ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

Stockton Parish Church
PCC of Durham

Author	Reviewer	Date	Version
Nathan Tonkin	Ian Shellard	13th March 2023	1.0

Contents

1. Executive Summary

An energy survey of Stockton Parish Church was undertaken by ESOS Energy 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. This audit has been provided in conjunction with 2buy2, the Church of England's Parish Buying scheme provider and is subsidised from Total Gas & Power, the Parish Buying schemes principal energy suppliers.

Stockton Parish Church is an early 18th century structure constructed of brick and pitched, tiled roofs. There have been minor renovations over the years to the clock and organ, with a full renovation in 1893 and reseating in 1906. In 1925 there was a side chapel and choir vestry added, and in 2007 received grant funding from English Heritage to help restore the building. There is both gas and electricity supplied to the site.

The church has a number of ways in which it can be more energy efficient and a clear path towards net zero carbon. 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 and the route to net zero carbon diagram below are used as the action plan for the church in implementing these recommendations over the coming years.

Energy and decarbonisation recommendations	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Payback (years)	Permission needed	CO2 saving (tonnes of CO2e/yr)
Contact suppliers to arrange for the meters to be changed to smart meters	None	None	Nil	N/A	None	N/A
Switch electricity (and gas) suppliers to ones which provide 100% renewable (or green gas) supplies	None	None	Nil	N/A	None	Offset 2.92 tonnes
Improve pipework lagging and insulation on existing boiler	750	£225	£1,254	5.6	List A	0.14
Change existing lighting for low energy lamps/fittings	837	£251	£1,890	7.5	List B	0.16
Timers on fuse spurs to water heaters	13	£4	£150	38.1	List A	0.00
Install an overdoor heater	N/A	N/A	£690	N/A	List B	N/A
Draught proof external doors	642	£77	£1,600	20.8	List B	0.12
Upgrade cavity wall insulation in hall	3,553	£426	£5,596	13.1	Faculty	0.65
Upgrade roof insulation to 270mm in hall	1,914	£230	£86,130	375.0	Faculty	0.35
Replace heating system for electrical based heating	214,758	£22,693	£28,494	1.3	Faculty	39.02

solution (Church) (Under pew heaters)						
Replace heating system for electrical based heating solution (Offices) (AASHPs)	56,673	£1,125	£157,960	140.4	Faculty	10.00
Replace heating system for electrical based heating solution (Church Hall) (AASHPs)	53,106	£697	£165,221	236.9	Faculty	9.35
Install solar photovoltaic panels	6,533	£1,960	£12,375	6.3	Faculty	1.26
Consider registering for Eco Church	The Eco Church programme, which is recommended by the Church of England, helps congregations care for the environment in all aspects of church life. The programme is free; you can, however, make a donation to A Rocha UK towards its costs.					
Create a procurement policy for appliances (and other goods)	Commit to buying only appliances with the new energy efficiency ratings of A, B or C at the lowest when those you currently have reach the end of their useful life. (NB ovens, air conditioners and space or water heaters are still on the older rating scale, so for these, try for A+++.)					

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

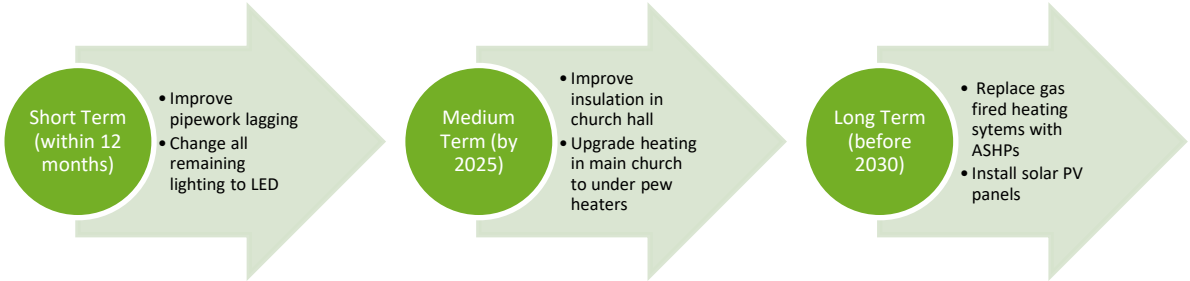
Figures in the table are based on current contracted/market prices of 30p/kWh and 10p/kWh for electricity and mains gas respectively. The carbon figures are based on the DEFRA 2022 carbon emission factors of 0.21107 for electricity, 0.18 for gas and 0.27 for oil. Do note that as energy prices increase, payback periods decrease.

2. The Route to Net Zero Carbon

Our Government has committed to move towards Net Zero Carbon – the point at which we have reduced emissions as much as we can and then balanced any residual emissions through removal of carbon from the atmosphere. They have done this as part of a worldwide agreement which aims to limit global warming to well under 2 degrees Celsius, with an aim of keeping it below 1.5 degrees Celsius. This will help protect all of us from the impacts of climate change.

In February 2020, the Church of England's General Synod set its own Net Zero Carbon target. The first stage of this target covers energy used by churches, cathedrals, schools, vicarages, other church buildings, as well as emissions caused by reimbursed transport. The target date is 2030.

This church has a clear route to become net zero by 2030 by undertaking the following steps:




ENCOUNTER

3. Introduction

This report is provided to the PCC of Stockton Parish Church 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 and seek to improve 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 Stockton Parish Church, High Street, Stockton-on-Tees, TS18 1SP was completed on the 11th of January 2023 by Nathan Tonkin. Nathan is an experienced energy auditor with over 4 years' experience in sustainability and energy matters in the built environment.

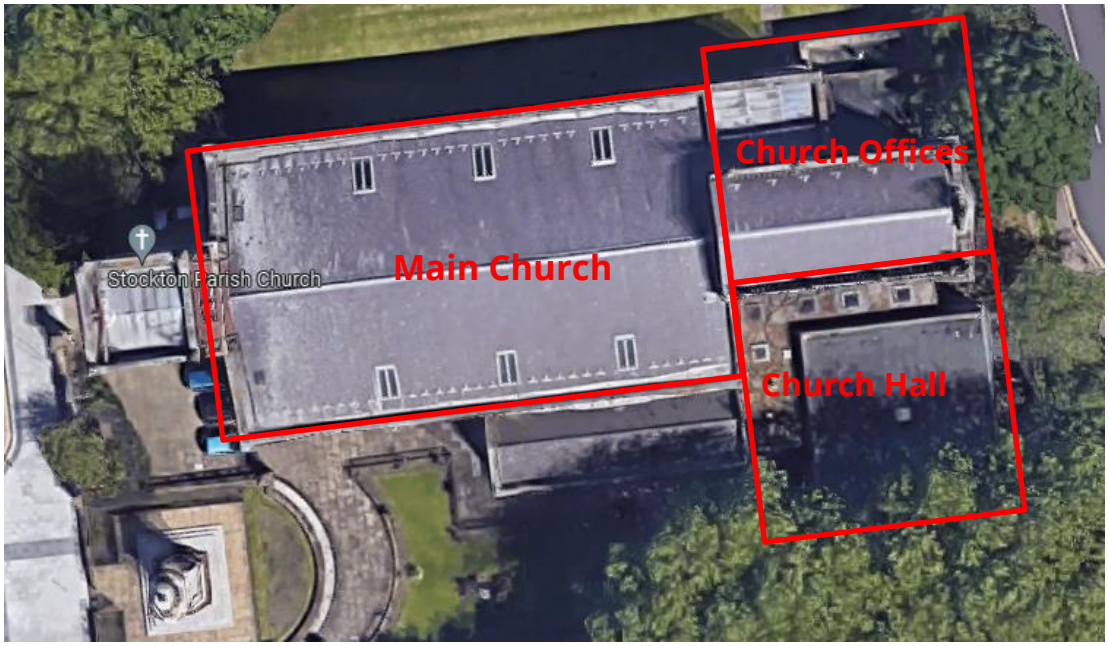
Stockton Parish Church	
Church Code	613321
Gross Internal Floor Area	1,051 m^2
Listed Status	Grade I
Average Congregation Size	120

The church is typically used for 10 hours per week for the following activities

Type of Use	Hours Per Week (Typical)
Services	4 hours per week
Meetings and Church Groups	4 hours per week
Community Use	2 hours per week

There is additional usage over and above these times for festivals, weddings, funerals and the like.

There are also offices housed within the church that are used 9-5 most days, as well as a church hall on the south side of the building that is used as a community space.



4. Energy Procurement Review

Energy bills for gas and electricity have been supplied by Stockton Parish Church.

The current electricity rates are:

Single / Blended Rate	33.0672p/kWh
Standing Charge	112.8522p/day

The current gas rates are:

Single / Blended Rate	8.5837p/kWh
Standing Charge	219p/day

The electricity is supplied by TotalEnergies and is not purchased on a renewable tariff. Going onto a renewable tariff is an important part of the process of taking churches towards net zero. The church is therefore encouraged to consider procuring its electricity from suppliers that offer 100% renewable electricity, and in some cases 'green' or 'carbon neutral' gas.

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

VAT	5%	The correct VAT rate is being applied.
CCL	not charged	The correct CCL rate is being applied.

The above review confirmed that the correct taxation and levy rates are being charged.

5. Energy Usage Details

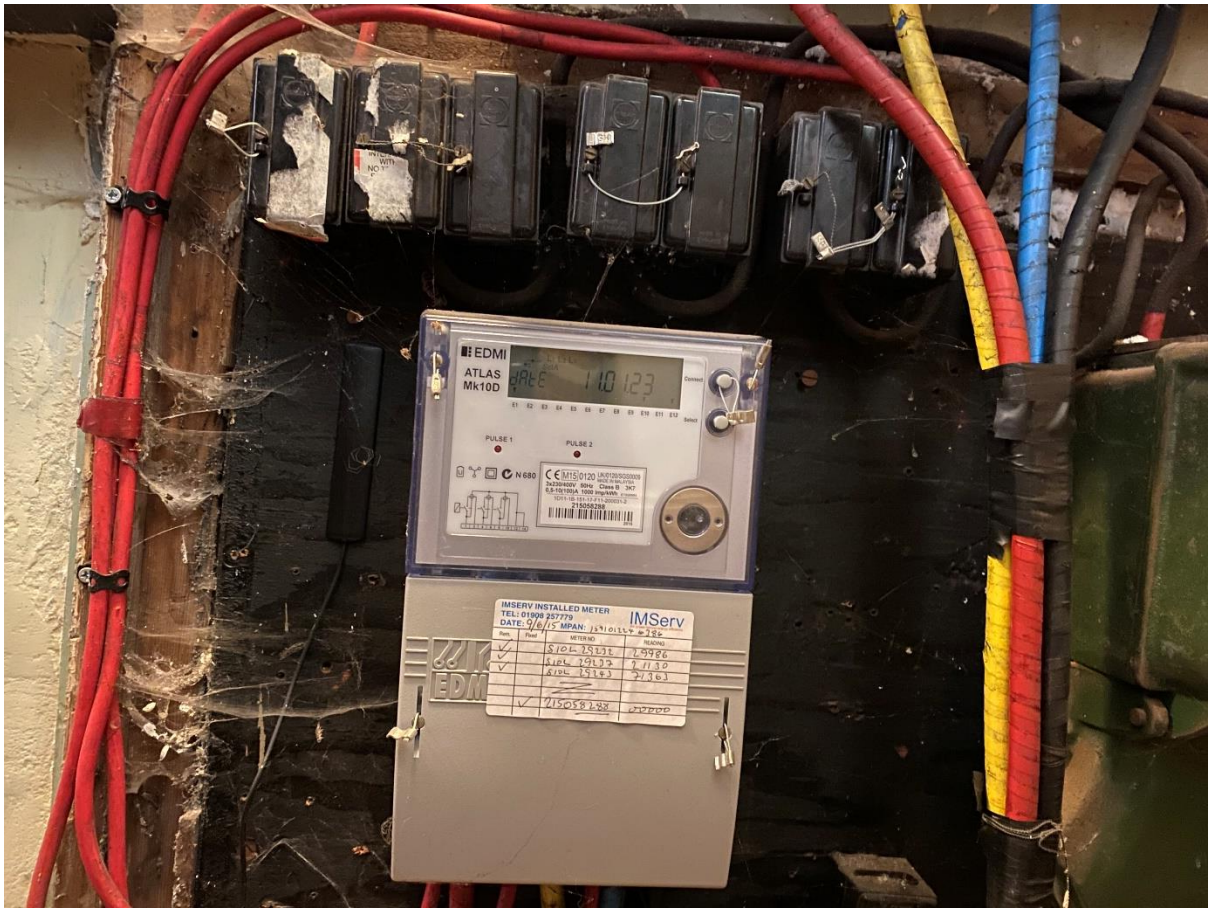
Stockton Parish Church uses 15,097 kWh/year of electricity, costing in the region of £4,529 per year, and 404,698 kWh/year of gas, costing £48,564. The total carbon emissions associated with this energy use are 76.79 CO_2e tonnes/year.

This data has been taken from the annual energy invoices provided by the suppliers of the site. Stockton Parish Church has one main electricity meter, serial number 215058288. There is one gas meter serving the site, serial number 75137252.

There was in issue with the gas meter during 2021 which caused a significantly higher reading in March of 2022 when the issue was corrected. This has skewed the total gas consumption to be higher than expected.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	215058288	EDMI ATLAS Mk10D 3 phase 100A	N but capable	GF elec switch room
Gas – Church	75137252			

It is recommended that the church consider asking their suppliers to install smart meters so that the usage can be monitored more closely, and the patterns of usage reviewed against the times the building is used.



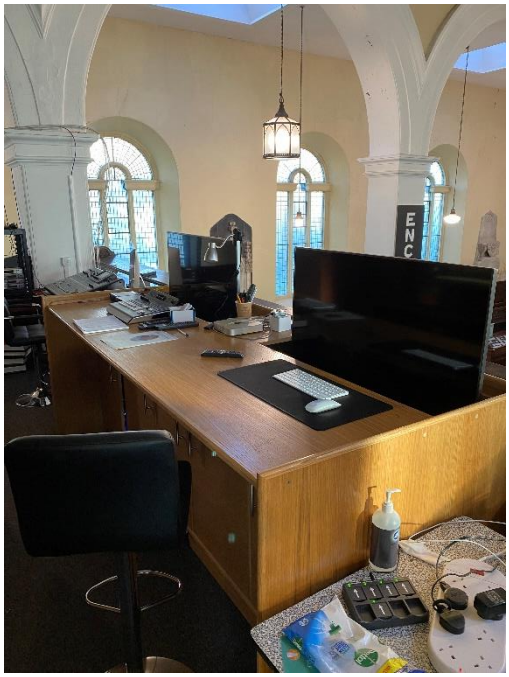
5.1 Energy Profiling

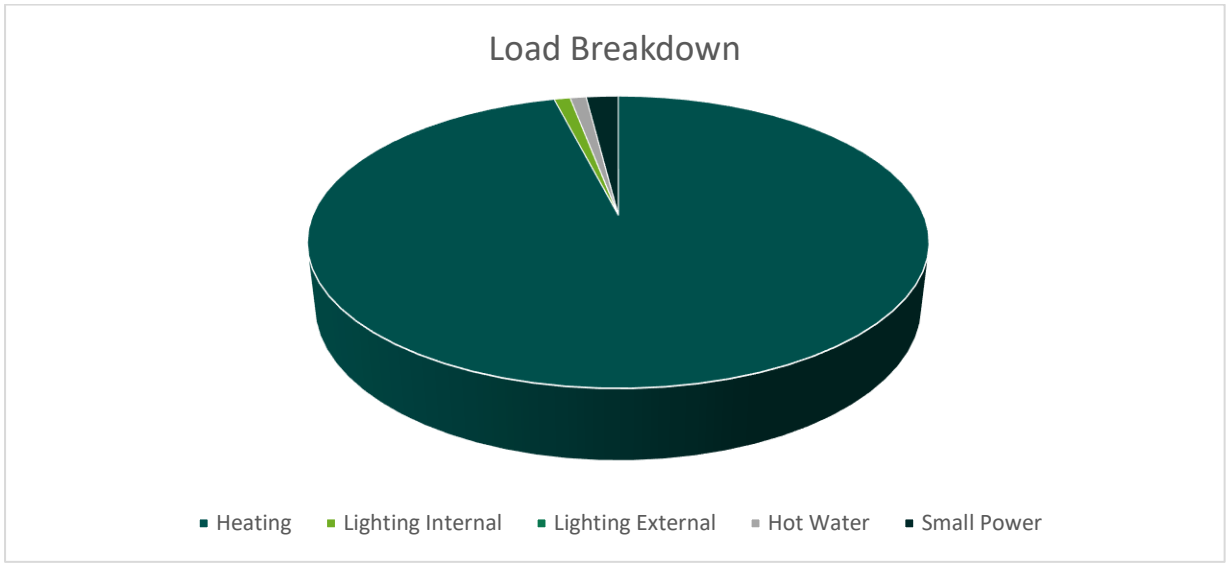
The main energy consuming plant can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting	**Main Church** >25 LED bulbs in various chandeliers **Church Offices** >25 LED strip lights and other assorted LED light fittings **Church Hall** >20 assorted LED and fluorescent tube fittings	1.5%
Heating	**Main Church** 2x Wessex ModuMAX gas-fired condensing boilers 160kW input = total 320kW **Church Offices** 1x Viessmann Vitodens gas-fired condensing boiler 80kW input **Church Hall** 1x unidentified gas-fired boiler Approximately 75kW input	96%
Hot Water	**Church Offices** Water heated off Viessmann Vitodens gas-fired condensing boiler **Church Hall** 1x Heatrae Sadia electric water heater supplying toilets and kitchen	0.5%
Other Small Power	**Main Church** 8x TV screens, projector, AV equipment **Church Offices** Assorted office IT equipment, photocopiers, kitchen appliances, other small power	2%


WESSEX


Nigel Stoves




Load Breakdown
Heating
Lighting Internal
Lighting External
Hot Water
Small Power

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 and IT equipment.

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use Stockton Parish Church uses 28% less electricity and 157% more heating energy than would be expected for a church of this size. It should be noted that the national benchmarks do not make any specific adjustment for the amount of time the church is used and the usage of this church will therefore affect how it performs against this benchmark.

The high gas usage is attributed to one larger reading in March due to an issue with the meter through 2021, as detailed above.

	Size (m^2 GIA)	Stockton Parish Church use kWh	Stockton Parish Church use kWh/m^2	Typical Church Use kWh/m^2	Variance from Typical
Electricity	1,051	15,097	14.36	20	-28.18%
Heating Fuel	1,051	404,698	385.06	150	156.71%
TOTAL	1,051	419,795	399.42	170	134.96%

6. Efficient / Low Carbon Heating Strategy

The energy used for heating a church typically makes up around 80% to 90% of the overall energy consumption. Heating also often uses gas or oil as its primary fuel. These are fossil fuels with high carbon emissions and little opportunity to decarbonise in the near future. 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' in the foreseeable future.

It is therefore important to review and set out a plan to make heating more efficient and less carbon intensive. One way to achieve this is to consider a transition to electrical heating where this also represents an efficient and comfortable solution for churches. 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 oil and coal-fired power stations.

The church is currently heated by a gas fired boiler which was installed in 2010 and appears to have a further 5 years serviceable life before requiring replacement. The boilers provide heating to cast iron column radiators around the perimeter of the church, including to the altar and chancel. In addition, there is oversized and exposed pipework which contributes to the heating of the church.

The church makes use of fixed wooden pews in the rear nave, with some flexible seating to the front and there are fixed pews around the perimeter.

The church is used once per week on a Sunday for service and the typical congregation size is 120, with additional services throughout the week. The heating is set to come on several hours earlier in the winter to ensure the church is warm for this service.

The various options for a decarbonised heating solution have been reviewed in the table below.

Decarbonisation Heating Solution	Viable
Air to Water Source Heat Pump	No – unsuited to current heating pipework and heat emitters
Air to Air Source Heat Pump	Yes – in office space and church hall
Water Source Heat Pump	No – no water source locally
Ground Source Heat Pump	No – significant archaeology
Under Pew Electric Heating Panels	Yes – in main church
Electric Panel Heaters (to provide supplemental heating only)	Yes – to supplement under pew heaters
Over Door Air Heater (to provide a supplemental warm welcome at the door only)	Yes – in main west facing entrance
Overhead Infra-Red Heaters	No – visual intrusion to the church would do harm, least preferred heating source due to comfort
Heated Chair Cushions	No – other solutions preferred

The recommendation is therefore that the church consider under pew heaters in the main church, air-to-air source heat pumps in the church office and hall. As described below.

6.1 Air to Air Source Heat Pumps

Air-to-Air Source Heat Pumps (AASHP) work by having an external unit which sucks air in and extracts the heat from it. The pumps concentrate this heat and put it into a refrigeration gas (in the same way as a fridge or freezer works). This refrigeration gas is then piped inside the building in a small pipe where is it then allowed to expand in an internal unit with a fan. This heat is then blown out into the space. This system is identical to an air conditioning system, but it works in reverse to heat the space. As warm air is blown into the space this type of system can heat spaces from cold relatively quickly. AASHPs provide around 4.5 units of heat for every 1 unit of electricity used in the heat pump; they therefore have a Coefficient of Performance (CoP) of up to 4.5.

The Centre for Sustainable Energy model[1] 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
Offices	680	0.033	22.4
Church Hall	783	0.033	25.8

Therefore, a heat pump of 22 and 25 kW would be required.

AASHPs require the installation of external units which look like air conditioning modules in well ventilated external locations. These external units will need an electricity supply and pipework running from them to the heating system. They will also need a drain nearby as the back of the units can build up moisture, which condenses and sometimes freezes on the coils. The larger units do create some low-level noise and therefore the location and baffling of the units may need to be considered carefully.

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

Examples of external units for AASHP comprising of three smaller 3kW units and two larger 10kW units.

Internal units come in a variety of styles. The most appropriate internal units for most churches are floor mounted units which look very similar to a fan convector heater. The offices could have a dropped ceiling with a cassette unit installed in it. The Church Hall would have floor mounted units to replace the radiators and convectors already installed.

FUA-A - Under ceiling cassette air conditioning unit

Unique under ceiling cassettes for high rooms with solid ceilings or false ceilings with a shallow void. Suitable for all types of commercial applications.

The FUA-A range provides comfortable heating and cooling even for rooms with high ceilings and has individual louvre control flexibility to suit every room layout.

FTXM-R - Wall mount air conditioning unit

Attractive, wall mounted design with perfect indoor air quality. 2 area motion detection sensor: air flow is sent to a zone other than where the person is located at that moment; if no people are detected, the unit will automatically switch over to the energy-efficient setting.

FVXM - Floor Mount Air Conditioning Unit

Designed to fit rooms of any size and shape, it blends well with the interior due to the new design which incorporates more flowing lines and softer edges. These units are ideal when it is not possible to fit a high level wall mount unit for aesthetic or practical reasons.

They are suitable for a wide range of applications including domestic, small to medium offices and commercial uses.

All these units do have a fan element within them and therefore a small amount of fan noise is emitted. This tends to be less than a fan convector heater on a boiler-based system and similar to the noise from a fridge or freezer. Air conditioning units are commonplace in hotel rooms, indicating that the noise is low enough even to be suitable for sleeping environments.

A case study of a church which has installed such a solution is available at 5. Air-source heat pumps at Hethel Church - All Saints Church, Hethel - A Church Near You

6.2 Install Electric Under Pew Heaters

Electric under pew heaters provide a high level of thermal comfort to people sat in the pews. They are not installed to try and heat the entire air volume of the church, instead thermal comfort is achieved through a flow of warm air rising past the person in the pew. This means that the heaters should be installed under the entire length of all the pews that are likely to be used.

These heaters warm up almost instantly and a flow of warm air over the pew area is created within around 15 minutes of their being turned on. This significantly reduces the amount of preheating required before each use of the building and can make electric heating cost competitive with gas. It is important that this reduced 'on time' is properly reflected in any comparisons with other types of heating.

We would therefore suggest that the following works could be considered:

Install under pew heaters suspended from brackets from the underside of the pew seat as follows:

Central Nave, 2x 11 rows with two 650W heaters in each row between uprights

South side, 10 rows with two 650W heaters between uprights

Cable runs to the pew heaters should run along the along the existing routes (all cabling should be in armoured cable or FP200 Gold when above ground) to both rows of pews. Each pew heater to be switched with a neon indicated fused spur located underneath the pew seat.

A case study of a church which has adopted this solution is available at https://www.churchofengland.org/about/environment-and-climate-change/st-andrews-chedworth-electric-heating

Photos of installations are shown below. In addition, several churches have recently installed such systems. If you would like to find out about churches whom you could ask about their experiences, please contact the diocese.

Brown BN Thermic 650W under pew heaters fixed to underside of pew seats for pews which have no solid backs.

Black 650W Norel under pew heaters fitted to solid pew backs.

6.3 Install Electric Panel Heaters

Electric panel heaters can provide additional heating to areas where there are no pews. Suitable electric panel heaters would be far-infrared panels. These heaters have a strong radiative effect (where heat is reflected to people from the surface) as well as a light convective effect (where air is warmed and moves around to heat the general space). For this reason, these heaters tend to provide a relatively instant sense of heat and comfort within a specific space and only need to be on for short periods of time. The heating effect spreads out from the panel by up to 3 meters, although this is reduced by people and furniture. This means that these heaters provide a useful source of supplementary heating or primary heating for some well-defined areas, but are not very well suited to providing a complete heating solution for a church without other forms of heating (such as under pew). As these heaters warm up almost instantly, this reduces the amount of preheating required before each use of the building and can make electric heating cost competitive with gas. It also means that areas using this form of heating can rapidly and economically be brought into used for short or unplanned meetings if needed.

It is recommended that the PCC consider installing supplementary electrical panel heaters in this area (on a time delay switch) allowing removal of the existing radiators.

These can be purchased widely and fitted by any competent electrician. It is recommended that they are fitted with a time delay switch so they cannot be left on accidently after use.

If you would like to discuss panel heaters with a church in the diocese that already makes use of them, please contact the diocese.

Electric panel heater installed behind an altar

6.4 Install an Overdoor Heater

In order to achieve the sense of a 'warm welcome' into the church an over door air heater could be provided. This would also help to provide warmth to the west of the church. Such an over door unit must be sized to cover the whole width of the door.

A variety of overdoor air heaters are available on the market and can be installed by an electrician. The heaters that will cover the entire width of the door tend to be larger output units, which will require a dedicated electrical cable of the correct size run to them. The church should resist the temptation to reduce the size and output of the heater to avoid running a new cable, as the output from smaller heaters and of those with insufficient width tends to be disappointing.

7. Energy Saving Recommendations

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.

7.1 New LED Lighting

The lighting makes up a relatively small overall energy proportion of the electricity used within the church. There are some areas of the building which have had efficient LED lights installed but there are still a large number of inefficient fluorescent fittings around the church.

It is recommended that the fittings scheduled in Appendix 1 are all changed for LED fittings. There are a vast number of specifications of LED light fittings on the market, but it is recommended that any purchased should come with branded chips and drivers and offer a 5 year warranty. An example of such a range of fittings is available through Parish Buying.

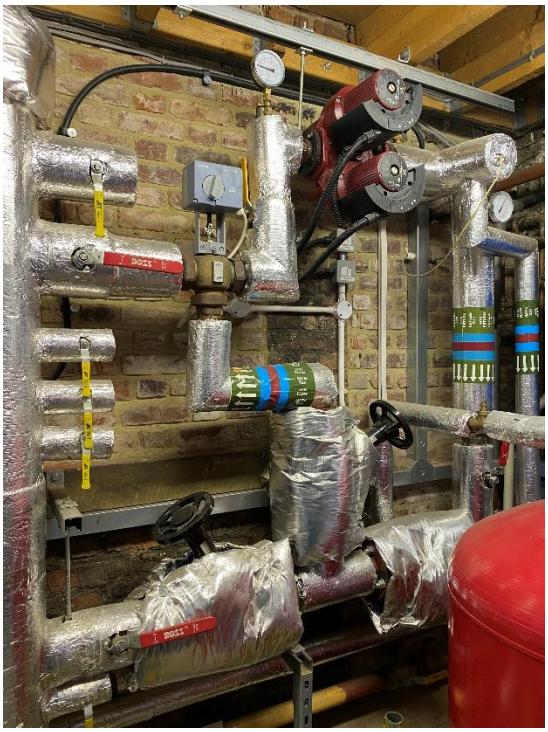
If all the light fittings were changed on a simple "like for like" the total capital cost (supplied and fitted) would be £1,890. The annual cost saving would be £251 resulting in a payback of around 7.5 years. This estimate includes the supply of the lights, the labour to install them and the access required. It does not include any upgrade to the wiring or a new lighting design, both of which the church may wish to consider. Guidance on lighting, produced by Historic England for churches, can be found at: https://historicengland.org.uk/advice/caring-for-heritage/places-of-worship/making-changes-to-your-place-of-worship/advice-by-topic/lighting/

There are some fittings such as in the bell tower staircase where the existing fitting can be made more efficient by simply changing the bulb/lamp within the existing fitting to a new LED bulb/lamp. This could be carried out by competent members of the churches internal team, very cost effectively and, unlike a change of fittings, would be a List A item, so no permissions would be required.

7.2 Insulation of Pipework and Fittings

The pipework within the boiler room has the majority of its straight lengths insulated, but the more complex-shaped pipework fittings, such as valves, have been left uninsulated. These exposed areas of pipework contribute significantly to heat loss from the system and make the plant room unnecessarily warm. The exposed hot surfaces also represent a health and safety risk of burns for those working in the area.

It is recommended that these areas of exposed pipework and fittings are insulated with bespoke flexible insulation jackets. These wrap around the various elements but can be removed and then replaced for any servicing activities.



7.3 Timers on Fuse Spurs to Water Heaters

There are a number of electric point of use water heaters in the church hall to provide hot water for hand washing. This only needs to heat the water to the required temperature when the building is in occupation but at the moment this heater is directly wired in without any form of time control and therefore maintains it set temperature 24/7.

It is recommended that the heaters are fitted with a 24 hour/7 day timeclock to replace the fused spur switch. They should be set up with times to match the times that the building is occupied. This will prevent the standing losses from the unit wasting energy during periods when the building is not occupied.

Such units can be purchased at any electrical wholesaler and fitted by your existing electrician or any NICEIC registered electrical contractor.

7.4 Draught Proof External Doors

There is one historic door on the west entrance of the church. The historic timber doors do not close tightly against the stone surround and hence a large amount of cold air is coming into the church around the side and base of these doors.

It is recommended that the draughtproofing around the door is improved and draught strips are added. This could be achieved in a number of ways:

For timber doors that close onto a stone surround, traditional solutions can be used such as brush draught strips rebated into the edge of the door by a skilled joiner. Other traditional methods such as using hessian or felt pads tacked to the door could also be used. Keeping the door maintained in a good condition is also important.

It is necessary to check with the DAC before undertaking any form of draughtproofing that involves work on the fabric of the door.

Simple measures such as having a 'sausage dog' style draught excluder laid along the base of a door (it needs to be sufficiently heavy to stay in place), using plasticine of the right colour to fill gaps where daylight can be seen, and putting painted fridge magnets over large keyholes can all be simple DIY measures which are effective.

Such measures should be considered carefully around bat conservation needs to ensure that access points bats use are not disturbed. Check your draught excluding plans with the Bat Conservation Trust's free helpline: 0345 1300 228 https://www.bats.org.uk/

7.5 Cavity Wall Insulation

The church is constructed with a cavity wall method, and the inspection of the wall showed no signs that insulation has been added. Prior to the early 1990's, building regulations did not require walls to be fully insulated and therefore it is likely that there is no insulation present. It could, however, be added through injection into the cavity walls.

It is recommended that cavity wall insulation is considered and added to the walls where appropriate. A survey to check the width of the cavity, exposure of the wall and condition of the cavity should be carried out by a CIGA-approved installer who will then be able to provide you with a quotation to undertake the works. Installing cavity wall insulation will help to reduce heat loss and improve the comfort of the space, but needs to be considered alongside other control measures such as TRV's or room sensors to ensure that the space does not overheat because of the additional insulation.

7.6 Insulation to Roof

The loft void above the ceiling was visible as part of this audit and found to have only little insulation present. In cases where there is 100mm or less of insulation within accessible roof spaces it is recommended that insulation be added to prevent heat loss and create a more comfortable environment for the occupants of the building.

Because heat rises, the ceiling/roof of a building is the largest contributing area to heat loss from a building. 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.

8. 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 Photo Voltaic (PV)	Yes – south facing roof and enough demand from offices
Battery Storage	Yes – viable solar PV

Now that the Feed in Tariff scheme has come to an end, the installation of solar PV panels in situations where there is not almost full usage of the electricity generated on site is not really viable.

There is potential for a small solar PV array on the roof of the tower or on the roof of the South Aisle. The church's energy consumption is significant enough, with the offices being used during office hours. It is then worth installing an array to try and offset this consumption, as well as future electricity consumption from the efficient heating strategy.

Battery storage is not strictly a renewable energy solution, but it does provide 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 solar PV is no longer generating. It therefore extends the usefulness of the existing solar PV system particularly in this sort of church. This is a new but fast-growing technology with prices expected to fall substantially over the next 2 to 3 years.

9. Funding Sources

There are a variety of charitable grants for churches undertaking works and a comprehensive list of available grants is available on this Parish Resources page:
https://www.parishresources.org.uk/resources-for-treasurers/funding/

10. 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 includes the installation of under pew heaters to pews which are made in or after 1850 and are not of historic interest.

All other works, including the like for like replacement of gas and oil boilers 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. This includes items such as solar PV installations.

11. Offsetting

As you take action to reduce your emissions, you may also wish to offset those that you cannot yet reduce. If you would like to engage in offsetting, it is important to use a reputable scheme. The Church of England recommends Climate Stewards, which has a simple calculator that can help you to work out how much you would need to offset. https://www.climatestewards.org/

Climate Stewards encourages people to 'reduce what you can and offset the rest' as part of your journey to Net Zero carbon emissions. They provide training and resources to help you understand climate change and its impacts, and to calculate the carbon footprint from your activities including travel, energy, expenditure, and food. Their online carbon calculators for individuals and smaller organisations are free to use, and they provide bespoke carbon footprint audits for larger organisations.

Having reduced as much of your organisation's carbon footprint as you can, there will always be unavoidable emissions from your work and travel. Carbon offsetting allows you to compensate for the negative impact of your carbon emissions by funding projects which take an equivalent

amount of CO2 out of the atmosphere. These either involve locking up ('sequestrating') CO2 as trees grow or reducing emissions by using low-carbon technology such as fuel-efficient cookstoves or water filters.

Climate Stewards has a close relationship with all their project partners in Ghana, Uganda, Kenya, Tanzania, Nepal, and Peru. They work closely with them to design, develop, implement and monitor projects which will not only mitigate carbon, but also bring tangible benefits to the local community - including improved health, savings in time and money previously spent on buying or collecting fuel, and improvements in local biodiversity. Each project is assessed using their Seal of Approval protocol which enables us to assess and monitor carbon mitigation and ensure robust, sustainable, and transparent partnerships.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Boiler room	2	1800mm LED Twin	£97	£320	3.3
Bell Tower	1	1800mm LED Twin	£49	£160	3.3
Bell Tower	1	1800mm LED Single	£23	£130	5.6
Bell Tower staircase	2	600 x 600 LED Panel	£15	£180	11.8
Church Hall corridor	10	16W LED 2D	£67	£1,100	16.5