to be calculated and recorded appropriately.
- On-site renewable electricity generation would need to be assessed with the aim of meeting targets. Upfront carbon limits for retrofit works are set within the standard in terms of kgCO₂e/m².
- Reporting annual operational water use. (There are no limits currently set in standard)
- Heating and cooling delivered to building shall be assessed, reported and submitted.
- Refrigerants assessed, reported and submitted.
- Carbon offsetting reported.

The standard describes retrofit works as either in 'One-Go' or 'Stepped'. It is likely that the works at The Neeld and the Town hall will be 'Stepped', since there are no immediate plans to make improvements to the building fabric. Instead the heating systems will be tackled initially.

In this report we focus on the heating and domestic hot water systems, and additionally make observations and recommendations relating to the fabric.

If CTC is interested in pursuing the UKNZB Standard in further detail we would welcome a discussion. At present this would sit outside the core scope of the project.



'One-Go' vs 'Stepped' retrofit image taken from UKNZCB Standard

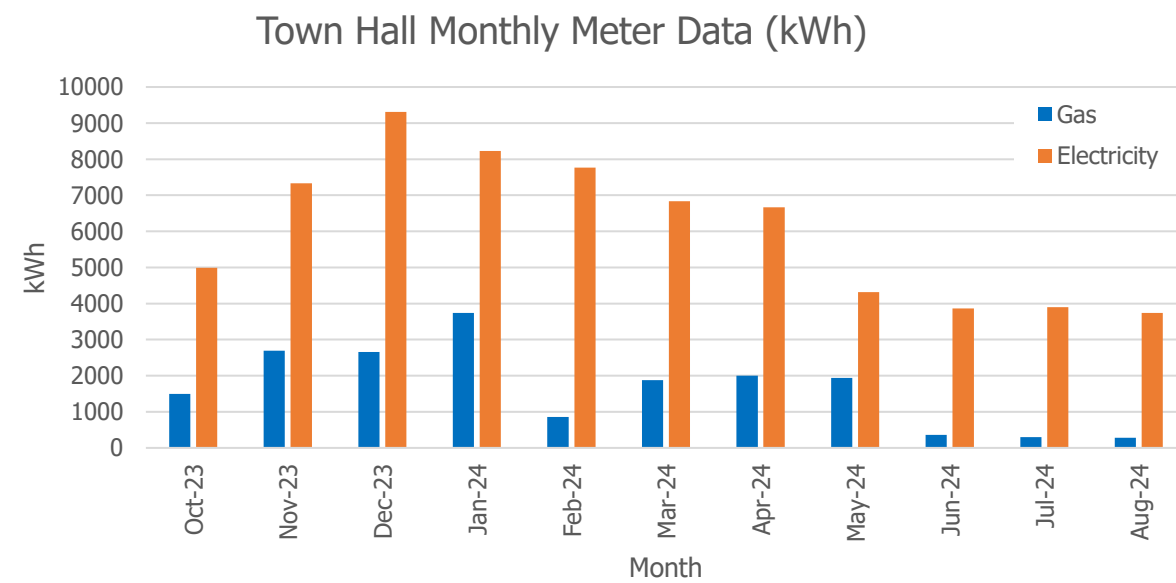
2 CHIPPENHAM TOWN HALL'S ENERGY USAGE

2.1 METERED DATA

Electric and gas meter utility readings over the last year have been made available. These have been used to produce the graphs below, which show monthly data for each of the buildings. Both buildings have independent incoming utility services, and independent heating systems, so can be considered individually.

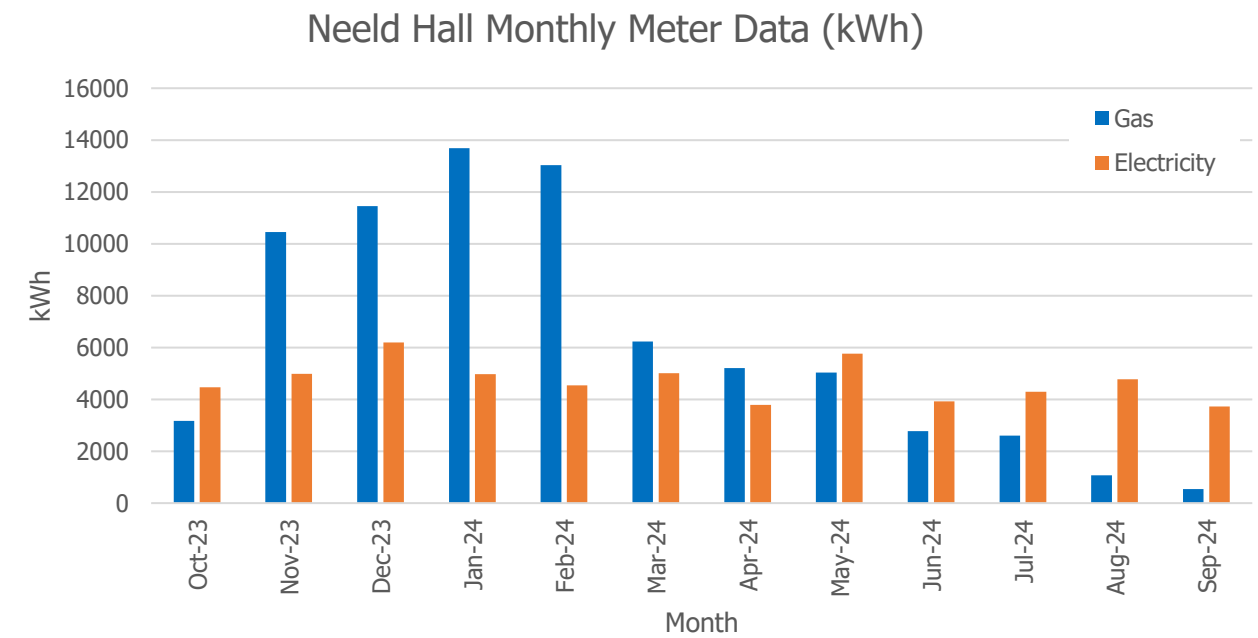
Town Hall

The Town hall is mainly driven by electricity throughout the year. This is because most of the heating to the building is provided by electricity, as well as regular plug-in loads. Gas is only used for heating of the Hall itself – all other accommodation (offices etc) has electric heating.



Neeld Hall

The Neeld hall energy consumption is driven by gas throughout the winter period as the majority of the building is heated using the gas fired boilers. However, electricity dominates in the summer when cooling in the hall and ancillary spaces is provided via electricity based systems.



2.2 BENCHMARKING

The Chartered Institution of Building Services Engineers (CIBSE) has up-to-date benchmarking figures for various building types on their online dashboard system. This supersedes the previous CIBSE Guide F information and gives electricity and fossil fuel usage data from case study buildings around the UK. This is based on information from Display Energy Certificates (DECs).

As well as the CIBSE benchmarks, the UKNZCB Standard has targets for operational energy use in buildings. These limits, amongst other requirements, would need to be met in order to meet the UKNZCB's definition of 'net zero'. This standard assumes no gas usage in the building. These targets also reduce year-on-year in the lead up to 2050.

It should be noted that both buildings are not heavily used compared with other similar buildings included in benchmarking data. This results in the buildings appearing more efficient than they likely are, when compared with benchmarking data.

2.2.1 Town Hall

Within the CIBSE benchmarking dashboard, data is available for 113 town halls. The town hall has therefore been compared with this data.

UKNZCB does not provide a target specifically for a town hall, therefore 2025 targets for offices have been included for comparison.

The graph opposite combines the town hall metering data with the benchmarking figures discussed above, for comparison.

For electricity usage, the town hall sits towards the high-end of the sample set.

The gas consumption is considerably lower than the CIBSE benchmarking sample set, this likely due to the irregularity of use and comparatively small area which is served by gas heating.

2.2.2 Neeld Hall

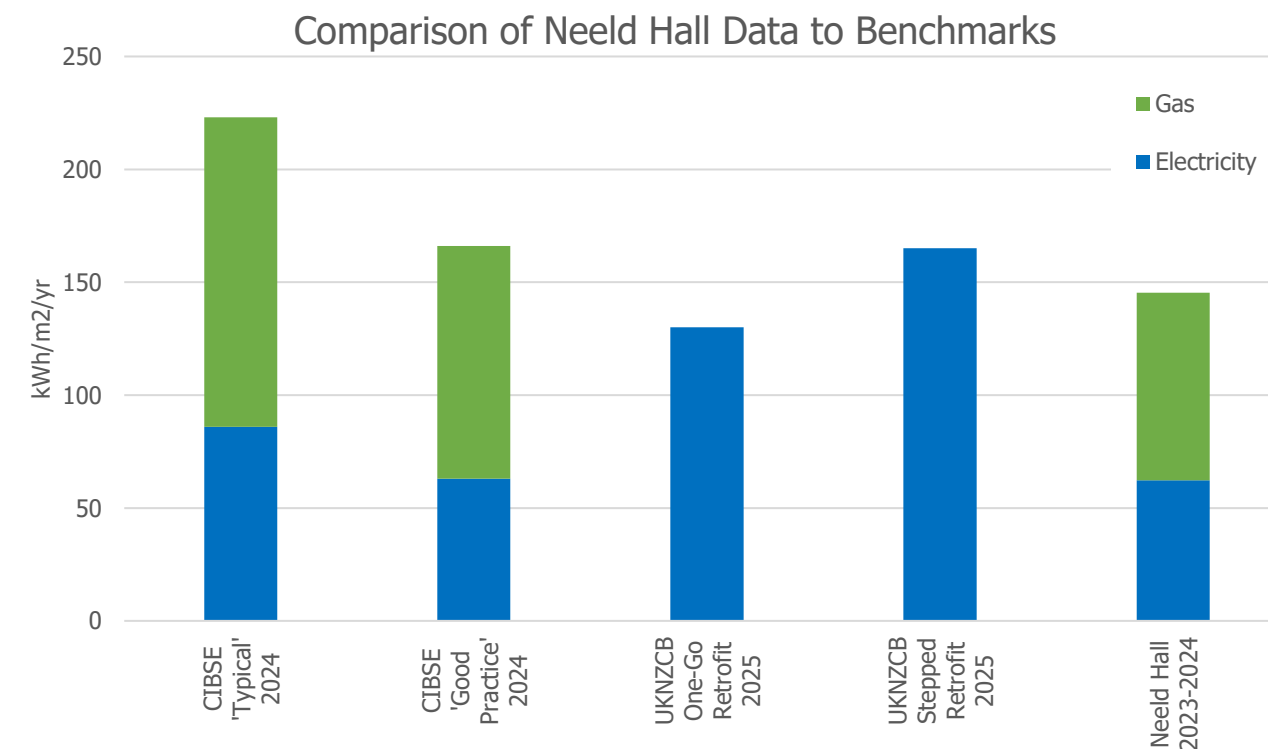
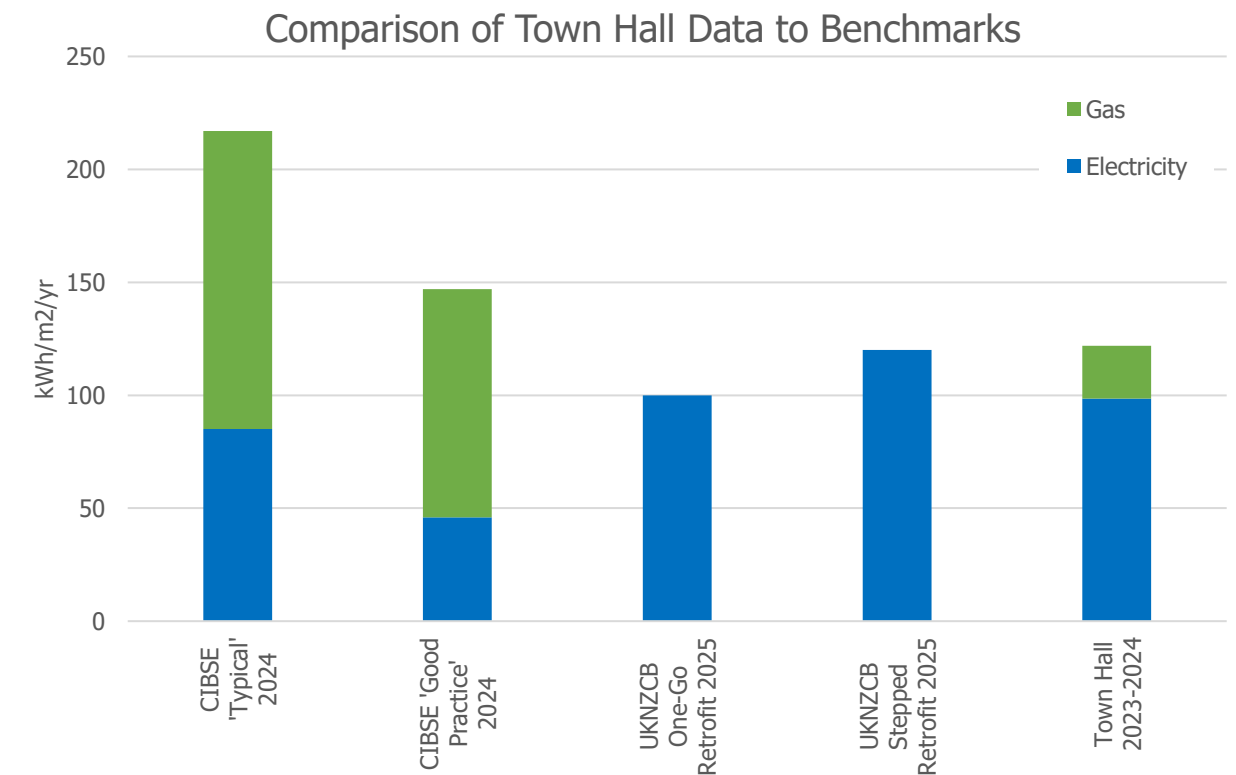
The usage of the Neeld hall as a mixed use and events space is less directly represented in the available benchmark data.

We have therefore used CIBSE benchmark data for the 91 theatres, reflected in the dashboard to compare with Neeld hall. UKNZCB targets have been also been compared for theatre spaces.

The graph opposite combines the Neeld hall metering data with the benchmarking figures discussed above, for comparison.

For both electricity and gas usage, the Neeld hall is fairly comparable with the CIBSE "good practice" data. Again, this likely due to the irregularity of use.

Gas usage provides a significant proportion of the energy consumption in this area, which indicates that significant improvements could be made in decarbonising the building by moving away from fossil fuels.



3 TOWN HALL: FABRIC AND SERVICES

This section describes the Town Hall fabric and the principal services. We consider heating, cooling, ventilation and domestic hot water services as these are the principal energy consuming systems. We also consider the incoming electrical power supply and distribution to understand the potential for adding electrical load to the system. Other services are not considered.

This section should be read in conjunction with the existing services diagrams in Appendix A.

3.1 FABRIC

The town hall is constructed of Ashlar Stone with solid walls, and solid floors except for the parts with a basement below. All windows are single glazed and some have secondary glazing fitted. The roof is generally a pitched slate roof with timber trusses and insulation at ceiling level in the void over the hall. The rear half has a flat lead roof has a small amount of insulation above the WC corridor only.

Opportunities to improve the fabric include:

- Provision of double glazed windows, or installing vacuum glass within existing timber windows.
- Extending the provision of secondary glazing.
- Internal wall insulation, being mindful of risks associated with interstitial condensation.
- Investigating opportunities to improve roof insulation.
- Carrying out an air leakage test and exploring opportunities to improve airtightness.

All of the above would be subject to gaining listed building consent.

In this report we don't explore these options further but recommend they are reviewed as part of a longer term strategy for the building.

3.2 HEATING

The Town Hall building is generally heated with electric night storage heaters, typically in the offices and ground floor areas. A number of these are soon to be replaced with electric panel heaters. The heating system is found to be effective. Some areas have electric panel heaters, and there are overdoor electric heaters at the main entrance to prevent draughts in reception. The overdoor heaters are rarely used due to noise issues.

The main hall is the exception. It is heated using a warm air system, gas fired. There is an air handling unit at roof level which has a direct fired gas heat exchanger which distributes warm air to ceiling mounted diffusers in the Hall. The gas burner is rated at 58.6kW output. Return passes through extract grilles in the ceiling and is ducted back to the enclosure housing the air handling unit. The extract fan is 400mm diameter. There are motorised dampers to allow the system to operate in recirculation mode, or introduce fresh air for ventilation.

The system has been found to be effective although it takes a long time to heat the room. Currently the system is not operational as it has ceased functioning. Instead of repairing it, it has been decided to use temporary electric heaters in the Hall. 4no heaters are used (up to December 2024), with a total output of 7kW and are found to be effective, although the warm up time is substantial (several hours)

The hall is only intermittently used, typically twice per week. It is only heated when an event is planned. Events include parties, craft fairs, conferences and council meetings. The maximum occupancy is 130 people.

There is a gas meter in the basement serving the gas fired heating system in the Hall. The kitchen is electric and there are no other gas fired systems in the building.



Disused gas fired air heater and ventilation system serving Hall



The main hall, with circular ceiling grilles visible. These are used for supply air for both heating and cooling systems.

3.3 VENTILATION AND COOLING

Generally the building is naturally ventilated to maintain comfortable conditions in the summer. Cooling is only provided to the following areas:

- Reception, via a wall mounted Direct Expansion (DX) fan coil unit. A DX external condensing unit is located in the gap between the Town Hall and the Neeld at first floor level.
- Ground floor office. A similar system/approach to the reception space.
- The Hall. Cooling to the hall is provided using three large DX fan coil units located in the roof void of the hall. They are ducted to supply grilles in the ceiling of the Hall, and return air is ducted from another grille to the fan coil units. They operate independently of the heating/ventilation system described earlier.
- The bar. There is also a DX fan coil unit serving the bar, with an external condensing unit at roof level.

Mechanical ventilation systems are also provided in the following areas:

- WCs – extract ventilation.
- The kitchen – extract ventilation via a canopy with local exhaust.
- The Hall – mechanical ventilation via the heating system as described above. We didn't measure ductwork sizes in the roof void, but it appeared that the ductwork connected to the extract fan is 400mm diameter. This would not be sufficiently sized to provide ventilation for 130 people, so it's likely that the hall is under-ventilated during times of peak occupancy.

The outdoor units at roof level have labels implying the refrigerant used is R407C. R407C is due to be phased out through the F gas regulations as it has a high global warming potential. We did not note the refrigerant in other systems.

There are opportunities to install heat recovery ventilation systems, for example in the main hall and toilets, to reduce energy losses associated with ventilation.

3.4 DOMESTIC HOT WATER

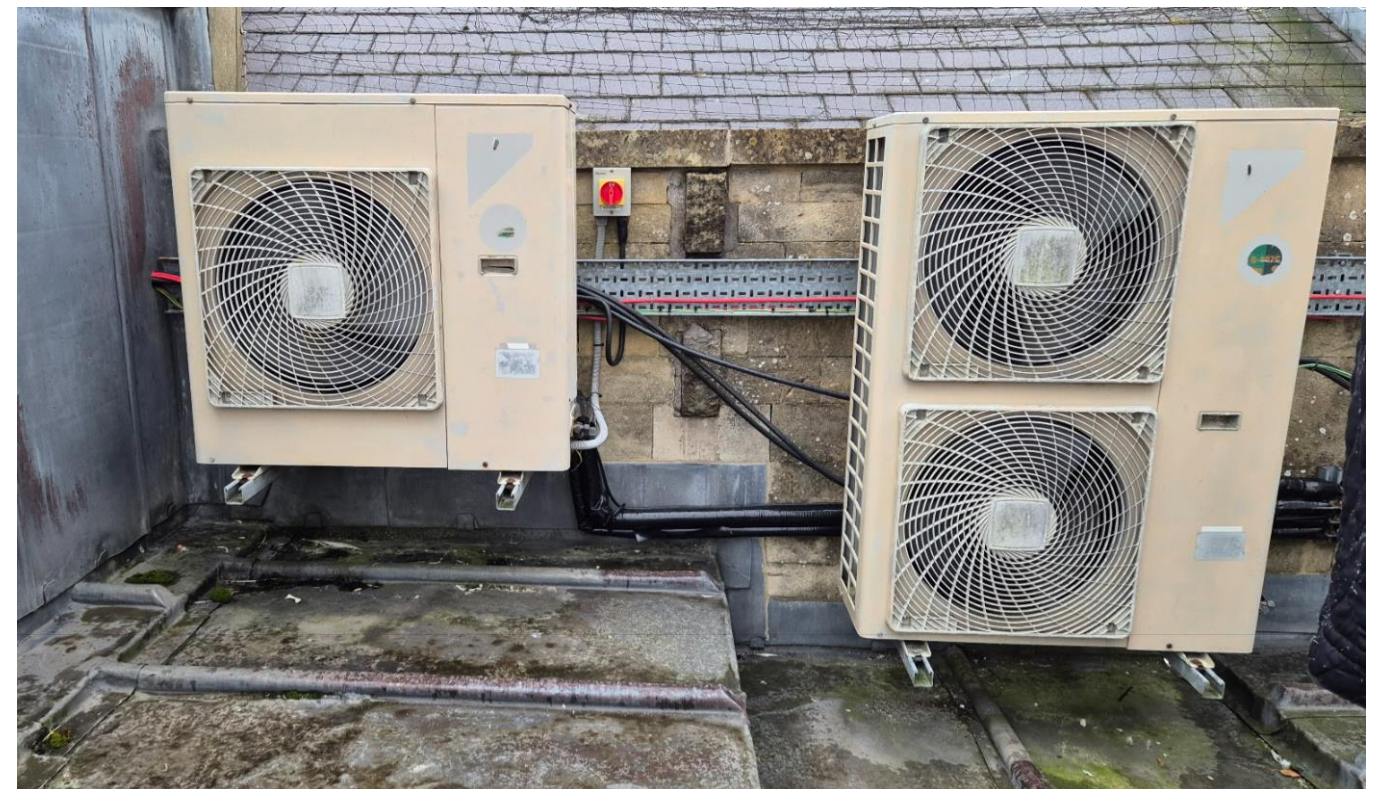
Domestic hot water is provided using local electric water heaters throughout the building, for example in the following areas:

- Ground floor WCs (assumed, not viewed)
- Third floor kitchenette
- The bar/kitchen, which has a hot water cylinder in a loft space above the kitchen, accessed through a hatch. Possibly also serving the 1st floor WCs (TBC, not viewed).

This is an appropriate strategy for the building, which has low domestic hot water usage. Domestic water generation is already independent of the space heating system. There would be no advantage in changing the approach.



Ductwork in the roof void over the hall, including a fan coil unit providing cooling.



DX condensing units at roof level serving cooling systems (fan coil units) for the Hall and Bar.

3.5 ELECTRICAL INFRASTRUCTURE

There is an independent incoming electrical supply to the Town Hall with a cut out and meter in a cupboard at ground floor level. The main switchpanel serves a number of distribution boards throughout the building, shown in the diagrams in Appendix A.

The incoming supply is 3 phase with 100A cut out. This would be capable of a peak load of 69kVA. The main switch is rated at 200A.

The maximum demand recorded on the meter appeared to be 28.4kVA. Our initial assessment would be that there appears to be around 40kVA of spare capacity available.

These figures should be validated by contacting National Grid or the CTC's current or previous electricity suppliers, SSE Energy Solutions or Crown Gas and Power, to understand the agreed supply capacity and the historic maximum demand. Alternatively it would be possible to monitor the peak demand during the months of January/February, which should be the peak months given the building is electrically heated.

The Town Hall benefits from a Day/Night tariff system with reduced rates for night use, when electric storage heaters are being charged. The current tariff only offers a slight reduction at night, at 24.7p/kWh compared to 29.0p/kWh during the daytime. CTC might be able to negotiate more beneficial rates, although the UK energy market remains volatile at present.

We have now received NICEIC Electrical Installation Condition Report certificates for the Town Hall and will review in due course.



Incoming cut out and meter serving Town Hall

4 NEELD HALL: FABRIC AND SERVICES

This section is structured in the same way as Section 3, this time to describe The Neeld Hall.

4.1 FABRIC

The Neeld Hall comprises various structures that make up the venue.

The historic structures are all of solid masonry construction with various materials used including Ashlar, stone and brickwork. Roofs are all pitched. The extent of roof insulation is unknown and should be investigated, but we suspect they may be uninsulated. Windows are generally single glazed.

The 1996 foyer extension is assumed to have insulated cavity walls and an insulated roof. Windows are double glazed. There has been a recent refurbishment project which involved reducing the area of roof glazing which has improved comfort levels in both summer and winter. It was previously excessively glazed.

There is a single storey flat roofed structure which is of very poor quality, between the Neeld and Boots, that until recently was used as a bar. It has been abandoned and the fabric is deteriorating with damp ingress. It represents a maintenance liability.

Opportunities to improve the fabric generally apply to the historic structures.

- Provision of double glazed windows, or installing vacuum glass within existing timber windows, or addition of secondary glazing.
- Extending the provision of secondary glazing.
- Internal wall insulation, being mindful of risks associated with interstitial condensation.
- Investigating opportunities to improve roof insulation. This has the potential to have a significant impact in the Neeld Hall which has a large roof surface.
- Carrying out an air leakage test and exploring opportunities to improve airtightness.

All of the above would be subject to gaining listed building consent.

In this report we don't explore these options further but recommend they are reviewed as part of a longer term strategy for the building.



View of the entrance to Neeld hall showing the various volumes that make up the venue. In the foreground is the 1996 extension with Ashlar stone, with historic masonry structures beyond. The gable wall and slate pitched roof of the hall itself is visible beyond.



Roof above the old bar. The Neeld Hall is visible to the left and the Town Hall in the distance (left)

4.2 HEATING AND COOLING

The Neeld Hall building has a number of heating and cooling systems.

4.2.1 Gas fired heating system

There is a gas fired Low Temperature Hot Water (LTHW) system which serves radiators in the Hall itself, some adjacent stores (behind the bleacher seating) and also the WCs/kitchen. The zone serving the WCs/kitchen is currently not operational and the reason for this is not understood. As a result the WCs are unheated. This should be investigated.

Boilers are located at second floor level, two storeys above the WCs. Levels 1 and 2 of the structure are unheated. The boiler room has a pair of floor standing boilers serving two pumped circuits. There is a constant temperature circuit serving all radiators described above, and a variable temperature circuit serving underfloor heating in the Foyer. The underfloor heating system has been decommissioned, so this circuit is no longer active. We found the pump still running in the plant room and so turned it off. Client feedback is that this has not resulted in any issues elsewhere. It would also be recommended to run the pump intermittently to avoid stagnation in the system, first checking that there is circulation in the circuit and it's not a dead leg.

A record drawing on the plant room wall indicates that the system dates from 1996. It was also designed for a future phase, and for heating the 1st and 2nd floors of the WC building. The boilers are each rated at 100kW output, making 200kW in total. Our expectation is that they are significantly oversized for the loads that they currently serve, particularly now that the foyer underfloor heating is not operational. There is a pair of 25mm pipes from the plant room serving all radiators, and this would typically be expected to provide up to around 30kW (depending on the design temperatures and pipework design criteria). The area heated by radiators is around 500m², which might be expected to have a heat demand of up to 50kW. This would reinforce the thought that the boilers are oversized. A heat loss calculation, together with a survey of the heat output from the radiators would help confirm this.

On the day of our survey the boilers were operating at a temperature of around 65degC. It is expected that the existing boilers are not weather compensated or run at a constant temperature.

It is not known if the radiators and pipework also date from 1996, or if it was a boiler replacement project at the time.

There is a gas meter in an external cupboard next the kitchen. The kitchen is electric and there are no other gas fired systems in the building (now that the direct fired hot water system has been decommissioned, as described later).

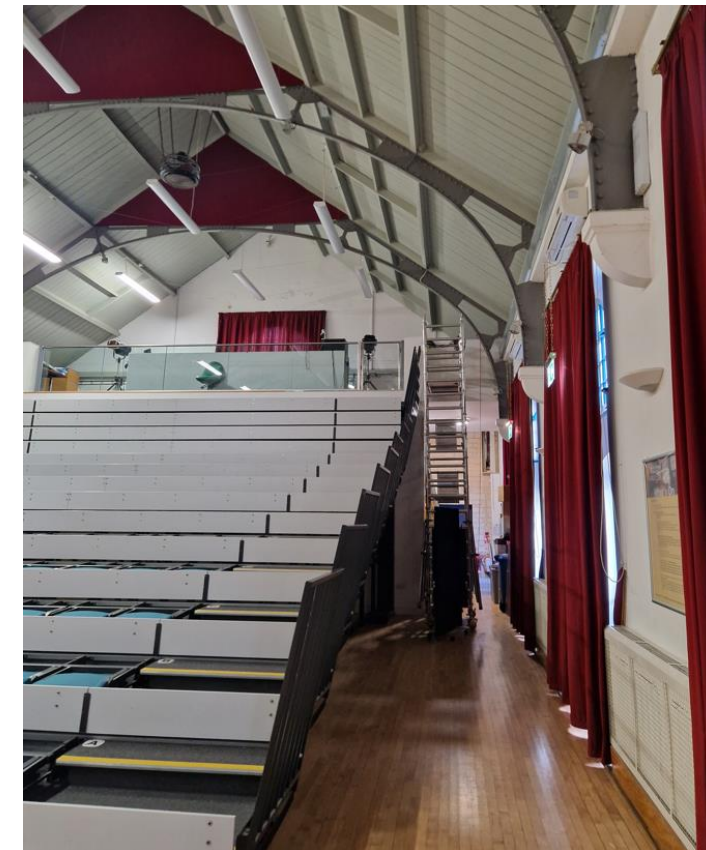
There is a basic control system, with a control panel in the plant room.

The hall is used often, for a range of events and the temperature requirements of hall users varies. The system therefore needs to be able to respond to the requirements of the users. The hall radiators are supplemented by the fan coil units described below.

Client feedback is that the hall is an acceptable temperature in winter, when all systems are running correctly.



Gas boilers serving The Neeld Hall (right) and decommissioned gas fired water heater (left)



Internal view of the Neeld Hall, with a radiator at low level and fan coil unit at high level (right hand side)

4.2.2 DX/VRF Fan coil units

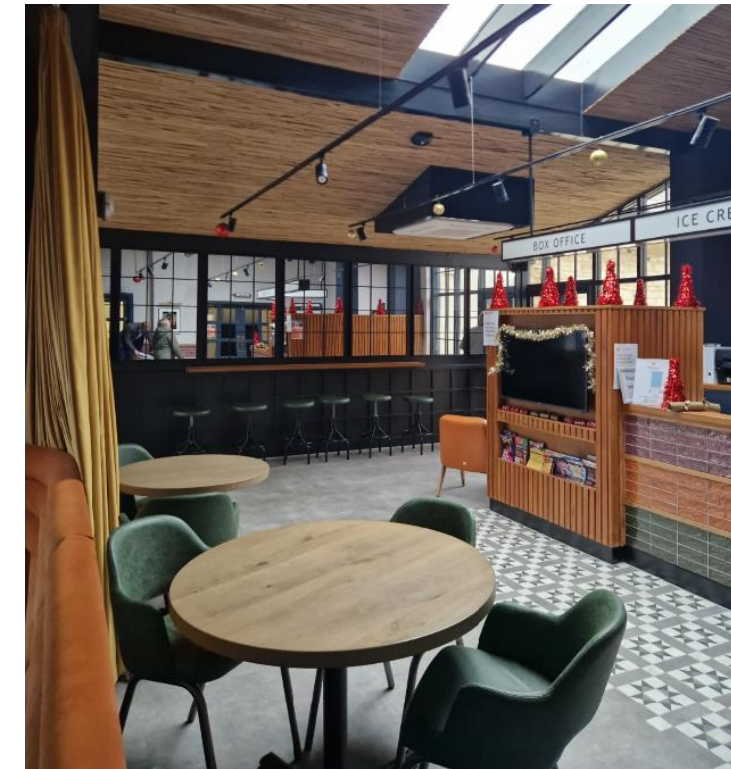
There are a number of DX and Variable Refrigerant Flow (VRF) systems, each comprising indoor fan coil units and outdoor condensing units interconnected by refrigerant pipework, as follows:

- Two DX systems serving fan coil units in the foyer and bar. These provide heating and cooling. The underfloor heating system in this area, as noted above, is redundant. The outdoor units are in the foyer courtyard.
- A VRF system serving 6no fan coil units at high level in the Neeld Hall. We understand that this system was primarily installed to provide cooling although it is also used to supplement the radiators in heating mode. The outdoor unit is in the foyer courtyard. The system is found to be audible in operation so for quiet events it is switched off after pre-cooling the room.
- A DX system serving fan coil units in the old bar, however this is not used as the area is now out of use. The outdoor unit is between the Neeld and the old bar, externally.
- There is also an outdoor unit associated with the beer cooling system in the foyer bar.

We did not check the refrigerants used in the systems.

4.2.3 Electric heaters

There are electric heaters in the green room area behind the stage at ground and first floor level.



Fan coil unit in Foyer



Foyer courtyard, with outdoor units behind a screen

4.3 VENTILATION

Generally the building is naturally ventilated via openable windows.

The ventilation provision in the main hall is minimal, and below that expected for an events venue. The windows on the side of the hall are generally not functioning, and occasionally the external doors at low level are used for ventilation. This however has acoustic and security implications.

The roof has what appear to be ventilation turrets at the ridge level and a louvre at one end of the ridge, however it's not known if they currently serve a purpose or if they were a historic feature. The air infiltration to the building due to draughts will provide a certain amount of uncontrolled background ventilation, which may be adequate for times when occupancy levels are low (eg smaller meetings).

It is not thought that there have been issues with complaints due to poor air quality in the Neeld, but our expectation would be that for long, highly occupied events the indoor air quality will deteriorate during an event and CO₂ concentrations will be very high. Occupancy can be as high as 217 people seated, or 250 standing. CTC may like to monitor this and consider improvements to the ventilation provision. Our working assumption (as described later) is that this would be outside the scope of the project although it would be helpful to know if CTC might plan for improving the ventilation provision in the future, because it would likely increase the required heating load for the building systems. A way to check air quality in the hall would be to use a CO₂ sensor and monitor levels during a typical performance, and we would recommend this is done.

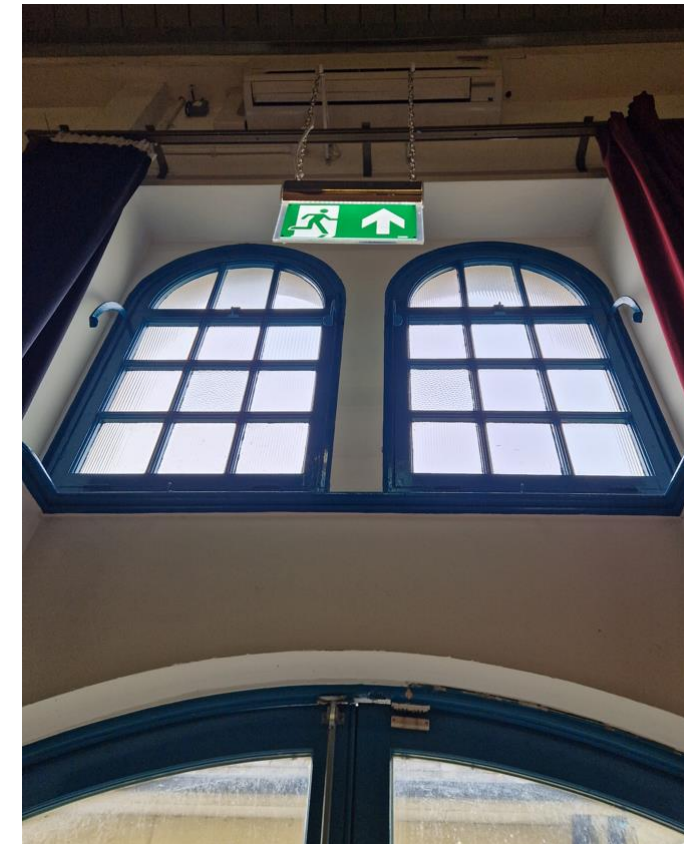
There would also be opportunities to install heat recovery ventilation systems, for example in toilets, to reduce energy losses associated with ventilation.

4.4 DOMESTIC HOT WATER

Until recently there was a gas fired water heater in the heating plant room, providing domestic hot water to the building. See image earlier in the document.

This has been decommissioned, and domestic hot water is now provided by local electric water heaters in the WCs, kitchen, bar, and a number of water heaters in the backstage area (both ground and first floor) including one electric shower.

Domestic hot water use in events venues can be high for short periods of time (eg intervals), it is our understanding that there have not been any issues with the capacity of local electric water heaters in the WCs. Therefore the existing strategy should be retained.



Typical window in the Neeld Hall – opening lights are not used.



Neeld hall roof with louvres at ridge level and at the gable. It's not known if these are used.

4.5 ELECTRICAL INFRASTRUCTURE

There is an independent incoming electrical supply to the Neeld Hall with a cut out and meter in a cupboard at ground floor level. The main switchpanel serves a number of distribution boards throughout the building, shown in the diagrams in Appendix A.

The incoming supply is 3 phase. The rating of the fuses was not visible. The main switch is rated at 400A, which would be capable of a peak load of 276kVA, however the main fuses and agreed supply capacity are likely to be lower than this.

The maximum demand recorded on the meter appeared to be 33.3kVA. This would imply there is significant capacity on the incoming supply.

These figures should be validated by contacting National Grid or CTC's electricity supplier, SSE Energy Solutions, to understand the agreed supply capacity and the historic maximum demand. Alternatively it would be possible to monitor the peak demand during the months of January/February, which should be the peak months given the building has some electric heating.

The Neeld Hall also has a day/night tariff, although it appears that the majority if use is during the day. There are no night storage heaters that we saw.

We have been issued a copy of the NICEIC Electrical Installation Condition Report certificates from 2021 for the Neeld Hall. These show a "satisfactory" installation although there are some Code C3 improvements recommended. We are not aware if the recommendations have been implemented. The next test will be due in 2026.



Incoming Power cut out and meter (left) and main switch panel (right)

5 DECARBONISATION OPTIONS

The rest of this report considers options to electrify the heating system, as the primary aim for the project. Other opportunities to improve the energy performance of the building have been noted in the sections above, and we would encourage CTC to consider these separately. E3 can advise further if required.

5.1 TOWN HALL

The Town Hall building is generally electrically heated with the exception of the hall itself as described earlier. In the long term, CTC could benefit from an investment in an air to water source heat pump serving radiators in all the areas currently heated using electric heaters. The total annual electricity consumption of the building is around 80,000kWh, equating to a cost of around £20,000 per year. Say 50% of this energy contributes to space heating (this requires further analysis), this would mean that a heat pump operating at a coefficient of performance of 3.0 would have the potential to save in the region of £6-7k per year in electricity bills.

Installation of pipework, radiators and a heat pump serving the whole building would be a fairly significant project and we assume is not currently a priority in the short term. However the idea warrants further feasibility investigation and E3 can advise further if this is of interest.

The rest of this section focusses on the existing gas fired heating system serving the hall itself, described earlier in the report. There are several options. For each option, ventilation of the hall requires consideration because, as described earlier, the existing heating system also provides mechanical ventilation to the hall.

5.1.1 Option 1 – Direct electric heating: high level radiant panels

Radiant heating is good way to heat tall spaces which are intermittently occupied. It is often used in spaces such as warehouses, and sports halls.

There are recent case studies of radiant heating being used in churches which have only occasional use. In this scenario it doesn't make economic sense to attempt to heat a church for long periods of time, mindful that warm up times are often several hours/days. The images opposite shows a radiant electric heater which has been developed specifically for an ecclesiastic environment, as well as a typical village hall installation. Surface mounted options are also possible.

Advantages:

- Low energy use for intermittently occupied spaces.
- Instant heating effect.
- Low maintenance costs.
- Wiring relatively unintrusive in Hall – through roof void.

Disadvantages:

- Visually intrusive. May be a challenge given the Grade II listing of the building though integration with lighting could be possible.
- Thermal comfort with radiant heating, for some people, is not as comfortable as air heating. When seated at desks people's feet can feel cooler than the head/face area. In a church/village hall environment this is not problematic as expectations are lower.
- High energy consumption during use, so less suitable if the hall is to be used more often and for longer in the future.



Examples of electric radiant heating in a church (above) and a village hall (below). Images courtesy of Herschel.



For this option, ventilation to the hall would be provided via a separate system. This would comprise a heat recovery air handling unit located on the roof, in the location of the existing gas fired heater. The existing housing/enclosure would be dismantled. Supply and extract ductwork would be installed in the roof void and connected to the existing ceiling mounted grilles. The design occupancy will need to be agreed, as this will determine duct sizes and ventilation flow rates. For a system providing ventilation for 130 people the air handling unit and ductwork would be substantial, so a lower target design occupancy may be appropriate. Monitoring of CO₂ levels in the hall in the coming months could help inform this decision.

5.1.2 Option 2 – Direct electric heating: low level electric heaters

The current temporary solution of portable electric heaters could be made more permanent with the installation of low level wall mounted electric heaters. This winter is a good opportunity to monitor the power required to keep the room comfortable. The current setup of 7kW has been effective so far, albeit with a warm up time of several hours.

Advantages:

- Simple and easy to control.
- Low installation cost.
- Best comfort levels of all options.
- Low maintenance costs.

Disadvantages:

- Visually intrusive – there is existing timber panelling at low level.
- Higher energy costs than radiant panel solution, due to longer warm up times and requirement to heat the air.
- Wiring required to multiple locations at low level.
- Challenging to accommodate with planning requirements.

Ventilation would be provided using a similar approach to that described under Option 1.



Typical heat recovery air handling unit



Typical flat panel electric heater

5.1.3 Option 3 – Air to air heat pump – fan coil units

The current provision of fan coil units in the ceiling void, which provide cooling to the room in summer, could be replaced with versions that provide heating and cooling. The fan coil units would recirculate room air and heat/cool the air as required. External condensing units would be mounted on the roof (similar to the existing provision).

For this option ventilation would also involve a similar solution to Options 1 and 2. The supply and extract ductwork from the heat recovery air handling unit could either be connected into new grilles in the ceiling of the hall, or alternatively integrated into the ductwork system for the fan coil units.

The size of the existing grilles may be a limitation with this approach and will need to be reviewed. One disadvantage with this approach is that heating a large volume from high level can result in stratification, with warm air at high level and cooler air at low level. The supply air grilles need to be carefully selected so that air is thrown down to low level in heating mode, whilst being careful not to cause high air velocities in the occupied zone. This issue may have been a challenge/compromise with the existing system as the supply grilles do not have any ability to control the throw pattern/direction for supply air.

Advantages:

- No visible elements in room
- Energy efficient as it uses a heat pump
- Adaptation of existing design.
- All wiring works contained within roof void, with the exception of sensors/controllers.

Disadvantages:

- Control of air in heating model requires careful design.
- Existing grilles may limit optimum performance.
- Increased maintenance cost.
- Use of piped refrigerant – this has a high global warming impact in the event of a refrigerant leak.
- Ventilation and heating/cooling plant are independent of each other – more equipment required.



Ducted fan coil unit



Outdoor Condensing Unit

5.1.4 Option 4 – Air to air heat pump – air handling unit

The final option combines the two components in Option 3 into one unit. This approach would use the ventilation system air handling to additionally provide heating and cooling to the room. This simplifies the number of components, however, means that the air handling unit will be larger.

The air handling unit would additionally include a heating/cooling coil, connected by refrigerant pipework to one or more outdoor condensing units. It would also include a recirculation section to enable the system to heat or cool the room without introducing outdoor air (for example during the warm up period, or for low occupancy events).

This option does have an additional benefit of having the potential to make better use of the array of the existing grilles in the ceiling, as 5no grilles could be used for supply air, and 4no for extract. However the issues around heating from high level (as with Option 3) still exist.

It would be a more logical approach if the ventilation system is designed for the peak occupancy of 130 people.

Advantages:

- No visible elements in room
- Energy efficient as it uses a heat pump
- Simplification of Option 3 – ventilation and heating/cooling plant and controls are combined.
- Better use of existing ceiling grilles.
- All wiring works contained within roof void, with the exception of sensors/controllers.

Disadvantages:

- Larger air handling unit.
- Control of air in heating model requires careful design.
- Increased maintenance cost.
- Existing grilles may limit optimum performance.
- Use of piped refrigerant – this has a high global warming impact in the event of a refrigerant leak.

5.1.5 Other options

Other options the have been considered, but are not proposed as primary options are:

- Air to water heat pump, with radiators. Our expectation is that pipework and radiators will not be desirable due to the visual impact on historic fabric.
- Air handling unit with heating/chilled water coils. This option would be similar to option 4, but would involve a water based system rather than refrigerant based. This would eliminate the issues with piped refrigerant use, however would be significantly more complex and have increased maintenance requirements.



Example of air handling unit providing heating, cooling and heat recovery ventilation

5.2 THE NEELD HALL

5.2.1 Overall Strategy

For the Neeld Hall, there are two key briefing questions that may influence the approach.

Firstly we would like to understand if the current lack of ventilation should be addressed as part of this project. If not then we would like to know if it may be a future project, or it is not something that should be planned for in the medium or long term.

Secondly, we are aware that the existing fan coil units are generally effective, but temperatures at high level can be high in the summer. Additionally they are audible when they run, which means that for quiet events they are occasionally switched off. We would like to understand if these issues are considered manageable/tolerable, or if they should also be addressed.

If the answer to both questions is that the existing ventilation and cooling systems are tolerable/manageable, then our recommendation will be to replace the existing gas fired heating system with an air-to-water heat pump. If a more fundamental review of the heating/ventilation/cooling system is a potential option, then an alternative approach would be explored. For the purposes of this report our assumption is that the scope of the project is only to address the heating system, however we would welcome a more detailed discussion if a fundamental review is of interest.

5.2.2 Air to water heat pump

The existing gas fired boiler system is proposed to be decommissioned and replaced with an air source heat pump. This would comprise:

- Removing all existing equipment in the plant room.
- Installing a heat pump located outside, or two/three smaller heat pumps working in parallel.
- Installing heating pipework from the external location to the heating plant room above the WCs.
- Installing a buffer vessel in the plant room, together with new pumps and associated controls.
- Possibly increasing the size of radiators in the hall and the toilets (see description later).
- Identifying and rectifying the existing problems with lack of heating in the toilets, corridor and kitchen.

Outdoor heat pump location

We have identified a few options for the location of the outdoor heat pump, which are shown on the diagrams in Appendix A. They are:

1. In the currently disused courtyard owned by Boots, if an agreement can be made regarding land use/access. This would be an ideal location from a practical perspective and would make use of otherwise neglected space.
2. In the location of the existing gas meter, although this is also not within the demise of the Neeld. Public access/vandalism would need to be considered. Also the space is not large so would need to be reviewed in more detail.
3. In the Foyer courtyard, in an enlarged enclosure, together with the other outdoor units serving the Foyer and Neeld. The pipe route back to the heating plant room is more complex for this option.
4. In the vicinity of the "old bar", either on the flat roof above it, or (as a more radical solution) demolishing the old bar structure, which is a maintenance liability, and creating an enclosed courtyard at ground floor level.



*Typical 20kW floor standing air source heat pump. R290 refrigerant.
Can be cascaded with up to 6 heat pumps operating in parallel.*

Radiators and Pipework

It is possible to operate air source heat pumps at high temperature, as a direct replacement for the gas boilers. However to maximise efficiency of the system it is desirable to operate them at lower temperatures. This significantly improves the coefficient of performance (COP) of the system.

At the next stage we will review the existing radiator sizes and pipework system to understand the potential for increasing radiator sizes to allow the system to operate at lower temperatures.

At this early stage, it should be assumed that radiators will be replaced, and possibly pipework systems.

Controls

With air source heat pumps operating at lower temperatures, it is more efficient to operate the heating system for longer at lower temperatures rather than higher temperatures for shorter periods of time. This does mean that temperature changes should be planned further in advance for optimal efficiency.

CTC has explained that controllability of the system in the Neeld is important and the room temperature needs to be able to be varied.

We would recommend exploring the option of using the radiators as the base heating system and supplementing them with the fan coil units to allow the temperature to be fine tuned as a fast response system.

6 REVIEW OF QUOTATIONS RECEIVED

CTC has shared a number of quotations by Contractors who have been approached for ideas and budget quotes. These are summarised in the tables below, which includes a summary of the option and E3's comments. Costs are rounded to the nearest £1000, and exclude VAT.

6.1 TOWN HALL

Option	Proposal	E3 comments
Thermocold	Replacement ducted fan coil unit to hall and bar. £27k.	This is E3 option 3. However it doesn't address the ventilation requirements. It has potential, subject to additionally adding ventilation plant.
Lee Hobbs	Replacement ducted fan coil unit to hall and bar. £17k.	Similar proposal to Thermocold
Greyman	Replacement ducted fan coil unit to hall and bar. Provision of 4no heat recovery ventilation units. £17k.	This is close to E3 option 3. It includes ventilation equipment, although using 4no smaller heat recovery units rather than 1no larger air handling unit. The principle is the same.
Loft boards/gantry	£5k to reinstate access boards in roof void. Advised by CTC.	Recommended for all options to provide safe access to roof void.

Additional costs to consider for all options:

- Decommission gas supply.
- Clarify any exclusions from quote.
- Main Contractor attendance and builderswork / making good.
- Electrical works included?
- Listed Building Consent/planning costs.
- Access to roof for decommissioning existing equipment and installation of new.
- Design fees (to include CDM/Contract Administration)

6.2 NEELD HALL

Option	Proposal	E3 comments
MB Bells	Electric panel heaters in WCs and corridor. £2k	We don't recommend this option. If a heat pump is being installed it makes sense to use it to heat the WCs too, using radiators.
Thermocold	New low level fan coil units, to replace the existing high level fan coil units and radiators. £36k or £40k depending on option pursued.	We assume it will have a higher capacity than the existing system. There are concerns with noise from the existing fan coil units. This proposal would require fan coil units for both heating and cooling. Would this be acceptable? For this reason it is not currently proposed by E3. It also doesn't provide a solution for the WCs.
Greyman	2no 115kW Electric boilers.	Electric boilers will have a significant long term running cost so they would not be our recommended approach. A heat pump would be preferable. Note that the load required is likely to be significantly lower than 2no 115kW boilers, as noted earlier in this report.
Lee Hobbs (option 1)	New low level fan coil units, to replace the existing high level fan coil units. £28k	Similar to Thermocold proposal, see comments above.
Lee Hobbs (option 2)	2no 80kW Electric boilers.	Similar to Greyman proposal, see comments above.
Decommission gas	£3k as advised by CTC.	Required.

Additional costs to consider for all options:

- Clarify any exclusions from quote.
- Main Contractor attendance and builderswork / making good.
- Electrical works included?
- Listed Building Consent/planning costs.
- Demolition works, if option 4 for location of heat pump is pursued.
- Design fees (to include CDM/Contract Administration)

7 HEALTH AND SAFETY

The Construction, Design and Management (CDM) regulations will apply to this project, and we have advised CTC of the need to appoint a Principal Designer for the project. We would recommend that this is put in place as the project moves to the design stage.

Early considerations regarding CDM include:

- Providing safe access to the roof void above the Town Hall. Currently there are no walkways in the roof void and the fan coil units are not accessible for maintenance.
- Safe access for removing plant from the roof, and lifting new plant up there.
- Maintenance access (internally) to the roof could be improved with better lighting and handrails/grab rails.
- Providing information on the condition of the electrical infrastructure in the Town Hall.
- Management of risks associated with Asbestos.

8 BUILDING REGULATIONS

Any works involving an increase to the installed capacity of a heating system in an existing building is subject to Approved Document L of the building regulations. Improvements to the fabric of a building need to be considered. There are exemptions which apply to Listed buildings if fabric improvements are not viable. The approach for this project should be reviewed. The installed capacity is unlikely to be increased because the existing boilers in the Neeld and gas burner in the town hall are both rated higher than equipment that E3 would propose to replace them with.

Nevertheless, we would recommend consulting a building regulations Approved Inspector, or CTC's in house Building Control Body regarding the project to run through any information required to comply with Approved Document L, and any other Approved Documents that may apply.

9 PLANNING/LISTED BUILDING CONSENT

The works are likely to be subject to Listed Building Consent and (depending on the option) possibly Planning approval.

We assume that CTC will manage this in-house, and we would suggest a meeting with the relevant personnel during the design period to establish the process and required input by E3. It may require input from a conservation accredited architect, depending on the option pursued.

10 OTHER CONSULTANT INPUT

Whilst this is not an extensive or complex project, there may be a requirement for limited input from other consultants, as follows:

- Structural engineer – particularly with reference to the roof void above the Town Hall, and roof loading if an air handling unit is
- Acoustic engineer – depending on any requirements the planning process and the option proposed. There are residential properties close by.
- Contract administrator, unless this can be managed in house by CTC.
- CDM Principal Designer, as noted earlier.

11 CONCLUSIONS/NEXT STEPS

Initially, we would welcome feedback from CTC on this report and the ideas presented in it. Ideally we would like to identify CTC's favoured options, to focus our efforts on developing the design for the preferred approach, although there may be some further work needed before confirming the direction for each building.

Following that the next steps will be:

Both buildings:

- Consider input from other consultants/CDM.
- Consider procurement options.
- Establish programme for design/procurement/planning/building regulations/installation.
- Confirm electrical maximum demand and agreed supply capacity.
- Consider longer term sustainability objectives / UKNZCB standard / fabric.

Town Hall:

- Confirm design occupancy and ventilation strategy.
- Heat loss / heat gain calculation.
- Measure flow rates of existing system.
- Draw/specify preferred option.
- Consider electrical works.

Neeld Hall:

- Confirm design approach (noting comments regarding ventilation/acoustics earlier in this report).
- Survey existing heating system: pipework sizes, pipework routes, pipework condition, LTHW flow rates, radiator sizes and outputs.
- Heat loss / heat gain calculation.
- Design heat pump system, and confirm if radiators/pipework should be replaced.

APPENDIX A – E3 EXISTING SERVICES SKETCHES

Note: refer to revised set of existing services drawings included in Tender Additional Information folder.