ESOS-ENERGY
Energy efficient solutions

Energy Audit and Survey Report

St Catherine's Church, St Catherine's Drive, Faversham

Version Control

Author	Reviewer	Date	Version
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1. Executive Summary

An energy survey of St Catherine's Church, St Catherine's Drive, Faversham 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 scheme's principal energy supplier.

St Catherine's Church, St Catherine's Drive, Faversham consists of a Norman core built on the site of a Saxon church, with 13th century additions, tower and windows and Victorian aisles. Only electricity 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?
Repair hopper windows on north aisle and choir vestry					List A / List B / Faculty	PCC
Ensure door draughtproofing is sufficient					List A / List B / Faculty	Warden / verger
					List A / List B / Faculty	
					List A / List B / Faculty	

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?
Replacement of light bulbs with LEDs.					List A / List B / Faculty	
					List A / List B / Faculty	
					List A / List B / Faculty	
					List A / List B / Faculty	

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 11p/kWh and 3p/kWh for electricity and mains gas respectively.

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

2. Introduction

This report is provided to the PCC of St Catherine's Church, St Catherine's Drive, Faversham 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 Catherine's Church, St Catherine's Drive, Faversham, was completed on the Wednesday 6th November by. 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 Catherine's Church, St Catherine's Drive, Faversham	
Gross Internal Floor Area	350 m^2
Listed Status	Grade II*
Typical Congregation Size	60

The church typically used for 5 hours per week for the following activities

Services	4 hours per week
Meetings and Church Groups	1 hours per week
Community Use	0 hour per week

Total annual use 260 hours. Heating hours (7/12) 150 hours.

The congregation has recently grown by 12%, a mixture of returnees and new people

3. Energy Procurement Review

Energy bills for electricity have been supplied by St Catherine's Church, St Catherine's Drive, Faversham and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	p/kWh	In line with / Below / Above current market rates
Night Rate	p/kWh	In line with / Below / Above current market rates
Single / Blended Rate	p/kWh	In line with / Below / Above current market rates
Standing Charge	p/day	N/A
Availability Charge	p/kVA	N/A
Meter Charges	p/day	N/A

The current gas rates are:

Single / Blended Rate	p/kWh	In line with / Below / Above current market rates
Standing Charge	p/day	N/A
Availability Charge	p/kVA	N/A
Meter Charges	p/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 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.

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.

A review has also been carried out of the taxation and other levies which are being applied to the bills. These are:

VAT	5% / 20%	The correct VAT rate is being applied/ The organization is

		understood to be a charity and therefore should be benefiting from only be charged a 5% VAT rate. A VAT declaration should be sent to the supplier to adjust this.
CCL	100% charged / not charged / reduced % rate charged	The correct CCL rate is being applied. / As the organisation is being charged the wrong VAT rate, they are also being charged CCL which should not be applied as they are a charitable organisation, domestic users (including children's homes/hospices/student accommodation and care homes) or users consuming less the 1,000kWh of elec and/or 4,397kWh gas per month. Sending the supplier a VAT declaration will remove this charge.
FiT	100% charged	A FiT charge is being applied. It should be checked that this is being charged in accordance with the supply contract.

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

The above review has highlighted that VAT and CCL are being charged when the organisation is understood to be a charity and have VAT exemption status. As such the PCC of St Catherine's Church, St Catherine's Drive, Faversham should send the supplier at VAT declaration confirming this and check all supplies on other sites.

4. Energy Usage Details

St Catherine's Church, St Catherine's Drive, Faversham uses 0,000,000 kWh/year of electricity, costing in the region of £1,600 per year.

This data has been taken from the annual energy invoices provided by the suppliers of the site (see Appendix 2). St Catherine's Church, St Catherine's Drive, Faversham has one main electricity meter.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	E18UP14286	EDMI Atlas Mk10D	2 pulses	Choir vestry at rear of church

All the meters are AMR connected and as such energy profile for the entire energy usage should be possible.

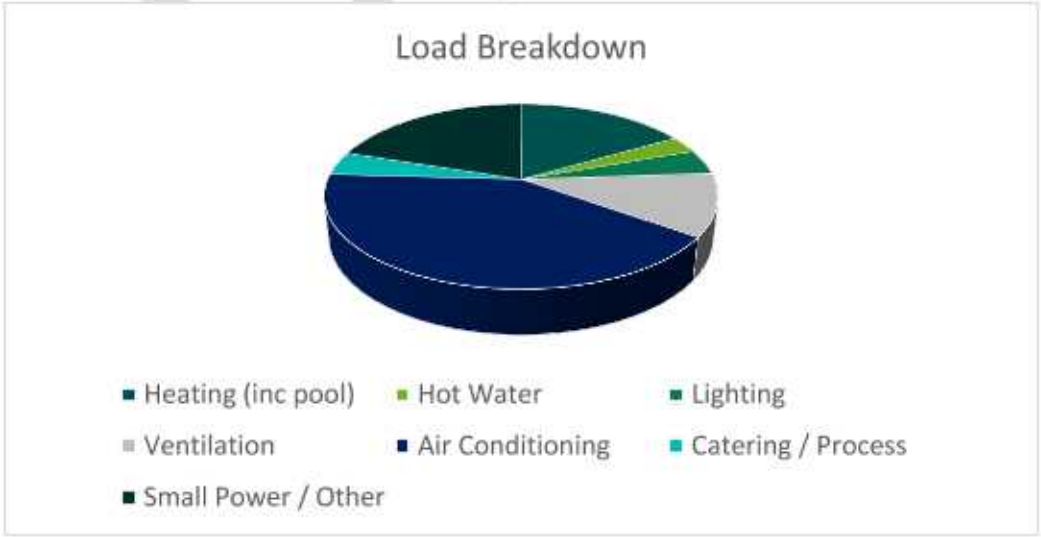
4.1 Energy Profiling

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

The church annual use is estimated at 260 hours. Assuming that heating is operative for 7 months per annum gives 150 heating hours.

Service	Description	Power	Annual Use/ kWh	Estimated Proportion of Usage %
Lighting	5-10 years old, thought to be mix of halogen and CFL. Nave and aisles, 11 downlights above pillars Chancel 5 spotlights One floodlight	 1100W 500W 250W	 480	20-X%
Heating	Overhead radiant electric, 30 elements			80%
Hot Water	Kettle 10 boils of 3 minutes/ week x 50 weeks	3kW	75	
Other Small Power	Organ. Electronic Keyboard Photocopier (small) Portable electric heater (rarely used)	500W 300W 500W 2kW	30 3 1 20	X%

Awaiting electric bill info



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 lighting.

4.2 Radiant Heating System

Heating is provided by five overhead rings of six radiant heaters in the nave / aisle area and a further two in the chancel which are rarely used. These are arranged to appear as a chandelier; thus the glowing effect of the traditional visible/IR radiant heaters is considered acceptable. Located level with the column capitals, they appear visually compatible with the surroundings.

The heaters are extremely effective at delivering heat rapidly, and the location, hung from the arch centres is directly over the main area of pews. When seated at the focus of a ring, a person will be exposed to the greatest concentration of heat – people are encouraged to move to the position where they feel most comfortable. The optimum position (height) is governed by aesthetic considerations (the height of the column capitals, for alignment), whereas the attachment point is fixed by the arch locations. Some individual elements have been isolated where they are very close to the rear wall.

Heating is typically used for two hours on a Sunday. On 3/11/19, only two out of seven rings were needed

If the elements were to be switched in pairs or threes, this would give control over the level of heat delivered which could then be modulated according to the temperature and occupancy pattern. It would add to wiring and switching costs but if each switch was connected to a pair of elements per chandelier, three levels of heat control would be achieved.

The system has been installed for approximately a year to replace the previous oil fired boiler which served a network of (very old) cast iron radiators and surface mounted 2 inch diameter pipework, which constitutes a trip hazard. These fittings are to be removed and sold.

Reports are that it is successful with the congregation, provided that they are not seated at the focus of six elements as can occur in a couple of spots. The Archdeacon of Maidstone, The Venerable Stephen Taylor is reported to be very enthusiastic. There is another system in the area, where pendant lighting is also hung off the same chandelier arrangement. [This has two added bonusses – lights close to congregation giving higher Lux levels in the pews, and they are within a safe distance of the floor (3m) to be changed by volunteers]. An independent report from a local member of the congregation shows the system drawback – your head gets hot!

It is suggested that the Diocese of Canterbury (possibly the DEO) monitors this installation over time with regard to congregation comfort, operating costs and if there any effects on the fabric.

Costs were approx. £18k for the heaters and £5k to install a three phase electricity supply.

The previous heating system was run from an oil fired boiler, giving a high rate of CO_2 production per kWh of heat and long warm up times.

4.3 Energy Benchmarking

In comparison to national benchmarks[1] for Church energy use, St Catherine's Church, St Catherine's Drive, Faversham uses xx% more electricity and xx% less heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	St Catherine's Church, St Catherine's Drive, Faversham use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Catherine's Church, St Catherine's Drive, Faversham (elec)	350	X	20	10	%
St Catherine's Church, St Catherine's Drive, Faversham (heating fuel)	350	Y	150	80	%
TOTAL	350	Z	170	90	%

[1] CofE Shrinking the Footprint – Energy

5. Energy Saving Recommendations (Electricity)

5.1 Lighting (fittings)

The lighting is stated to be 5 to 10 years old and is assumed to consist of halogen bulbs.

On the day of the audit, Lux levels between 100 and 250 were recorded; this is good however there was strong sunlight at 10am, so levels in dull weather or darkness are unknown.

Future replacement should use LED lights which have an estimated 15 to 20 year lifespan compared to around 5 years for halogen bulbs. Replacement by LEDs will lead to less frequent changes and thus reduce access charges.

The chancel is lit by spotlights and one floodlight.

For the spot lights the Megaman range of LED spot (reflector) lights https://www.megamanuk.com/products/led-lamps/reflector/ provides some very suitable substitutes to the current lamps.

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 £XXX. The annual cost saving would be £XXX resulting in a payback of around XXX years.

In this case the £150 grant available through this process could be very usefully employed to fund the purchase of replacement LED lamps.

5.2 Lighting (control for internal lights)

Control for future lights should allow for the light level to be varied.

This could be achieved with a small number of switches as follows:

Instead of having a separate switch for each aisle and each side of the nave (four switches), so the aisle lighting is either on or off, if each switch controlled front / centre / rear lights then it allows each area; the two aisles or the nave to have three or four levels of lighting (currently there are lights installed above each of the three sets of columns).

6. Energy Saving Recommendation (Heating)

6.1 Heating System and Strategy

The church currently uses overhead infrared heaters to heat the church. This is reported to work well and provides adequate thermal comfort into the church. Given that the system is successful and not overly wasteful of energy we would recommend that this system is continued with and consideration is given to the following option if necessary.

If it is found in time that there are areas of the church where the overhead heaters are unsuitable, a small area of pews could be fitted with under pew heaters.

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 should be in armoured cable or FP200 Gold when above ground.

7. Energy Saving Measures (Building Fabric)

7.1 Draught Proofing to Doors

There are a number of external doors in the building. These have historic timber doors on them.

The west door has a draught and water excluder fitted. It is presumed that this door is used rarely, if so it should be kept draught free. The north porch door as main entrance has two sets of doors, the internal ones closing against a wooden frame. This gives the option for adequate draught proofing.

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 can not 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 key hole 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.

7.2 Windows

This window in the north aisle (above) is a source of draughts. The hopper window (second panel up) is broken, only one of the support bars is still in place and the hinged section appears to not be fully closed. It may well be suffering from "rust jacking" where rust (of greater volume than iron) builds up in the crack and forces the window inward. Gaps can be filled temporarily with black plasticene (which will cause no damage and can be easily removed). Repair of this window is recommended – including discussing if it can be reinstalled as a fixed panel.

A second window in the choir vestry (south west corner) is stuck open, behind temporary secondary glazing.

8. Saving Recommendations (Water)

8.1 Tap Flow Regulators

When a toilet is added to the church it is recommended that the tap is fitted with a tap flow regulator so that it cannot be left running.

Rather than installing hot water, it is suggested that detergents specifically designed for washing hands in cold water are provided.

9. Other Recommendations

9.1 Health and Safety Issues

As discussed, there are places where the redundant surface pipework constitutes a trip hazard and should be removed.

10. 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 – insufficient demand, visible roof
Battery Storage	No – no viable PV
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 – no wet heating system planned
Air Source Heat Pump	No – not required at present
Biomass	No – not enough heating load / frequency of use

Having reviewed the site it is not considered that renewables are not currently viable or needed.

The church should ensure that it purchases 100% renewable electricity and look to renew its lighting with an all LED system.

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, however the government proposes to introduce a "Smart Export Guarantee" to replace the Feed in Tariff.

In future, if the church experiences growth in use, and the SEG is in place, it would be worth exploring solar. There is potential for a small PV array on the almost flat roof of the south aisle.

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 4) would be worth considering if at all.

11. 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 .

12. 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.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
North Aisle	3	LED lighting in suitable luminaire delivering at least 100 Lux at pew level from each lamp	1/3 running costs plus 3-4x longer life		
Nave	6	As above			
South Aisle	3	As above			
Chancel	5 spotlights 1 floodlight	LED spotlights or floodlights as appropriate for area to be lit			
Choir vestry		As required – higher lighting level needed if any			

		office work is to be done in the room			