ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

St Thomas Church
PCC of Carlisle

Author	Reviewer	Date	Version
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Contents

1. Executive Summary

An energy survey of St Thomas 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.

St Thomas Church was built from 1835 to 1837 from designs from local architect George Webster. It is constructed of stone with pitched slate roofs, with a tower to the east side of the building. It has been extensively remodelled inside, but the main changes have been the addition of the parish centre, constructed in 1980 of concrete. In more recent times there has been another extension onto the parish centre which has pitched timber roofs. 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 5.42 tonnes
Change existing lighting for low energy lamps/fittings	2,183	£655	£4,720	7.2	List B	0.42
Replace gas fired domestic hot water with electric under sink replacements	3,900	-£855	£6,600	N/A	Faculty	0.63
Replace or upgrade glazing in extension	2,104	£252	£14,750	58.4	Faculty	0.38
Upgrade roof insulation to 270mm in extension	4,296	£516	£4,274	8.3	Faculty	0.78
Replace heating system for electrical based heating solution (Church) (AWSHPs)	69,745	£2,263	£138,143	61.0	Faculty	12.36
Replace heating system for electrical based heating solution (Extension) (AASHPs)	39,614	£1,285	£59,250	46.1	Faculty	7.02

Replace heating system for electrical based heating solution (New Extension) (AWSHPs)	13,001	£422	£24,950	59.1	Faculty	2.30
Install solar photovoltaic panels	14,465	£4,340	£16,500	3.8	Faculty	2.80
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.

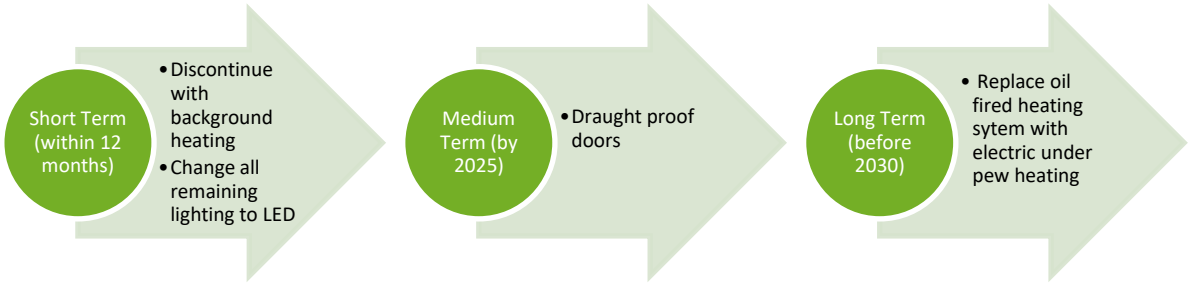
Figures in the table are based on current contracted/market prices of 30p/kWh and 10p/kWh for electricity and mains gas respectively. The carbon figures are based on the DEFRA 2022 carbon emission factors of 0.21107 for electricity, 0.18 for gas and 0.27 for oil. Do note that as energy prices increase,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



3. Introduction

This report is provided to the PCC of St Thomas 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 St Thomas Church, Stricklandgate, Kendal, LA9 4QG was completed on the 12th 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.

St Thomas Church	
Church Code	607234
Gross Internal Floor Area	800 m^2
Listed Status	Grade II
Average Congregation Size	150

The church typically used for 30 hours per week for the following activities:

Type of Use	Hours Per Week (Typical)
Services	5 hours per week
Meetings and Church Groups	5 hours per week
Community Use	20 hours per week
Office Use	40 hours per week

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

4. Energy Procurement Review

Energy bills for gas and electricity were not supplied by St Thomas Church therefore no review could be completed.

It is not known who supplies electricity but is assumed to be 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	Unknown	The church is a charity and therefore should be benefiting from only be charged a 5% VAT rate. Bills should be checked by those responsible at the church to verify this.
CCL	Unknown	If the church is being charged the wrong VAT rate, they should also check they are being charged CCL which should not be applied as they are a charitable organisation. Sending the supplier a VAT declaration will remove this charge.

The church should review if VAT and CCL are being charged at the appropriate rates. The church is a charity and therefore can claim VAT exemption status. If the incorrect rates are being charged, the PCC of St Mary's Church should send the supplier at VAT declaration confirming this and check all supplies on other sites. 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

St Thomas Church uses 28,030 kWh/year of electricity, costing in the region of £8,409 per year, and 181,876 kWh/year of gas, costing £21,825. The total carbon emissions associated with this energy use are 38.62 CO_2e tonnes/year.

This data has been taken from a summary of monthly usage compiled by the church. St Thomas Church has one main electricity meter, serial number E1012869. There is one gas meter serving the site, serial number M016A2483101A6.

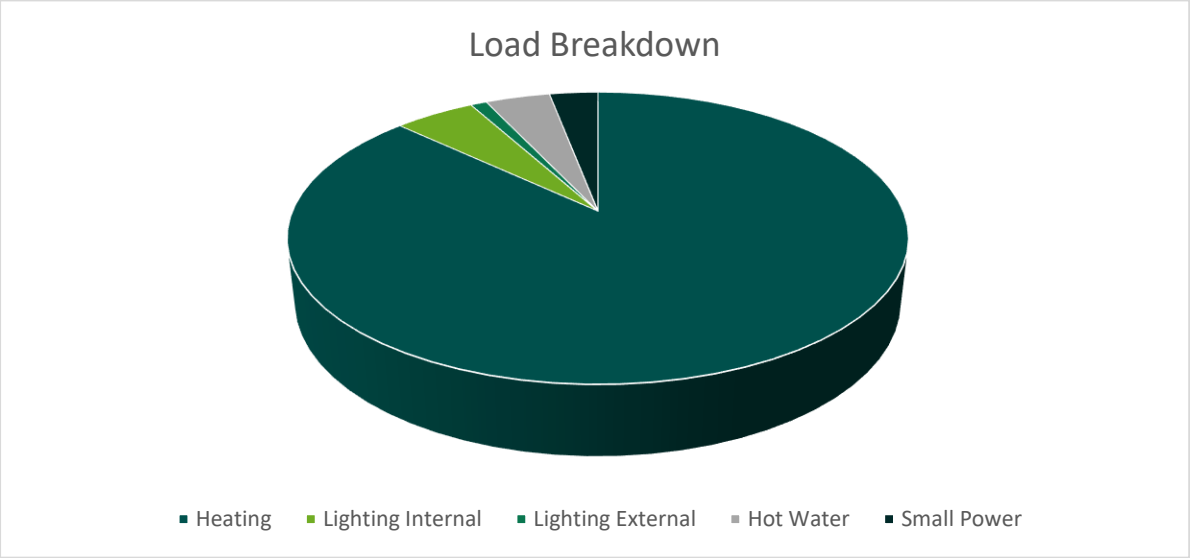
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	E1012869	EDMI Mk10 3 phase	N but capable	GF boiler room
Gas – Church	M016A2483101A6	Schlumberger MDA 16	N	GF cupboard

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** >15 halogen uplighters >10 LED stage lights Additional fluorescent lighting and halogen spotlights in the Narthex **Extension** >20 LED lights >5 T8 fluorescent tubes **New Extension** <10 T8 fluorescent tubes >10 LED spotlights	6%
Heating	**Main Church** 2x Potterton Sirius gas fired boilers. 70kW heat output. 10 years old. Distributes heat to 2 underfloor heating zones in main church and Narthex, and radiators in Prayer Room and Balcony Office. **Extension** 2x Lennox G30R-109 gas fired warm air heaters. Over 40 years old. Heat distributed via ductwork integrated into the walls. **New Extension** 1x Ideal Logic+ gas fired boiler. 15kW heat output. Distributes heat to underfloor heating.	87%
Hot Water	1x Andrews gas fired storage water heater. 109 litre capacity.	4%
Other Small Power	Office IT equipment, kitchen appliances, other small power	3%



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 hot water.

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use St Thomas Church uses 75% more electricity and 52% 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.

	Size (m^2 GIA)	St Thomas Church use kWh	St Thomas Church use kWh/m^2	Typical Church Use kWh/m^2	Variance from Typical
Electricity	800	28,030	35.04	20	75.19%
Heating Fuel	800	181,876	227.34	150	51.56%
TOTAL	800	209,906	262.38	170	54.34%

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 myriad of different systems, zones, and emitters. Each of the conventional boilers looks to have another 15-20 years left of serviceable life before requiring replacement. The warm air heaters are over 40 years old and are considered past their end of life and should be replaced as soon as possible. The conventional boilers supply heat to underfloor heating manifolds and radiators across the church and new extension area. The extension is served by the warm air heaters and distributed through vents and ductwork in the walls.

The church uses flexible seating throughout the whole building, with the exception of the balcony above the nave.

The church is used throughout the week for services, events, and general office work. The typical congregation size is 150. The heating is set to come on several hours earlier in the winter to areas that are due to be used to ensure that the church is warm.

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	Yes – in areas with underfloor heating
Air to Air Source Heat Pump	Yes – to replace existing warm air system in extension. Useful also during summer months as system can provide cooling in the offices.
Water Source Heat Pump	No – no water source locally
Ground Source Heat Pump	No – significant archaeology
Under Pew Electric Heating Panels	Yes – potential for installation in balcony area if underfloor heating does not reach.
Electric Panel Heaters (to provide supplemental heating only)	Yes – cheaper solution to replace hot water radiators in Prayer Room and Balcony Office
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 replacing conventional boilers with AWSHPs, warm air heaters with AASHPs, hot water radiators with electric panel heaters in Prayer Room and Balcony Office, and under pew heaters in balcony area. As described below.

6.1 Air to Water Source Heat Pumps

Air-to-Water Source Heat Pumps (AWSHPs) work by having an external unit which sucks air in and extracts the heat from it. It concentrates this heat and puts it directly into water that can then flow through the heating system. They work most efficiently when trying to produce water temperatures in the heating system between 40°C and 50°C. They tend to warm up slowly and steadily and are therefore well suited to situations where the heating is required for long periods of the day, and with heating systems that have a low temperature requirement such as underfloor heating systems. As they warm up spaces slowly, it is important that the warmth being slowly emitted is retained within the building so that the overall heat levels build up. This requires good levels of insulation and air tightness to ensure that the heat loss is lower than the heat being emitted. AWSHPs provide around 3 units of heat for every 1 unit of electricity used in the heat pump; they therefore have a Coefficient of Performance (CoP) of 3.

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
Main Church	1824	0.033	60.2
New Extension	213	0.033	7.0

Therefore, a heat pump of 60 kW would be required in the main church.

AWSHPs 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.

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

The larger units do create some low-level noise and therefore the location and baffling of the units may need to be considered carefully.

Areas for consideration to install external ASHP units

A case study of a church which has installed this solution is available at Heat pumps and fabric improvements make a rural church warm and well used : St Anne in Ings | The Church of England

6.2 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[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
Extension	648	0.033	21.4

Therefore, a heat pump of 21 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.

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

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

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.

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

6.3 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:

Balcony, 4x 5 rows with two 650W heaters in each row 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.

6.4 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 electrical panel heaters to replace the existing hot water radiators in the Prayer Room and Balcony Office.

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

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 large 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 and halogen fittings within 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 £4,720. The annual cost saving would be £655 resulting in a payback of around 7 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/



7.2 Secondary Glazing

The windows of the building are singled glazed with metal frames. It is not possible or desirable to change the windows in the main church as the building carries listed status. However, in the extension the windows are relatively small and have a simpler surround, and they are not primary or important windows within the church, they would be suitable to have secondary glazing installed.

The introduction of secondary glazing would considerably reduce the heat loss through the existing windows and improve both thermal comfort and noise levels, as well as providing added security.

Any possible installation would need to be carefully specified.

7.3 External Wall Insulation in Extension

The extension is constructed with a solid concrete 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 internal insulation boards installed.

It is recommended that wall insulation is considered and added to the walls where appropriate. A survey to check the width of the insulation to be installed, exposure and condition of the wall 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 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.

7.4 Insulation to Roof in Extension

The ceiling void was not inspected as part of this audit but assumed to have little or no 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. Other Recommendations

8.1 Replace gas fired domestic hot water with electric under sink replacements

Currently all domestic hot water for handwashing is generated from the gas fired stand alone heater. In order for the church to become net zero it must look to replace all gas fired appliances.

Therefore, the church should consider replacement of this system with individual under sink electric heaters. Because they are smaller units which only consume energy when in use, they are often much more efficient.

In calculations such as the one carried out for this report, they can often show negative paybacks, primarily due to the higher cost of electricity. This is because it is assumed the new units will use the same amount of kWh as the existing system. However, this is rarely the case and such systems have shown to reduce annual consumption consistently.

These heaters should be fitted with a 24 hour/7 day timeclock instead of a 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.

9. 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 – sufficient demand
Battery Storage	Future potential

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 southeast facing roof of the church. The church's energy consumption is currently very small and the consumption during the daytime when the sun is shining is likely to be very low indeed, however once the church moves away from gas to electric heating/cooling this will become a lot more viable.

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.

Area for solar PV consideration

10. 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/

11. 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.

12. 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
Narthex	6	1500mm LED Single	£40	£540	13.5
Narthex	4	LED Spotlamps	£58	£60	1.0
New Extension	6	1800mm LED Single	£112	£780	6.9
Extension	6	1800mm LED Twin	£233	£960	4.1
Nave	14	35 W LED Column	£212	£2,380	11.2