Energy Audit and Survey Report

St Mary's Church, White Waltham

"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's Church, White Waltham 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's Church, White Waltham is a grade II* listed parish church which dates back to 1240 and was subject to a major Victorian reordering. There is both oil and electricity (two single phases) 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	184	£27	£750	27.85	List B	
Install PIR motion sensors on selected lighting circuits	2	-	£22	67.88	List B	
Place board against north under floor vents	Comfort Improvement	N/A	Nil	N/A	Temporary only	

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	600	£88	£800	9.13	List B	
Repair broken quarries in leaded light windows	Comfort Improvement	N/A	£800	N/A	List A/B	
Electric heating solution throughout.	N/A	-	Budget £30,000	-	Faculty	

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

Based on current market prices of 14.6p/kWh and 6p/kWh for electricity and oil respectively.

If all measures were implemented this would save the church £115 per year.

2. Introduction

This report is provided to the PCC of St Mary's Church, White Waltham 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's Church, White Waltham is a Grade II* listed parish church which dates back to 1240 and was subject to a major Victorian reordering.

An energy survey of the St Mary's Church, White Waltham, Church Hill, White Waltham, SL6 3JH was completed on the 27th June 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 Mary's Church, White Waltham	
Gross Internal Floor Area	413 m^2
Listed Status	Grade II*

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

Services	3 hours per week
Meetings and Church Groups	-
Community Use	-

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

3. Energy Usage Details

St Mary's Church, White Waltham uses 6,769 kWh/year of electricity, costing in the region of £773 per year, and 30,000 kWh/year of oil costing £1,800.

This data has been taken from the annual energy cost provided by the church St Mary's Church, White Waltham has one main electricity meter. There is an old bulk fill oil tank.

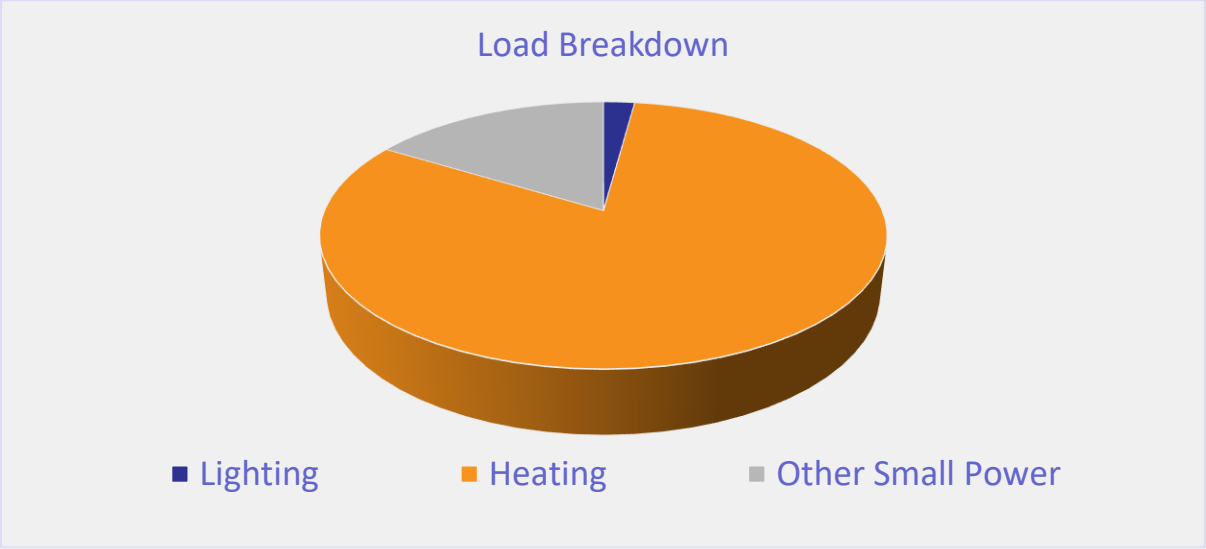
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	Not Noted	Dial Meter	No	GF elec switch room
Electricity – Hall				
Oil – Church	N/A – Bulk Fill Tank	-	-	Basement boiler room

The oil use is not metered, and the electricity meter is an old-style meter so its usage profile is not logged. It is recommended that the church consider asking their suppliers to install 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.

3.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Mainly compact fluorescent lighting with some poor efficiency lighting remaining to the WC and vestry.	2%
Heating	Heating from oil fired boiler to radiators around the church	82%
Other Small Power	Heating pumps, organ, supplemental heaters and the like	16%



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

3.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St Mary's Church, White Waltham uses 18% less electricity and 52% less heating energy than would be expected for a church of this size. This is mainly due to the low number of hours that the church is used for.

	Size (m^2 GIA)	St Mary's Church, White Waltham use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Mary's Church, White Waltham (elec)	413	6,769	16.38	20.00	-18%
St Mary's Church, White Waltham (heating fuel)	413	30,000	72.59	150.00	-51.61%
TOTAL	413	36,769	88.97	170.00	-48%

4. Energy Saving Recommendations

4.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building, and most areas are lit by relatively efficient fittings compact fluorescent lamps. The WC and vestry still have old inefficient lighting and the compact fluorescent fittings would also benefit from being upgraded to the more modern LED 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 £750. The annual cost saving would be £81 resulting in a payback of around 9.28 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.

4.2 Lighting (control for internal lights)

There are several lights which could currently remain on all the time the building is being used such as the vestry and toilet areas. These areas are only used occasionally and for a short amount of time and as such, the light does not need to remain on constantly. There are also spaces which benefit from a good amount of natural daylight coming in through the windows where artificial lighting is not required for much of the year during the day.

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

It is recommended that such sensors are installed on the WC and vestry lighting when it is replaced for LED fittings.

4.3 Convert the Church to Electric Heating

Having reviewed the heating arrangements and usage of the church it is recommended that is considered converting to a direct electrical form for heating and abandoning the old oil system.

The current oil-fired boiler is at the end of its life and the current oil tank is a single skin metal tank which does not conform to the latest oil storage regulations. The cast iron radiators within the church provide some heat but not in the places where it is most required. To be able to reach comfortable levels within the church the heating is likely to have to be turned on for many hours in advance which is inefficient and costly. The continued use of oil, which is a highly polluting fossil fuel, in a low carbon future is also highly undesirable and does not align to one part of the churches mission to be good stewards of creation.

The current incoming electricity arrangements appears to be two single phase supplies coming into the building and it appears as if a third phase may be possible. This should be reviewed by contacting the electrical District Network Operator (DNO) SSE Power Distribution - www.ssepd.co.uk; 0800 0483516. The use of electricity for future heating is likely to prove the most efficient can direct provide heat to where it is most needed and there is rapid and continued de-carbonisation of the national grid currently occurring resulting in this being a much cleaner source of energy.

4.4 Under Pew Heaters

Given the churches usage profile we would suggest that a revised heating strategy for the church would provide a much more efficient use of energy and a more comfortable church.

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 under pew panels are installed under the pews in the central nave area and also under the choir stalls.

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.

We understand that there is a desire to remove pews from the side aisle and there will also be some for of heating required to the chapel area, behind the altar and around the font. In these areas it is recommended that the PCC consider installing electrical panel heaters in this area on a time delay switch and remove the existing radiators.

> 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.

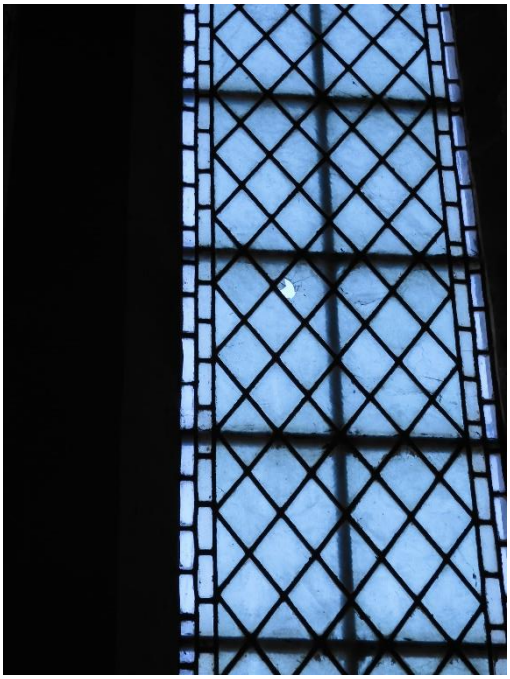
In order to achieve the sense of a 'warm welcome' into the church an over door air heater could be provided. This would also help to provide warmth to the rear of the church up to and include the font. Such an over door unit should be sized to cover the whole width of the door and it is suggested the BN Thermic 860 model would be quite suitable.

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.

4.5 Replace Broken Glazing in Leaded Windows

It was noted during the audit that there were a number of places where the glazing within the leaded windows had broken. This is allowing cold air to easily enter into the building and will be resulting in cold draughts.

It is recommended that the windows are reviewed and repaired by a suitable specialist to makes sure that all glass is intact and all joints are well sealed.



4.6 Draught Proofing to 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 into 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

4.7 Other Fabric Measures

There are air vents to the low level of the external walls. These are required to provide ventilation to the timber within the floors, but they also provide a route for cold air to come into the building and result in a very uncomfortable cold draught rising up from the floor. This is especially prevalent on the north side when a cold wind blows in from this direction. To modulate the ingress of cold air in winter it is recommended that a temporary board is propped up against these vent holes on the outside. If this is at a slight angle against the wall some air will still be able to get into ventilate the floor but the direct flow of cold air will be reduced.

5. 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 – south roofs are very visible
Battery Storage	No
Wind	No
Micro-Hydro	No
Solar Thermal	No – visible roofs and little hot water needs
Ground Source Heat Pump	No – unsuitable heating load profile
Air Source Heat Pump	No – unsuitable heating load profile
Biomass	No – access and storage issues for fuel

Having reviewed the site we do not consider that renewable energy solutions are viable at this church. PV and Solar Thermal panels are not currently permitted on visible listed roofs and therefore would not be viable at this church. The use of the church means that heating is only required for a short (intense) burst to provide comfort for the occupants for the service once a week. This heating requirement is not well matched to the heat pump technology which provides low grade heat constantly. The fabric of the church would be incapable of retaining this low-grade heat sufficiently to allow the temperatures to build up to sufficient levels that means that a heat pump would be anywhere close to efficient.

6. 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.

7. 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 BC lamps	10	LED GLS	£43.37	£315.00	7.26
Chancel	4	LED GLS	£17.35	£126.00	7.26
West door and WC	2	LED GLS	£2.89	£21.00	7.26
WC	1	4ft Single LED	£1.97	£72.10	36.64
Vestry	1	LED GLS	£4.14	£10.50	2.54
Vestry	1	5ft Single LED	£5.30	£93.70	17.69
Porch	1	LED GLS	£1.45	£10.50	7.26
Chapel Room	1	LED GLS	£4.34	£31.50	7.26