Energy Audit and Survey Report

St John the Baptist 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
David Legge	Matt Fulford	25th March 2019	1.0

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1. Executive Summary

An energy survey of St John the Baptist 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 John the Baptist Church is a Victorian red brick church with bath stone dressing, consecrated in 1873 with the chancel a later addition in 1889. In 1968, there is a further extension to the Western end of the church, also of red brick with a flat roof which contains the hall, kitchen, toilets, office and storage areas. The roof was replaced in 2010 and the church had new boilers and controls installed in 2011. There is both gas 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?
Utilise thermostatic radiator valves (TRVs)	1,875	£59	Nil	immediate	List A	
Optimise control settings	10,417	£485	£750	1.55	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)	6,250	£198	£640	3.24	List A	
Change existing lighting for low energy lamps/fittings	5,651	£863	£3,495	4.05	List A/B	
Tune the boiler to more efficient combustions settings	3,472	£110	£500	4.56	List A	
Insulate exposed pipework and fittings in plantrooms	3,472	£110	£600	5.47	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?
Fit Quattroseal draft proofing to historic doors	1,250	£191	£1,500	7.86	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 3.16p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church £2,015 per year.

2. Introduction

This report is provided to the PCC of St John the Baptist 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 John the Baptist Church is a Victorian red brick church with bath stone dressing, consecrated in 1873 with the chancel a later addition in 1889. In 1968, there is a further extension to the Western end of the church, also of red brick with a flat roof which contains the hall, kitchen, toilets, office and storage areas. The roof was replaced in 2010 and the church had new boilers and controls installed in 2011. There is both gas and electricity supplied to the site.

An energy survey of the St John the Baptist Church, Waterloo Road, Crowthorne, Berks, RG45 7JRwas 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 John the Baptist Church	
Gross Internal Floor Area	732 m^2
Listed Status	Grade II
Typical Congregation Size	95

The church typically used for 27 hours per week for the following activities

Services	5 hours per week
Meetings and Church Groups	7 hours per week
Community Use	15 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 St John the Baptist Church and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single / Blended Rate	15.27 p/kWh	In line with current market rates
Standing Charge	43.78 p/day	N/A

The current gas rates are:

Single / Blended Rate	3.16 p/kWh	In line with current market rates
Standing Charge	31.8 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 and should continue with their current procurement practices.

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

St John the Baptist Church uses 9,772 kWh/year of electricity, costing in the region of £1,492 per year, and 69,448 kWh/year of gas, costing £2,195.

This data has been taken from the annual energy invoices provided by the suppliers of the site (see Appendix 2). St John the Baptist Church has one main electricity meter, serial number E13Z007606. There is one gas meter serving the site, serial number E016K06087.

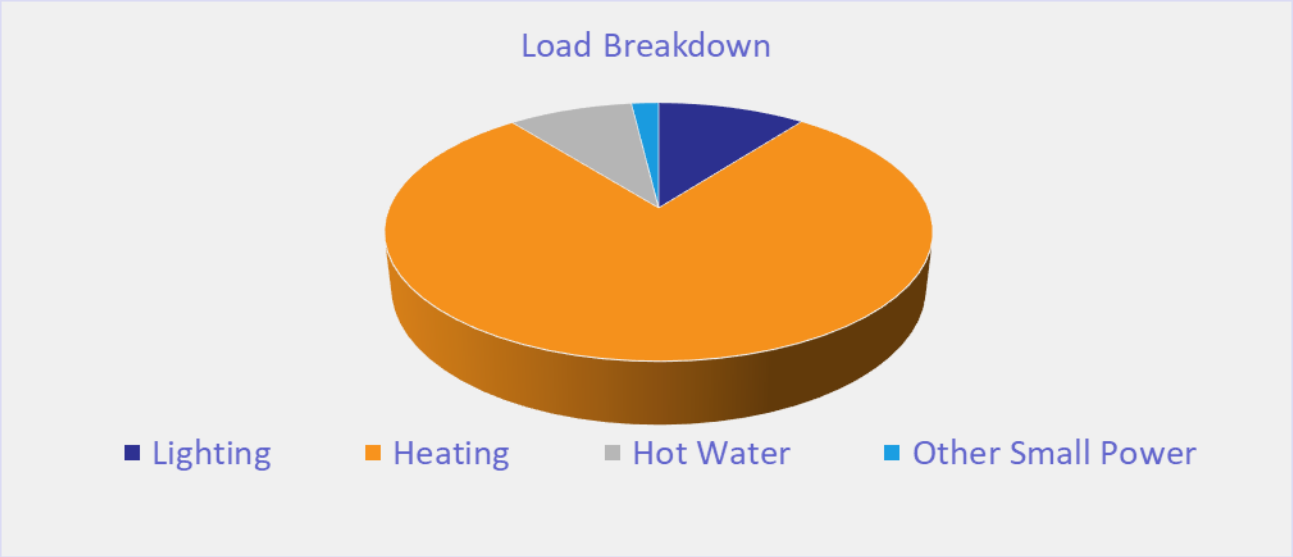
Utility	Meter Serial	Type	Pulsed output	Location
Electricity	E13Z007606	3 phase 100A	Pulse output, no AMR connected	Vestry
Gas	E016K06087	M16 / BKG10E	Pulse output, no AMR connected	External gas meter cupboard

It is recommended that all the AMR metering is collected on a single web-based portal such as Stark so that regular automated energy profiles can be easily produced and shared with the site team. LSI can arrange for this to be put in place.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Very inefficient T12 fluorescent tube fittings in main hall space. Church uses a range of inefficient spot lights and T8 fluorescent tubes as well as more efficient compact fluorescent lamps and there are a number of very efficient LED lamps.	10%
Heating	Two Ideal Evomax gas fired condensing boilers providing heating to the church, controlled by a TREND BMS with zonal control for the main church and vestry. Hall heating provided by a Potterton Therma gas fired boiler, controlled by a Hive internet enabled controller.	79%
Hot Water	Provided by the gas fired boilers.	9%
Other Small Power	Alarm and fire systems, office equipment, kitchen appliances and the like.	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 John the Baptist Church uses xx% more electricity and xx% less heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	St John the Baptist Church use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St John the Baptist Church (elec)	732	13.35	20	10	-33.3%
St John the Baptist Church (heating fuel)	732	94.87	150	80	-36.8%
TOTAL	732	108.22	170	100	-36.3%

5. Energy Saving Recommendations

5.1 Lighting (fittings)

The lighting makes up a relatively large overall energy load within the building, and large areas are lit by relatively inefficient T12 and T8 fluorescent tube fittings, including the main hall, vestry, office and kitchenette.

As the vestry lights remain on overnight as a security measure, it is strongly recommended that these lights are changed for LED fittings as these will have a reasonable impact on the electrical consumption on site.

There also still remains a large number of inefficient halogen and metal halide spot lights throughout the church, namely in the side aisles.

It is recommended that the fittings scheduled in Appendix 1 are all changed for LED.

If all the lights were changed the total capital cost (supplied and fitted) would be £3,495. The annual cost saving would be £863 resulting in a payback of around 4.05 years.

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.

Endotherm can be supplied and self-installed or supplied and installed by Inspired Efficiency (contact matt@inspiredefficiency.co.uk, 07971 787363).

5.3 Insulation of Pipework and Fittings

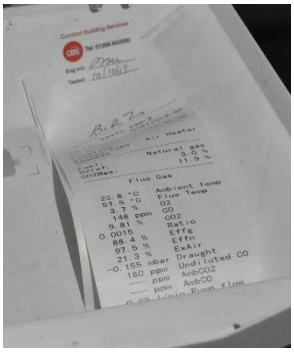
The pipework within the plant room has the majority of its straight lengths insulated but the more complex shaped pipework fittings, such as valves, have been left uninsulated. These exposed areas of pipework contribute significantly to wasted heat loss from the system and make the plant room unnecessarily 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 Controls and Behaviours

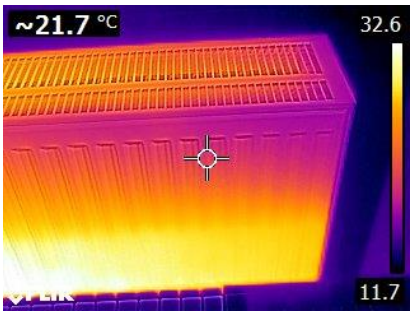
The church and vestry's main heating and hot water is controlled by a centralised building management system (BMS). This is a TREND system operated from a control panel located in the vestry.

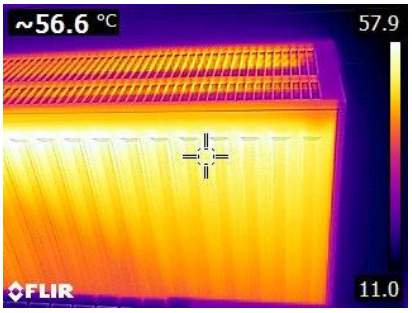
During the site survey, it was noted that there were a number of items that would benefit from being optimised and others where a routine maintenance and checking would be welcome to reduce consumption and associated cost. Within the trend control panel, the summer hold off temperature (i.e. the outside temperature above which the boiler will not fire) was set to 20°C. This is considered to be excessive and should be reduced to 17°C or lower to stop the boiler from firing on warmer days during the late spring and early autumn. In addition, time schedules were generally well matched to occupation, but this needs to be monitored to ensure that the boiler is not running when the space is unoccupied.

With regards to general housekeeping and behaviours, there were a number of items noted that would be worth rectifying and routinely checking.

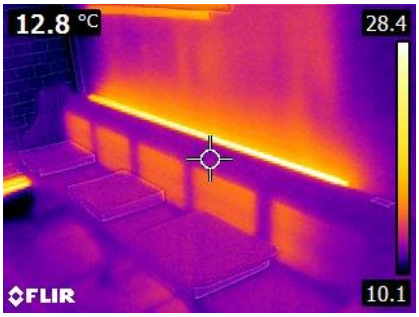
These items included:

- Air within the radiators. Radiators should be checked and air bled from the system to maximise efficiency. The radiator in the vestry contained a significant amount of air and regular checks will remove the build up of air (see thermal images before and after below). The system pressure in the boiler room will need to be checked following bleeding of radiators and topped up as necessary.





- Remove items away from radiators. Items blocking the convection of heat from the radiator will reduce the amount of useful heat entering that space and as such all radiators should have free air movement around them. The radiators in the vestry were particularly well obstructed by chairs and a keyboard. In the chancel, the last row of pews were pushed right back to the radiator, meaning the heat will be lost within the pews themselves and not dispersed effectively into the general space.



- Tube heater control. It was noted that there were 2 electrical tube heaters in the chancel below the stained glass window. These were switched on during the survey and had likely been on for some time. A simple solution to controlling these is to

purchase a timeclock to wire into the fused spur switch that currently controls these heaters. 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.

5.6 Thermostatic Radiator Valves (TRVs)

The building is heated by radiators and all of these have thermostatic radiator valves (TRVs) installed on them.

TRV's on the existing radiator 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 full. It also allows un-used spaces to have the heating in them turned down. However, all TRVs were noted to be turned to their maximum setting (6), effectively bypassing their usefulness and leaving them all on full. It is recommended that the TRVs are set to a maximum setting of 5 to allow them to control temperature as they have been designed but also if some areas are warmer than others, the TRVs can be used to balance the general temperature.

5.7 Draughtproofing to external doors

The main entrance door to the vestry has worn and poor draught stripping and a gap between the doors as well as around the top, base and side is evident. It is 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.

These doors can have their draught proofing improved by using the Quattroseal system (http://www.theenergysavers.co.uk/) which is suitable for historic and listed buildings.

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 – Visible roofs or high pitch leads to significant overshading
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.

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
Vestry	2	LED GLS	£162.12	£21.00	0.13
Vestry	1	5ft Single LED	£86.28	£93.70	1.09
Vestry	1	5ft Single LED	£74.11	£93.70	1.26
Flower vestry	1	LED GLS	£12.99	£10.50	0.81
Lady chapel	2	R50 LED	£11.43	£23.78	2.08
Lady chapel	2	R50 LED	£28.34	£23.78	0.84
Nave	8	LED GLS	£108.88	£252.00	2.31
Side aisles	4	R50 LED	£116.37	£47.56	0.41
Side Aisles and Nave	6	R50 LED	£55.18	£71.34	1.29
Organ loft	1	5ft Single LED	£11.88	£93.70	7.89
Hall	11	5ft Single LED	£152.11	£1,030.70	6.78
Office	2	5ft Single LED	£27.66	£187.40	6.78
Kitchenette	1	5ft Single LED	£13.83	£93.70	6.78
WCs - on failure only	8	2D LED 7W	£32.86	£436.40	13.28
Organ loft	1	LED GLS	£12.99	£10.50	0.81
Hall	4	2D LED 7W	£15.98	£218.20	13.65
Narthex/entrance porch	4	2D LED 11W	£30.70	£218.20	7.11