Energy Audit and Survey Report

St Giles Church, Standlake

"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
Paul Hamley	Matt Fulford	10th October 2019	1.0

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1 Executive Summary

An energy survey of St Giles Church, Standlake 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 Giles Church, Standlake is a Grade II* listed church dating from around 1228, with a Victorian restoration and an extensive 1990s restoration. New lighting and heating were installed in 2009. Electricity only is 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?
Under pew heaters in nave are controlled in blocks. Ask people to sit in just one area when a congregation is small and just heat just that area	2000 Less if you are already doing this!	300	0	0	None	

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?
Replace lighting (10 y.o. CFL) with LED lights (of 20-30 year lifetime)	20% reduction in power requirement	10 (ten) operating cost 14 capital cost	250, Bulbs only	11	List A for Bulbs only, List B if new fittings.	
Save installation costs with extended lifetime LEDs						

The Church should check any faculty requirements with the DAC Secretary at the Diocese before commencing any works.

Estimates are based on current contracted prices of 13.662p p/kWh (electricity, evening & weekend), 16.011p/kWh (electricity, weekday) and current hardware costs.

With group procurement of 100% clean electricity, the church will achieve both fossil fuel free status, and a reduction in electricity costs.

2 Introduction

This report is provided to the PCC of St Giles Church, Standlake 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 can seek to improve the levels of comfort.

An energy survey of the St Giles Church, Standlake, OX15 4FT was completed on the 3rd October 2019 by Dr. Paul Hamley. Paul is an energy auditor with experience of advising churches and small businesses. He is part of the Diocesan Environment Officers Energy Group developing advice for the Church of England and authored the "Assessing Energy Use in Churches" report for Historic England. He is a CIBSE Associate member and a Chartered Scientist, with experience of the faculty process gained from chairing the building committee of a Grade I listed church.

St Giles Church, Standlake	
Gross Internal Floor Area	360 m^2
Listed Status	Grade II*
Typical Congregation Size	25 Sunday mornings 20 Wednesday mornings

The church is open daily (unheated)

It is typically heated for 6 hours per week for the following activities:

Services	3 hours heat per week
Meetings and Church Groups	1.5 hours per week
Community Use	Coffee Club
Occasional Offices (Weddings, Funerals)	Average 0.5 hours per week (6 per year)

3 Energy Procurement Review

Energy bills for gas and electricity have been supplied by St Giles Church, Standlake and have been reviewed against the current market rates for energy. Current electricity rates are:

Weekday Rate	16.011p/kWh	Higher than current market rates [12.99 to 13.77p/kWh]
Evening / Weekend Rate [more relevant]	13.662p/kWh	Higher than current market rates for off peak periods
Single / Blended Rate	p/kWh	N/A
Standing Charge	18p/day	
Availability Charge	p/kVA	N/A
Meter Charges	p/day	N/A

The church has a "Green Deal" contract with SSE for a two year period. Charges are higher than average – this is a likely result of choosing a green tariff which tend to cost more than for conventional (fossil fuel) tariffs. The church is to be commended for choosing green energy.

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 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 electricity and therefore it is an important part of the process of making churches more sustainable. The exact rates are dependent on the market at the time of application and the number of churches in the "basket", but they will be less than for a single customer.

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 Giles Church, Standlake used 6,495 kWh/year of electricity over the year from 25/08/ 2018 to 22/08/2019, costing £1,121 per year.

This data has been taken from the annual energy invoices provided by the suppliers of the site.

Utility	Annual use 25/08/2018 – 22/08/2019	Total including standing charges and VAT
Electricity	6,495kWh	£1,121

St Giles Church, Standlake has one main electricity meter, serial number D00C69594

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	D00C69594	Polyphase AMPY Automation Type 5192F		Electrical cupboard, rear of church

The meters is AMR connected and as such obtaining the energy profile for the entire energy usage should be possible.

4.1 Energy Profiling

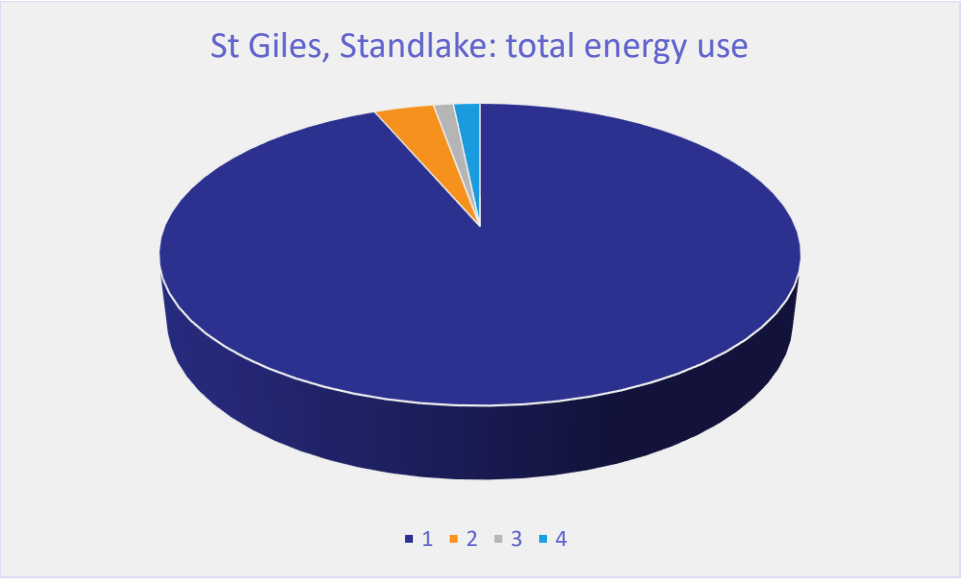
The main energy use within the church can be summarised as follows:

Electricity annual consumption	6.495kWh
Annual use hours (6 per week)	312
Average load	20.8kW
Internal load, heat and light (estimated)	40kW

The power ratings of the heaters have been estimated

Service	Description	Estimated Proportion of Usage
Heating (electric)	Nave under pews. Four blocks of independently switched heaters. Two x 4 pews at front 8kW Two x 8 pews at rear 16kW Two radiant heaters at rear 4kW	92.3%

	Aisles: 6 radiant heaters at roof level 6kW Tower: portable heater (occasional) 2kW Vestry: 2 radiant heaters (occasional) 4kW Total 40kW 150 hours use per year, which equates to 3.8 hours/week for 9 months = 6000kWh	
Lighting (internal)	Nave: 10 downlights 250W 8 uplights 200W Aisles 4 downlights (north) 100W 4 downlights (south) 100W Assumed 25 watts each CFL Chancel Tower 2 x CFL 30W Vestry 2 x T8 fluorescent (1" diameter x 4') 70W Total 0.75kW Annual consumption at 6 hours/week x52 = 234kWh	3.6%
Lighting (external)	None installed	
Hot Water	Water heater (under sink) 3kW Urn 1.8kW Kettle 1.2kW Annual consumption at 1 hour/week, mostly urn est 100kWh	1.5%
Other Small Power	Audio system 0.5kW Toaster 2kW Annual consumption at 3 hour/week (audio) 78kWh	1.2%
	Total annual use approximately 6500kWh	



Key 1: Heating 2: Lighting 3: Hot water 4: small power

As can been seen from this data, heating makes up the largest proportion of the energy usage.

4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St Giles Church, Standlake uses 10% less electricity; effectively 10% less heating energy as most consumption is for heating than would be expected for a church of this size.

St Giles Church, Standlake	Size (m^2 GIA)	Annual use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
Electricity	360	18	20	10	90%

Use of radiant electric heating (using traditional heating elements) gives a lower than average result.

There is potential for improvement in the future by substituting the most efficient infrared radiant panels.

5 Energy Saving Recommendations

5.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building.

Most of the lamps appear to be compact Fluorescent lamps (CFLs), which in time should be replaced by LEDs. This will reduce power consumption by 20-25% per lamp, so a minimal saving on electricity but, on average give a longer lifetime. It is worth looking at Parish Buying to make a bulk order, rather than fitting piecemeal as the present lighting comes to the end of its life. CFLs have lives of 8000-20000 hours, so if installed in 2009 with a 6 hour per week use they have functioned for around 3000 hours. When it is noted that bulbs begin to fail then attention should be given to replacement of all at once – there will be an access cost as the lights are all at high level. LED replacements will have around 3x longer lifetime than CFLs, so there would be a much longer time before access would be needed once again. It will of course be necessary to ensure that the replacement bulbs are compatible with the existing luminaires (fittings) unless it is desired to change the lighting regime.

Consider the colour temperature; a lower number gives a warm, yellow light (2700K), whilst higher numbers give a bright, white light (4000K, which can confusingly be referred to as “cool”) whereas daylight is 6500K. Most churches suit a colour temperature of around 3000K.

5.2 Lighting (control for internal lights)

Controlled from switch banks – this could benefit from a clear diagram on the inside of the cabinet door. The switch for the south aisle lights could not be located.

5.3 Lighting (control for external lights)

Not applicable.

5.4 Heating Overview

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

Occupants comfort depends to an equal extent on air temperature and radiant surface temperature.

Adjacent cold surfaces such as pillars and walls, which readily accept radiant heat from bodies can be covered with soft furnishings (traditionally, tapestries were used for this purpose, and wooden panelling in some churches). At St Giles it appears that most of the congregation sit away from the walls.

5.5 Electric Heating Panels

Replacement of radiant bar heaters with Infrared radiant panel heaters is a medium term option.

Infrared heaters will be more efficient (deliver the same heating effect with lower power consumption). There may be an option of angling the panels for optimum effect.

Suitable electric panel heaters would be far infrared panels such as https://www.warm4less.com/product/63/1200-watt-platinum-white- . These can be purchased widely and fitted by any competent electrician. It is recommended that they are fitted with a time delay switch such as https://www.danlers.co.uk/time-lag-switches/77-products/time-lag-switches/multi-selectable-time-lag-switch/159-tlsw-ms so they cannot be left on accidently after use. Some suppliers are able to supply panels in bespoke colours to blend in (camouflaged!), even possibly disguised as works of art. Examples are http://www.solray.co.uk/wp-content/uploads/2019/01/Churches-and-Historic-Buildings-Flyer.pdf

5.6 Heaters

Modern under pew heaters can replace the existing under pew heaters when they require replacement.

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 to the adjacent vestry / organ area where there would be power, or alternatively to the new vestry area on the south side and incorporated with its redevelopment. (All cabling should be in armoured cable or FP200 Gold when above ground) to the both rows of pews quite easily).

5.7 Roof Insulation

The nave and chancel have exposed roof structures.

It might be possible to fit insulation panels between the beams; however given that most of the church heating is radiant, this would have a small effect.

5.8 Wall Insulation

Walls are exposed stone with some monumental plaques. Permission for insulation would not be granted for a Grade II* listed building.

5.9 Quattro Seal

The external doorways have the original historic timber doors on them, where these do not close tightly against the stone surround a large amount of cold air will enter 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

5.10 Other Fabric Measures

Curtains may be used to assist in making a draught screen around a doorway.

Black plasticine may be used as a remedy for sealing small gaps around draughty heritage windows.

6 Saving Recommendations (Water)

Tap Flow Regulators

The church is open to the public and it appears that the vestry is also open to allow access to the toilet. The taps should be fitted with flow regulators to prevent them being inadvertently left on by visitors.

7 Other Recommendations

Electric Vehicle Charging Points

The church has a car parking area next to it. 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.

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.

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	Comments

Solar PV	Yes	Low priority
Battery Storage	Yes	Low priority
Wind	No	
Micro-Hydro	No	
Solar Thermal	No	
Ground Source Heat Pump	No	
Air Source Heat Pump	No	
Biomass	No	

There is potential for a small PV array on one of the low angled roofs as they do not appear to be visible from the road or other buildings. 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 electricity 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.

Battery Storage is not strictly a renewable energy solution, but 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 particularly in this sort of church. This is a new but fast-growing technology with prices expected to fall substantial over the next 2 to 3 years therefore investment into this may be worth delaying at this stage.

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.

Disclaimer

Inspired Efficiency give no specific endorsement to any third parties products or advice mentioned in this document. The information is provided to illustrate technology which may be suitable; however it is the PCC's responsibility to ensure that any new equipment is suitably specified and meets DAC approval requirements

Appendix A Photographs

Figure 1 Nave showing lighting. Two radiant heaters on tower wall.

Lux levels were measured at between 115 and 150 in the pews, which is adequate for services.

Figure 2 Independent switching of heaters (above) and lighting banks (lower right).

Figure 3 Vestry radiant heater

Figure 4 Vestry radiant heater

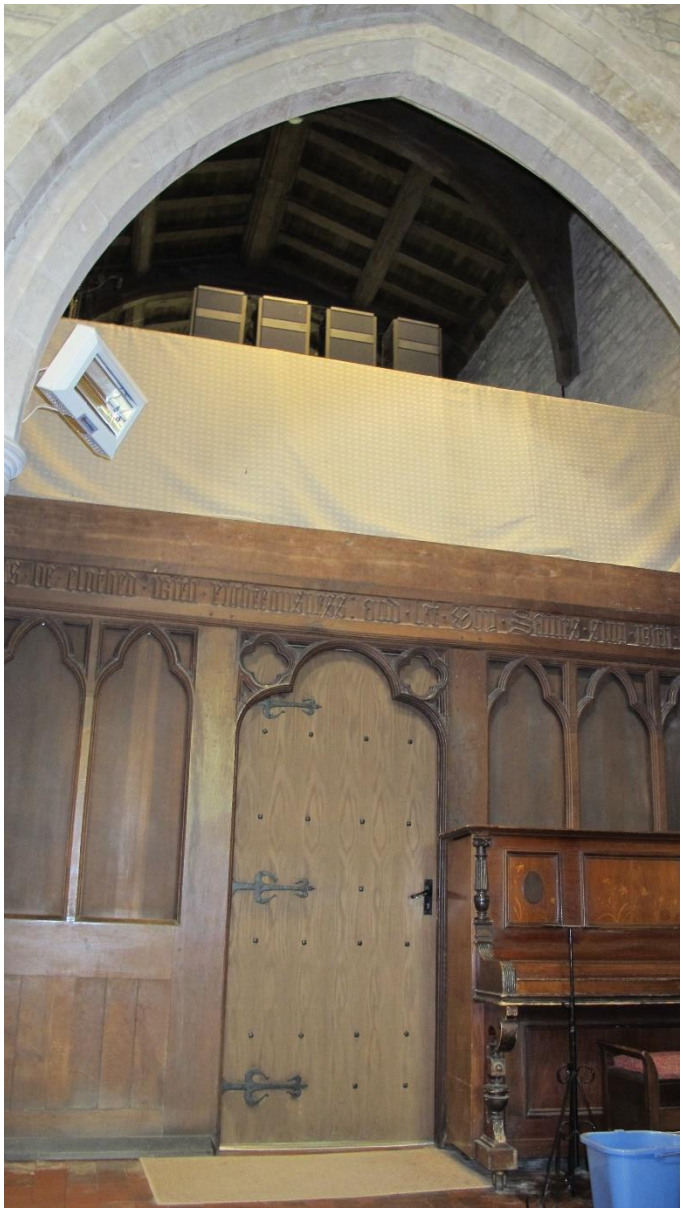


Figure 5 The vestry has a false ceiling. It was not possible to investigate the level of insulation above this. As the building is unheated for most of the time, insulation will not retain heat, so it may not be effective to add it. Is the radiant heater aimed at the pianist?