Energy Audit and Survey Report

St Peter'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
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1. Executive Summary

An energy survey of St Peter'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 Peter's Church is located in Wolvercote on the outskirts of Oxford. The present church building dates from 1860. It replaced an earlier smaller church built in the Perpendicular period (1377-1485). Merton College records indicate that the chancel was built in 1482. It's possible the nave was built then, but of that 15th century church, only the tower now remains. The church is heated by gas fired boilers to perimeter radiators and there is a mix of efficient LED lighting and inefficient T8 fluorescent tube lighting. 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?
Optimise control settings	3,600	£214	Nil	Immediate	List A	
Insulate exposed pipework and fittings in plantrooms	3,600	£130	£50	0.38	List B	
Install thermostatic radiator valves (TRVs)	3,672	£133	£220	1.66	List B	
Install SavaWatt devices on fridges and freezers	140	£14	£50	3.63	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	556	£55	£1,506	27.54	List A/B	
Install PIR motion sensors on selected lighting circuits	102	£10	£527	52.65	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 9.84p/kWh and 3.61p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church £555 per year.

2. Introduction

This report is provided to the PCC of St Peter'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.

An energy survey of the St Peter's Church, First Turn, Wolvercote, Oxford OX2 8AQ was completed on the 19th August 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 Peter's Church	
Gross Internal Floor Area	403 m^2
Listed Status	Grade II
Typical Congregation Size	50

The church typically used for 18 hours per week for the following activities

Services	8 hours per week
Meetings and Church Groups	3 hours per week
Community Use	7 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 were not supplied by St Peter's Church and therefore it is not possible to review the bills against the current market rates for energy.

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 energy and therefore it is an important part of the process of making churches more sustainable.

4. Energy Usage Details

St Peter's Church uses an estimated 42,949 kWh/year of electricity, costing in the region of £4,226 per year, and 72,009 kWh/year of gas, costing £2,600.

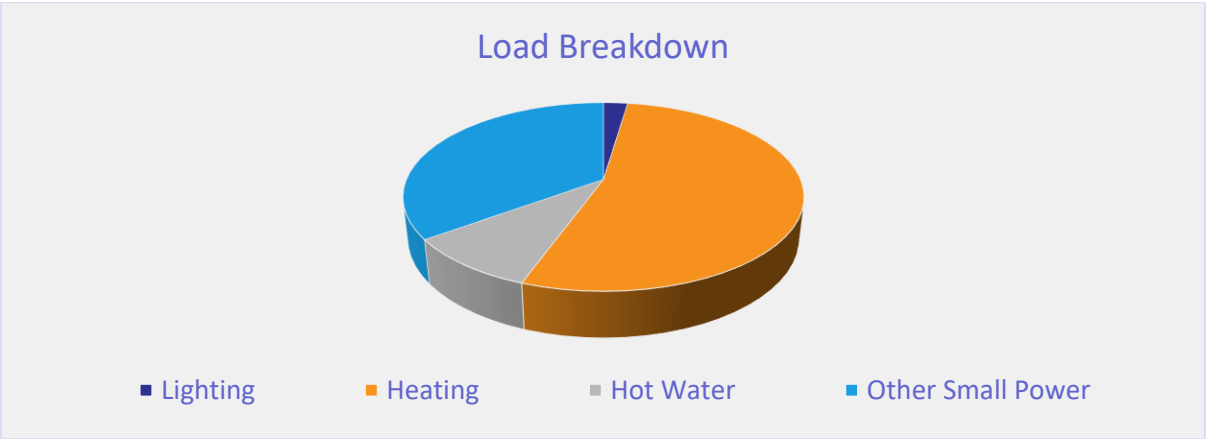
This data has been taken from the single annual costs (£) provided by the site and has not been verified against any energy invoices provided by the suppliers of the site, so may not be accurate. Consumption has been estimated using current market rates per unit (pence per kWh). St Peter's Church has one main electricity meter and there is one gas meter serving the site

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	Lighting is predominantly LED, with some efficient T5 lighting. There are still some inefficient T8 fluorescent tubes.	2%
Heating	Provided by condensing gas fired boilers to perimeter radiators throughout.	53%
Hot Water	Provided by electric point of use water heaters to all areas.	9%
Other Small Power	small kitchen appliances, fridges, plug in equipment, alarm systems and the like.	35%



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 the remaining small power loads.

4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St Peter's Church uses 433% more electricity and 19% more heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	St Peter's Church use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Peter's Church (elec)	403	42,949	106.57	20.00	433%
St Peter's Church (heating fuel)	403	72,009	178.68	150.00	19%
TOTAL	403	114,958	285.26	170.00	68%

5. Energy Saving Recommendations

5.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building, and many areas are lit by efficient LED fittings. However, the lights in the vestry are T8 fluorescent tube fittings, whilst the hall has more efficient T5 fluorescent tube fittings. 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.

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 £1,506. The annual cost saving would be £55 resulting in a payback of around 27 years. 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.

5.2 Lighting (control for internal lights)

The lighting circuits within the building WCs 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

Across the site there is a domestic refrigeration unit within the hall kitchen for storage of milk and occasional food. This unit runs 24/7 and contributes to the baseload electrical consumption of the building.

To reduce the electrical consumption of these appliances it is recommended that the fridge is 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 of these units can 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 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 ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com).

5.5 Controls

The main heating plant for the church, hall and kitchen are each separately controlled by a Honeywell wall mounted control panel located in each of the areas. It was reported that at present only one person understands the controls and sets up the programmers as they determine necessary. It is recommended that in the first instance, a small group of people are educated in how to use the heating programmers. More than one person should be competent in the operation of the controller for minimising risk if people are on holiday/not available and also to check that the time and temperature settings are appropriate for the space.

A high-level review of the settings within this control system highlighted a number of areas where the way in which it operates the building can be optimised to both reduce energy consumption and improve comfort. For example:

- The heating in the hall is always set to 15°C (as a non-occupied set point) and 18°C when the hall is occupied. However, the time schedules do not

appear to be correctly set; occupied times appear at odds with reported occupation. The occupied times noted during the survey were:
    - Tuesday 1300 – 1500
    - Thursday 1810 – 2150
    - Saturday 0810 – 1140
    - Sunday 0820 – 1100
- Occupied times may be more closely controlled to match occupation in the church and kitchen as well.

Within the church, there is also a non-occupied set point, which is set to 13°C. The use of background heating is not generally needed to preserve the fabric and running the church at 13°C background temperature is not recommended. Heating needs 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 and is an incredibly wasteful practice. If the church refuses to remove the background heating setting the background level to 10 degrees would be a good first step.

It is therefore recommended that a controls optimisation process is undertaken to re-programme the controls to match occupied times and to switch off the heating when the church is not occupied. This can be undertaken by anyone with good knowledge of the heating control panel.

5.6 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.

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

Solar PV is not really considered feasible at this church for a variety of reasons. Firstly, the church is listed and there is no viable roof space where solar panels could be installed without being very visible or alternatively not visible but in large amounts of shade due to either the steep church roof itself or the tall trees that surround the site. Secondly, the site has a low electrical demand following the installation of LED lighting throughout, so there is no real continual baseload that would require supply. Finally, as the Feed-in-Tariff has now been scrapped, any excess electrical loads not used by site would simply be fed back to the grid with no financial benefit to the church.

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.

eligible for a grant of up to about £5,000.

9. Other Observations

It was noted during the survey that there was a significant amount of debris on the tops of the radiators, particularly within the hall, where there have been numerous child groups using the space. This debris and dust will be impeding the radiators' ability to efficiently heat up the space around them.

The radiators should be regularly checked and cleaned as necessary; this can simply be done by removing the top cover and using a vacuum cleaner to remove all dust and debris from them.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Hall kitchen	4	2D LED 11W	£4.69	£218.20	46.57
WCs	7	2D LED 11W	£13.49	£381.85	28.31
Vestry	2	5ft Single LED	£4.94	£187.40	37.96
Vestry	2	5ft Single LED	£4.94	£187.40	37.96