Energy Audit and Survey Report

St Luke's Church, Cheltenham

PCC of St Luke's

Version Control

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1. Executive Summary

An energy survey of St Luke's Church, Cheltenham was undertaken by ESOS Energy 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. This audit has been provided in conjunction with 2buy2, the Church of England's Parish Buying scheme provider and is subsidised from Total Gas & Power, the Parish Buying schemes principal energy suppliers.

St Luke's Church, Cheltenham is a large Grade II parish church dating back to 1854 in a town environment close to a district hospital site. 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	CO2 saving (tonnes of CO2e/year)
Investigate changing gas and electricity suppliers	None	£600	Nil	N/A	None	None
Change existing lighting for low energy lamps/fittings	3,841	£665	£3,977	5.98	List B	1.18
Install Endotherm advanced heating fluid into heating system	4,387	£205	£1,280	6.23	List A	0.81
Insulate exposed pipework and fittings in plantrooms	2,193	£103	£700	6.82	List A	0.40

Medium Term: Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Simple Payback (years)	Permission needed	CO2 saving (tonnes of CO2e/year)
Fit insulation to under pew platforms, bell floor and to nave roof when re-roofed	4,387	£205	£3,000	14.61	List B	0.81
Fit Quattroseal draft proofing to historic doors	877	£152	£800	5.26	List B	0.27

Long Term: Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Simple Payback (years)	Permission needed	CO2 saving (tonnes of CO2e/year)
Consider PV panels with battery storage on nave roof when re-roofing.	8,771 (based on 10kWp array)	£1,519	£14,000	9.22	Faculty	2.69

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

Based on current contracted/market prices of 17.32p/kWh and 4.68p/kWh for electricity and mains gas respectively.

If all measures (excluding PV) were implemented this would save the church £1,331 per year.
(Note: this excludes any double counting of any reduce energy rates)

2. Introduction

This report is provided to the PCC of St Luke's Church, Cheltenham 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 Luke's Church, Cheltenham, St Luke's Road, Cheltenham, GL53 7JJ was completed on the 22nd November 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 Luke's Church, Cheltenham	
Gross Internal Floor Area	450 m^2 (estimated)
Listed Status	Grade II
Typical Congregation Size	100+

The church typically used for 7 hours per week for the following activities

Services	4 hours per week
Meetings and Church Groups	0 hours per week
Community Use	3 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 have been supplied by St Luke's Church, Cheltenham and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	17.321p/kWh	Above current market rates
Night Rate	17.321p/kWh	Above current market rates
Standing Charge	£6.12/month	N/A

The current gas rates are:

Single / Blended Rate	4.68p/kWh	Above current market rates
Standing Charge	£6.12/month	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 CofE parish buying scheme, https://www.parishbuying.org.uk/index.php/categories/energy/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 Luke's Church, Cheltenham uses 11,261kWh/year of electricity, costing in the region of £1,950 per year, and 43,868kWh/year of gas, costing £2,053.

This data has been taken from the annual energy invoices provided by the suppliers of the site. St Luke's Church, Cheltenham has one main electricity meter, serial number E2041472. There is one gas meter serving the site, serial number M016A0868911A6.

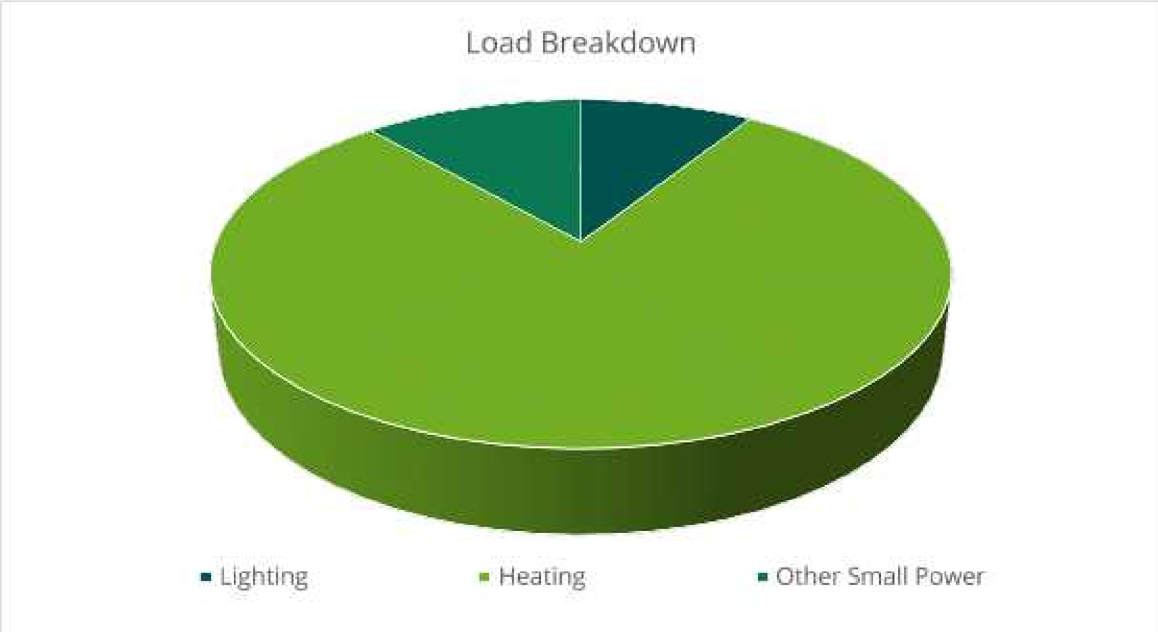
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	E2041472	Not seen	Unknown	Unknown
Gas – Church	M016A0868911A6	Itron MDA16	Capable but not connected	Boiler room

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	Mainly flood and spot lighting throughout the body of the church	9%
Heating	Gas fired heating into church via radiators around the perimeter	80%
Other Small Power	Electric heaters in office area, kitchen and office appliances, organ, sound equipment and the like.	11%



As can be seen from this data, the heating makes up by far the largest proportion of the energy usage on site.

4.2 Energy Benchmarking

In comparison to national benchmarks[1] for Church energy use, St Luke's Church, Cheltenham uses 25% more electricity but 35% less heating energy than would be expected for a church of this size.

	Size (m² GIA)	St Luke's Church, Cheltenham use kWh/m²	Typical Church use kWh/m²	Efficient Church Use kWh/m²	Variance from Typical
St Luke's Church, Cheltenham (elec)	450	25.02	20	10	25%
St Luke's Church, Cheltenham (heating fuel)	450	97.48	150	80	-35%
TOTAL	**450**	**122.51**	**170**	**90**	**-28%**

The lower than expected gas consumption will be down to the new efficient gas boilers that have been installed and the fact that the heating is only turned on when required. The higher than expected benchmark for electrical consumption is an outcome of the inefficient lighting within

[1] CofE Shrinking the Footprint – Energy

the church and the use of electrical heaters in the more frequently used office area. The recommendations within this report will help to make significant reductions to the electrical usage.

5. Energy Saving Recommendations (Electricity)

5.1 Lighting (fittings)

The lighting makes up a significant proportion of the electrical usages within the church and all areas are lit by inefficient fittings.

The side aisles are lit by halogen flood lights which can be easily changed for much lower LED versions. Within the Nave and Chancel there are high energy wall lights with an up and downlight component. It appears as if there are fittings inside the casing would could be changed for lower energy LED units but this would require further investigation and inspection of the fitting.

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 £3,977. The annual cost saving would be £665 resulting in a payback of around 6 years.

5.2 Other Electrical Saving Measure

Whilst not a primary recommendation of this report, it should be noted that it is possible for the electric panel heaters to the office and other locations within this church to be changed for slightly more efficient versions. Suitable modern and efficient electric panel heaters would be 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 can not be left on accidently after use.

6. Energy Saving Recommendation (Heating)

6.1 Heating System and Strategy

The church has a good gas boiler heating arrangement which was installed in April 2012 and consists of two Ideal iMax xtra F80 condensing boilers which serve radiators around the church. The church advises this provides adequate comfort and is only set to be on for when the church is occupied. This arrangement should be expected to last another 15 to 20 years.

As this is a system which operates well and has relative high efficiency standards it is not recommended that this should sought to be changed for any other system, renewable or otherwise, at this stage, doing so is likely to involve creating greater carbon emissions from the manufacture of new equipment and disposal of the existing. Consideration of suitable low carbon technologies should be given when this is due to for replacement by which time technological developments may well have advances so advice on current technologies in this regard is superfluous.

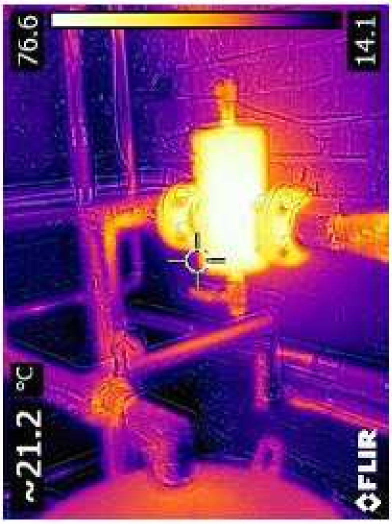
6.2 Endotherm Advanced Heating Fluid

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 in 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 self-installed.

6.3 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 through ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com).

7. Energy Saving Measures (Building Fabric)

7.1 Roof Insulation

The roof to the chancel has been insulated with the re-roofing works that have occurred there in recent years. The positive effect of this is notable with thermal image inspections within the building. The Nave roof is due to replacement in the coming years and insulation should be incorporated with those works too.

The bell floor above the tower should be insulated as this can be the source of much heat loss and draughts as warm air is sucked up the tower.

There is also an area under the timber pew platforms which is both accessible and un-insulated. This will be the source of uncomfortable cold draughts and insulation should be installed between the floor joist from underneath to help to improve the heat loss and the draughts from the floor.

7.2 Draught Proofing to Doors

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.

Where a timber door closes against a timber frame it is recommended that draught proofing is fitted. 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. Note this cannot be used where the timber door closes directly against a stone surround.

Other simple measures such as using a small fridge magnet painted black over the large keyhole or the use of 'sausage dog' type draught excluders at the base of little used doors can prove to be very effective. Doors should be reviewed in daylight and gaps where the light shines through sealed or filled in whatever the most appropriate way is for the specific door.

8. Other Recommendations

8.1 Secondary Glazing to the Office Window

While not normally a measure that is aesthetically viable within a church building (and a measure that is not a primary recommendation of this report), secondary glazing to the office window would be worth exploring. This would need to be very carefully specificed and companies such as https://www.selectaglaze.co.uk/heritage-listed-buildings can provide very discrete and appropriate systems. The window in the office is not a key window within the church and its more regular use and need for comfort would result in meaningful improvements in comfort and heat loss within this specific space.

9. 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	Maybe - visible roof
Battery Storage	Possibly is PV is viable
Wind	No – no suitable land away from buildings
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Ground Source Heat Pump	No – archaeology in ground and radiator system
Air Source Heat Pump	Not currently – review again when heating system approach end of life
Biomass	No – not enough heating load as well as air quality issues

Now that the Feed in Tariff scheme has come to an end the installation of solar PV panels in situations where there is not almost full usage of the electricity generated on site is not really viable. The current usage of the church would not support the viability of a PV array and the feasibility on the church hall is much better and this is where efforts should be focused..

There is a possible potential for a PV array on the south facing nave roof that could be considered at the time of re-roofing. This is a visible roof and it would therefore not normally be considered acceptable but if the re-roofing design could be as such that the panels were flush and flashed into the surrounding tiles the nave roof could possibly be discrete enough for it to be considered. In any event the church will need to demonstrate that the usage would support the need and viability for PV generation and that all steps had been taken to reduce the demand of electrical energy first (such as the full installation of LED lighting).

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.

10. Funding Sources

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 .

11. 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.

12. 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, 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.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
External	2	100W LED Flood	£157.97	£244.00	1.54
Side Aisle	10	50W LED Flood	£85.91	£913.00	10.63
Nave and Chancel	10	50W LED Flood	£206.47	£913.00	4.42
Nave and Chancel	24	AR111 LED	£119.72	£1,068.96	8.93
Nave and Chancel	8	R63 LED	£68.56	£171.92	2.51
Office Area	2	5ft Single LED	£19.68	£187.40	9.52
Office Area	2	2D LED 11W	£7.04	£109.10	15.50