



Energy Audit and Survey Report
St Mary the Virgin Church
Diocese of Oxford



"There is a plan to reduce global carbon emissions to net zero by 2050. The plan will work. It involves all of us. We need to begin now, in our homes and workplaces and churches"

Revd Dr Stephen Croft, Bishop of Oxford

Version Control

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1. Executive Summary

An energy survey of St Mary the Virgin Church was undertaken by Inspired Efficiency Ltd to provide advice to the church on how it can be more energy efficient and provide a sustainable and comfortable environment to support its continued use.

St Mary the Virgin Church is a small Grade II* listed parish church, dating back to Norman times, located in the village of Upton, Oxfordshire. There is only electricity supplied to the site.

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 is used as the action plan for the church in implementing these recommendations over the coming years.

Long Term: Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Simple Payback (years)	Permission needed	To be actioned by who / when?
Change existing lighting for low energy lamps/fittings	402	£34	£1,605	47.49	List B	
Fit Quattroseal draft proofing to historic doors	66	£6	£500	89.98	List B	
Consider replacing the pew heaters for upgraded under pew heaters and removing the overhead infrared units.	N/A – benefit is more in relation to improve comfort and aesthetics					

The Church should check any faculty requirements with the DAC Secretary at the Diocese before commencing any works. Paybacks are very long due to the current unit rate being paid and the

Based on the current contracted price of 8.404p/kWh for electricity.

If all measures were implemented this would save the church £40 per year.



2. Introduction

This report is provided to the PCC of St Mary the Virgin Church to provide them with 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.

St Mary the Virgin Church is a small Grade II* listed parish church, dating back to 1092 but with some Victorian refurbishment and an early C20th vestry, located in the village of Upton, Oxfordshire. There is only electricity supplied to the site.

An energy survey of the St Mary the Virgin Church, Church Street, Upton, OX11 9JB was completed on the 4th April 2019 by David Legge. David is an experienced energy auditor with over 10 years' experience in sustainability and energy matters in the built environment. David is a fully qualified ESOS lead assessor with CIBSE and a CIBSE Low Carbon Consultant and a fully qualified ISO50001 lead auditor.

St Mary the Virgin Church	
Gross Internal Floor Area	107 m ²
Listed Status	Grade II*
Typical Congregation Size	15

The church typically used for 3 hours per week for the following activities

Services	3 hours per week
Meetings and Church Groups	Ad hoc use only
Community Use	Ad hoc use only

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



3. Energy Procurement Review

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

The current electricity rates are:

Single / Blended Rate	8.4040 p/kWh	Below current market rates
Standing Charge	12.07 £/quarter	N/A

The above review has highlighted that the current rates being paid are in line or below current market levels and the organisation can be confident it is receiving good rates and should continue with their current procurement practices.

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.
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.



4. Energy Usage Details

St Mary the Virgin Church uses 3,789 kWh/year of electricity, costing in the region of £318 per year.

This data has been taken from the annual energy invoices provided by the suppliers of the site (see Appendix 2). St Mary the Virgin Church has one main electricity meter, serial number V01C00964.

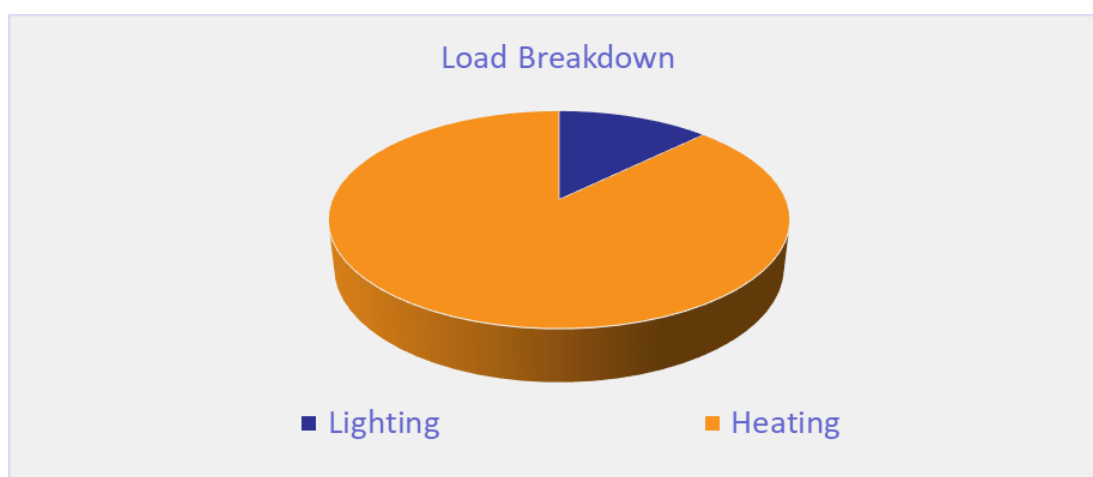
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	V01C00964	3 phase 100A	Yes but no AMR connectivity	Vestry

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.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Inefficient T12 fluorescent tube uplighters and GU10 spotlights in the Nave and Vestry. Inefficient PAR38 spotlights to the Chancel.	13%
Heating	13no. electric pew heaters throughout as well as 13no. radiant heaters located at 3.7m height.	87%



As can be 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.



4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St Mary the Virgin Church uses 79% less electricity than would be expected for a church of this size, as the combined benchmark is the only true reflection of energy use at the church. This is likely to reflect the hours of use more than the efficiency of the heating and lighting.

	Size (m ² GIA)	St Mary the Virgin Church use kWh/m ²	Typical Church use kWh/m ²	Efficient Church Use kWh/m ²	Variance from Typical
St Mary the Virgin Church (elec)	107	35.47	20	10	77%
St Mary the Virgin Church (heating fuel)	107	0.00	150	80	n/a
TOTAL	107	35.47	170	100	-79%



5. Energy Saving Recommendations

5.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building, and all areas are lit by inefficient fittings. The ceiling uplighters in the nave were not closely inspected due to access, but are believed to be T12 fluorescent tube fittings, similar to the fitting in the vestry. These fittings are widely available on the market and it is suggested that the complete fitting (not just the lamp) is replaced. Any new LED fitting would have a much longer life and hence reduce the need to replace the lamps in the ceiling.



The downlights in the nave are GU10 halogen spotlights and the chancel uses PAR38 spotlights to highlight the altar. For the spot lights the Megaman range of LED spot (reflector) lights <https://www.megamanuk.com/products/led-lamps/reflector/> provides some very suitable substitutes to the current lamps.

It is recommended that all of the fittings, scheduled in Appendix 1, are changed for LED.

If all the lights were changed the total capital cost (supplied and fitted) would be £1,605. The annual cost saving would be £34 resulting in a payback of around 49 years. Many of the lights could be self-installed and therefore cost much less than the supply and fit cost above. In this case the £150 grant available through this process could be very usefully employed to fund the purchase of replacement LED lamps which the church installs themselves.



5.2 Quattro Seal

The main entrance door to the church is an historical timber door, but this does not close tightly against the stone surround and hence a large amount of cold air is coming in to the church around the side and base of these doors.

It is recommended that draught proofing is fitted to all external doors. A product called QuattroSeal (see link below) is often used in heritage environments to provide appropriate draught proofing.



http://www.theenergysavers.co.uk/application/files/1714/7197/4194/National_Trust_Case_Study.pdf

5.3 Church Heating Options

The church currently employs two heating systems: pew heaters, each on separate 13 amp plugs; and radiant heaters located at a height of 3.7m in the nave and chancel. It is reported that the 13no. pew heaters (one on each pew) are not particularly effective but the radiant heaters do provide warmth to the church, which has a relatively small air volume to heat.



Given that the pews are remaining in situ and there are no plans to move to a removeable seating arrangement, and the typical congregation sizes are 15, it is recommended that new and ungraded electric under pew heating is considered as a replacement for the existing radiant heating system. As there is a three phase electrical supply to site, heaters could be installed to all of the pews as per the existing system. As the existing heaters are individually switched and assuming periodic electrical testing does not find any faults, no rewiring works are required so



that any new pew heaters could be simply replaced, likely providing a more efficient and higher heat output.

For a typical service, by only using 4 or so pew heaters and asking the small congregation to sit together in certain pews removes the need to switch on every single pew heater. This immediately reduces the energy consumption for pew heating by 60% with the remainder are then only used for larger services.

For replacement, two most popular under pew heaters within churches are BN Thermic PH30 heaters (<http://www.bnthermic.co.uk/products/convection-heaters/ph/>) or similar from <http://www.electriceatingsolutions.co.uk/Content/PewHeating>. Both of these heaters could be located in front of the pew as they are currently or fixed more discretely underneath the pew. Cable runs to the pew heaters could run along the North and South walls (all cabling should be in armoured cable or FP200 Gold when above ground) to the both rows of pews quite easily.

The priest's vestry is only used for short periods of time. Given the nature of its use, a simple Far infrared electric panel heater (<https://www.warm4less.com/store/7/premium-white-panels>) with a time delay switch (<https://www.danlers.co.uk/time-lag-switches/77-products/time-lag-switches/multi-selectable-time-lag-switch/159-tlsw-ms>) will be a suitable and simple solution where the occupant can switch on the heat which will provide instant heat and it will then automatically switch off after the chosen amount of time so that it is not able to be left on accidentally.

Although the radiant heaters are providing heat to the church, their efficiency is questionable as they are located at 3.7m high within the nave, reducing their effectiveness of providing heat to the areas where it is needed (i.e. to the parishioners in the pews). Most of these types of heaters need to be mounted around 2.4m high, to be effective but mounting at such a height is going to be highly detrimental to the aesthetics of the church. It is suggested that if new pew heaters were installed, the existing radiant heaters would be superfluous and could be removed.

6. Other Recommendations

6.1 New Extension Plans

The church has plans for a new DDA WC and small kitchenette to the West side of the vestry. This space it likely to be used for short periods at various times during the week but will not require constant heating. It should therefore be designed to be able to accommodate being unheated for periods when it is not being used and able to be heated up quickly and effectively when being used. The inclusion of good standards of insulation and air tightness within any new fabric will therefore be important. In this regard the church should specify that wall and roof insulation should be in



excess of the current Part L building regulation standards and that an tested air tightness value of no more than 5 should be achieved.

As per the recommendation for vestry heating, it is recommended that the use of electrical far infrared panel heaters (<https://www.warm4less.com/product/62/900-watt-platinum-white>) with a simple time lag switch (<https://www.danlers.co.uk/time-lag-switches/77-products/time-lag-switches/multi-selectable-time-lag-switch/159-tlsw-ms>) would be most appropriate. These panels are very thin and can discretely be mounted on the walls or even built into the ceiling of the extension, but they are very effective and efficient at warming the space quickly. They should be switched on about 20 minutes before the space is occupied and then turned off immediately the space is empty.

The hot water to the kitchenette and WC should be provided by an electric point of use heater which has little or no stored water within it; simple over sink units can be very effective in this situation.

Lighting should be LED and within the WC should be controlled with a simple PIR sensor to automatically switch off the light when the space is unoccupied. This sensor should be set to as short a period as possible, with a suggested time of 5 minutes without movement before switching off the light.



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 – insufficient demand to make financial sense
Battery Storage	No – no viable PV
Wind	No – no suitable land away from buildings
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need even with new WC
Ground Source Heat Pump	No – archaeology in ground no radiator system
Air Source Heat Pump	No – insufficient electricity supply
Biomass	No – not enough heating load as well as air quality issues

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.



8. 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. It may be prudent to use this to fund the trial of one of the recommended under pew heaters.

There are a variety of charitable grants for churches undertaking works and a comprehensive list of available grants is available at <https://www.parishresources.org.uk/wp-content/uploads/Charitable-Grants-for-Churches-Jan-2019.pdf> .

Trust for Oxfordshire's Environment (TOE) does have some funds available (over and above the small implementation grants of £150 available through this scheme) to support energy efficiency improvements in community facilities. If your church is used by the wider community, visit www.trustforoxfordshire.org.uk or contact admin@trustforoxfordshire.org.uk to find out if your project is eligible for a grant of up to about £5,000.

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.



Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Nave	13	GU10 LED	£11.59	£153.40	13.24
Nave - Uplighters	11	5ft Single LED	£12.40	£1,030.70	83.11
Chancel	4	PAR38 LED	£8.68	£178.16	20.52
Vestry	1	5ft Single LED	£1.13	£93.70	83.11

