



Energy Efficiency and Zero Carbon Advice



St. James's Church Diocese of York

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1. Executive Summary

An energy survey of St. James’s 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. James’s church is a Grade II listed church located in the rural town of Murton, on the outskirts of York. The church is estimated to have been first constructed in the 13th century with repairs throughout its life. In 2016 there was a small extension built on the south side thanks to a fundraising drive of over 20 events. Internally, there are tables and chairs set up which can be moved to suit the needs of the space. Heating is provided by overhead infrared lamps positioned around the nave. There is only electricity supplied to the site by a single-phase supply.

The church has a number of ways in which it can be 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 and the route to net zero carbon are 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)
Change existing lighting for low energy lamps/fittings	43	£12.90	£474	36.7	List B	0.008
Install PIR motion sensors on selected lighting circuits	12	£3.60	£120	33.3	List B	0.002
Replace heating system for electrical based heating solution	156.8	£47.04	£3,000	63.8	Faculty	0.030

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

Based on current market prices of 30p/kWh and 12p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church £64 per year and reduce its carbon footprint by 0.04 tonnes (18%)

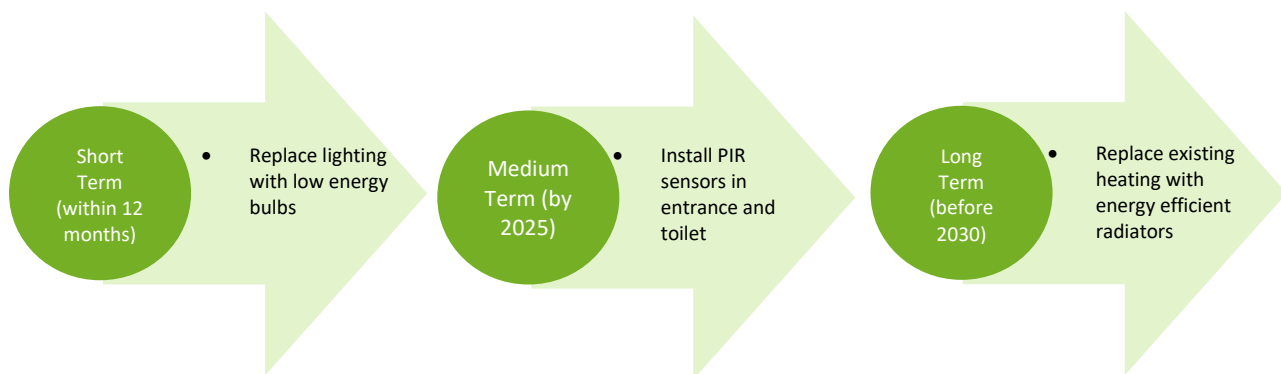


2. The Route to Net Zero Carbon

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 balance 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. James's 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. James's Church, Murton Way, Murton, York, YO19 5UJ was completed on the 16th of November 2022 by Nathan Tonkin. Nathan is an experienced energy auditor with over 4 years' experience in sustainability and energy matters in the built environment.

St. James's Church	
Church Code	643057
Gross Internal Floor Area	69 m ²
Listed Status	Grade II

The church typically used for 8 hours per month for the following activities:

Type of Use	Hours Per Month (Typical)	Average Number of Attendees
Services	2 hours per month	<10
Meetings and Church Groups	6 hours per month	20-25
Community Use	N/A	N/A

The building is not used for any additional events that might be expected of a church.



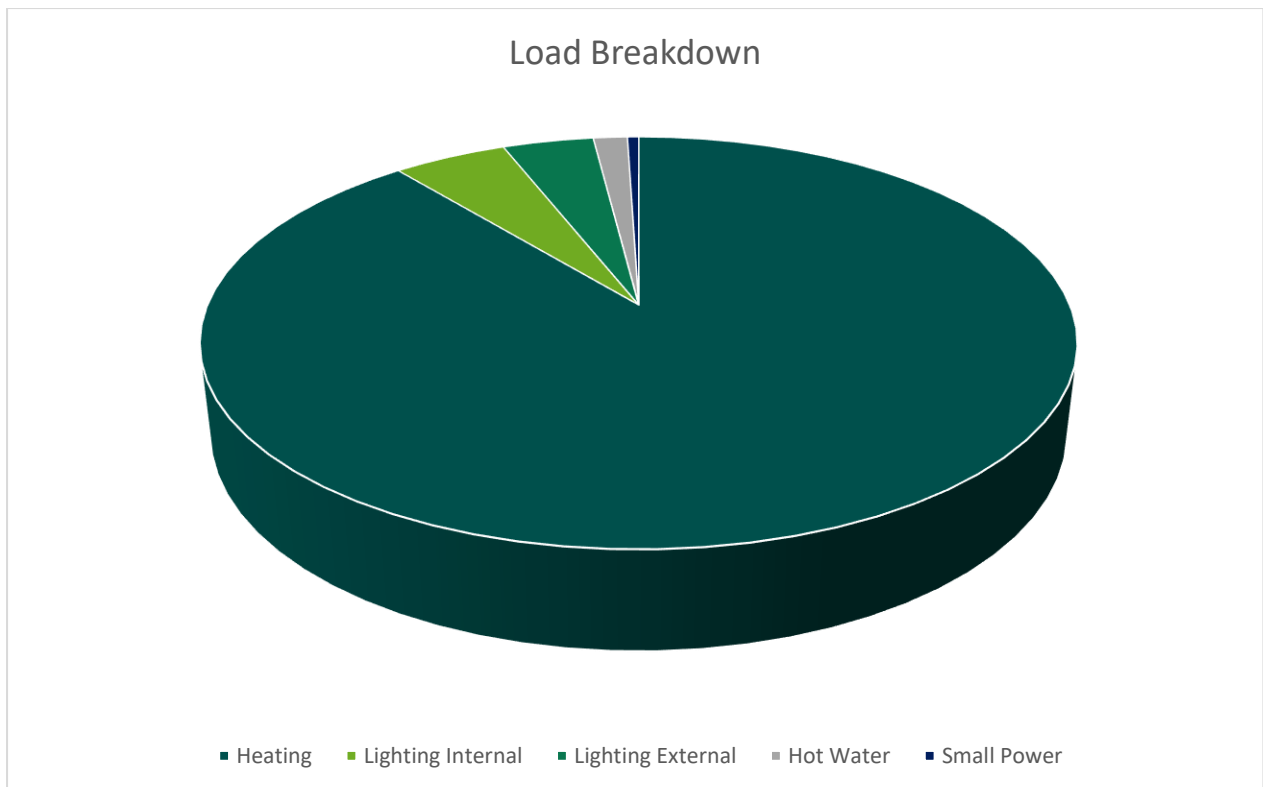
4. Energy Usage Details

4.1 Annual Consumption

St Thomas Church, Murton uses 1,176 kWh/year of electricity (2021 data), costing in the region of £353 per year.

This data has been taken from the annual energy invoices provided by the suppliers of the site.

4.2 Energy Profiling



4.3 Energy Benchmarking

In comparison to national benchmarks for church energy use St Thomas Church uses 15% less electricity and heating energy than is average for a church of this size.

	Size (m ² GIA)	Annual Energy Usage (kWh)	Actual kWh/m ²	Benchmark kWh/m ²	Variance from Benchmark
St. James's Church (elec)	69	1,176	17.04	20	-15%
Total	69	1,176	17.04	20	-15%



5. Efficient/Low Carbon Heating Strategy

The energy used for heating a church typically makes up around 80% to 90% of the overall energy consumption. Putting in place a heating strategy that is energy efficient and low carbon is, therefore, of the highest priority.

The Church of England is in the process of reviewing its heating guidelines. The process has already established some principles for heating that can help churches as they seek an acceptable combination of comfort, conservation, affordability, and environmental care. The principles can be found at <https://www.churchofengland.org/sites/default/files/2020-04/CBC%20Heating%20guidance%20principles%20FINAL%20issued.pdf>

As the principles make clear, every church's strategy will be unique to it, informed by many factors, including the nature of its usage, the system it's starting from, the conservation needs of the building, and the resources available. The strategies in this audit are designed specifically for your church.

Our recommendations on heating generally fall within three major areas. Firstly, for all churches we make recommendations that will help to reduce energy wastage and, as a starting point, to optimise the system that you already have.

Secondly, we recommend options for many churches that focus on heating people rather than the full volume of the church. Some of the changes that can help with this will be 'soft' changes – others will relate to the heating system itself.

Finally, we make recommendations about moving away from fossil fuels. Moves away from fossil fuels are key to cutting emissions. For most churches, this will involve moving from gas, oil or LPG to electricity. Electricity currently creates carbon emissions around the same level as mains gas, but the carbon emissions associated with it are reducing rapidly as the UK builds more renewable energy and decommissions its remaining oil and coal fired power stations. Mains gas does have some potential to reduce its carbon content through the use of biogas and hydrogen, but these are less developed solutions and will be unable to deliver 'zero carbon mains gas'. Some local areas may also be considering the option of district heating networks.

While moving away from fossil fuels may not always be possible, as the principles state, "churches should be expected to have at least carefully considered the option of moving away from fossil-fuel based heating (gas and oil boilers) towards electric-based heating." And if such options are not viable now, the churches "can try to be ready for a future retro-fit when technology and the grid has progressed."

The current heating arrangement is infrared heating lamps positioned in the rafters around the perimeter of the church. The current system was installed around 10 years ago and, although considered carbon net-zero, should be considered for replacement. Hot water is provided by electric point of use water heaters which is already classed as being decarbonised.





The approach to the heating system could be achieved in one main way, as detailed below.

5.1 Install Electric Panel Radiators

Simply installing electric radiators is a simple, cost-effective solution to replace the existing inefficient lamps. Due to the operating hours of the church this solution should be seriously considered, as other electrical-based solutions may take longer to heat the space, whereas these radiators should be switched on just before the space is required.

Electric panel radiators are very versatile and can be programmed in a large variety of ways. It is easy for certain zones to be set on different circuits so heating particular areas or even individual radiators are able to be switched on and off where required.

The current electrical supply may not be sufficient so will have to be upgraded to three phase supply. It is assumed that the current supply is sufficient to install the relatively small number of radiators required, but this should be checked prior to installation.

It is assumed, based on the model, that the existing infrared heaters are only 80% efficient. Newer electric radiators can work at 100% efficiency so energy savings have been calculated from this.



6. 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.

6.1 New LED Lighting

The lighting makes up a relatively large overall energy proportion of the electricity used within the church. The majority of the lights are halogen downlighters, with the extension also being served by halogen tubes.

It is recommended that the fittings scheduled in Appendix 1 are all changed for LED. There are a vast number of specifications of LED lights on the market, but it is recommended that any LED light should come with branded chips and drivers and offer a 5-year warranty.

If all the lights were changed on a simple “like for like” the total capital cost (supplied and fitted) would be £474. The annual cost saving would be £13 resulting in a payback of around 36 years. This estimate includes for the supply of the lights, the labour to install them and the access required. It does not include for 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/>

6.2 Lighting Controls

There are several areas which are only used occasionally and for a short amount of time so that, in actuality, the light does not need to remain on constantly. There are also spaces which benefit from a good amount of natural daylight coming in through the windows, such that artificial lighting is not required for much use during the year.

It is recommended that a motion sensor is installed on these specific lighting circuits so that the lights come on only when movement is detected in the space and turn off approximately two to five minutes after the last movement has been detected (note that the duration of the time lag after which the light goes off needs to be considered alongside the type of light that is fitted. LED lights are much more suited to being switched off after only a short duration than some fluorescent lights). These movement sensors, commonly called PIRs, also have light sensors integrated into them so they can be used to make sure that the light does not come on if there is already sufficient daylight in the space.

Your existing electrician or any NICEIC registered electrical contractor can install PIR sensors onto existing lighting circuits. This can be carried out without significant disruption to the use of the space.



7. 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	No – not sufficient demand
Wind	No – no suitable land away from buildings
Battery Storage	No – no viable PV
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Biomass	No – not enough heating load as well as air quality issues
Air Source Heat Pump	No – not enough demand
Ground Source Heat Pump	No – archaeology in ground

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.

Having reviewed the site it is not considered that there is good viability for any renewables and instead a good clear focus on reducing the energy demand of the building should continue with a targeted approach on reducing the heating energy.

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

8. 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.pariahresources.org.uk/resources-for-treasurers/funding/>



9. 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 as 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.

10. 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 ('sequestering') 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 (years)
Church Hall	5	LED Downlighter	£1.98	£300	151.5
Toilets	5	LED Spotlamps	£7.2	£25	3.5
Entrance	3	600 x 600 LED Panel	£3.62	£150	41.4