Energy Audit and Survey Report

St James's Church

"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	8th November 2019	1.0

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1. Executive Summary

An energy survey of St James's 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.

St James's Church is a Grade II listed church, located on the outskirts of the village of Barkham. There is heating 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.

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 control settings	10,594	£676	Nil	Immediate	None	
Fit Quattroseal draft proofing to historic doors	700	£45	Nil	Immediate	List B	
Insulate exposed pipework and fittings in plantrooms	1,766	£113	£50	0.44	List A	
Install Endotherm advanced heating fluid into heating system(s)	3,500	223	£560	2.51	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 thermostatic radiator valves (TRVs)	2,100	134	£1,210	9.03	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?
Change existing lighting for low energy lamps/fittings	29	£5	£148	31.56	List B /Faculty	
Replace over door heater with full width version	n/a	n/a	n/a	n/a	List B	

Based on current contracted prices of 16.43p/kWh and 6.38p/kWh for electricity and heating oil respectively.

The Church should check any faculty requirements with the DAC Secretary at the Diocese before commencing any works. **If all measures were implemented this would save the church £1,195 per year**.

2. Introduction

This report is provided to the PCC of St James's 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.

St James's Church is a Grade II listed Victorian church, located on the outskirts of the village of Barkham. There is heating oil and electricity supplied to the site. A new central heating system was installed in 2018 complete with new oil boiler.

An energy survey of the St James's Church, Church Lane, Barkham, RG40 4PL was completed on the 7th February 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.

St James's Church	
Gross Internal Floor Area	240 m^2
Listed Status	Grade II
Typical Congregation Size	100

The church typically used for 2.5 hours per week for the following activities

Services	2 hours per week
Meetings and Church Groups	1 hours per week
Other Events and Community Use	1 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 oil and electricity have been supplied by St James's Church and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	16.43 p/kWh	Above current market rates
Standing Charge	31.86 p/day	N/A

The current oil rates are:

Single / Blended Rate	68.95 p/litre	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.
FiT	100% charged	A FiT charge is being applied. It should be checked that this is being charged in accordance with the supply contract.

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

4. Energy Usage Details

St James's Church uses 2,827 kWh/year of electricity, costing in the region of £465 per year, and an estimated 35,000 kWh/year of heating oil, costing £2,232.

This data has been taken from the annual energy invoices provided by the suppliers of the site (see Appendix 2). St James's Church has one main electricity meter, serial number S69C05391.

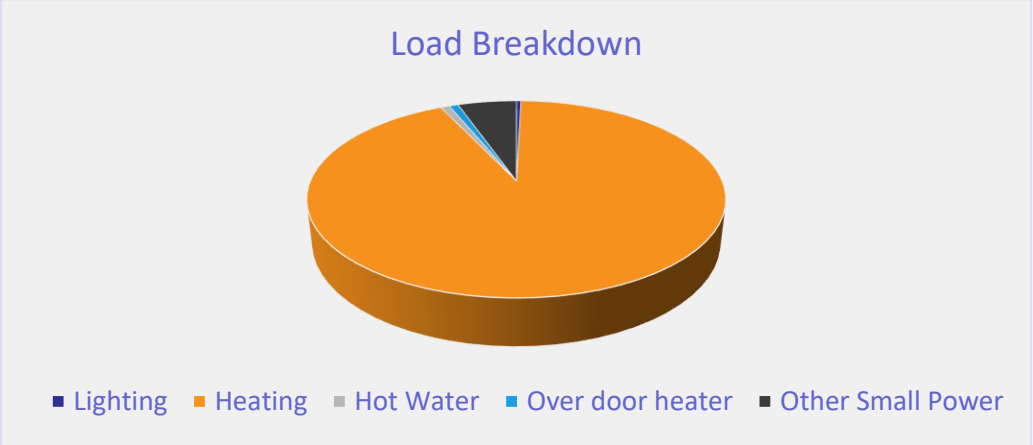
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	S69C05391	1 phase 100A	No, dial meter	Vestry

It is recommended that the church consider asking their suppliers to install smart meters 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	Church is lit by CFL lamps in pendant fittings as well as LED spot lights and inefficient halogen spotlights.	1%
Heating	Provided by a Worcester Bosch Danesmoor 70kW oil boiler distributed via perimeter radiators.	92%
Hot Water	Heatrae Sadia electric point of use water heater in the vestry.	1%
Overdoor heater	A small overdoor electric heater but no fan.	1%
Other Small Power	Heating pumps, hot water urn, plug in heaters, sound system, and other plug loads	5%



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 James's Church uses 41% less electricity and 3% less heating energy than would be expected for a church of this size. This is likely to be more reflective of the low number of hours per year that the church is used for as opposed to demonstrating high efficiency.

	Size (m^2 GIA)	St James's Church use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St James's Church (elec)	240	2,827	20	10	-41%
St James's Church (heating fuel)	240	35,000	150	80	-3%
TOTAL	240	37,827	170	90	-7%

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 lit by relatively efficient compact fluorescent fittings in pendant fittings, although the light output from these lights is most likely to be quite poor.

The church has decorative wooden beams within the ceiling which is currently unlit. To provide good general area lighting to the nave and chancel, the use of up and downlighters should be considered to promote a welcoming environment but which could also serve to provide different lighting options.

Care should be taken to the exact fittings which are specified, and consideration should be given to using a slightly whiter light than might otherwise be used in churches. Something around the 3500K colour range should provide a good balance of a white light without being too yellow.

It is therefore suggested that track spot lighting fittings are located on top of the wall beams in the nave and chancel. 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. These fittings can provide the opportunity for both up and down lights if the fittings can be wired to allow dimming the up lighting and down lighting fittings to different levels.

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

Installing track lighting would allow for various lighting options and all other light fittings could then be removed.

There are also a number of inefficient halogen spotlights for the organ and lectern. 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 bulbs.

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 £148. The annual cost saving would be £5 resulting in a payback of around 32 years. The £150 grant

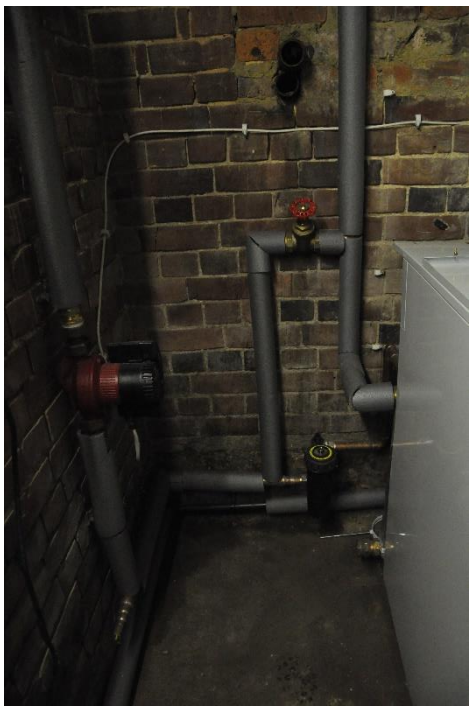
available through this process could be very usefully employed to fund the purchase of replacement LED lamps which the church installs themselves.

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 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 ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com).

5.4 Boiler Controls

The boiler is controlled by a Drayton LP711 controller and is located in the vestry. The church reported that the heating should be switched on from 5am to 7pm on Sundays only. When the controller was viewed however, the settings were found to be different; the heating was set to run from 1700 until 2359 on both Saturday and Sunday. This was due to the controller having the ability to set up Saturday and Sunday together or separately and the lighting in the area being quite poor so that the LCD display was difficult to read.

With permission, the auditor reset the controller to run from 0500 – 1230 and 1600 to 1915 hrs on Sundays only.

The recommendation is that more than one person should understand the controller and how to make adjustments as necessary. To support this, a copy of the instruction manual is issued alongside this report. The relevant detail relating to the weekend settings can be found on pages 14 and 15 of the manual and outlined below.

Set weekend

- Press YES and alter ON1, OFF1, ON2, OFF2, ON3 and OFF3 times in the same way.

Set each day

- If, after you've set OFF3 for both SAT & SUN, you want to fine-tune Saturday or Sunday, press SET? until you find the first day you want to adjust – then go through the procedure, altering any time you wish. Press SET? to move on to the next day. When you press SET? after setting your hot water for Sundays, the programmer will go back to normal operation.

5.5 Thermostatic Radiator Valves (TRVs)

The building is heated by radiators and not all of these have thermostatic radiator valves (TRVs) installed on them.

TRV's can be installed on the existing radiator and allow the users of the room to have some element of control over the temperature in the room and prevent over-heating which often leads to situations where the heating is on and the windows are open. It also allows un-used spaces to have the heating in them turned down.

It is recommended that TRVs are installed on all radiators and users advised as to the best way to operate these once they have been installed. TRV's can be supplied and installed by any good heating engineer.

Chairs and other items should be moved away from all radiators to allow free air movement and for the radiator to work effectively to convect hot air into the space.

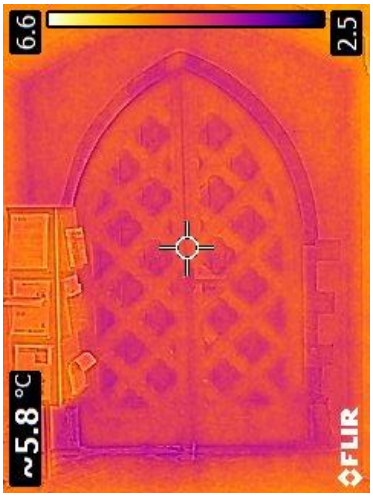
5.6 Water Heater Timeclocks

There is an electric hot water heater serving the vestry. This only needs to heat the water to the required temperature when the building is in occupation but at the moment the heater is directly wired in without any form of time control and therefore maintain their set temperature 24/7 if left on inadvertently.

It is recommended that the heater is 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.

5.7 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 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

5.8 Over door heater

There is currently a small over door electric ceramic heater above the South porch. This does provide heat to the space but it is unlikely to provide much of a barrier between the cold outside air and the warmer air inside when the door is open.

It is recommended that a dedicated over door fan heater is installed that covers the full width of the door opening. The benefit of a heater with a fan is that by creating a stream of air circulating across a doorway, it creates an invisible barrier between the air inside the building and the outdoor air. Although this is not an energy saving measure, this should assist with reducing the amount of cold air that enters the church and therefore improve the thermal comfort for the occupants. BN Thermic offer a range of overdoor heaters that come in widths up to 1.6 metres
http://www.bnthermic.co.uk/products/fan-assisted-heaters/800-series/

6. Other Recommendations

6.1 Electric Vehicle Charging Points

The church has a car park to the side of it which serves the village hall as well as the church. 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 hall, the church may wish to consider installing an electric vehicle charging point, probably on the side of the church hall to allow visitors to charge their electric car.

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 hall is a place of work for the pre-school users 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.

6.2 Window Repair

The existing windows are single glazed units, of which two were noted to be in need of repair and will be poor at keeping the outside air out of the building. It is recommended that these windows are considered for repair.

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 – not sufficient demand, visible roof
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.

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.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Lectern light	1	GU10LED	£1.35	£11.80	8.76
Organ light	1	LEDGLS	£1.28	£10.50	8.22
Porch/outside	2	LEDGLS	£1.41	£21.00	14.89