Energy Audit and Survey Report

St Kenelm's Church, Minster Lovell

"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

Author	Reviewer	Date	Version
Matt Fulford	David Legge	29th July 2019	1.0

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1. Executive Summary

An energy survey of St Kenelm's Church, Minster Lovell 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 Kenelm's Church, Minster Lovell is Grade 1 listed historic parish church dating date to 1430. There is only electricity supplied to the site.

The church has a number of ways in which is 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.

Short 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	29	£4	£281	79.93	List A	
Switch off vestry heater and turn on extract fan	6,480	£782	Nil	Immediate	None	

Medium 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?
Fit draft proofing to historic doors	171	£21	£800	38.77	List B	
Upgrade under-pew tube heaters with under pew panel heaters and overhead radiant heaters	1,966	£237	£4,000	16.86	List B	
Remove overhead radiant and install overdoor air heater to main door	-1,404*	-£169	£600	N/A	List B	

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?
Install Far IR panel heaters to north transept when pews removed.	N/A	N/A	N/A	N/A	Faculty	

*This measure results in increased energy consumption and annual cost of £169/year but is recommended due to the overall comfort benefits.

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

Based on current contracted prices of 12.07p/kWh for electricity.

If all measures were implemented this would save the church £874 per year.

2. Introduction

This report is provided to the PCC of St Kenelm's Church, Minster Lovell 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 Kenelm's Church, Minster Lovell is a Grade 1 listed historic parish church dating date to 1430.

An energy survey of the St Kenelm's Church, Minster Lovell, Witney OX29 0RR was completed on the 2nd July 2019 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 Kenelm's Church, Minster Lovell	
Gross Internal Floor Area	214 m^2
Listed Status	Grade I
Typical Congregation Size	20

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

Services	3 hours per week

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 Kenelm's Church, Minster Lovell and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	13.8217p/kWh	In line with current market rates
Night Rate	12.0458p/kWh	In line with current market rates
Standing Charge	30.4077p/day	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.

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

4. Energy Usage Details

St Kenelm's Church, Minster Lovell uses 17,254 kWh/year of electricity, costing in the region of £2,100 per year.

This data has been taken from the annual energy invoices provided by the suppliers of the site. St Kenelm's Church, Minster Lovell has one main electricity meter, serial number V01R01137.

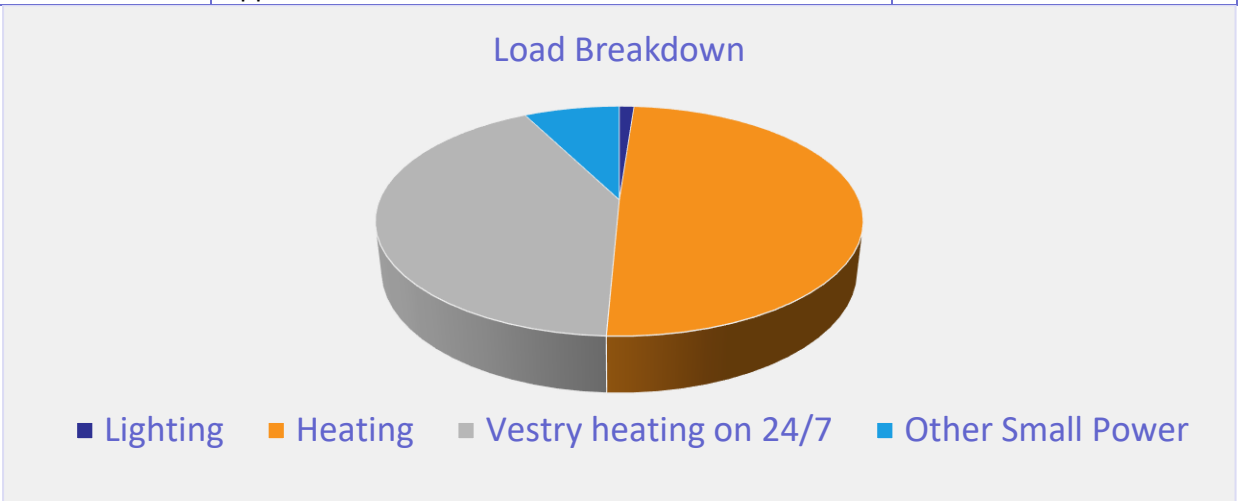
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	V01R01137	3 phase 100A	No AMR connected	Vestry cupboard

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.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	LED lighting to all but one external lights and vestry light	1%
Heating	Overhead radiant and under pew tube heaters	50%
Vestry heating on 24/7	Wall mounted electric heater left on in vestry 24/7	42%
Other Small Power	Organ, water heater, sound system and other appliances	8%



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 the vestry heating which is left on 24/7.

4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St Kenelm's Church, Minster Lovell uses 53% less energy than would be expected for a church of this size.

	Size (m^2 GIA)	St Kenelm's Church, Minster Lovell use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Kenelm's Church, Minster Lovell (elec)	214	80.54	20	10	303%
St Kenelm's Church, Minster Lovell (heating fuel)	214	0.00	150	80	N/A
TOTAL	214	80.54	170	90	-53%

As the church is all electric it uses significantly more electricity but no other heating fuel therefore it is the combine benchmark that should be considered. The use of direct electrical heating is an efficient strategy for this church and the recommendations in this report seek to continue that but improve both the efficiency and comfort of such a system.

5. Energy Saving Recommendations

5.1 Lighting (fittings)

The vast majority of the lighting within the church has been changed to good quality and highly efficiency LED units and the church should be congratulated for undertaking this.

There are just two fittings remaining which would benefit from being replaced for LED units. The 2D bulkhead fittings in the vestry which should be changed to LED when the worked currently being considered within this area are carried out.

There is also an external flood light to the porch that would benefit from an LED replacement and this would be a suitable piece of work to fund using the grant available from this audit (see Section 9).

5.2 Switch Off Vestry Heater

There is a 1250W wall heater located within the vestry. This was found to be on full during the audit which was being undertake on a warm July afternoon. It is report that this heater get frequently left on 24/7 as some in the church are of the opinion it helps to reduce damp in that area.

The use of this heater to reduce damp is an ill-informed attempt to treat the symptoms rather than the cause and the root cause of the damp should be addressed (be that repairing rainwater goods, reinstating French drain arrangements around the external walls of the church or removing cement from external walls). Warming the air inside means that the air can hold more moisture (the warmer the air the more moisture it can hold) and therefore has a tendency to draw damp through the building. Good ventilation is important and therefore it is recommended that the heater is turned off and the extract fan in that space turned on. This was actioned as part of the audit.

5.3 Under Pew Heaters

Given the churches usage profile we would suggest that the direct electrical heating strategy for the church provides an efficient use of energy. The current under pew tube heaters are of such a low output and of an age where they are not likely to be effective at providing comfort. The high level infra-red heaters are mounted too high to be effective in warming on congregation and emit an unpleasant red glow.

As with most medieval churches, this church would have survived most of its life without any form of heating the modern additional of heating is not needed to preserve the fabric but only to provide thermal comfort to occupants. The previous trend of 'conservation heating' for fabric issues is now largely considered to be unnecessary and is being avoided by the likes of National Trust and English Heritage.

We would recommend that the under-pew tube heater as replaced for under pew panel heaters which have a much greater heat output than the tube heaters. The overhead units can then be removed and a net saving will be achieved. 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.electricheatingsolutions.co.uk/Content/PewHeating. 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 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.

5.4 Use of Electric Panels for Heating North Transept

The heating in the north transept is currently a combination of poor under pew tube heaters and ineffective overhead radiant heaters but there are proposals for the pews in this area to be removed which would mean that the proposed under pew heating recommended above would not be possible. It is therefore recommended that the PCC consider installing electrical panel heaters in this area on a time delay switch and removing the overhead units as part of the reordering works.

Suitable electric panel heaters would be far infrared panels such as https://www.warm4less.com/product/63/1200-watt-platinum-white- . These can be purchased widely and fitted by any competent electrician. It is recommended that they are fitted with a time delay switch such as https://www.danlers.co.uk/time-lag-switches/77-products/time-lag-switches/multi-selectable-time-lag-switch/159-tlsw-ms so they cannot be left on accidently after use.

5.5 Overdoor Air 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 rear of the church up to and include the font. Such an over door unit should be sized to cover the whole width of the door and it is suggested the BN Thermic 860 model would be quite suitable.

There is currently an overhead radiant heater above the door and it is recommended that this is removed and replaced with the overdoor unit noted above. This would not only provide a warm welcome but would also help to prove heat around the font area for baptisms.

This recommendation will result in increased energy usage but the overall heating recommendations within this report result in increased efficiency and therefore there is a good net saving and this recommendation goes to form part of the overall heater strategy for a comfortable church.

The overdoor heater will have some fan noise associated with it especially when running at high speed. For quieter services the use of it can be limited to being on for 30mins of so prior to a service and as the congregation arrived and then switched off or to a low speed during the welcome/first hymn. It can then be switched on at the end of a service if required.

5.6 Draught Proofing External Doors

There are a number of external doors in the building. These have the original historic timber doors on them, but these do 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

6. 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	Yes - but only as small array on tower roof
Battery Storage	Yes - but very small unit only
Wind	No – No suitable site
Micro-Hydro	No – Water course
Solar Thermal	No - No significant hot water need
Ground Source Heat Pump	No – Does not match heating needs of church
Air Source Heat Pump	No– Does not match heating needs and fabric of church
Biomass	No – issues with deliveries, storage and existing heating system

There is potential for a small PV array on the roof of the tower. The current arrangements around solar panels mean that to be financially viable the building on which they are mounted needs to consume the vast majority of the energy that they produce. The churches energy consumption is already very small and the consumption during the daytime when the sun is shining is likely to be very low indeed, therefore while technically viable only a very small number of panels (maximum of around 4) would be worth considering if at all.

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 therefore investment into this may be worth delaying at this stage.

7. 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 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.

8. 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.