Energy Efficiency and Zero Carbon Advice

St Mary's, Pyrton

PCC of St Mary's

Author	Reviewer	Date	Version
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1. Executive Summary

An energy survey of St Mary's was undertaken by Inspired Efficiency Ltd to provide advice to the church on how it can be more energy efficient, provide a sustainable and comfortable environment to support its continued use, and move towards net zero.

A church has been on the site of St Mary's since 983AD, however the current building was completed in the 1850's, which retained some of the historic features from its lifetime. The church is heated by overhead infrared heaters. The lighting is from CFL lamps in pendant fittings. There is electricity supplied to the site.

The church has recently been used as a recording venue for artists and students. There is a plan to develop the church as a music education venue for students from Royal Academy of Music and local schools. As such adequate heating and lighting is required for this new purpose, and therefore this report concentrates on advice for improving the heating and lighting for this purpose.

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	-542	-£75	£13,892	N/A	Faculty	-0.14
Up-grade electrical based heating solution from overhead infra-red to under pew	-3,064	-£424	£24,286	N/A	Faculty	-1.16

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

Based on current contracted prices of 13.83p/kWh for electricity.

If all measures were the solutions proposed would increase the annual electricity costs by £500 per year but provide a significantly more comfortable church which is more sustainable in having a long term function and purpose.

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. The Diocese of Oxford has a diocesan commitment to reach a more broadly scoped Net Zero target by 2035 or as soon thereafter as possible.

By only having electricity as a source of energy this church is already 'zero carbon ready' and can achieve zero carbon status by continue to procure its electricity from a 100% renewable source. The proposed new heating system maintains this situation so the church can continue to be net zero carbon.

3. Introduction

This report is provided to the PCC of St Mary's 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 Mary's, Church Lane, Pyrton, OX49 5AN was completed on the 13th April 2021 by Matt Fulford. Matt is a highly experienced energy auditor with over 15 years' experience in sustainability and energy matters in the built environment. He is a chartered surveyor with RICS and a CIBSE Low Carbon Energy Assessor. He is a Member of the DAC in the Diocese of Gloucester and advises hundreds of churches on energy matters.

St Mary's	
Church Code	627016
Gross Internal Floor Area	285 m^2
Listed Status	Grade II*

The church is used on average 12 hours per week for the following activities

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	3 hours per week	30
Community Use - Recording	5.5 hours per week, based on an annual use of 288 hours	-
Other - Concerts	3.5 hours per week, based on an annual use of 180 hours	100

4. Energy Procurement Review

Energy bills for electricity have been supplied by St Mary's and have been reviewed against the current market rates for energy.

The current electricity rates are:

Weekday Rate	14.412 p/kWh	In line with current market rates
Evening/Night/Weekend Rate	12.138p/kWh	In line with current market rates
Single / Blended Rate	13.83p/kWh	In line with current market rates

The electricity is supplied by SSE and is reported to be 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 the Parish Buying Scheme, which uses the power of group purchasing to offer economies of scale in the procurement of energy. Its 'Green Energy Basket' tariff delivers 100% renewable electricity and 20% green gas. We would recommend that the church obtain a quotation for its gas and electricity supplies from the scheme: http://www.parishbuying.org.uk/energy-basket.
Alternatively, there are other 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
FiT	100% charged	A FiT charge is being applied. It should be checked that this is being charged in accordance with the supply contract.

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

5. Energy Usage Details

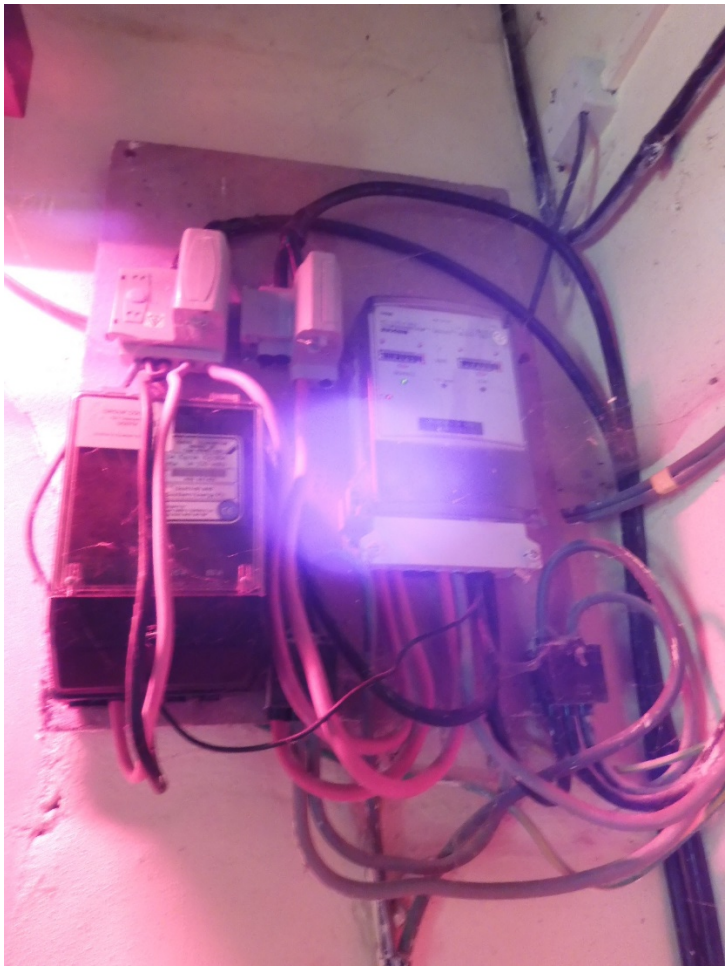
St Mary's uses 5,944 kWh/year of electricity, costing in the region of £822 per year. The total carbon emissions associated with this energy use are 1.5 CO_2e tonnes/year.

This data has been taken from the annual energy invoices provided by the suppliers of the site. St Mary's has one main electricity meter, serial number V02R03326.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity	V02R03326	ISKRA	Full AMR Connected	Vestry

All the meters are AMR connected and as such energy profile for the entire energy usage should be possible.

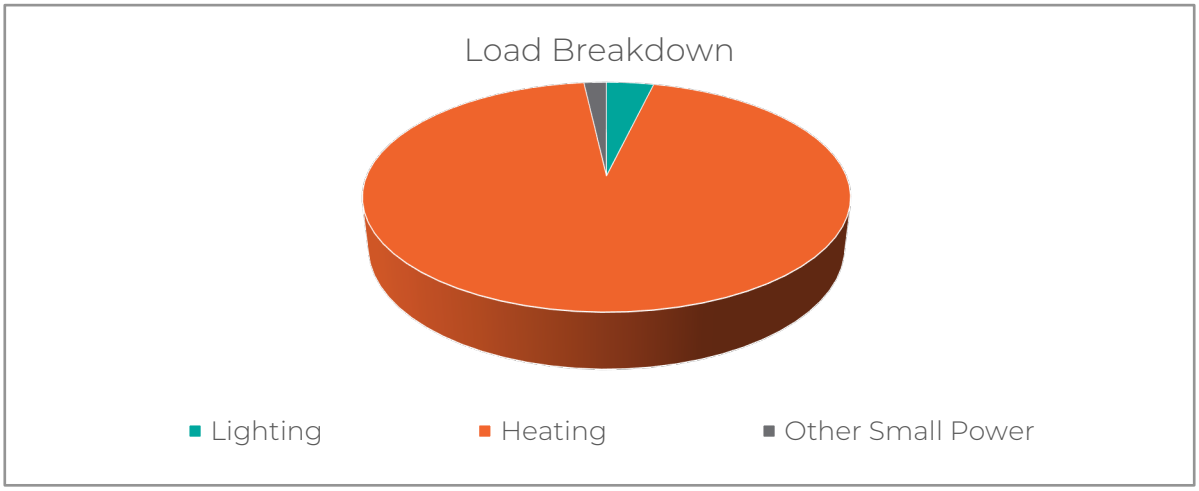
The church has a (somewhat messy) incoming supply of a single phase plus a split phase supply meaning that it has a virtual 3 phase supply into it which will be sufficient for the new electric heating system.



5.1 Energy Profiling

The main energy use within the church can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting	CFL lamps in pendant fittings providing inadequate light output into church	4%
Heating	Heating via overhead new infra-red units	94%
Other Small Power	Minor use of appliances for cleaning etc. Organ.	2%



As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site.

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use St Mary's uses 88% less energy overall than would be expected for a church of this size.

	Size (m^2 GIA)	St Mary's use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Mary's TOTAL	285	5,944	20.86	170.00	-88%

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. 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.

The church is currently heated with electric infra-red heating, and this has been in place for over 20 years. The heating requires up-grading to suit the needs of the church as use as a music recording venue and concert space. The current infra-red heaters are visually very unattractive and prohibit the use of video recording. They also provide a poor quality heat. It is therefore recommended that the current heating system is removed and an electric under pew system is installed with supplementary electric panel heaters. The details of the types of heating recommended is below.

6.1 Install Electric Under Pew Heaters

We suggest that the following under pew heaters could be considered for the church.

Area	Type/ Size	Length (mm)	Watts	Number (or m) Required
Nave	Electric Under Pew 450W	702	450	54
Choir	Electric Under Pew 650W	948	650	10

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.

The high level radiant heaters within the nave should be removed completed with all associated cabling back to the distribution boards.

The under pew (see photo below) and panel heaters have been recently installed at St Andrews Church, Chedworth, Gloucestershire, GL54 4AJ. The church is open in daylight hours so can be viewed at any time. If you would like other examples, please contact the diocese, which can direct you to some that may be nearer to you.

6.2 Install Electric Panel Heaters

In addition to the under pew heaters, there are other areas of the church where this is not suitable and therefore it is recommended that the PCC consider

installing electrical panel heaters in these areas on a time delay switch and remove the current heaters.

Area	Type/ Size	Length (mm)	Watts	Number (or m) Required
Font	Electric Far IR Wall Panel 580W	1000	580	1
Front of Nave	Electric Far IR Wall Panel 580W	1000	580	2
Behind Altar	Electric Far IR Wall Panel 580W	1000	580	1

Suitable electric panel heaters would be far infrared panels. 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.

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 the space and only need to be on for short periods of time. 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 the building can rapidly and economically be brought into used for short or unplanned meetings if needed.

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

7. Lighting Recommendations

In addition to having a revised heating strategy the church would also benefit from improved lighting to make the space more usable for its concert function.

7.1 New LED Lighting

The current lighting is predominantly compact fluorescent lamps within pendant fittings mounted from high level brackets from the wall plate of the church. This provides a poor quality light output and the pendant fittings create a visual impact of narrowing the church and providing an artificial ceiling level. The removal of these units would help to improve the appearance of the church.

It is recommended that new track spot fittings are installed located at high level on the wall plat with the spots appearing above the wall plate at the feet of the rafters. A track mounted spot arrangement allows for flexibility to direct the spots as required and add additional fittings. 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. An example of such a range of fittings is available through Parish Buying.

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)
Nave	8	3 Spot Track lights	-£50	£8,000
Chancel	4	3 Spot Track lights	-£25	£4,000

The cost for the light replacement is not on a simple 'like for like' basis, however it includes a lighting design change to allow for greater flexibility of lighting in the church, especially with the proposed use of the church for concerts. Therefore, the total capital cost (supplied and fitted) would be £13,892 with a slight increase in the cost of lighting per year. 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/

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 PV	No – not sufficient demand, visible roof
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 – insufficient electricity supply
Ground Source Heat Pump	No – archaeology in ground and radiator system

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.

9. Funding Sources

This audit programme offers each participating church the chance to apply for a grant of up to £150 towards implementing some of the audit's recommendations. An application form is included with this report.

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 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.

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/

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