Energy Audit and Survey Report

All Saints Church, Wokingham

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	Marisa Maitland	26th February 2019	1.0

Contents

1. Executive Summary

An energy survey of All Saints Church, Wokingham 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.

The All Saints Church, Wokingham is a large and active town centre church serving the community. It dates back to the 15th century but had a major Victorian restoration by Woodyer in the 1860s. There is both gas and electricity supplied to the site.

The church is about to embark on a major reordering scheme to remove the pews and open up the church to more extensive usage. This report therefore focuses more on providing guidance on how the reordering plans could be developed to improve the energy efficiency but there are some short-term actions which can be undertaken which would help to improve the energy efficiency now and endure to continue to be useful after the reordering. These are recorded in the table below and advice on the reordering plans is contained within the body of this report.

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?
Install new LED lighting to the church	6,620	£1,011	£6,924	6.85	List B / Faculty	
Replace / install draught proofing to all existing external doors	2,682	£410	£950	2.32	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 15.27p/kWh and 2.2412p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church £2,431 per year.

It should also be noted that the church operates the Cornerstone building adjacent to the church which is an office type building let out to various community organisations as well as for the administration of the church. This appears to have significant energy saving potential including, but by no means limited to, a replacement of the lighting within the building to LED.

2. Introduction

This report is provided to the PCC of All Saints Church, Wokingham 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.

Given the major reordering plans for this church a section of this report has been dedicated to advice on how to ensure these plans are as energy efficient as possible and the initial short-term recommendations have been considered bearing in mind the future project.

All Saints Church, Wokingham is a large Grade II* listed 15th century church located just off the town centre of Wokingham. It had a major Woodyer restoration in the Victorian times and is now an active church performing many community functions and out reach as well as being open to visitors.

An energy survey of the All Saints Church, Wokingham, Norreys Avenue, Wokingham, RG40 1UE was completed on the 5th December 2018 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.

All Saints Church, Wokingham	
Gross Internal Floor Area	850 m^2 (approx.)
Listed Status	Grade II*
Typical Congregation Size	100 + to main Service

The church typically used for 67 hours per week for the following activities

Services	5 hours per week
Meetings and Church Groups	6 hours per week
Open for Visitors	51 hours per week
Other	5 hour 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 and electricity have been supplied by All Saints Church, Wokingham and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single / Blended Rate	15.27p/kWh	In line with current market rates
Standing Charge	15.38p/day	In line with current market rates

The current gas rates are:

Single / Blended Rate	2.2412p/kWh	Below current market rates
Standing Charge	£4.06/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. The church is currently procuring its electricity through Ecotricity who are a good supplier of 100% renewable electricity and score highly in Ethical Consumer reviews, the continued contract with them is encouraged and the church may be interested to note that they can also supply 'green' gas. The current rate being paid for gas is below market rates so rate increases should be expected at the next renewal.

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	not charged	Being renewable energy this is correctly not being levied

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

4. Energy Usage Details

All Saints Church, Wokingham uses 10,663 kWh/year of electricity, costing in the region of £1,650 per year, and 157,761kWh/year of gas, costing £3,550.

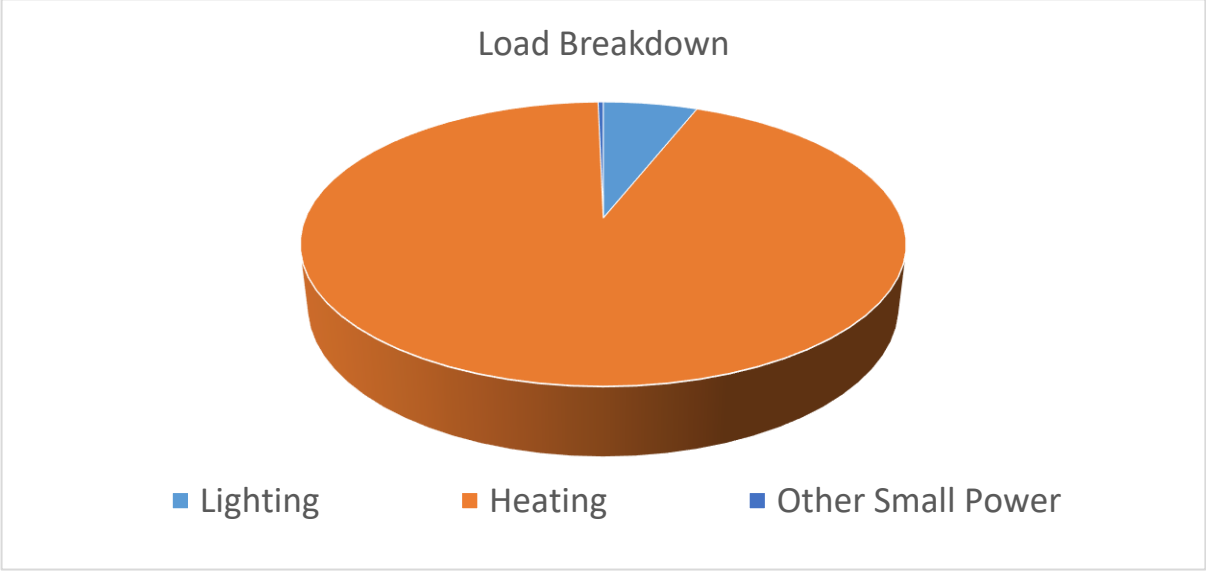
This data has been taken from the annual energy invoices provided by the suppliers of the site between 30/11/17 and 30/11/18.

The meters are not automatically read smart meters and the church does not take weekly meter readings or the like. The electricity meter will be replaced with a smart meter by the supplier in forthcoming years which will allow a full detailed energy profile to be viewed. Given the amount of gas used by the church it is recommended that the church consider contacting the supplier to investigate getting the gas meter converted to an AMR (automatic meter reading) meter so that a detailed usage profile can be gained and areas of wastage highlighted.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Predominantly flood lighting to the church by 250W metal halide flood fittings	6.0%
Heating	Direct gas fire warm air heating to the church	93.7%
Other Small Power	Small power appliances, organ blower and the like	0.6%



As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site. The lighting is by far the largest electricity using element.

4.2 Energy Benchmarking

In comparison to national benchmarks[1] for church energy use All Saints Church, Wokingham uses 37.3% less electricity and 23.7% more heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	All Saints Church, Wokingham use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
All Saints Church, Wokingham (elec)	850	12.54	20	10	-37.3%
All Saints Church, Wokingham (heating fuel)	850	185.60	150	80	+23.7%
TOTAL	850	198.15	170	100	+16.6%

This shows that the existing heating system, while noted to be effective at heating the church, is not greatly efficient and does consume high amounts of gas. This is not surprising given that the current heating system relies on heating up the entire air volume in this large church in order to be effective.

[1] http://www.churchcare.co.uk/images/ShrinkingtheFootprint/Energy_Audit_report.pdf

5. Energy Saving Recommendations

5.1 Lighting (fittings)

The church is current lit with metal halide flood lights located high up on the wall plate. These are effective at providing a general level of area lighting across the whole church but do not enhance or highlight any particular the features of the church.

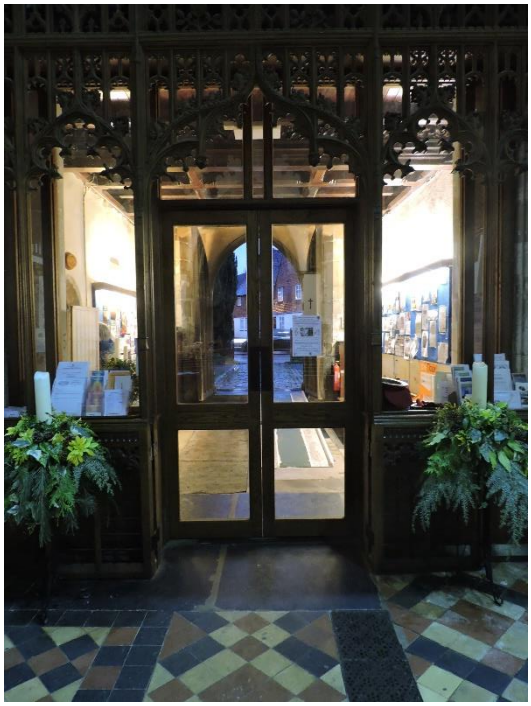
Given the high and open architecture of the interior of the church is it challenging to recommend a radical different form of lighting for the general area lighting within the church but it is recommended that these existing lights are replaced for LED units. As well as providing substantial energy savings from the current versions they also have the advantage of having a longer life and being able to be switched on and off without a warm down period and can also be dimmed to create a greater degree of different ambiances than is currently possible.

There are a large number of LED flood units on the market but it is advised that a suitable specification will be a unit with a colour of between 3000K and 4000K with a dimmable driver and an antiglare coating. A 100W LED unit should be a very suitable replacement for the existing fittings.

In addition to the recommendation to replace the current floodlight units with LED flood units, the church may also wish to upgrade its lighting design as part of its reordering in order to enhance the appearance of the church. The use of multi LED spot lights can be particularly effective in highlighting various features within the church such as the altar or font and units such as https://www.jcc.co.uk/en_GB/products/jc14200blk can be very suitable.

The lighting in the side aisle can be successful located on the wall plate which is much lower and a track type spot system such as that referred to above could be a very appropriate approach to take. The lighting in the priests vestry could also be easily upgraded to LED versions in the short term.

5.2 Draught Proofing



The main entrance door has a useful porch area but the outside door is usually held open in order to provide a welcoming arrival to the church. This means that the internal, more modern, door is providing the barrier to the cold air entering the church. This door currently has worn and poor draught stripping and a gap between the doors as well as around the top, base and side is evident. As both the current and any new heating system is going to relying on retaining warm air inside the church it is very strongly recommended that the draught stripping and adjustment of this door is carried out to ensure a much better level of air tightness in this area.

There are other more historic doors within the church such as the door to the vestry. These too can have their draught proofing improved by using the Quattroseal system (http://www.theenergysavers.co.uk/) which is suitable for historic and listed buildings.

5.3 Other Existing Energy Issues.

It was advised that the ringing chamber in the tower can be a difficult space in regard of thermal comfort, being cold in the winter and having over heating issues in the summer. To provide effective heating to the space it is suggested that an overhead far I-R heater could be used (https://www.warm4less.com/product/79/3200-watts-bar-heater) this provides a useful yet subtle heat which the more energetic bell ringers may prefer to more harsh forms of heating.

For the summer overheating there needs to be a way of venting out the hot air from the top of the ringing chamber. There is an existing hatch or a new hatch could be sympathetically created above the bell ringer chamber which could then have an automatic opening arm fixed to it (on similar principles as those used in greenhouses and more often used for smoke ventilation in commercial premises). This would allow hot air to vent up and out of the tower and be a major improvement to the conditions. To improve them further there should be a route for air to come in at the base of the ringing floor to create a through flow of air and create a stack/chimney effect. There is an openable door under the glass screen but this is somewhat difficult to open requiring someone to crawl down and open it. There is a timber shelf and the boarding immediately above this which could have vents fitted within it that could have a sliding louvre on them so that they can be more easily open and shut depending on the conditions.

6. Re-Ordering

6.1 Heating

An outline of the re-ordering plans was provided. Given that the pews are being removed and the usage of the church is extensive the use of an underfloor heating system within the nave is a sensible approach. As this gently heats the air in the church it is important that the warm air is retained as much as is possible hence the recommendation for draught proofing the doors earlier in the report. Any underfloor heating system will and must include insulation beneath it. There is little that can be done to the walls and the roof can only really be insulated at the time of re-roofing, it has been advised that some roofs have been insulated when they have been recovered and this should be extended to the remaining roofs.

The key to efficiency will be how the underfloor heating system will be controlled. Underfloor heating systems are not very effective at providing a quick boost to the heating, they react very slowly. They are good at providing a steady background heat and will be much kinder to the fabric than the current blown warm air system. It is doubtful whether an underfloor heating system alone will be capable of emitting sufficient heat to warm the church to inside air temperatures of around 18 to 20 degrees and a supplementary heating system may also be needed.

It is therefore recommended that an efficient solution would be to have underfloor heating providing background heating to a level of around 14 degrees. This should be maintained as the background level which will be suitable for visitors to the church during the week. For services the temperature should be boosted to around 18 degrees but using the underfloor system to do this is likely to take a long time and be moderately inefficient. It is therefore suggested that some fan convector units (such as http://www.spc-hvac.co.uk/product/belgravia-supreme/) may need to be located on the perimeter walls and used for a few hours prior to a service to increase the temperature from the base 14 degree level to the 18 to 20 degree level. As they are only having to pull the temperature up by around 5 degrees they should be capable of doing this without running for long periods of time. As there is a fan noise associated with these units it could then be preferable to turn them off at the start of a service and rely upon the underfloor heating to maintain the temperature at a higher level.

A gas based underfloor and supplemental heating solution will be the most efficient in terms of both cost and carbon emissions. While there is often an understanding interest in the use of air source heat pumps with underfloor systems these do not perform well in historic buildings which are inherently poorly insulated and draughty, they are very effective in highly insulated and well-sealed new build developments but a historic church is a long way from that ideal. Air Source Heat Pumps therefore tend of have a much reduced efficiency in church environments and when this is taken into account they do not provide a solution which is more efficient in terms of carbon emissions (or costs) than gas and in most circumstances are substantially worse.

The chancel area is not proposed to have underfloor heating installed within it and there are no plans to disturb the floor. This area is less used and the relocation and re-use of the cast iron radiators which are currently in parts of the church would be a very appropriate and sensible approach which would pleasingly reuse these existing units rather than see them scraped.

The choir vestry is intended to be are space for a kitchen and WC's . It may well be acceptable to consider the use of secondary internal glazing to the windows in this space as the visual impact will be very minor. The use of a high quality system such as the bespoke system from Selectaglaze (https://www.selectaglaze.co.uk/improving-church-window-efficiency) may be able to be acceptable. A simple gas radiator-based heating system will work well in this area and this should be zoned separately so it can be controlled independently of other areas. The existing cast iron style radiator in this space can be reused in the chancel. The provision of hot water within the church should be made through the use of electric point of use heaters fitted with a simple timer fuse spur (such as the timeguard FST77 unit) so they can be automatically switched off overnight) it would be rather inefficient to have a gas boiler heating volumes of stored hot water for the churches usage so this should be avoided.

The priest's vestry is used for short periods of time only. Given the nature of its use a simple Far I-R 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. The existing cast iron radiator in this space could again be relocated to the chancel.

There are solid panels to the vestry windows at present, thought to be more due to security reasons. It would be an improvement to the current visual impact as well as a useful improvement in reducing the heat loss to replace these with opaque secondary glazed units.

The lighting in the priests vestry can be easily upgraded for LED versions and if this area is not going to be subject to much change in the future plans then this could be a small step that could be undertaken now.

7. Other Recommendations

7.1 Electric Vehicle Charging Points

In order to support sustainable travel solutions for the congregation and those that use the facilities it is recommended that the church review the installation of an electric vehicle charging point on the Cornerstone building. This would only need to be a simple 3kW type 2 charger. Government grants are available to part fund the installation of a charging point.
https://www.gov.uk/government/publications/workplace-charging-scheme-guidance-for-applicants-installers-and-manufacturers

8. 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 space
Micro-Hydro	No – no water course
Solar Thermal	No – no extensive hot water need
Ground Source Heat Pump	No – archaeology
Air Source Heat Pump	Yes - but not recommended (see above)
Biomass	Yes - but not recommended due to presence of gas and air quality issues in town centre setting.

PV, there is a large south facing roof on the nave that appears to be non-visible due to the edge parapet (note that the timing of the audit in the late afternoon in winter resulted in the audit being undertaken when it was dark). It is reported that the roof has either been recently recovered or is shortly due for recovering. The roof structure appears visually sound. It therefore appears as if an installation of PV on this church roof may be viable and it is recommended that further consideration of an installation is made as part of the reordering scheme.

Battery Storage, whilst not strictly a renewable energy solution, 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. This is a new but fast-growing technology and still has high install prices. It may therefore be prudent to consider enabling the future installation of such technology with any PV installation and then considering the installation of a battery storage unit in future years when there have been price reductions.

9. 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.

10. 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.