Energy Audit and Survey Report

St Swithun's Church Hall, Kennington

"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	30th March 2020	1.0

Contents

1. Executive Summary

An energy survey of St Swithun's Church Hall, Kennington 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 Swithun's Church Hall, Kennington is a stone church of constructed in 1828 with Romanesque features with a pitched roof, with a kitchen and toilet extension. It is the original church, replaced by the adjacent larger building in 1958. There is both gas and electricity supplied to the site.

The hall 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?
Window and window frame repairs	20% 3,500	£135	£500	4	List A	PCC
Install draughtproofing measures	5% 900	£38	<£50	1	List A	Warden
Close curtains when building not in use	5% 900	£38	0	Immediate	None	Warden
Install thicker curtains which fit closely to walls	10% 1800	£77	Circa £1000	lots	None	PCC
Purchase a temperature datalogger to optimise heating times	5% 900	£38	N/A if bought for church already	<1	None	Warden
Change lighting to LED bulbs	500	£78	30	<1	None	Warden

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 Sava Watt apparatus to fridge	135	21	£120	5.7	None	Warden
Install insulation in ceiling void	10% 1,800	77	£2,000	High	List B	PCC
Investigate secondary double glazing inside windows	10% 1,800	77	£5,000	High	Faculty	PCC
Double glaze kitchen windows and door replacement	5% 900	38	£1,000	High	Faculty	PCC

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?
Replace gas heaters with Air to Air Heat Pumps	12,000	Even or slightly more (replace gas with electric)	£40,000	N/A	Faculty	PCC

The Church should check any faculty requirements with the DAC Secretary at the Diocese before commencing any works. Figures are based on current contracted prices of 15.58p/kWh and 3.80p/kWh for electricity and mains gas respectively.

If all short and medium term measures were implemented this would save the church around £600 in operating costs per year.

2. Introduction

This report is provided to the PCC of St Swithun's Church Hall, Kennington 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 Swithun's Church Hall, Kennington, OX1 5PL, was completed on the 9th March 2020 by Dr. Paul Hamley, meeting with Helen Beale, Isabelle, Brian and Roger.

St Swithun's Church Hall, Kennington	
Gross Internal Floor Area	100 m^2
Listed Status	Grade II
Typical Congregation Size	N/A

The hall is typically used for 35 hours per week for the following activities:

Apple Café, Band practice, Brownies, Guides, Lent Group, Memory Club, Pilates, Quizzes, Youth Group, Yoga, Zumba and is bookable for parties and rehearsals, etc

Estimated annual hours of use: 1800 hours

Estimated annual heating hours: 600 hours (on ¾ power), (460 if heaters are always on full)

Estimated annual footfall: 14,000 (based on March calendar, 20 attendees for most events)

3. Energy Procurement Review

Energy bills for gas and electricity have been supplied by St Swithun's Church Hall, Kennington and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single / Blended Rate	15.58p/kWh	Slightly above current market rates
Standing Charge	24p/day	N/A

The current gas rates are:

Single / Blended Rate	3.80p/kWh	Above current market rates
Standing Charge	25.35p/day	N/A

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 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.

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

4. Energy Usage Details

St Swithun's Church Hall, Kennington uses around 2,500 kWh/year of electricity, costing in the region of £475 per year, and approximately 18,000kWh/year of gas, costing around £770.

This data has been taken from information provided by the church from the utility bills.

Utility	Annual use/ kWh	from	to	Cost
Electricity	2,510	01/03/19	23/02/20	£475
Gas	17,883	01/03/19	23/02/20	£770

Carbon footprint = 3.9 tonnes per year:

Electricity 642kg CO2 (or Zero IF a fully renewable tariff is being used)

Gas 3,280kg CO2

St Swithun's Church Hall, Kennington has separate electricity and gas meters for the 1958 church and 1828 hall.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Hall	E11Z92678	EDMI Atlas Mk10D	Yes	West wall
Gas – Hall				

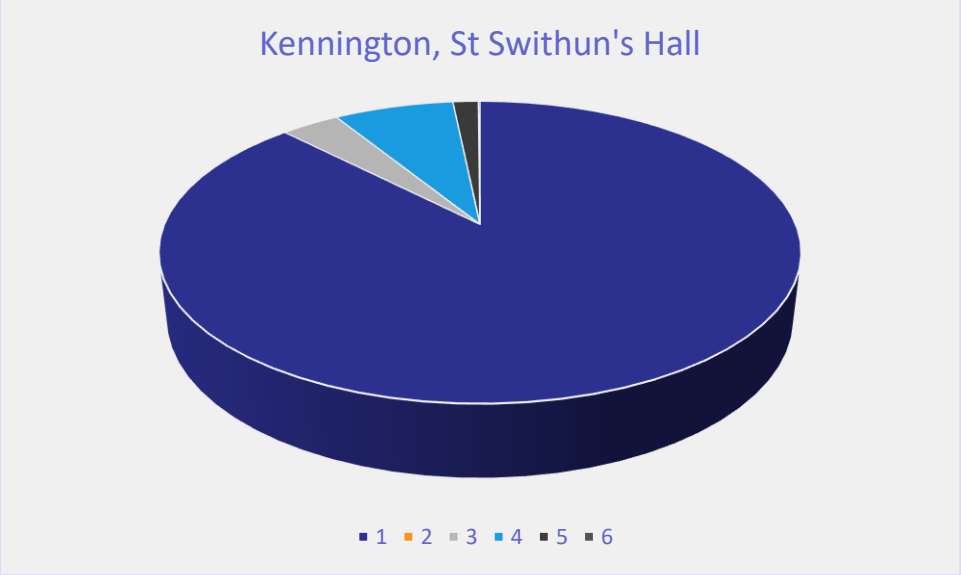
The electricity meter is AMR connected and as such an energy profile for the annual energy usage should be available from the supplier.

4.1 Energy Profiling

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

Service	Description	Power	Annual Use/ kWh	Estimated Proportion of Usage %
Gas Heating	3 x 13kW flued gas heaters 460 hours annual use *if always on fully*	39kW	**17,883**	87.7%
Lighting **Hall** **Kitchen** **Toilets**	6 bulbs, various ratings Occasional use **TOTAL**	360W 100W 50W	600 100 20 **720**	3.5%
Kitchen	Dishwasher (1 hour per week) Oven (1 hour per week) Fridge Freezer 2 x Microwave oven (1 hour per week) Sandwich maker (1/2 hours per week) Toaster (1 hours per week) **TOTAL**	4.5kW 3kW 300W 1kW 1kW 1kW	230 156 900 52 26 104 **1468**	7.2%
Hot Water	Urn (2 hours per week – café) Kettles (1.5 hours use per week estimated) **TOTAL**	2kW 2kW	156 156 **312**	1.5%
Other Small Power	Vacuum cleaner **TOTAL**	1.5kW	20 **20**	0.1%

Total Annual Consumption 2019-20: 2510kWh



KEY 1 Gas heating 2 Electric heating (zero) 3 Lighting

4 kitchen 5 Hot water 6 Small power

4.2 Energy Benchmarking

In comparison to national benchmarks[1] for Church energy use St Swithun's Church Hall, Kennington uses 25% more electricity and 19% more heating energy than average figures for a *church* of this size. This is mostly due to the regular hours of use of the building.

	Size (m^2 GIA)	St Swithun's Church Hall, Kennington use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Swithun's Church Hall, Kennington (elec)	100	25.1	20	10	125%
St Swithun's Church Hall, Kennington (heating fuel)	100	179	150	80	119%
TOTAL	100	204	170	90	120%

There is currently no benchmark data which takes hours of use and footfall into account.

[1] CofE Shrinking the Footprint – Energy Audit 2013

5. Building Overview and Performance

5.1 Overview and Options

The building is currently heated by three 13kW flued gas heaters (the same as fitted to the church) which directly vent their exhaust through the walls. These are situated directly under windows – some of which have large gaps where the opening sections do not close properly within the frames.

As with the church, alternative options are direct electric heating using far infra-red radiant panels (which offer rapid heat up times), or use of Air to Air Heat Pumps in place of the gas heaters (see Section 6.3).

Direct electric heating can offer the advantage of much less preheating time compared to a gas central heating system. The flued gas heater system requires little preheating, so there are less energy reduction advantages from switching to IR panels, plus electricity is more expensive per kWhour.

6. Energy Saving Recommendations – Electrical and Heating

6.1 Lighting (fittings)

The lighting consists of six bulbs, whose power rating could not be identified with certainty, but appeared to be as follows:

Door end of building

11W	115W
115W	40W
?	?

Window end

Only one of these bulbs is identifiable as low energy.

It is recommended that these bulbs be changed for LED; which will reduce lighting energy consumption by about half, and also reduce the frequency with which bulbs have to be changed.

This could reduce lighting energy consumption by around 500kWh per annum, or 20% of total current use.

6.2 Electric infra-red Panels

The gas heaters could be replaced by far infra-red panels heaters. If located at the same place, at low level, these would need to be the larger low surface temperature panels as used in schools (surface temperature 55°C). However, to supply the same amount of heat would require higher expenditure, at current tariffs electricity is 4.1 times more expensive than gas.

For a building which is used daily for over 5 hours per day on average, little preheating is normally needed and the advantages of radiant heaters are minimised.

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.

6.3 Air Source to Air Heat Pumps

These devices are electric powered heat exchangers using reversed refrigeration technology to heat the air inside a building using small fan assisted radiator units. Outside of the building, units similar to air conditioning modules would be fitted in a well ventilated place. They can also be used for cooling in the summer. A major advantage is that less electricity is used to run them than the heat delivered, so they are not only lowering carbon footprint, but the operating costs are similar to gas.

Daikin claim a COP of 4 for their product (probably a best case scenario). This would require around 4,500kWh of electricity, or more likely 6,000kWh at a COP of 3, which would cost £935 at current rates, which is of the same order as the current gas annual cost for the church of £770.

Although it is a 21% price increase, if the electricity is procured from 100% renewable sources this would lower the church hall's carbon footprint by 3.2 tons per annum.

The cost of offsetting this amount of carbon (e.g. by tree planting) varies widely between different organisations, types of carbon generating activity and cost model. Climate Stewards, who organise tree planting schemes, use a figure of £20 per ton offset. £770 + (3.2 x £20) = £834. An AAHP may be slightly more expensive to run than gas + offsetting cost at £935 – but it is a similar order of cost.

A second reason in favour of installing AAHPs is that they can operate in reverse to supply cooling in the summer. As longer periods of heat look likely as the UK climate continues to warm, installation of AAHPs would allow the church hall to become a cool community asset during the summer. This would be especially useful for meetings held during the day.

Although this would increase the electricity bill more by running the pumps for cooling, you could ask users of the building to donate to offset the heat!

https://www.greenmatch.co.uk/blog/2015/09/the-pros-and-cons-of-an-air-to-air-heat-pump

https://www.daikin.co.uk/en_gb/product-group/air-to-air-heat-pumps.html

It is envisaged that the existing heaters could be replaced by AAHP units. The external modules could be hidden behind low hedges or similar shrubs, forming a boundary to the parking area.

7. Energy Saving Recommendations – Building Fabric

7.1 Roof Insulation

There is an existing ceiling with void above. The church hall is already in regular use and thus is worthwhile to insulate. The inspecting architect should be consulted to ascertain whether the existing ceiling structure is safely accessible to install insulation.

7.2 Doors: Draughtproofing Measures

External doors to the building should be kept well maintained and draught proofed. Any gaps will result in a large amount of cold air is coming into the church during cold and windy conditions, 24/7. Draughtproofing can save a considerable amount of energy.

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

For non-listed environments, cheaper methods of insulation include rubber E and P cross section strips, lining door edges with felt and other "home-made" interventions which should be made suitable for each particular door. The kitchen and rear doors would benefit from replacement with insulated security doors, the current single glazed/plywood panel doors are neither particularly secure nor insulated.

The small vertical step offers a location for a draughtproofing strip, as do the vertical white frame surfaces. The stonework appears to slope downwards away from the building and should not have any strip attached in order to continue to facilitate drainage.

7.3 Windows

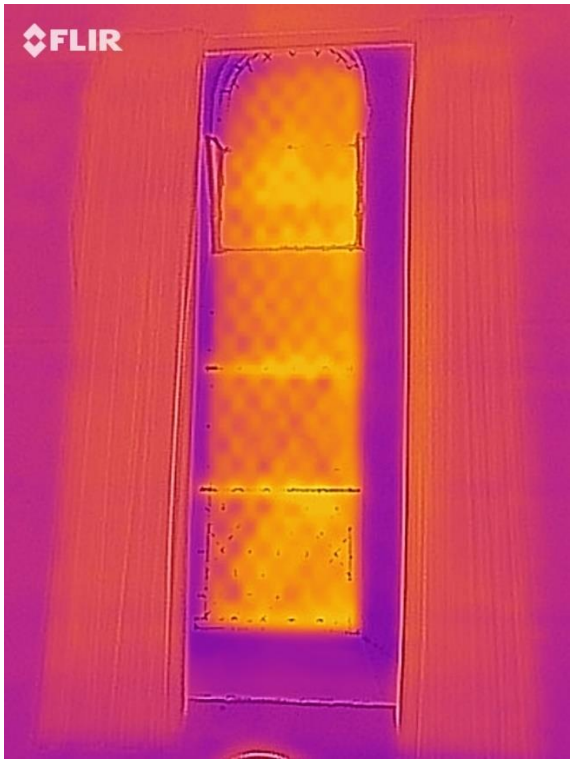
Windows should be kept well maintained. Where draughts can be identified in opening panels, these can be filled using plasticine which can easily be removed when required.

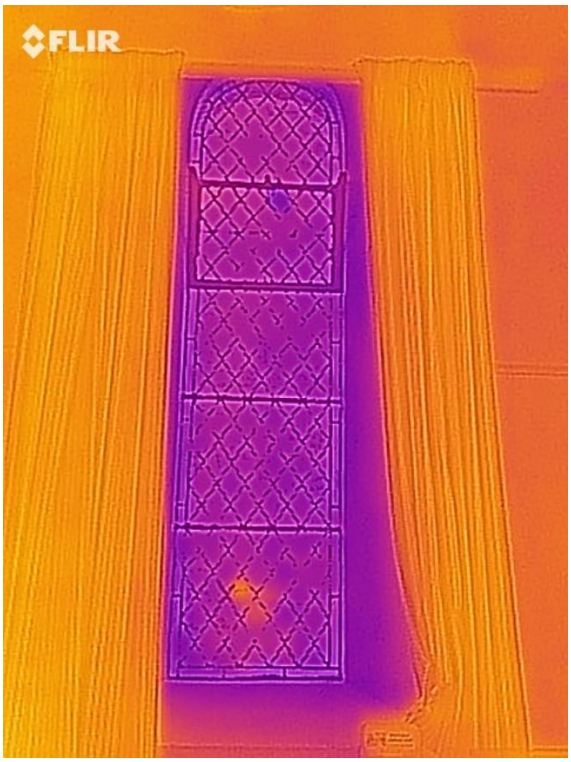
The east window of the south wall has an opening section which is bent so badly that there is a gap of over an inch allowing the hot air from the radiator immediately below to escape, and much cold air to enter. This opening light was found to be insecure in its frame.

The main east window (below, left) has a broken light at the top left next to the wall, with cobwebs helpfully illustrating the draught.

Hopper windows (above) often do not close properly and benefit from maintenance and draughtproofing measures. When it is considered that gaps, cracks and broken window panes allow cold air in constantly, they may account for 10% of more of building heat loss, especially where they allow heat to escape directly.

Each of the windows on the north and south sides are curtained. This gives the possibility of avoiding some heat loss, especially during winter evenings by closing the curtains. Use of heavier curtains which fit closely against the wall would help.





A south facing window (left) allows for solar insolation (the glass temperature is 16.3°C), whilst a north facing window (right) is losing heat (glass at 11.3°C). It is recommended that curtains are kept closed whilst the building is out of use.

The windows in the kitchen, which appears to be an extension to the 1828 building, could be replaced by double glazed units which would offer a security advantage as well as insulation. Small toilet windows can benefit from seasonal double glazing film.

8. Saving Recommendations (Water)

8.1 Tap Flow Regulators

It is recommended that tap flow regulators are installed for a well utilised building.

The flow rate of the taps can be easily regulated by fitting flow regulators within the taps It is recommended that flow regulators such as those manufactured by neoperl (

http://www.neoperl.net/en/) are fitted into all the viable hand wash basin taps to save on both water and heating of the hot water. Regulators can be self-installed or by any good facilities staff.

8.2 Reduce Toilet Flushing Volume

This can be achieved either by installing a duo flush cistern, or (cheaply) by reducing the flushing volume using a toilet hippo, or alternatively placing some suitably sized glass jars full of water (with lids) in the cistern.

9. Other Recommendations

9.1 Electric Vehicle Charging Points

The church hall has a car park adjacent which serves the church and the frequently used church hall. 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

10. Renewable Energy Potential

The potential for the generation of renewable energy has been reviewed and the viability noted.

Renewable Energy Type	Viable
Solar PV	No - listed building, visible roof
Battery Storage	No
Wind	No
Micro-Hydro	No
Solar Thermal	No
Ground Source Heat Pump	No – no radiator network
Air Source Heat Pump	Possible air to air installation, Section 6.3
Biomass	No – small, irregular load

11. Other Recommendations

11.1 Carbon Offsetting

There are a number of carbon offsetting schemes available. The Church of England often works with Climate Stewards (www.climatestewards.org), whose calculator has been used for illustrative purposes earlier in this report.

11.2 EcoChurch

A Rocha's EcoChurch programme is a very useful scheme offering a structure and resources for the church to improve its environmental performance and engagement in several areas including buildings, liturgy, children's work, creation care, lifestyle.

12. 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.

13. 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.

14. Report Circulation

In addition to the PCC, this report is also sent to:

1. Your DAC secretary and your DEO, because
   - They maybe be able to offer you help and support with implementing your audit
   - They want to look across all the audits in your diocese to learn what the most common recommendations are.
2. Catherine Ross and team, the officer in the Cathedral and Church Buildings team centrally who leads on the environment, who wants to learn from all the audits across the country. She will be identifying cost-effective actions churches like yours might be able to make.