Energy Audit and Survey Report

St John the Baptist 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
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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 dates back to the 13th Century but was largely rebuilt and enlarged in the 14th Century before the most recent rebuild in 1843. It is a Grade II* listed church located in the village of Bodicote, near Banbury. The church has electric infrared panel heaters throughout and a a mix of inefficient T8 and T12 fluorescent tube fittings through to more efficient CFL lamps in the nave. There is only 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. Due to the infrequent use of the church, paybacks appear to be quite long, but if the church was used more frequently, these paybacks would obviously diminish.

Long Term: Energy saving recommendation (church only)	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	258	£38	£977	25.98	List A/B	
Fit Quattroseal draft proofing to historic doors	80	£12	£400	34.30	List B	
Install under pew heating as part of reordering works	n/a	n/a	n/a	n/a	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 for electricity.

If all measures were implemented this would save the church £49 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.

An energy survey of the St John the Baptist Church, Church Street, Bodicote. OX15 4DW was completed on the 16th May 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	285 m^2
Listed Status	Grade II*
Typical Congregation Size	50

The church typically used for 6 hours per week for the following activities

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

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

Energy bills for electricity have not been supplied and therefore an energy procurement review cannot be undertaken.

3. Energy Usage Details

St John the Baptist Church is estimated to use 4,556 kWh/year of electricity, costing in the region of £665 per year.

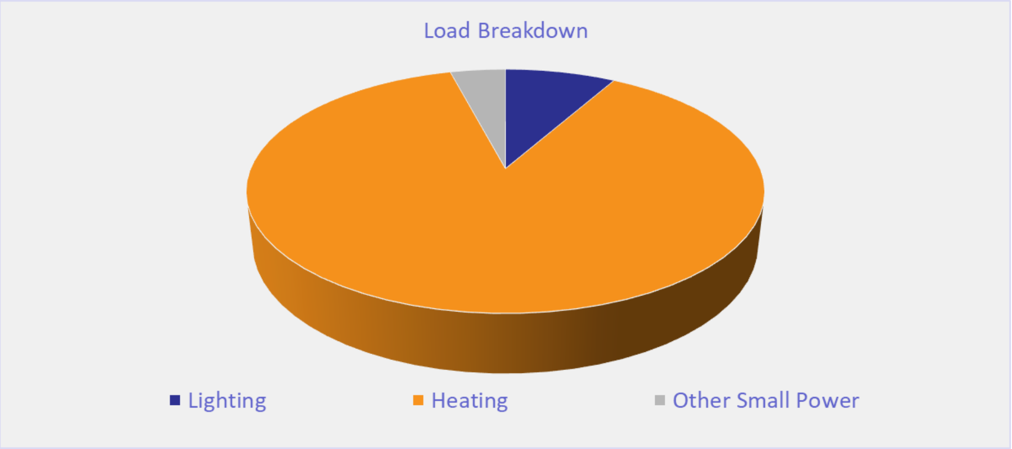
This data has been estimated based on the loads viewed during the site survey.

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.

3.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	CFL lamps in pendant fittings in nave, with additional halogen spotlights. Inefficient T8 and T12 fluorescent tube lighting to chancel, altar, vestry and bell tower	8%
Heating	Provided by infrared electric heaters located at high level to all areas.	88%
Other Small Power	Organ, sound system, and other small plug loads.	4%



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.

3.2 Energy Benchmarking

Energy bills for electricity have not been supplied and therefore energy benchmarking cannot be undertaken.

4. Energy Saving Recommendations (Church)

4.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the church, and nearly all areas are lit by inefficient fittings. The main lighting in the nave is the most efficient lighting, with CFL lamps in pendants. However, the spot lights to the altar and the North aisle are inefficient halogen lights whilst there are T8 and T12 fluorescent tube fittings in the vestry, bell tower, chancel and altar. These fittings are widely available on the market and it is suggested that the complete fitting (not just the lamp) is replaced. Any new LED fitting would have a much longer life and hence reduce the need to replace the lamps in the ceiling. 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 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 £977. The annual cost saving would be £38 resulting in a payback of around 25 years (not index linked). 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 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. The current high level infra-red heaters are mounted too high to be effective in warming the congregation and emit an unpleasant red glow. The church have stated that the pews are to remain as they are considered important by the DAC due to their completeness.

As with most medieval churches, this church would have survived most of its life without any form of heating the modern addition 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.

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.

During smaller services, only a few pew heaters need to be turned on to provide heating to the congregation as the proximity of the heat is such that all heaters do not need to be switched on to create a comfortable environment.

4.3 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. Savings Recommendations (Church Hall)

5.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building, and the mian hall is lit by relatively efficient fittings, T5 fluorescent tubes. The lighting to the kitchen and the smaller back hall is still inefficient however and is lit by T8 fluorescent tubes. These fittings are widely available on the market and it is suggested that the complete fitting (not just the lamp) is replaced. Any new LED fitting would have a much longer life and hence reduce the need to replace the lamps in the ceiling.

If all the lights (with the exception of the main hall and WC lighting) were changed the total capital cost (supplied and fitted) would be £1,343. The annual cost saving would be £73 resulting in a payback of around 18 years (not index linked). There are a vast number of specifications of LED lights on the market but it is recommended that any LED light should come with branded chips and drivers and offer a 5 year warranty. An example of such a range of fittings is available from http://www.qvisled.com/

The supply and installation can be carried out by any reputable electrical contractor and a free survey and quotation can be obtained from Batchelor Electrical, contact Stuart Patience on 01202 266212; 07793 256684; stuart@batchelor-electrical.co.uk.

5.2 Lighting (control)

Several of the lighting circuits within the building already have motion / daylight sensors installed on them. However, it was noted during the audit that these sensors are not currently set up to work to their full potential.

It is recommended that the existing lighting sensors installed within the building are reviewed and optimised so that the time lag before they turn off the lights, and the light level at which they allow the artificial light to be turned on is adjusted so that it is suitable for the space. Depending on the type of light fitting installed it is normally recommended that WCs switch off after 5 minutes. Generally lighting levels should be around 300lux but it is highly dependent on the use of the space.

5.3 Refrigeration Controls

In the kitchen area there is a domestic fridge for storage of milk and food. These units run 24/7 and contribute to the baseload electrical consumption of the building.

To reduce the electrical consumption of these appliances it is recommended that they are all fitted with a SavaWatt unit. These units work by automatically detecting the load of the compressor and turning down the power when it is not in full load. This reduces the energy consumption of the refrigeration unit by around 18% while maintaining the cooling of the appliance. It does this by reducing the voltage delivered to the unit when it is idling but allowing the full energy to the unit when it is required.

The supply and installation for all units and further details can only be undertaken by SavaWatt directly http://savawatt.com/. The installation does not cause any significant disruption to operations and can be undertaken during normal operating times.

5.4 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.

5.5 Other Observations

In order to achieve the greatest heat output from the radiators, it would be wise to keep the area around the radiators clear of any obstructions, including the stacking of plastic chairs. This will allow the heat to convect to the space more easily without heating the backs of the stacked chairs which will not re-radiate the heat to where it is needed.

6. Savings Recommendations (Dance Studio)

6.1 Lighting (fittings)

The lighting makes up a relatively large overall energy load within the building, and although the main hall is lit by relatively efficient T5 fluorescent tube fittings, other areas are lit by less efficient 2D bulkheads in the lobby and inefficient GU10 spotlights in Studio 2. The main hall fittings could be retained, but changing these for LED would result in a payback of around 10 years. All fittings are widely available on the market and it is suggested that the complete fitting (not just the lamp) is replaced. Any new LED fitting would have a much longer life and hence reduce the need to replace the lamps in the ceiling. For the lights within Studio 2, the Megaman range of LED GU10 replacement https://www.megamanuk.com/products/led-lamps/reflector/gu10/ provides some very suitable substitutes to the current lamps.

If the lights in Studio 2 were changed, the total capital cost (supplied and fitted) would be £156. The annual cost saving would be £124 resulting in a payback of just over one year. If all lights were changed, the total capital cost would be £1,131, with a cost saving of £219 and a payback of just over 5 years.

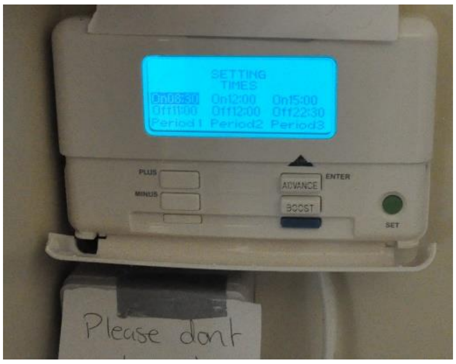
6.2 Lighting (control)

Several of the lighting circuits within the building already have motion / daylight sensors installed on them. However, it was noted during the audit that these sensors are not currently set up to work to their full potential.

It is recommended that the existing lighting sensors installed within the building are reviewed and optimised so that the time lag before they turn off the lights, and the light level at which they allow the artificial light to be turned on is adjusted so that it is suitable for the space. Depending on the type of light fitting installed it is normally recommended that WCs switch off after 5 minutes and the entrance lobby area after 2 minutes. Generally lighting levels should be around 300lux but it is highly dependent on the use of the space.

6.3 Heating controls

The dance studio has a reasonably flexible heating programmer, allowing three different daily settings for heating. It was reported that these are correctly set up, but it is worth periodically checking the time settings in the controller against the actual occupied hours of the dance studio to ensure that the heating does not come on when the space is unoccupied.



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
Battery Storage	No
Wind	No
Micro-Hydro	No
Solar Thermal	No
Ground Source Heat Pump	No
Air Source Heat Pump	No
Biomass	No

The church is Grade II* listed with visible roofs all round, so it is unlikely in the first instance that any installation would be approved on heritage grounds. More importantly, the current arrangements around solar panels mean that to be financially viable the building on which they are mounted needs to consume the vast majority of the energy that they produce. The churches energy consumption is already very small and the consumption during the daytime when the sun is shining is likely to be very low indeed, therefore while technically viable only a very small number of panels (maximum of around 4) would be worth considering if at all.

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
Nave	6	LED GLS	£6.89	£189.00	27.44
Chancel	4	AR111 LED	£12.66	£178.16	14.07
Altar	2	AR111 LED	£5.50	£89.08	16.19
Lectern light	1	R50 LED	£1.95	£11.89	6.08
N aisle	2	R63 LED	£2.82	£42.98	15.27
Vestry	2	5ft Single LED	£2.44	£187.40	76.75
Bell tower	1	5ft Single LED	£3.77	£93.70	24.88
Bell tower	1	5ft Single LED	£1.57	£93.70	59.87
HALL					
Main hall - wall washers	PLL	PLL LED	£0.96	£210.00	219.47
Kitchenette	t8 5ft	5ft Single LED	£15.34	£93.70	6.11
Lobby/cupboards	2D	2D LED 7W	£4.04	£291.00	71.97
Back room	t8 5ft	5ft Single LED	£52.64	£374.80	7.12
DANCE STUDIO					
Studio 1	T5 5ft	5ft Single Proteus LED	£72.76	£763.80	10.50
Studio 2	GU10/MR12	GU10 LED	£124.25	£106.20	0.85
Lobby	2D	2D LED 7W	£11.33	£109.10	9.63