Energy Audit and Survey Report

Assumption of the Blessed Virgin Mary 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

Author	Reviewer	Date	Version
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Contents

1. Executive Summary

An energy survey of Assumption of the Blessed Virgin Mary 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.

Assumption of the Blessed Virgin Mary Church is a Grade I listed church located in the village of North Marston. There is both oil 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.

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?
Install Endotherm advanced heating fluid into heating system(s)	850	£37	£416	11.16	List A	
Change existing lighting for low energy lamps/fittings	232	£36	£468	12.95	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?
Tune the boiler to more efficient combustions settings	425	£19	£500	26.82	List A	
Fit Quattroseal draft proofing to historic doors	170	£7	£800	107.30	List B	

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

Based on current contracted prices of 15.60p/kWh and 4.38p/kWh for electricity and oil respectively.

If all measures were implemented this would save the church £99 per year.

2. Introduction

This report is provided to the PCC of Assumption of the Blessed Virgin Mary 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.

Assumption of the Blessed Virgin Mary Church is a Plantagenet period, Grade I listed parish church, constructed in the 13th Century with later 15th Century additions of the Chancel and clerestory windows, with the chancel and other parts most recently restored in 1920-21. There is both oil and electricity supplied to the site.

An energy survey of the Assumption of the Blessed Virgin Mary Church, Church Street, North Marston, Aylesbury, Bucks MK18 3PH was completed on the 13th March 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.

Assumption of the Blessed Virgin Mary Church	
Gross Internal Floor Area	235 m^2
Listed Status	Grade I
Typical Congregation Size	40

The church typically used for 4 hours per week for the following activities

Services	2 hours per week
Meetings and Church Groups	Ad hoc use only
Community Use	2 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 oil and electricity have been supplied by Assumption of the Blessed Virgin Mary Church and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	15.60 p/kWh	Above current market rates
Standing Charge	25.090 p/day	N/A

The current oil rates are:

Single Rate	46.95p/litre or c. 4.388 p/kWh	In line with current market rates

The above review has highlighted that there are opportunities to gain cost savings from improved procurement of the energy supplies at this site. We would therefore 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

Assumption of the Blessed Virgin Mary Church uses 463 kWh/year of electricity, costing in the region of £72 per year, and 8,496 kWh/year of oil, costing £373.

This data has been taken from the annual energy invoices provided by the suppliers of the site (see Appendix 2). Assumption of the Blessed Virgin Mary Church has one main electricity meter, serial number S72FM07071. Oil is delivered on an as needed basis and delivery notes of quantity delivered are well maintained by the PCC Treasurer.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	S72FM07071	1 phase 60A	No pulse or AMR	Vestry

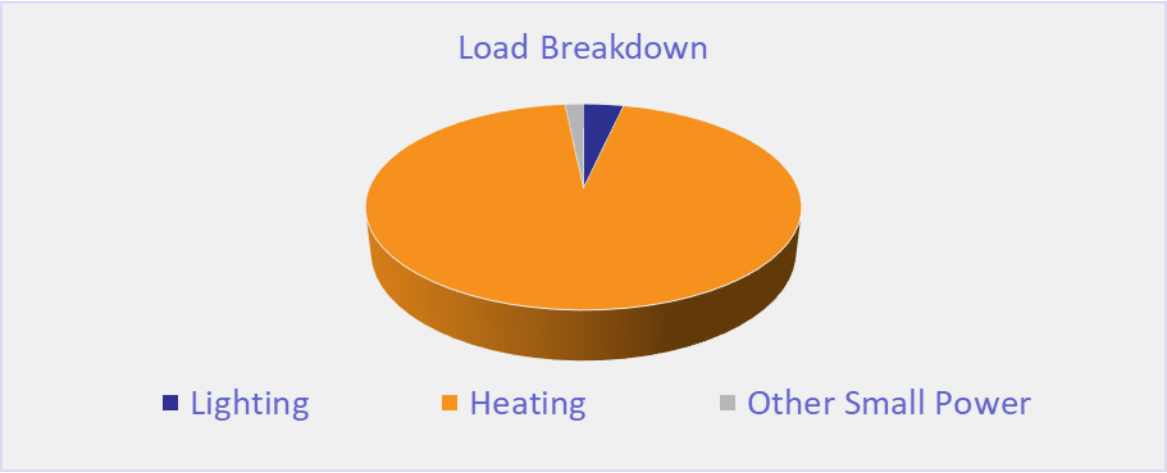
It is recommended that the church consider asking their supplier to install a smart meter so that the usage can be monitored more closely and the patterns of usage reviewed against the times the building is used.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Mainly efficient CFL lamps in the nave, with some inefficient halogen spot lights.	4%
Heating	Two oil fired boilers providing heating to all areas via 11 panel radiators within the church.	95%
Other Small Power	Kettles for tea and coffee.	1%

As can been seen from this data, the heating makes up nearly all of the energy usage on site.



4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use Assumption of the Blessed Virgin Mary Church uses 90% less electricity and 76% less heating energy than would be expected for a church of this size. This is most likely due to the hours of operation than a particularly efficient heating system.

	Size (m^2 GIA)	Assumption of the Blessed Virgin Mary Church use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
Assumption of the Blessed Virgin Mary Church (elec)	235	1.97	20	10	-90%
Assumption of the Blessed Virgin Mary Church (heating fuel)	235	36.15	150	80	-75.90%
TOTAL	235	38.12	170	100	-78%

5. Energy Saving Recommendations

5.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building, and the nave is predominantly lit by relatively efficient compact fluorescent fittings in pendant fittings.

There still remains a number of inefficient halogen spotlights to highlight particular features of the church, and a T8 fluorescent tube is in use at the organ.

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.

In the longer term, as there are a number of areas that would benefit from better lighting, it is suggested that track spot fittings are located at the top of the roof pitch on the rear side of the arches into the nave. The track mounted spot fittings will be able to be directed to give a better range of light and can be easily added to as required.

There are hundreds of fittings on the market and merely one example of what could be considered is the JCC Starspot 3000 range https://www.jcc.co.uk/en_GB/products/jc14204blk

If all the lights were changed the total capital cost (supplied and fitted) would be £484. The annual cost saving would be £468 resulting in a payback of around 13 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 bulbs which the church installs themselves.

5.2 Endotherm Advanced Heating Fluid

In order to improve the efficiency of the heating system further it is recommended that an advanced heating fluid (http://www.endotherm.co.uk/) is added to the heating system.

This fluid is in addition to, and complements any, existing inhibitors in the heating system and is added in a similar way. The fluid works to improve the ability of the boiler to transfer

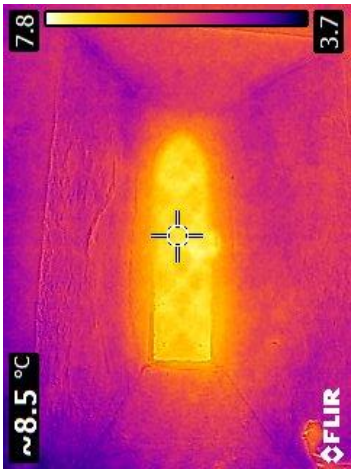
heat into the heating system and for the radiators and other heating elements to give out their heat into the rooms. It does this by reducing the surface tension of the water and increasing its capacity to transfer and hold heat. Case studies have demonstrated that the addition of this fluid into heating systems reduces heating energy consumptions by over 10% as well as helping the building heat up quicker.

5.3 Tune Boiler

The existing boilers on site are serviced at least annually during which time the flue gas is analysed and the results from this are displayed on the front of the boiler. The main purpose of this analysis is to make sure that the boiler is combusting the gas properly and not releasing too many toxic gases into the atmosphere. The flue gas analysis also provides an indication as to the efficiency of the boilers.

It was noted from the results of this flue gas analysis that while the flue gases are within the permitted limits there is more scope to adjust the burner to increase the efficiency of combustion. It is therefore recommended that the boiler engineer is requested to maximise the burner efficiencies during their next service visit.

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, most notably, the South, West and East doors and the window in the NW corner. The clerestory windows should also be checked to ensure a good level of air tightness to reduce the draughts on windy days and improve thermal comfort.

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

5.5 Other Heating Advice

The church currently has a reasonably efficient heating system, which is fit for purpose for the majority of the time. However, the PCC report that the heating system is not capable of heating the congregation to a comfortable temperature during particularly cold or windy weather conditions. The main issue here is that the current heating strategy for the church relies on a very carbon intensive fuel (oil) to heat the entire air volume of the church which is a poorly insulated and not very air tight building.

The church does not currently have any reordering plans, but if additional heating is to be added, the following should be considered in addition to the measures outlined above.

The existing oil boilers provide 52kW of heat output, which should be sufficient to serve the 11 radiators sited around the church. It is reported however that the flow temperature from the boilers to the heating pipework does not reach a high enough temperature to sufficiently heat the space. The incumbent heating engineer has not found any issue with the system, and it may be pertinent to obtain a second opinion in raising the flow temperature around the system.

As well as the oil boilers being a relatively recent installation and hence having a number of years of serviceable life, it is understood that there is no gas main in close proximity to the church, so a switch to mains gas is not viable.

The church does have existing floor grilles with electrical trench heaters installed but not in use. Retaining and replacing these heaters will still mean that the church relies on heating the whole air volume of the building to deliver some level of comfort. As these electrical heaters will have some cables running to them there will be power to the grilles which could then be fed out to the under pew platform and provide some under pew heaters on the more frequently occupied pews and provide either the main, or supplemental, heating to warm the occupant of the pew and not to try and heat the whole air volume of the church. For spring and autumn services these electric under pew heaters could prove sufficient on their own, with both the under pew and current oil system only being required in the depths of winter. In the long-term investigations could be made as to the feasibility of first increasing the incoming supply to a 100amp single phase supply and then to a 100amp 3 phase supply so more heaters could be added, as it is the supply capacity which will be the limiting factor in this proposed solution.

The 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. All cabling should be in armoured cable or FP200 Gold when above ground.

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	No – not sufficient demand, 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
Ground Source Heat Pump	No – archaeology in ground and 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.

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.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Nave	16	LED GLS	£10.72	£168.00	15.68
Tower	2	AR111 LED	£4.67	£89.08	19.06
Organ	1	4ft Single LED	£0.47	£57.00	121.99
Organ	1	LED GLS	£1.97	£10.50	5.34
South Aisle	2	AR111 LED	£4.67	£89.08	19.06