Energy Audit and Survey Report

St James the Less Church, Pangbourne

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
David Legge	Matt Fulford	28th February 2019	1.0

Contents

1. Executive Summary

An energy survey of St James the Less Church, Pangbourne 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 James the Less Church, Pangbourne is located in the heart of Pangbourne and is a Grade II* listed church sited in a conservation area. Parts of the church date to 1718, whilst it was largely rebuilt in 1865-6. A reordering occurred in 2001, providing a raised floor and new lighting and controls amongst other works. There is both gas and electricity supplied to the site.

The church as 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?
Fit flow regulators onto existing taps	860	£17	£50	2.92	List A	
Insulate exposed pipework and fittings in plantrooms	1,434	£29	£100	3.51	List B	
Change existing lighting for low energy lamps/fittings	5,598	£709	£8,301	11.70	List A/B	
Tune the boiler to more efficient combustions settings	1,434	£29	£500	17.53	List A	

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)	2,437	£49	£1,290	26.59	List A	

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?
Boiler Replacement	3,656	£73	£15,000	206.18	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 12.67p/kWh and 1.99p/kWh for electricity and mains gas respectively.

If all measures (excepting the boiler replacement) were implemented this would save the church £873 per year.

2. Introduction

This report is provided to the PCC of St James the Less Church, Pangbourne 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 James the Less Church, Pangbourne is located in the heart of Pangbourne and is a Grade II* listed church sited in a conservation area. Parts of the church date to 1718, whilst it was largely rebuilt in 1865-6. A reordering occurred in 2001, providing a raised floor and new lighting and controls amongst other works. There is both gas and electricity supplied to the site.

An energy survey of the St James the Less Church, Pangbourne Hill, Pangbourne, RG8 7AX was completed on the 17th December 2018 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.

St James the Less Church, Pangbourne	
Gross Internal Floor Area	c. 308 m^2
Listed Status	Grade II*
Typical Congregation Size	150

The church typically used for 9 hours per week for the following activities

Services	6 hours per week
Meetings and Church Groups	3 hours per week
Community Use	Ad hoc use only

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 St James the Less Church, Pangbourne and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single / Blended Rate	12.670 p/kWh	In line with current market rates
Standing Charge	40.44 p/day	N/A

The current gas rates are:

Single / Blended Rate	1.99 p/kWh	Below current market rates
Standing Charge	99.43 p/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, particularly as it is buying 100% renewable electricity from Solartricity. Upon contract renewal, we would recommend that the church also obtains a quotation for its gas and 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% electricity / 20% gas	The organization is understood to be a charity and therefore should be benefiting from only be charged a 5% VAT rate on their gas supply. A VAT declaration should be sent to the supplier to adjust this.
CCL	Not charged	The correct CCL rate is being applied.

The above review has highlighted that VAT is being charged on gas consumption only, when the organisation is understood to be a charity and have VAT exemption status. This seems to be an error as the supplier are not charging 20% VAT or CCL on the electricity supplies, so this needs to be resolved. As such the Church should send the supplier at VAT declaration confirming this and check all supplies on other sites.

4. Energy Usage Details

St James the Less Church, Pangbourne uses 8,381 kWh/year of electricity, costing in the region of £1,062 per year, and 28,674 kWh/year of gas, costing £571.

This data has been taken from the annual energy invoices provided by the suppliers of the site (see Appendix 2). St James the Less Church, Pangbourne has one main electricity meter, serial number E12Z044797. There is one gas meter serving the site, serial number M025A0090101A6.

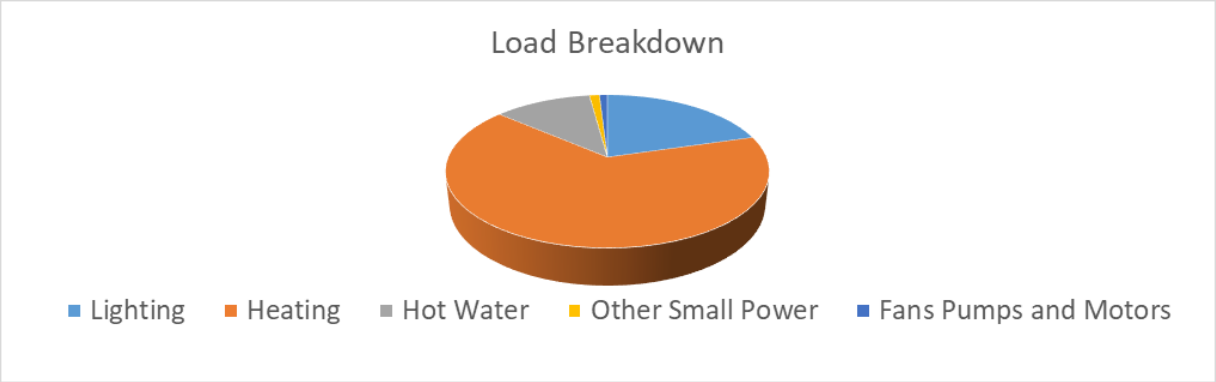
Utility	Meter Serial	Type	Pulsed output	Location
Electricity	E12Z044797	3 phase 100A	Yes but not full AMR connectivity	External meter cupboard
Gas	M025A0090101A6	R5 MDA 25 Schlumberger	No pulse or AMR	External meter cupboard

Given the low energy usage full AMR metering is not likely to be of great benefit but the church should seek to benefit from any Smart Meter roll out by suppliers in future years if offered.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	A variety of inefficient fittings including metal halide and SON flood lights, PAR38 and AR111 spot lights.	20%
Heating	Two Ideal Concord CX 275 gas fired boilers providing heating via perimeter panel radiators and Biddle fan convectors.	66%
Hot Water	Hot water to WCs and kitchenette.	12%
Other Small Power	Heating pumps, organ power and other small appliances.	2%



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 lighting.

4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St James the Less Church, Pangbourne uses 36.0% more electricity and 37.9% less heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	St James the Less Church, Pangbourne use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St James the Less Church, Pangbourne (elec)	308	27.21	20	10	36.0%
St James the Less Church, Pangbourne (heating fuel)	308	93.10	150	80	-37.9%
TOTAL	308	120.31	170	100	-29.2%

5. Energy Saving Recommendations

5.1 Lighting (fittings)

The church is predominantly 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 and the spot lighting is provided to enhance and highlight particular the features of the church, but all fittings are inefficient.

Given the high and open architecture of the interior of the church is it challenging to recommend a radically 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 may currently be possible, despite the comprehensive lighting control the church has installed.

There are a large number of LED floodlight units on the market, and 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 anti-glare coating. A 100W LED unit should be a more than suitable replacement for the existing fittings. In order to integrate with the existing lighting control system a dimmable flood light would have to be used, these are available on the market but it would be worth contacting the lighting control company that installed the current system to check any new units integrate with the existing controls.

In addition to the recommendation to replace the current floodlight units with LED flood units, all halogen spotlights should be replaced with LED direct replacement equivalents, which are widely available for all types of fitting.

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 in 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 Insulation of Pipework and Fittings

The pipework within the plant room has the majority of its straight lengths insulated but the more complex shaped pipework fittings, such as valves, have been left uninsulated. These exposed areas of pipework contribute significantly to wasted heat loss from the system and make the plant room unnecessarily warm. The exposed hot surfaces also represent a health and safety risk of burns for those working in the area.

It is recommended that these areas of expose pipework and fittings are insulated with bespoke made flexible insulation jackets. These wrap around the various elements but can be removed and then replaced for any servicing activities.

A free survey and quotation for the supply and installation of insulation of pipework fittings can be arranges through Anthesis Ltd (contact Margaret Davis, 0117 403 2689, Margaret.Davis@anthesisgroup.com) or ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com).

5.4 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.

5.5 Boiler Replacement

The existing boilers on site are approaching the end of their serviceable life and are discounted by the manufacturer. Spare parts will become more difficult and expensive to source and consideration should be given to replacement of the boilers with high efficiency, condensing boilers. These are likely to result in a 15% improvement in efficiency with associated consumption and cost savings. It is advised that any replacement boilers are checked for correct sizing for the heaters and radiators in the space they are serving, as the current boilers may be oversized and replacement capital costs are likely to be £15,000 for an equivalent rated boiler(s).

5.6 Timeclock on water heater

There is an electric hot water boiler (for tea making and the like) located in the kitchenette. These only need to heat the water to the required temperature when the building is in occupation but at the moment these heaters are directly wired in without any form of time control and therefore maintain their set temperature 24/7.

It is recommended that the heaters are fitted with a 24 hour/7 day timeclock to replace the fused spur switch. An example of such a unit would be a TimeGuard FST77. They should be set up with times to match the times that the building is occupied and this will prevent the standing losses from the unit wasting energy during periods when the building is not occupied.

Such units can be purchased at any electrical wholesaler and fitted by your existing electrician or any NICEIC registered electrical contractor.

6. Saving Recommendations (Water)

6.1 Tap Flow Regulators

The taps to the wash hand basins within the building have been checked as part of the audit and the average flow rate within these has been measured to be 10 litres/min. The recommended flow rate for hand washing is 4.8l/min and therefore the taps are providing around double the amount of water that is necessary.

The over provision of water for hand washing is not only a source of excessive water use, but in the case of hot water, it is also a source of wasted energy in the heating that has to go into providing the hot water.

The flow rate of the taps can be easily regulated by fitting flow regulators within the taps. It is recommended that flow regulators such as those manufactured by neoperl (http://www.neoperl.net/en/) are fitted into all the viable hand wash basin taps to save on both water and heating of the hot water. These can be self fitted.

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	No – Visible roofs
Battery Storage	No – No viable PV
Wind	No – No suitable land
Micro-Hydro	No – No water course
Solar Thermal	No – no significant hot water demand
Ground Source Heat Pump	No – archaeology, no ground works
Air Source Heat Pump	Yes - but no need with current heating system
Biomass	No – issues with running hours, storage and deliveries

Given that all the roofs are highly visible and the other attributes of this church there are no renewable energy generation measures that are considered feasible to consider at the current time.

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.

10. Other Observations

It was reported that the grilles on the fan convectors were only cleaned every 2-3 years at present. These should be routinely checked on a more regular basis and then cleaned as necessary. The filters are relatively easy to clean with a vacuum cleaner and attachments to remove any dust and debris from the housing. This in turn will lead to better heat distribution and efficiency of the units with increased thermal comfort and lower operating costs.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Nave – floods	31	50W LED Flood	£227.93	£2,830.30	12.42
Side Aisle - floods	24	50W LED Flood	£176.46	£2,191.20	12.42
Church	16	AR111 LED	£68.31	£712.64	10.43
Church	1	AR111 LED	£7.36	£44.54	6.05
John Davis Grave	2	GU10 LED	£6.05	£23.60	3.90
Vestry Door	1	LED GLS	£3.59	£10.50	2.92
Church High Level	8	GU10 LED	£24.19	£94.40	3.90
Bell Ringing Room	2	5ft Single LED	£5.41	£187.40	34.62
WC	2	GU10 LED	£6.05	£23.60	3.90
Sacristy	1	LED GLS	£3.59	£10.50	2.92
Vestry	4	LED GLS	£14.37	£42.00	2.92
Lectern light	1	GU10 LED	£9.90	£11.80	1.19
Narthex	2	AR111 LED	£8.54	£89.08	10.43
Narthex	1	50W LED Flood	£7.35	£91.30	12.42
Kitchenette	2	5ft Single LED	£2.89	£187.40	64.76
External Floods	2	50W LED Flood	£137.25	£182.60	1.33