Energy Audit and Survey Report

St Peter's Church, Caversham

"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
Matt Fulford	David Legge	1st August 2019	1.0

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1. Executive Summary

An energy survey of St Peter's Church, Caversham 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, Caversham is a Grade II* listed parish church dating back to 11th Century but with a predominantly Victorian interior. 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.

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?
Change existing lighting for low energy fittings in vestry	148	£17	£207	12.45	List B	
Adjust heating controls to match occupied times only	3,814	£429	Nil	Immediate	None	

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?
Consider revised heating options for the church	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 contracted prices of 13.85p/kWh for electricity.

If all measures were implemented this would save the church £445 per year.

2. Introduction

This report is provided to the PCC of St Peter's Church, Caversham 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 Peter's Church, Caversham is a Grade II* listed parish church dating back to 11th Century but with a predominantly Victorian interior. The church is only served with an electricity supply and have a mixture of under pew panel heating and overhead radiant heating units. The lighting has been upgrade to LED in the main body of the church.

An energy survey of the St Peter's Church, Caversham, The Warren, Caversham, Reading, Berks, RTG4 7AQ was completed on the 16th July 2019 by Matt Fulford. Matt is a highly experienced energy auditor with over 15 years' experience in sustainability and energy matters in the built environment. He is a chartered surveyor with RICS and a CIBSE Low Carbon Energy Assessor. He is a Member of the DAC in the Diocese of Gloucester and advises hundreds of churches on energy matters.

St Peter's Church, Caversham	
Gross Internal Floor Area	500 m^2

Listed Status	Grade II*

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

Services	8 hours per week
Meetings and Church Groups	2 hours per week
Other	10 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 electricity have been supplied by St Peter's Church, Caversham and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	13.85p/kWh	In line with current market rates
Night Rate	12.03p/kWh	In line with current market rates
Standing Charge	44.8394p/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. We would recommend that the church obtains a quotation for its electricity supplies from the Diocese Supported parish buying scheme, http://www.parishbuying.org.uk/energy-basket the next time it is looking at its supply contract. 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 Peter's Church, Caversham uses 31,881 kWh/year of electricity, costing in the region of £3,585 per year.

This data has been taken from the annual energy invoices provided by the suppliers of the site. St Peter's Church, Caversham has one main electricity meter, serial number E15UP13319.

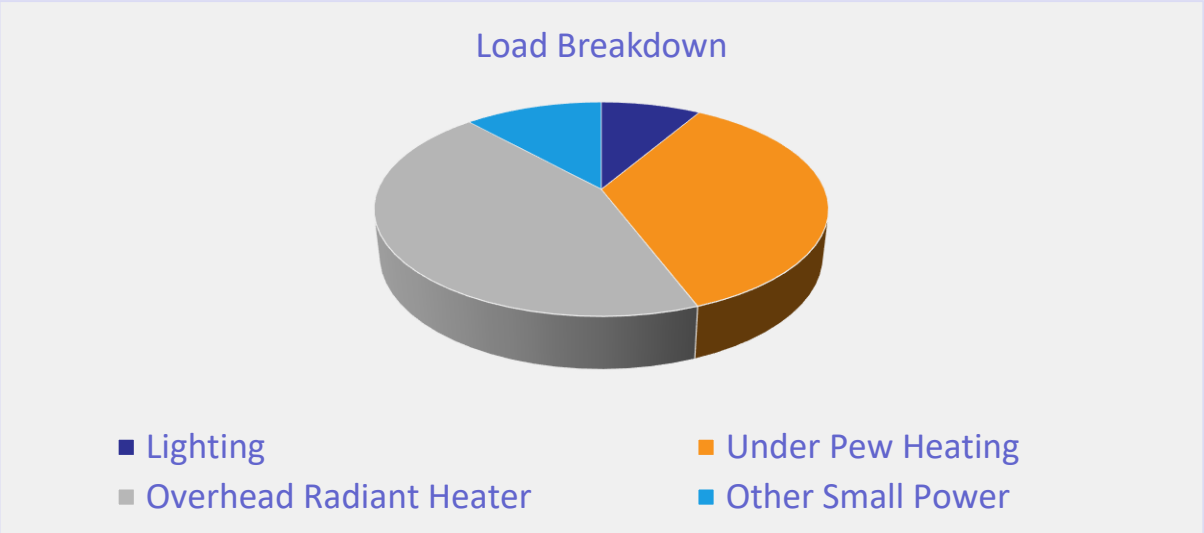
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	E15UP13319	3 phase 100A	Y	Corner of Vestry

All the meters are AMR connected and as such energy profile for the entire energy usage should be possible. It is recommended that the church consider asking their suppliers to provide access to the half hour energy data that should be available from this meter so that the energy profile can be examined in detail.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Mainly LED and CFL lighting inside the church	8%
Under Pew Heating	73nr 500W under pew heaters.	36%
Overhead Radiant Heater	15nr 3kW Overhead radiant heaters	44%
Other Small Power	Kitchen appliances, sound system and other appliances	12%



As can been seen from this data, the heating (both overhead and underpew) makes up by far the largest proportion of the energy usage on site.

4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St Peter's Church, Caversham uses 62% less energy than would be expected for a church of this size.

	Size (m^2 GIA)	St Peter's Church, Caversham use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Peter's Church, Caversham (elec)	500	63.76	20	10	219%
St Peter's Church, Caversham (heating fuel)	500	0.00	150	80	-100.00%
TOTAL	500	63.76	170	90	-62%

It can be seen that St Peters is already an efficient church due to its low energy lighting installation and use of an efficient direct electrical heating strategy. The issue is therefore less about how to further save energy but how the changing needs of the church can be met in a way that provides adequate comfort. One significant issue at the moment is the electrical capacity in the church as the current heating system is over-loading the supply when it is all on.

5. Energy Saving Recommendations

5.1 Lighting (fittings)

The main body of the church has had LED flood lights installed within it some years ago and has also converted its PAR38 spots to low energy compact fluorescent units. While the church should be commended for its positive action in installed LED lighting unfortunately the specification of the LED floods was poor in that the colour rendering installed is far too blue (around 6000K) for the church environment and there is also no anti-glare diffuser on the units. In the long term the church's appearance could be improved by replacing these units with a flood light that has a colour rendering of around 3000K and has full antiglare diffusers.

The only remaining lights within the church that would benefit from replacement to a lower energy unit is the two strip lights within the vestry. 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/.

5.2 Controls

The heating is controlled via a domestic style 7 days programmer in the vestry. The notice next to this shows that the heating is set to come on for several hours each day.

The heating is only required to provide comfort for any people inside the church, the fabric of the church does not need nor will it benefit from the heating being on, any background heating times should therefore be removed. The times of the heating programme appear to be much longer than the reported use of the church and should be reviewed to ensure that the heating is only on at times when the church is occupied. As both the under pew and overhead heaters are there to warm the people (not the whole body of air in the church) they only need to be turned on around 15 mins prior to a service or event and can be turned off immediately at the end of the church being occupied.

5.3 Revised Heating System

The current system has overhead radiant heaters, most of which are mounted too high to be in their ideal operating range, and under pew heaters that do not cover the entire length of the pews. The overhead heaters are relatively high power and the use of all of them overloads the system. In terms of useful heat output compared to electrical input they are not ideal.

The church is considering reordering plans which could see some or all of the pew removed.

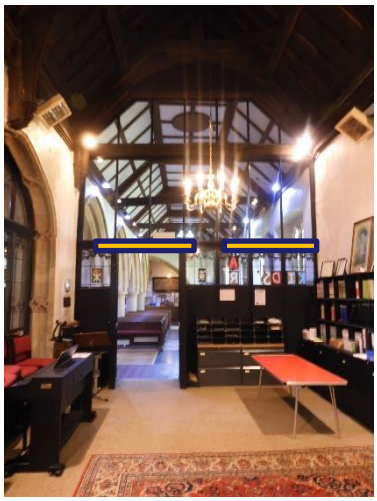
Vestry

The vestry currently has three overhead radiant heaters within it (only two are used). This is excessive and not that useful for this sort of place. It is recommended that electric panel heaters could be more useful in this space. 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.

This would free up some capacity for heating elsewhere.

Choir Vestry

The choir vestry currently has four overhead units within it (only three are used). These are again mounted rather too high to be totally effective. It is recommended that more linear bar, far infra-red heaters could be fixed onto the horizonal sections of the screens to provide better heating located closed to the people and without the red glow. Such heaters could be https://www.warm4less.com/p/2.4kw-delta-bar-heater-w-controller/ and four of these roughly located as indicated on the photos below, would used 9.6kW compared to the 9kw – 12kW currently provided but produce much more useful heat to the space.



Sanctuary and Choir

The sanctuary is currently heaters via 4 wall / oil filled heaters. These could be replaced for far IR panel heaters as recommended for the vestry above that will provide more useful heat for lese electrical input therefore freeing up capacity.

The under-pew heaters in the choir stall is a sensible approach and should be retained ensuring that there is an under-pew heater under all lengths of pews.

Main Door

There is an overhead unit above the main door. Again, this is rather too high to be effective and this type of heater is also less useful where there is moving air and therefore its output will be noticeably less in this location. It is recommended that this unit is replace with an over door air heater could be. This would also help to provide warmth to the rear of the church. Such an over door unit should be sized to cover the whole width of the door and it is suggested the BN Thermic 860 model would be quite suitable. The remaining over head heaters to the west end of the church could then be removed.

Lady Chapel

The lady is currently heaters via four overhead radiant heaters. These could be replaced for far IR panel heaters fixed to the lower levels of the walls as recommended for the vestry above that will provide more useful heat for lese electrical input therefore freeing up capacity.

Nave and Side Aisles

The pews to the nave and side aisles are currently heated with 500W under pew heaters but there are under every other pew section at the moment.

There are plans to remove some pews and to adjust the level of the floor at the west end. If the pews to the side aisles are removed then these spaces could be heaters with the far IR panel heaters as suggested for various areas above. The under-pew heaters could then be moved to provide heating under all of the pews in the central nave area.

Removing the pews from the central nave area then makes the heating of the church rather challenging. The churches fabric is no where near thermally efficient enough for underfloor electric heating to be sufficient to provide any comfort. The continued use of overhead units is not likely to deliver satisfactory comfort levels as the units have to be located far too high to be effective and

there would be no pews on which to mount small panel heaters. Trying to heat the entirety of the air volume in this space will require a large input of heat (requiring a definite increase in the electrical supply capacity to the church) and will require some fans (with their associated noise) to transfer the heat into the space. From a heating point of view the retention of the pews to the central nave area is infinitely preferable.

If it is chosen to remove the pews to the central nave area then the only real option for heating this space would be to installed electric fan heaters in four lines down the nave (one in line with the nave arches and one down the line to the edge of the pew platforms to the current aisle on each side). These would be recessed into the flor using the void under the current pew platforms and a unit such as www.trenchheating.com/electrofan.php could be used. This will have a fan noise associated to it and when the fan is not running the comfort levels will drop.

While it is frustrating for those considering the future use and flexibility of the church to have to consider rather technical matters of heating as an intrinsic part of the pew removal debate all taking part in this debate are encouraged to give serious consideration to how any flexible space created will be able to be enjoyed in terms of thermal comfort by its occupants as the removal of the pews in the central area poses considerable issues in having a pack of any suitable area in which to fix heating systems to provide such comfort.

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	Yes – to south pitch of nave and chancel roofs
Battery Storage	Yes
Wind	No
Micro-Hydro	No
Solar Thermal	No – no major hot water demand
Ground Source Heat Pump	No – archaeology in ground
Air Source Heat Pump	Yes - but unlikely to be successful in providing efficient comfort levels
Biomass	No – major issues with air quality as well as delivery and storage of fuel

There is potential for a small PV array on the roof of the tower or on the roof of the south nave and chancel slopes. 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 6) 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.

An air source heat pump could be described as being theoretically possible in this church but it would require a complete underfloor heating system to be installed across the whole area of the church and then these systems only really work successfully in a well-insulated and airtight building, the church does not have those attributes. The system would also need to be on 24/7 and would have running costs around 3 times those of the current system. We would not recommend an air source heat pump as a solution within this church and if the PCC is considering this approach we would advise them to visit Oddington Church near Stow on the Wold (Diocese of Gloucester) and speak to the church wardens their about their experience with such a solution.

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.