Energy Efficiency and Zero Carbon Advice

St Stephen's Church, Colchester
PCC of St Stephen's Church

Author	Reviewer	Audit Date	Version
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Contents

1. Executive Summary

An energy survey of St Stephen's Church, Colchester was undertaken by ESOS Energy Ltd to provide advice to the church on how it can be more energy efficient and provide a sustainable and comfortable environment to support its continued use.

St Stephen's Church, Colchester consists of an Edwardian era church dating from 1902 which has become the church hall. A new church worship area and facilities area including an entrance foyer, kitchen, vestry and toilets weas constructed c. 2000.

There is both gas and electricity supplied to the site.

The church has a number of ways in which it can become more energy efficient. Our key recommendations have been summarised in the table below and are described in more detail later in this report. It is recommended that this table is used as the action plan for the church in implementing these recommendations over the coming years.

Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Payback (years)	Permission needed	CO2 saving (tonnes of CO2e/year)
SHORT TERM						
Investigate current provision of insulation in roofs (consult plans, sample areas).	Up to 5% if it is presently insufficient (3,000)	(£125)	Access at height costs	N/A	List A [Discuss with DAC]	
Inspect cavity wall insulation provision	N/A				None	
Remove or isolate radiator in lean to store east of hall.	10% of hall portion, 5% of total 3,000	£125	£200 Disconnect or install valve	2	List A	0.5
Replace kitchen water heater with a boiling tap (tankless).	1,000	£160	£300	2	List A	0.1
Replace broken secondary glazing, hall	Low	N/A	£200		List A	
Purchase a temperature and humidity monitor	Informs optimisation of heating times		£80		None	
Engage with heat pump installers and obtain quotes	N/A	N/A	Zero	N/A	None	
Main Porch Door draught proofing maintenance	1% 600	£25	£200	8	List A	0.1
Hall door draught proofing	2% 1,200	£50	£200	4	List B	0.2
Investigate secondary glazing options	10% 6,300	£250	£2,000 using acrylic sheet	8	List B	1.1
MEDIUM TERM						
Install Roof insulation as part of re-roofing /	10% of church/	£125	unknown	unknown	Faculty	0.5

repair process	service rooms portion 3,000					
Install light pipes (or reflective lining) in existing skylight portals.	Small drop in electric use given LED lighting		unknown	unknown	List B	
Install Roof insulation in hall	10% of hall portion (5%) 3,000	£125	Unknown, requires structural work	unknown	Faculty	0.5
Install LED lighting in hall	3,600	£576	£600	1	List B	0.76
Replace boilers with heat pump system [Figures for air to air system]	63,000 gas [15,750 electric use]	Equivalent at present cost rates	£29,000		Faculty	11.34 gas
LONG TERM						
Install solar photovoltaic panels	25,000 maximum	£4,000	£26,600 see text	7	Faculty, Planning Permission	Up to 9.9

The church should check any faculty requirements with the DAC Secretary at the Diocese before commencing any works.

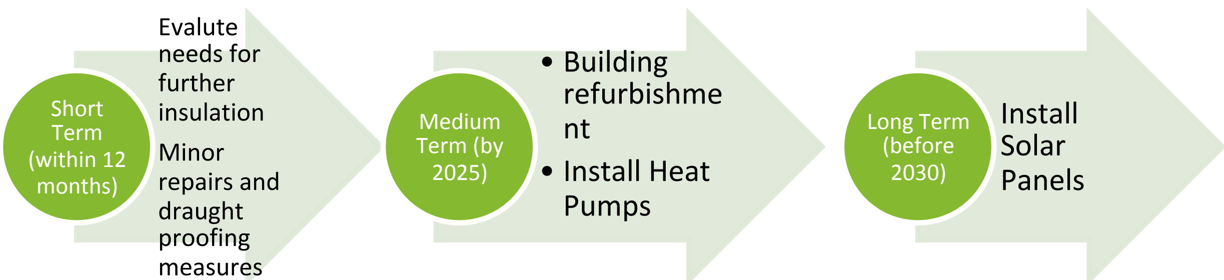
Based on the current contracted prices of 16.71p/kWh (day), 11.33p/kWh (night) for electricity and 3.24p/kWh for mains gas respectively. Note the current gas rate continues until 31/7/2025 when it is likely to rise considerably, thus the payback periods will shorten.

If all measures were implemented this would save the church around £2,000 per year in operating costs.

2. The Route to Net Zero Carbon

The General Synod of the Church of England has indicated that the Church of England should be Net Zero Carbon by 2030. Every church, cathedral, church school and vicarage will therefore need to convert to be a net zero building in the next 10 years.

This church has a clear route to become net zero by 2035 by undertaking the following steps:



3. Introduction

This report is provided to the PCC of St Stephen's Church, Colchester to give them advice and guidance as to how the church can be improved to be more energy efficient. In doing so the church will also become more cost effective to run with improvements in the levels of comfort. Where future church development and reordering plans are known, the recommendations in this report have been aligned with them.

An energy survey of the St Stephen's Church, Colchester, Canterbury Road, CO2 7RY was completed on Saturday 21st January 2023 by Dr. Paul Hamley. Paul is an energy auditor with experience of advising churches and small businesses. He is part of the Church Energy Advisors Network developing advice for the Church of England and authored the "Assessing Energy Use in Churches" report for Historic England. He is a CIBSE affiliate member and a Chartered Scientist, with experience of the faculty process gained from chairing the building committee of a Grade I listed church and has been an assessor for EcoCongregation.

The church was represented by Dr. John Clifton, Church Warden.

St Stephen's Church, Colchester	CHURCH	HALL 1902 building
Church Code	608468	
Gross Internal Floor Area	$504m^2$	$276m^2$
Volume	$2,150m^3$	$1,050m^3$
Heat loss	46kW	32kW
Listed Status	Unlisted	Unlisted

The site is typically used for 65 hours per week for the following activities:

Type of Use	**Hours Per Week (Typical)**	**Average Number of Attendees**
Services / Worship area use	9 hours per week	45
Community Use	56 hours per week	Daily use by various groups from 07:00 until 21:00
Occasional Offices	1-2 weddings occasional funerals	100 100

4. Energy Procurement Review

Energy bills for gas and electricity have been supplied by St Stephen's Church, Colchester and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	16.71p/kWh
Night Rate	11.33p/kWh
Standing Charge	25.00p/day

Supplier: Opus Energy, Contract End Date: 29/09/2023

The current gas rates are:

Single Rate	3.24p/kWh
Standing Charge	61.00p/day

Supplier: British Gas, Contract End Date: 31/07/2025

The above review has highlighted that when the current contracts expire, there will be opportunities to gain cost savings from improved procurement of the energy supplies at this site using a group purchasing scheme. The current rates are lower than the market rate and should be retained at present.

We would therefore recommend that the church looks into 100% renewable tariffs and obtains quotations for its gas and electricity supplies from group purchasing schemes such as the Big Church Switch scheme, Charity Buying Group and the diocese supported Parish Buying scheme, http://www.parishbuying.org.uk/energy-basket.

These scheme offers 100% renewable electricity and a proportion of renewable gas and therefore are an important part of the process of making churches more sustainable.

A review has also been carried out of the taxation and other levies which are being applied to the bills. These are:

VAT	20% on electricity and gas bills	The organisation is understood to be a charity and therefore should be benefiting from only be charged a 5% VAT rate. A VAT declaration should be sent to the supplier to adjust this.
CCL	100% charged	As the organisation is being charged the wrong VAT rate they are also being charged CCL which should not be applied as they are a charitable organisation.

Whenever monthly electricity consumption exceeds 1,000kWh, or gas consumption exceeds 4,397kWh (52,000kWh per annum), 20% VAT is charged unless the customer has submitted a VAT declaration form. This should always be done when changing supplier.

The church is a charity and therefore can claim VAT exemption status.

Excess VAT paid can be reclaimed for the past three years.

VAT declarations are available from the suppliers website and can usually be found by typing the suppliers name followed by “VAT Declaration Certificate” into most website search engines.

5. Energy Usage Details

5.1 Annual Consumption

Utility	Annual use/ kWh	from	to	Cost At current rates
Electricity Whole site	12,786	16/11/2021	13/11/2022	£2,733
Gas	62,808	05/10/2021	06/10/2022	£2,540

Utility	Meter Serial	Type	Pulsed output	Location
Electricity - Church	216685973	EDMI Atlas Mk10D Three Phase	Yes	Charles Hawkins Room, electrical cupboard
Gas – Church	M016 A016128 00 A6	Schlumberger Metric	Yes	External brick cabinet outside boiler room

All the meters are AMR connected and as such an annual energy use profile for the site could be obtained from the supplier for gas. Some detailed consumption data is supplied for electricity.

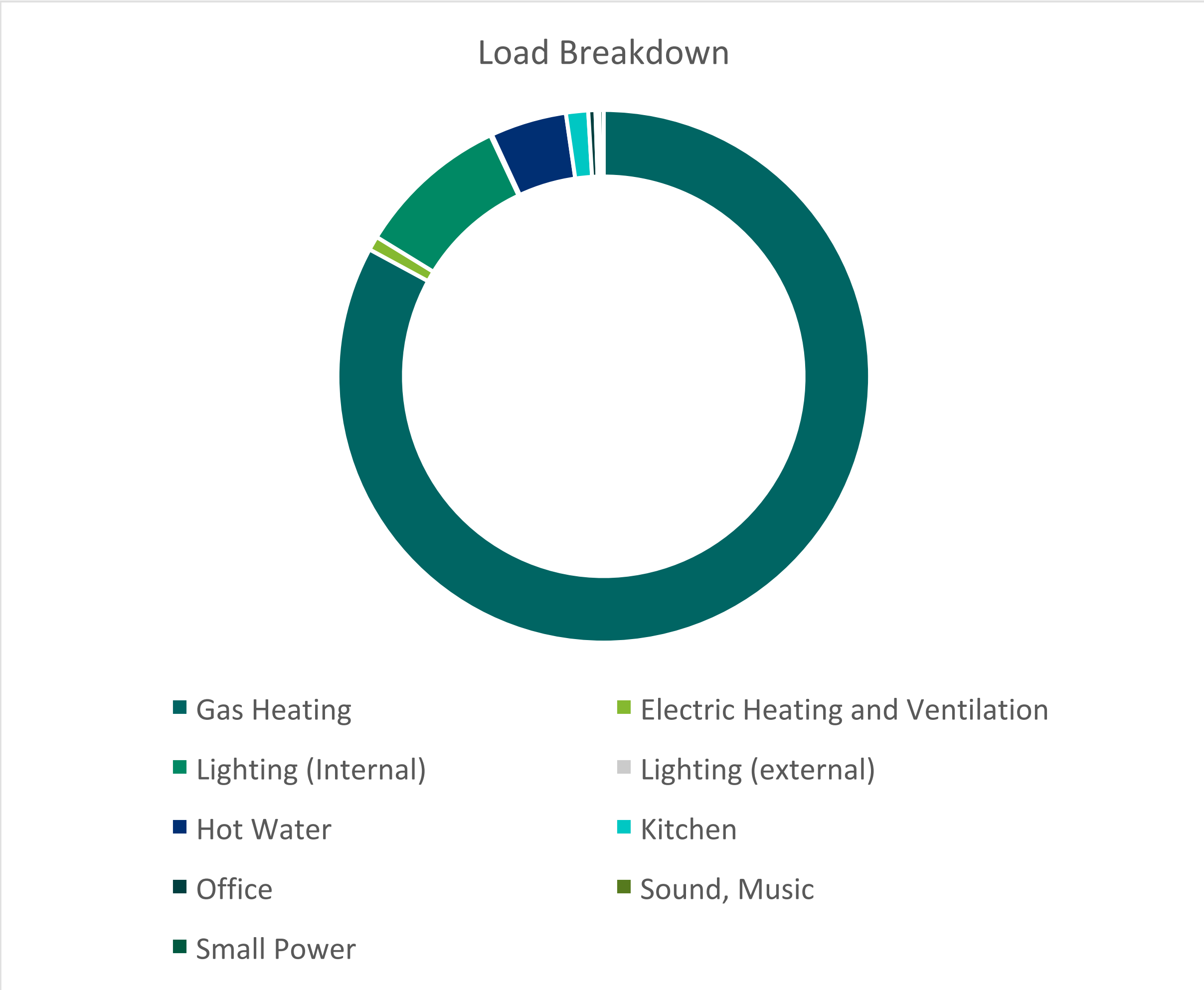
5.2 Energy Profiling

The main energy consuming plant can be summarised as follows:

	Equipment	Power kW	Annual Consumption kWh	Portion
Heating [Gas]	2 Glow Worm Micron boilers of 110,000BTU output each (32kW each) [1,000 hours operation] + Gas hob/ cooker	64	63,000	83%
Heating [Electric]	Boiler circulation pumps Toilet hand driers, 3 x 1kW	0.5 3	500 150	0.8%
Lighting [Internal]	CHURCH [470 hours maximum] 11 spotlights (unknown type) 16 uplights fluorescent 8 side lights fluorescent FOYER / facilities area [2,600 hours but only part lit] Spotlights 3 x 100W (?) playroom Fluorescent 4 xF70W + 8 x F58W Bulkhead 6 x 28W Compact fluorescent 17 x 18W LED recessed 5 x 7W HALL [2,600 hours] 28 fluorescent F70W 8 recessed [LED ?] Office lighting	 1000W 930W 320W 300W 744W 168W 306W 35W 1960W 80W 120W	500 3,000 3,500 TOTAL 7,000	9.3%
Lighting [External]	Security lighting	200W	80	0.1%
Hot Water	300L Ariston tank, run off gas boiler only including summer Washing Machine (1 use/ week) Dishwasher (3 hours/week) Lincat Fixed water heater, kitchen [LEFT ON] Coffee machine, regular use	(0) 3 5 3 2	 250 750 1,500 (half standing losses) 1,000 TOTAL 3,500	4.6%
Kitchen	Microwave Fridges Full + half height (on constantly) Extraction fan	1 0.3 0.2	100 900 20 TOTAL 1,020	1.3%
Office	Use 30 hours/week, one workstation Photocopier, printer	0.2 0.5	300 30	0.4%
Sound, Music	Sound system Organ, electronic	0.5 0.2	125 50	0.2%
Small Power	Vacuum cleaner	1.5	200	0.2%

Sum of electricity use estimates: 12,875kWh

Annual site electricity consumption, 2022: 12,786kWh



As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site. The other significant load is lighting / hot water.

6. Efficient / Low Carbon Heating Strategy

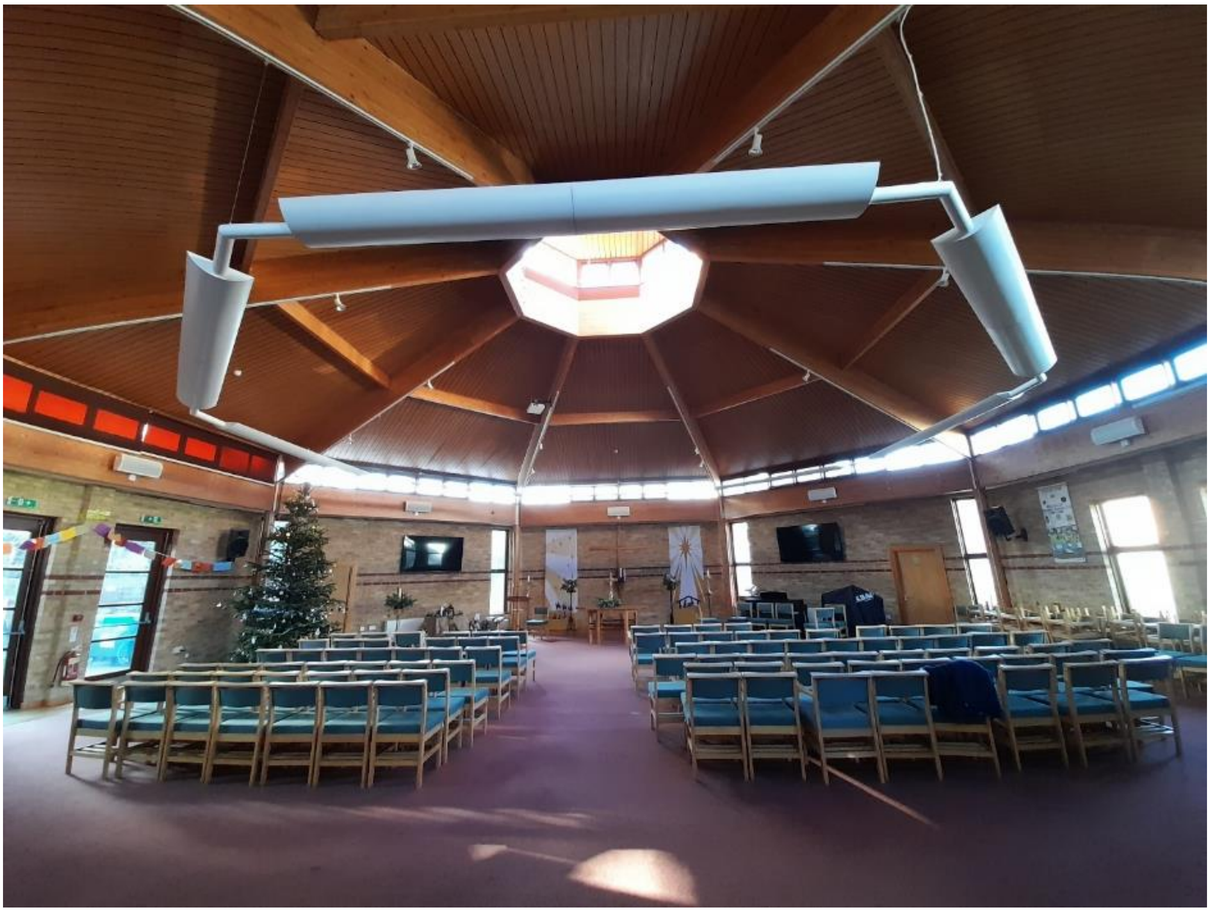
6.1 Overview of Buildings, Structural Issues

St Stephen's Church site consists of three linked structures; the original church dating from 1902 which now serves as the hall and an octagonal worship area constructed in 2000 which are linked by a facilities area of the same date. This contains the entrance foyer, office, kitchen, Charles Hawkins room, playroom, vestry, and toilets.

View with the 1902 hall to the left, which has its own independent entrance. This allows parallel, separate events to be held. To the right of the main entrance into the central foyer is a chapel which also has an independent entrance.

The entrance to the main foyer.

The worship area is surmounted by an octagonal cupola. Two of the eight sides lead to storage areas, one (above, right) containing the boilers.



The worship area is seated by chairs and lit by fluorescent lighting, due to be replaced by LEDs.

To the rear is a small room (the Playroom) which has potential for use for small meetings.

The 1902 hall has been subdivided with a mezzanine floor inserted at the south end which contains a room used for pilates classes.

The construction suffers from various defects which are reported as resulting from wall cappings at the edges of the central flat roof area allowing water to penetrate the walls.   Results include the render on the south façade of the playroom / disabled toilet / vestry detaching, mould growth on the wall indicating high moisture level and areas where the render has fallen away.

The sanctuary, which has an octagonal form is believed to have structural weaknesses at the eight corners.

The reasons leading to the problems are outside of the scope of this energy audit, but the issue of damp and water penetration which lead to greater energy use (as a result of the extra energy required to vaporise the water emanating from the wall surfaces) is relevant.

The church is embarking on a program of fundraising and remedial works which are likely to involve re-roofing and re-capping the walls in a water tight manner.

An overall recommendation is that, where roof covering replacement is to be undertaken, this opportunity should be used to ensure that roof insulation is either already present, or is installed up to the current standards.

This will require some preliminary work – assessment of the building plans and inspection of test areas to ascertain what insulation is present. If it is insufficient, installation of further insulation should be included as part of the work program – but structural engineering calculations will be necessary to ensure the roof structures are able to support the additional weight.

- It is recommended that any installation of roof insulation is a part of the main project (i.e. not a separate project with different contractors) so that project planning, management and access equipment costs can be shared.

- The cavities of the walls should be inspected to check that (a) solid insulation has been added at build and (b) if the insulation has become waterlogged where there has been water ingress.

Drying out a wall is a long term issue and advice should be taken (ideally from the project architect).

- As well as taking the opportunity of roof and wall repairs to ensure that the "new" building is effectively insulated, if the roofing is completely replaced, the skylights could be replaced by light pipes. If the skylights themselves are retained, fitting light pipe reflective tubing underneath to bring extra light down through the structure is recommended.

- There are various maintenance interventions needed to reduce draughts.

The hall, which has solid walls and single glazing is uninsulated. The church has begun thinking of adding an insulated suspended ceiling in the main hall; this project would be the opportunity to simultaneously change the lighting where there are a large number of fluorescent tubes, to LED Strip lighting, lowering lighting energy use by around 80%.

Secondary glazing this building is recommended as it has high hours of use.

6.2 Reducing Environmental Impact

The energy used for heating a church typically forms 80% to 90% of its energy consumption. Electricity currently has carbon emissions of around the same level as mains gas but the carbon emissions associated with electricity are reducing rapidly as the UK builds more renewable energy and decommissions its remaining coal fired power stations. Mains gas does have some potential to reduce its carbon content through the use of bio gas and hydrogen but these are less developed solutions and will be unable to deliver 'zero carbon mains gas'.

It is therefore important to review and plan to increase building efficiency and become less carbon intensive. One way to achieve this is to consider a transition to electrical heating where this also represents a more efficient and comfortable solution.

The church should develop a boiler replacement plan, by obtaining detailed quotations for the options presented in this report. Where electric heating can be obtained at similar or lower operating cost, this is recommended.

Addition of further insulation will reduce heat loss and lower running costs of the heating system. Reducing heat loss will reduce the size of heat pump plant required and lower the capital cost.

Given the age of the boilers, fundraising for their replacement as an independent project to the roof is encouraged.

6.3 Site Heat Demand

The Centre for Sustainable Energy model[2] can be used to estimate heat load for the building.

Heat Load (kW) = Volume V (m^3) x Insulation Factor

Insulation Factors

Condition	**Factor kW/m^3**
Poorly insulated with open or broken windows, draughty doors (add 5%)	0.034
Poorly insulated (assume no interventions)	0.033
Some insulating features	Estimate value
Well insulated	0.022
Insulated to 2010 regulations	0.013

Area	Volume m^3	Insulation Factor kW/m^3	Heat Required (Space heating) kW
Worship and Facilities areas combined	2,150	0.022 0.013	46 28
1902 Hall and rooms	1,050	0.033	32

2 www.cse.org.uk/local-energy/download/estimating-the-heat-demand-of-a-hypothetical-community-building-79

The boiler outputs suggest that the modern portion of the building is reasonably well insulated.

7. Future Heating Options

7.1 Heat Pump Overview

Heat Pumps are a low carbon method of creating heat. Electrically operated heat pumps can provide between 2.5 times and 5 times the amount of heat in kW which they consume in electricity (This is termed the Coefficient of Performance, CoP). When replacing gas boilers directly, sometimes larger radiators are required, or fan assisted radiators, or running the system for longer periods to achieve the same temperature.

With electricity prices now only three times more per kWh than gas (it was about four times), heat pumps are becoming steadily more cost effective. Refrigeration technology is mature and reliable; the units appear to offer lower maintenance costs compared to gas boilers.

Heat pumps generally deliver water at around 50^{o}C (although there are higher temperature ones on the market which require more energy to run); thus they are compatible with a building which is regularly used and can be supplied with constant, medium heat, rather than a full power heat up on Sunday mornings.

Air (to water) source systems deliver between 2.5 and 3 times the amount of heat in kWh to water that they consume.

Ground source systems are more efficient (since the average ground temperature is higher than the average air temperature), but require an expensive borehole. They are more efficient than their Air Source equivalent. Where a site has a daily requirement for heat (and thus high daily expenditure), the lower operating costs of a ground source pump outweigh the higher capital costs.

There is a further type, combining the higher efficiency of ground source with the lower capital costs of air source: Air to Air systems deliver warm air through indoor fan units and have a CoP rating of up to 5. They can also provide cooling. The existing heating pipe and cable trenches around the sanctuary walls could provide a pipework route and could be used to house some small output fan units (which would require a particular manufacturer's product to fit in the space available). Other fan heaters would be required above ground, for instance in the present radiator locations. Installing these would be more disruptive as the entire radiator and pipework network would need to be removed. It would be replaced either by:

A) a new network with a centralised heat pump feeding the individual fan emitters
B) several small heat pumps at suitable locations on external walls or the roof, each serving one or two fan emitters.

Some of the extra electricity required to run heat pumps can be obtained from solar PV panels. Some types of heat pump can provide cooling – solar powered cooling in summer is very efficient.

The efficiency advantages of heat pumps mean that in some circumstances they can work out at equivalent or cheaper operating cost than gas despite the higher cost of electricity per kWh. This effect is increased if electricity is generated on site by solar power.

7.2 Options Overview

The church is currently seated using up to 150 moveable chairs, so under pew heating is not an option. Any form of direct electric heating will give operating costs of about 3 times that of gas (dependent on rates) due to the long hours of building use.

The church is recommended to obtain quotes from Heat Pump installers.

There are several options:

A] Air to Water Heat Pump using existing radiator network.

This would supply water at about 50°C and is likely to require installation of more, or larger radiators. Adding fan assisted radiators would reduce heating times and also supply heat at ground level rather than it flowing to the ceiling first.

This would require the existing pipework to have sufficient lifetime.

The external unit is envisaged to be located outside of the existing boiler room and connect into the pipework.

Capital costs at £400 per kW output x 78kW = £31,200

B] Ground Source using boreholes

Lower operating cost than above, but high capital cost (estimate around £1,000 per kW output, so £78,000).

C] Air to Air Heat Pump, centralised system

This would also require one centralised external unit, supplying a number of new fan coil heaters (in approximately the same positions as the existing radiators) via a refrigerant pipework network. The fan heaters would be expected to give a quicker heating time than for the current space heating system. There may be an issue with the volume of refrigerant (most, but not all current refrigerants are flammable). A control system for heating the 1902 hall independently of the rest of the building may be desirable, but add extra expense.

Capital costs at £450 per kW output x 78kW = £35,100

D] Air to Air Heat Pumps, distributed system

This would involve a number of small external units, wall mounted, each supplying one or two internal fan units locally. Advantages include minimisation of pipework (less installation work, less cost, less refrigerant) and each area of the building could then clearly be independently heated.

Capital costs at £450 per kW output x 78kW = £35,100.

Costs may be less than option C as there will be less pipework, and disruption.

7.3 Air to Air Source Heat Pumps Details

Air to Air Source heat pumps require internal fan units, blowing warm air, connected to external units – they do not use water radiators. Systems provide summer cooling as well as winter heating and can deliver up to 4 to 5 times the amount of heat which they consume in electricity.

Four of the 3kW input units below left (installed in 2012) supply one floor of an office of area 165m^2. These are the small, individual units which serve one or two internal units.

The two large units (each 10kW input, 37.5kW output) serve 500m^2 of building over three floors via a network of piping.

There are a wide variety of internal units for ceiling, high wall mounting (above) and floor standing units.

7.4 Heat Pump Calculations

The current boilers are of 64kW capacity. Current annual heat input is at around 63,000kWh, split approximately equally between hall (which ahs a higher use) and the 2000 buildings.

Option A - Air to Water Source (using radiator network)

Annual Gas Use & heat requirement kWh	Estimated Heating hours	Output kW	CoP	ASHP Power Needs kW	ASHP annual Electric Needs kWh	Operating Cost (without solar PV) @ 16p/kWh	Capital cost
63,000	3,400	65	2.5	26	25,200	£4,032	£26,000

Option B - Ground Source (using radiator network)

Annual Gas Use & heat requirement kWh	Estimated Heating hours	Output kW	CoP	GSHP Power Needs kW	GSHP annual Electric Needs kWh	Operating Cost (without solar PV) @ 16p/kWh	Capital cost
63,000	3,400	65	4.0	16.3	15,750	£2,520	£65,000

Option C - Air to Air Source Centralised

Annual Gas Use & heat requirement kWh	Estimated Heating hours	Output kW	CoP	AASHP Power Needs kW	AASHP annual Electric Needs kWh	Operating Cost (without solar PV)	Capital cost
63,000	3,400	65	4.0	16.3	15,750	£2,520	£29,250

Option D - Air to Air Source Distributed

Annual Gas Use & heat requirement kWh	Estimated Heating hours	Output kW	CoP	AASHP Power Needs kW	AASHP annual Electric Needs kWh	Operating Cost (without solar PV)	Capital cost
63,000	3,400	65 total	4.0	16.3	15,750	£2,520	£29,250 *

*may be less due to less pipework.

It is expected that gas prices will rise faster than electricity in the short term. Electricity will always be more expensive per kWh, since it has to be generated, but the efficiency advantages of heat pumps generating 2.5 to 5 times the amount of heat in kW compared to the amount of electricity consumed can make the cost equivalent or less. This depends on the two utility tariffs and the CoP of the heat pump system chosen.

If none of the heat pump options are found to be not viable, then the option of a high efficiency condensing boiler should be pursued.

8. Improve the Existing Heating System

8.1 Heating System Description

The site is heated by two Glowworm micro boilers giving a combined output of 65kW. These are about 20 years old. They serve the entire site, for which the 1902 hall has a heat loss of 32kW. The 2000 building, if fully insulated to modern standards would require 28kW heating (to maintain a stable temperature). Thin air gap (6mm) double glazing reduces this performance. It is unknown whether the roof insulation was installed to current thicknesses. The actual heat requitement is likely to be higher than 28kW. The sum for the whole site is around that of the boiler output.

In the years before the replacement of the existing heating system it is recommended that measures are taken to improve the efficiency of the existing heating system, this should include:

8.2 Radiator in Hall Lean to Storage Room

This radiator was found to be running, heating a store room. It has no accessible valve.

Either it should be disconnected from the network, or fitted with a thermostatic control valve and turned down low.

8.3 Data and Dataloggers

A temperature and relative humidity datalogger should be purchased. This can be used to help identify areas which are suffering from damp (and hence to inform the rebuilding project), and also to help understand, manage and reduce energy use by monitoring temperatures.

These retail at £70-80 and collect data which is downloaded to a computer to be viewed.

One product is the Lascar EL-USB-2

8.4 Magnetic Particle Filter

If the radiator and piping network is retained for use with an Air to Water Heat Pump, a magnetic particle filter should be fitted to collect magnetic sludge which will otherwise circulate and reduce system effectiveness, and can cause valve blockages.

8.5 System Clean and Flush

At the same time as either installing a filter, or changing to a heat pump system, the system should be cleaned and flushed. This can improve efficiency by up to 7%.

9. Energy Saving Recommendations - Equipment

In addition to having a revised heating strategy there are also a number of other measures that can be taken to reduce the amount of energy used within the church.

9.1 Fixed Water Heater: Timer Control

A Lincat water heater is located in the kitchen sink. This was described as being turned on all the time. This type of tank can be poorly insulated and lose heat through the case.

The building is used regularly and thus installing a timer control is likely to result in the device being programmed to be on for the regular opening hours of the site, which are considerable. Standing losses from maintaining 10 litres of water at temperature will continue to be high (the unit was described as having a hot case). Standing losses can involve the same amount of energy as a traditional light bulb, up to 1,000kWh per year.

Therefore is recommended that the unit is replaced by a boiling tap; an instantaneous heater which will heat only the water required and have no standing losses. There are an increasing number of such units on the market which can be bought or leased (useful for a high use environment if the lease conditions include replacement within a day of failure).

9.2 Fixed Hot Water Tank – Replacement

If a heat pump system is installed, hot water provision to sinks should be via point of use instantaneous heaters rather than a large central tank.

The current 300 litre tank appears to be sized to supply the shower room – which was described as never being used.

If showering facilities are required in future following heat pump installation, an electric shower should be provided.

9.3 New LED Lighting

The lighting makes up a relatively large overall energy proportion of the electricity used within the church, and large areas are lit by relatively inefficient large fluorescent tubes within the sanctuary and main hall. The work in the main hall should be scheduled as part of ceiling insulation works if this is proceeded with.

It is recommended that the fluorescent tubes are replaced by a form of LED lighting strip – not necessarily LED tubes sourced to fit the existing luminaires (which will have non compatible controls and ballast, as well as having to source tubes of the exact length in mm). Various types of strip lighting are available

It is recommended that any LED light should come with branded chips and drivers and offer a 5 year warranty. An example of such a range of fittings is available from http://www.qvisled.com/

It is understood that the easily accessible (and low level) compact fluorescent lighting is being changed for LED as the bulbs require replacement.

The spotlights at high level in the worship area and the three in the playroom should be changed for LED units if this has not already occurred. Halogen spotlights are often 80 to 100W each.

10. Energy Saving Recommendations – Building Fabric

10.1 Draught Proof External Doors

The foyer is entered via two pairs of doors firming a draught lobby.

The outer pair have hydraulic closers and an upstand on the floor to prevent water ingress – these may need adjustment of the hydraulic mechanism for more efficient operation.

The inner pair, wood framed, appear to have sprung closure mechanisms (there are plates on the floor). A rubber draught excluder strip is rebated into the edge of one door, but has split and requires replacement. Additional strips each side of the doors (and above and below) would enable the draughtproofing to become effective.

A local double glazing or door repair company may be able to advise on suitable draught proofing.

The 1902 hall has the original wooden outer doors, closing against wood. Daylight could be seen on all sides and there is a large gap adjacent to the lock which should be addressed. At the same time, the numerous holes between planks which allow light and cold air in should be addressed – the door appears to be due for "life extension maintenance / restoration" with these gaps filled and the door revarnished or repainted to prolong its life.

The inner pair of doors could also benefit from draught proofing.

10.2 Secondary Glazing

The single glazed sash windows in the 1902 hall were described as never being opened.

It is recommended that secondary glazing is installed.

Internal secondary glazing could be added to the wooden frame using acrylic sheet, attached by magnetic adhesive strips. There are companies who will supply sheet cut to size.

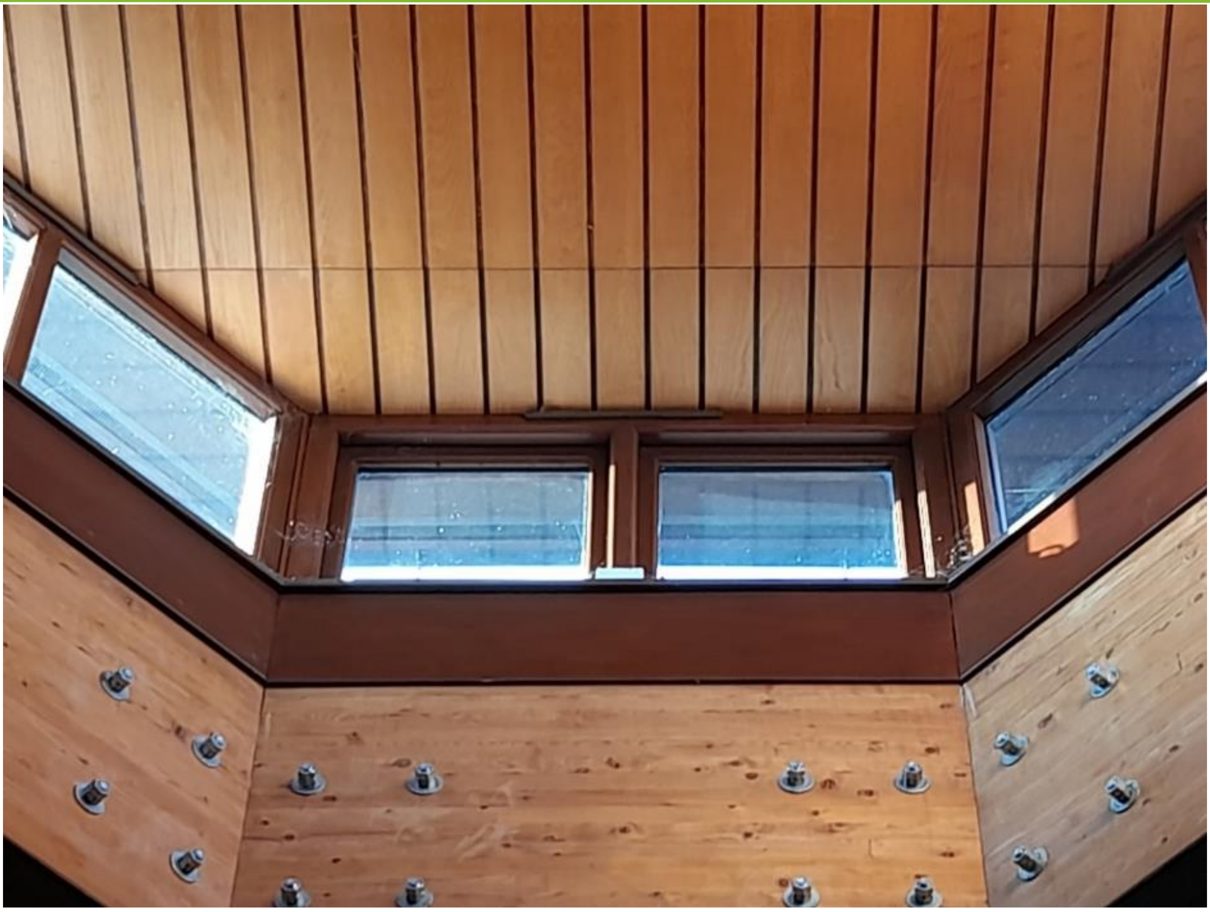
This would be at low cost (compared to ~ £500/m^2 for framed glass internal glazing units) and are removable (they are held in place by magnetic strips with adhesive backing).

Secondary glazing should also be applied to the street facing three light north window of the hall.

The south facing three light windows have been externally secondary glazed.   One of the glazing panels (left) is broken and should be replaced. UV Protected polycarbonate sheet should be used (this prevents yellowing and prolongs lifetime).   "Axgard" is one such product.

One of the skylights in the chapel is cracked – replacement should be costed as part of the roof refurbishment programme.

Skylights can import more light if the vertical portion is lined with highly reflective material. "Light pipes / light tubes / tubular skylights" incorporate collectors (covers) whose geometry maximises incoming light. The church may wish to consider incorporating these into the reroofing project for the centre to serve toilets and the rear passageway. This would reduce the amount of lighting needed, but only if the lights are controlled by presence detectors which also incorporate light sensors.



The glazing at high level around the worship area and the cupola above should be double glazed.

If not, this should be provided on refurbishment (or secondary glazing added).

10.3 Cavity Wall Insulation

The provision, and condition of the wall insulation installed in the 2000 buildings should be investigated.

If insufficient, or wet, this should be addressed as part of the refurbishment project.

10.4 Roof Insulation

The ceiling/roof of a building is the largest contributing area to heat loss from a building as heat rises. The insulation of such spaces can therefore have a dramatic impact on both the efficiency of the heating system and the temperature of the space below.

As mentioned, any shortfall in the insulation of the 2000 building should be addressed during refurbishment.

The 1902 hall has a loft, with two ventilation panels in it over the middle third of the roof structure. This was inaccessible.

The church is considering lowering the ceiling and adding further insulation – given the high hours of the hall, this would help to lower energy costs.

A full width new ceiling would require spanning an 8.9m by 14.4m space with beams of suitable strength to support a new ceiling.

Alternatively, utilising the existing beams (which tie the main beams to stop them spreading) spanning about 2/3 of the roof could be used to support a new ceiling structure.

The remaining 1/3 sloping portions of the ceiling could have insulation board added. A “deluxe” installation would recover the wooden ceiling and re-install it underneath, or replicate its appearance with tongue and grooved boards under the new insulation.

As this project would require plans and structural support, costings are not available.

11. Other Recommendations

11.1 Electric Vehicle Charging Points

The church has a car park on the west side of the site which serves the church and also the frequently used church hall. In order to make a visible statement on the churches mission of stewardship and to facilitate more sustainable transport choices by those both visiting the church and using the hall, the church may wish to consider installing an electric vehicle charging point, probably on the side of the church hall to allow visitors to charge their electric car.

Installing a unit such as a Rolec Securi-Charge http://www.rolecserv.com/ev-charging/news/view/Robust-EV-Charging-With-Rolecs-SecuriCharge-EV-Wall-Unit-Coin-Token-PAYG would allow the organisation control over who is allowed to use the unit with a key operated system. Or given the type of use of the building and control over the usage of the car park as a whole a simple 32 amp type 2 wall pod type charger may be most suitable and these are widely available through many suppliers such as http://www.rolecserv.com/ev-charging/product/EV-Charging-Points-For-The-Home.

12. Renewable Energy Potential

The potential for the generation of renewable energy on site has been reviewed and the viability noted.

Renewable Energy Type	Viable
Solar PV	Yes
Battery Storage	Yes
Wind	No – no suitable land away from buildings
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need

Biomass	No –urban air quality issues
Air Source Heat Pump	Yes – compare costs
Ground Source Heat Pump	Possible but likely too expensive
Air to Air Source Heat Pump	Yes – compare costs

12.1 Solar Photovoltaic Panels

Installing solar panels is recommended as the building is in regular daily use each day of the week.

Following installing heat pumps, and LED lighting replacing fluorescent strips, the electricity load of the building can be assessed accurately to calculate the size of a solar photovoltaic installation.

The re-roofing project should include assessment of the likely weight of a large solar photovoltaic system to ensure it can be supported.

The following formula calculates annual generation. A 1kWpeak system can generate up to 1000kWh annually,

Annual Generation (kWh) = Area x 0.15kWp/m^2 x 1000kWh/kWp x Orientation Factor x Overshading Factor.

Roof Section	Useable area / m^2	System Size / kW peak	Orientation factor	Shading factor	Annual Generation, kWh
Worship Area	160 maximum. South/west facing 100	15	180 degrees (averaged)/ 20° 0.96	1	14,400
Facilities Area	160 (skylights considered)	24	180 degrees / 35° Optimum on supports 1.00	0.9 (Hall to east)	21,600
1902 Hall (west facing)	100	15	270 degrees / 40° 0.76	1	11,400
TOTAL	360	44			47,400

This is the maximum likely figure, which may be reduced by factors such as the weight of panels (due to roof strength) and access space between panels. The ability of the roof structures to support the extra loads should be discussed with the church's inspecting architect.

The maximum potential generation is greater than the church centre's annual recent electricity use (12,786kWh in 2021). Installing LED lighting in the 1902 hall could cut this by around 3,500kWh to around 9,500kWh.

If heat pumps are installed, the system should be sized appropriate for current electricity consumption.

Heat pumps are predicted to use between 15,000 - 25,000kWh (depending on the type installed) and thus with a reduced site consumption following further LED lighting installation, the new site requirement would be 25,000 – 35,000kWh.

As there are several unknowns it is recommended to install solar power last, after decisions have been made, new equipment installed and the building load in kW accurately assessed.

Use of around half of the available roof area for panels looks likely.

Battery Storage is not strictly a renewable energy solution but provides a means of storing energy generated from solar PV on site to be able to be used at peak times or later into the day when the PV is no longer generating. It therefore extends the usefulness of the existing PV system. This is a new but fast-growing technology.

If costs are too high for battery installation, the system should be installed with wiring ready to accept one in the future.

Using average 2019 installation costs (£1,300 per kWpeak); a (largest) 44 kWpeak system would cost £57,200. As this is producing around double what is envisaged to be required, a 22kW system costing £26,600 is more feasible.

13. Funding Sources

There are a variety of charitable grants for churches undertaking works and a comprehensive list of available grants is available at www.parishresources.org.uk/resources-for-treasurers/funding/

This includes a 77 page guide to funders and their criteria:

https://www.parishresources.org.uk/wp-content/uploads/Charitable-Grants-for-Churches-Jan-2020.pdf
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The church has previously received Landfill Tax Credit funding. This indicates that it is within range of and fits the criteria for a local LTC project.

It is recommended that the church investigate this as one potential source of funds.

14. Faculty Requirements

It must be noted that all works intended to be undertaken should be discussed with the DAC at the Diocese.

Throughout this report we have indicated our view on what category of permission may be needed to undertake the work. This is for guidance only and must be checked prior to proceeding as views of different DACs can differ.

Under the new faculty rules;

List A is for more minor work which can be undertaken without the need for consultation and would include changing of light bulbs within existing fittings, repair and maintenance works to heating and electrical systems and repairs to the building which do not affect the historic fabric.

List B is for works which can be undertaken without a faculty but must be consulted on with permission sought from the Archdeacon through the DAC. This includes works of adaptation (but not substantial addition or replacement) of heating and electrical systems and also the replacement of existing boilers so long at the same pipe work, fuel source and flues are used. It can also be used to replace heating controls.

All other works will be subject to a full faculty.

Works which affect the external appearance of the church will also require planning permission (but not listed building consent) from the local authority and this will be required for items such as PV installations.