Energy Audit and Survey Report

St Michael's, Warfield

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

Author	Reviewer	Date	Version
Matt Fulford	David Legge	7th May 2019	1.0

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1. Executive Summary

An energy survey of St Michael's, Warfield 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 Michael's, Warfield is Grade II* listed medieval church which has been recently reordered in 2010. There is both LPG gas and 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?
Optimise heating control settings	14,375	£1,016	£600	0.59	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 Quattroseal draft proofing to historic doors	2,875	£203	£800	3.94	List B	
Change existing external bulkhead lighting for LED fittings	1,789	£242	£1,076	4.44	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 PIR motion sensors on selected lighting circuits	31	£4	£120	28.95	List B	
Consider installing EV charging point in car park	N/A	N/A	N/A	N/A	Unknown	

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

Based on current contracted prices of 13.54p/kWh and 7.07p/kWh for electricity and LPG respectively.

If all measures were implemented this would save the church £1,466 per year.

2. Introduction

This report is provided to the PCC of St Michael's, Warfield 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 Michael's, Warfield is a Grade II* listed church which dates back to 1016. It has been extended through the centuries with a major Victorian restoration. It has under gone a major reordering in 2010 and this included new, mainly LED, lighting and a new LPG fired gas heating system with underfloor and radiators.

An energy survey of the St Michael's, Warfield, Church Lane, Warfield, Bracknell, Berks. RG42 6EG was completed on the 23rd April 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 Michael's, Warfield	
Gross Internal Floor Area	600 m^2 (approx.)
Listed Status	Grade II*

The church typically used for 32 hours per week for the following activities

Services	4 hours per week
Meetings and Church Groups	28 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 gas (LPG) and electricity have been supplied by St Michael's, Warfield and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single / Blended Rate	13.540p/kWh	In line with current market rates
Standing Charge	24.270p/day	N/A

The current LPG gas rates are:

Single / Blended Rate	50.20p/litre	In line with current market rates
Standing Charge	£6.50/month	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.

It is difficult to procure green LPG, but is it possible to procure 100% renewable electricity and when the electricity contract comes up for renewal it is recommend that the church obtains a quotation for its electricity supplies from the Diocese Supported parish buying scheme, http://www.parishbuying.org.uk/energy-basket. This scheme only offers 100% renewable energy sourced energy and therefore it is an important part of the process of making churches more sustainable.

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 Michael's, Warfield uses 6,998 kWh/year of electricity, costing in the region of £950 per year, and 143,754 kWh/year of LPG, costing £10,165.

This data has been taken from the annual energy invoices provided by the suppliers of the site broadly covering the period from Jan/Feb 2018 to Jan/Feb 2019. St Michael's, Warfield has one main electricity meter, serial number LO7C73520. There is not a gas meter and the LPG usage has been derived from the delivery quantities.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity	LO7C73520	3 phase 100A	Y	Entrance porch cupboards
Gas – LPG	N/A	N/A	N/A	External tanks to NW corner of church

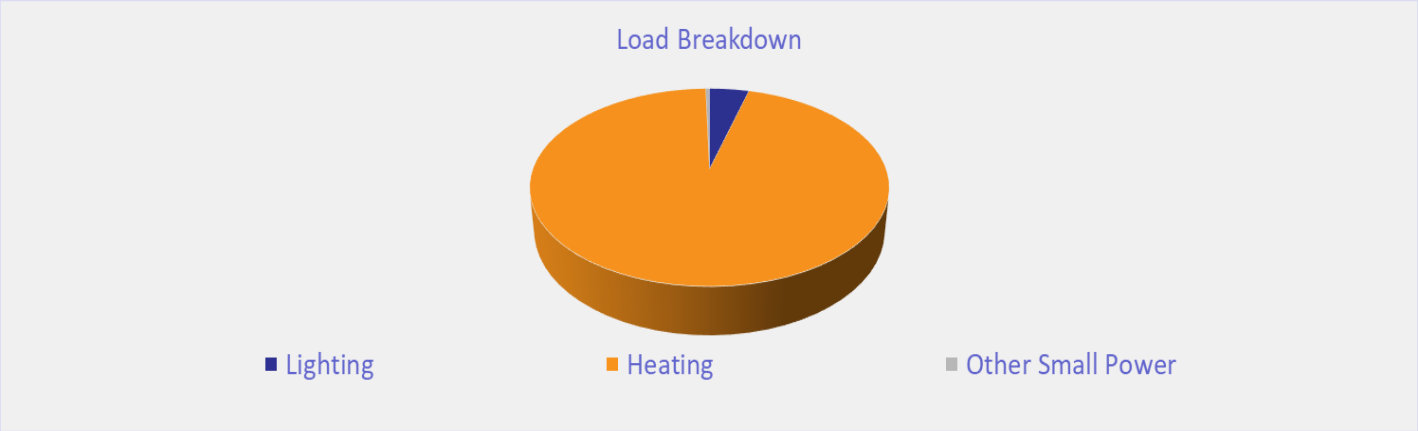
It is recommended that the church consider asking their suppliers to install a smart electricity meter so that the usage can be monitored more closely, and the patterns of usage reviewed against the times the building is used.

Such meters are also available for LPG tanks such as http://www.fuelandlpgservices.co.uk/lpg-consumers/what-is-lpg-smart-guard.html and this would greatly assist in the church better understanding its usage profile of LPG.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Predominantly LED lighting throughout	4.2%
Heating	LPG fired boilers to a mixed radiator and underfloor heating system	95.4%
Other Small Power	Small plug in appliances and the like	0.4%



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

4.2 Energy Benchmarking

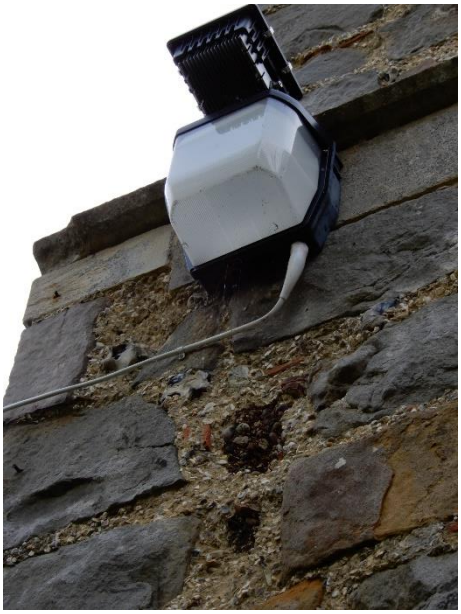
In comparison to national benchmarks for Church energy use St Michael's, Warfield uses 41.7% less electricity and 59.7% more heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	St Michael's, Warfield use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Michael's, Warfield (elec)	600	11.66	20	10	-41.7%
St Michael's, Warfield (heating fuel)	600	239.59	150	80	59.7%
TOTAL	600	251.25	170	100	47.8%

Given both the very high proportion of heating energy and the fact that heating consumption is well over benchmark, it is clear that the more efficient usage of LPG would need to be the focus for any energy saving measures. The electricity usage is already very efficient, and the church should be commended for an efficient reordering and operation in respect of electricity usage.

5. Energy Saving Recommendations

5.1 Lighting (fittings)



The lighting makes up a relatively small overall energy load within the building, and all internal areas are lit by efficient LED or CFL fittings.

The only light fitting where possible energy efficiency could be improved is the external bulk head lights. Due to the opaque cover and the high-level installation it was not possible to determine the actual wattage of this fitting during the survey, but it may be that these eight fittings mounted around the perimeter wall of the church would be beneficial to change to lower energy LED units,

If all these lights were changed the total capital cost (supplied and fitted) would be £1,076. The annual cost saving would be £242 resulting in a payback of around 4.44 years.

5.2 Lighting (control for internal lights)

The lighting within the church is generally well controlled but it was noted that the lighting to the porch tended to remain on.

It is recommended that a motion sensor is installed on the porch specific lighting circuits so that the lights come on only when movement is detected in the space and turn off approximately two 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 consider 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.

5.3 Heating System Controls

The heating system is served by a modern and efficient LPG condensing boiler located up in the tower. The pipework is pressurised and well lagged. The boiler provides heat to an underfloor heating circuit and to a radiator circuit which have their own separate pumps and can be controlled independently.

The system itself appears to be as efficient as it can be, and it is the control and operation strategy for the system which should be reviewed. At the time of the audit (a warm morning in late April) the boiler was firing to heat the underfloor heating, but the radiator circuit was off. The floor of the church was no warmer than the ambient air temperature and was providing no useful heat, yet the heating system was consuming gas. The LPG delivery notes indicate that LPG is used from the start of September through to the end of May.

There is a multi-layered array of controls for the heating system but unfortunately the person with the in-depth knowledge of the controls was not present during the audit. There appears to a master heating timer in the porch/lobby cupboards which is a Siemens RWB27. AT the time of the survey this was set to heat 5:30 to 09:00am and 12:00 to 12:30pm Monday to Friday and then 06:00 to 10:40 and 12:00 to 12:20 Saturday and Sunday. However, the unit was manually set to on, so the heating is enabled 24/7.

There is then a smart thermostat system (from Inspire Home Automation) which allows for different temperatures to be programmed in for different times and days. This allows the church to schedule in the heating for the radiators and underfloor systems to suit events.

The current approach appears to that of having some level of constant background heating provided by the underfloor heating. A further detailed examination of the exact timing and logic around this in relation to the usage of the church would be beneficial but it currently appears that the background/minimum temperature levels are maintained through the Spring and

Autumn months (Apr, May, Sept and Oct) when, as was noted on site, this provides very little in terms of useful heat for the occupants. It should be considered if the underfloor heating could be switched off completely from early Apr until mid-October and the heating in the spring and autumn can be successfully provided from the more instant heat of the radiator system. From the demand data sent through after the audit, it can be seen that the underfloor heating system is constantly cycling and calling for heat throughout most days and nights. The use of a lower background set point and a higher occupied set point may help to reduce the cycling and intermittent demands.

In order to obtain the most efficient heating strategy, a smart meter on the LPG tank should be installed and then temporary temperature loggers installed on the boiler flow pipework and within the church so that the LPG usage, boiler firing patterns, and heat demands from the church can be analysed.

The church raised their own concerns to the auditor that the system may not be operating as it should be. While the installation appeared visually sound, the low surface temperature of the floor at the time of the audit is a possible indicator that the outputs may be limited by an incorrect configuration within the installation as it is installed (for example valves may not be opening fully). This potential limiting in the system may in turn be impacting on the way in which the controls are set. A further examination of the heating when it is running at full bore in winter time would be needed to comment further.

5.4 Quattro Seal

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. Other Recommendations

6.1 Electric Vehicle Charging Points

The church has a car park to other side of the road which serves the church and the parish offices. In order to make a visible statement on the churches mission of stewardship and to facilitate more sustainable transport choices by those both visiting the church and using the parish offices, the church may wish to consider installing an electric vehicle charging point, probably fed from the electricity supply to the lamp posts.

Installing a unit such as a Rolec Securi-Charge http://www.rolecserv.com/ev-charging/news/view/Robust-EV-Charging-With-Rolecs-SecuriCharge-EV-Wall-Unit-Coin-Token-PAYG would allow the church to be able to sell tokens or have a coin operated device that would at least cover the costs of the electricity use and could make a small income. As the parish office is a place of work it may be able to benefit from a grant to part cover the installation costs of a charger from https://www.gov.uk/government/publications/workplace-charging-scheme-guidance-for-applicants-installers-and-manufacturers

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	Yes
Battery Storage	Yes
Wind	No – no suitable location
Micro-Hydro	No – water course
Solar Thermal	No – insufficient hot water needs
Ground Source Heat Pump	No – archaeological issues
Air Source Heat Pump	No – unlikely to be successful on installed heating system in church building.
Biomass	No – issues with delivery and boiler location

There is potential for a small PV array on the top of the south facing slope of the roof of the North Aisle which would be non-visible.

As the feed in tariffs have now come to an end the financial viability of any PV array requires almost all of the electricity to be used on site, ideally as it is generated. The electrical usage of the church is small and therefore only a small number of panels would be needed and viable. Coupled with a small battery storage system (possibly located in the tower) it could be possible for the church to be large self sufficient in terms of electrical need.

While such installations can be considered as feasible, they are not high priority and could be considered more as a 'nice to have' item which should only be considered if it is coupled with using it to demonstrate the churches stewardship mission.

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.

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 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.