ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

Holy Trinity, Westcott

PCC of Holy Trinity

Author	Reviewer	Date	Version
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1. Executive Summary

An energy survey of Holy Trinity was undertaken by ESOS Energy 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.

Holy Trinity was constructed in 1852. The church also has a toilet and an upstairs meeting / store room. The church is heated by a Potterton gas fired boiler which has reached the end of its serviceable life. Heating is distributed via perimeter radiators and heating pipes within trenches. The main aisle has raised pew platforms and the church uses pews for seating during normal operation (pews removed during Covid-19 due to social distancing). The lighting is predominantly LED but there are still some inefficient T8 fluorescent tube fittings. There is both gas and electricity supplied to the site. The church has a number of ways in which it 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.

Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Payback (years)	Permission needed	CO2 saving (tonnes of CO2e/year)
Install Endotherm advanced heating fluid into gas heating system (if retained)	6,648	270	744	2.76	List A (None)	1.23
Change existing lighting for low energy lamps/fittings	333	46	1082	23.63	Faculty	0.08
Replace heating system for electrical based heating solution	52,826	818	21225	25.94	Faculty	8.81
Install PIR motion sensors on selected lighting circuits	16	2	114	52.31	List B	0
Adjust existing timer on external lighting	5	1	50	66.60	List A (None)	0

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

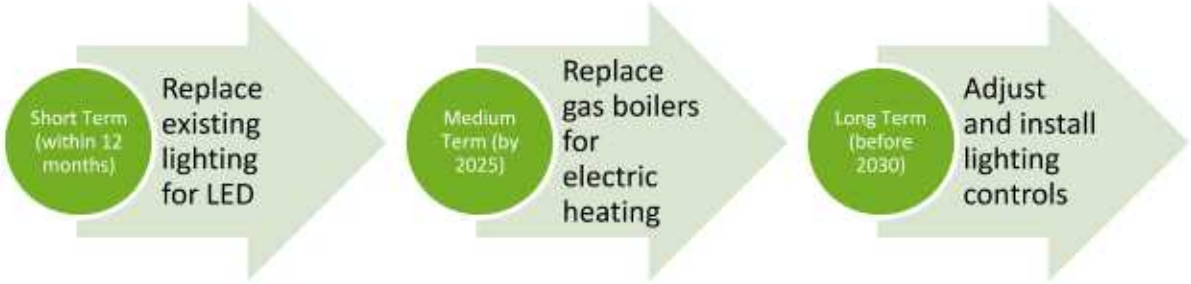
Based on current prices of 13.75p/kWh and 4.05p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church £1,137 per year.

2. The Route to Net Zero Carbon

The General Synod of the Church of England has indicated that the Church of England should be Net Zero Carbon by 2030. Every church, cathedral, church school and vicarage will therefore need to convert to be a net zero building in the next 10 years. Furthermore, the PCC of Holy Trinity has also declared a climate emergency and has an ambition to be carbon neutral by 2030 and has recently implemented a policy that will not allow the replacement of oil heating systems.

This church has a clear route to become net zero by 2030 by undertaking the following steps:



3. Introduction

This report is provided to the PCC of Holy Trinity to give them 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 Holy Trinity, Logmore Lane, Westcott Heath, Westcott, Dorking, RH4 3JZ. was completed on the 13th October 2020 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.

Holy Trinity	
Church Code	617134
Gross Internal Floor Area	467 m^2
Listed Status	Grade II*

The church typically used for 8 hours per week for the following activities

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	8 hours per week	120
Meetings and Church Groups	0 hours per week	n/a
Community Use	0 hours per week	n/a

There is additional usage over and above these times for festivals, weddings, funerals and the like

4. Energy Usage Details

Holy Trinity uses 4,303 kWh/year of electricity, costing in the region of £592 per year, and 66,484 kWh/year of gas, costing £2,696.

This data has been taken from the annual energy invoices provided by the suppliers of the site. Holy Trinity has one main electricity meter, serial number E14UP08311. There is one gas meter serving the site, serial number M016A04958 15 A6.

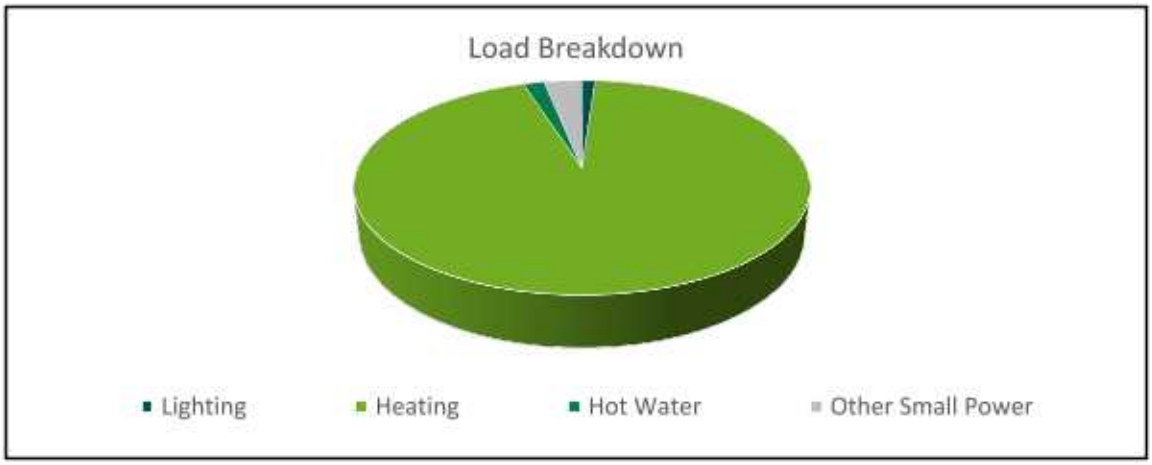
Utility	Meter Serial	Type	Pulsed output	Location
Electricity	E14UP08311	EDMI ATLAS MK7C	Pulse output, no AMR connected	Next to church entrance
Gas	M016A04958 15 A6	Itron MDA 16	Full AMR Connected	Gas meter cupboard at lych gate

It is recommended that the church consider asking their suppliers to install smart meter for the electric 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 consuming plant can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting	Predominantly LED lighting but still some inefficient T8 fluorescent tube fittings	1%
Heating	Provided by Potterton Diplomat gas fired boiler at end of life, distributed to column radiators within church	94%
Hot Water	Electric point of use water heater	2%
Other Small Power	Organ, sound system, mobile mast (sub-metered) and small plug-in loads	3%



As can been 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 for church energy use Holy Trinity uses 54% less electricity and 5% less heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
Holy Trinity (elec)	467	4,303	9.21	20.00	-54%
Holy Trinity (gas)	467	66,484	142.36	150.00	-5%
TOTAL	467	70,787	151.58	170.00	-11%

5. Efficient / Low Carbon Heating Strategy

The energy used for heating a church typically makes up around 80% to 90% of the overall energy consumption. Heating also often uses gas or oil as its primary fuel, these are fossil fuels with high carbon emissions and little opportunity to decarbonise in the future. Electricity currently has a carbon emission around the same level as mains gas, but the carbon emissions associated with electricity are reducing rapidly as the UK builds more renewable energy and decommissions it remain coal fired power stations. Mains gas does have some potential to reduce its carbon content through the use of bio-gas and hydrogen but these are less developed solutions and will be unable to deliver 'zero carbon mains gas'. It is therefore a critical element to review and set out a plan to make more efficient and less carbon intensive and one way to achieve this is to consider a transition to electrical heating where this also represents a more efficient and comfortable solution for churches.

5.1 Install Electric Heaters

The current heating system would be best replaced with an electric based heating system. Given the layout and use of the church, there are a number of types of electric heating that would be most suitable for the different spaces.

In the Lady Chapel, side aisles, vestry, the upstairs room and creche, the most suitable type of heater would be far infrared electrical panel heaters with a time delay switch. Suitable electric panel heaters would be far infrared panels such as https://www.warm4less.com/p/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.

These heaters have a strong radiative effect (where heat is reflected to people from the surface) as well as a light convective effect (where air is warmed and moves around to heat the general space). As such these heaters tend to provide a relative instant sense of heat and comfort within the space and only need to be on for short periods of time.

In the main Nave area, the type of heating would depend on the decision made with the pews, whether to retain them, or remove. If they are retained, as currently assumed, then we would recommend electric pew heaters. If removed, then moving to electrical heating provides more of a challenge to heat the central aisle space. To maximise the usage, the side aisle could utilise moveable chairs to allow for a more flexible space whilst all areas being able to be electrically heated.

The two most popular under pew heaters within churches are BN Thermic PH65 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 could run along the walls at low level and alongside the raised pew platforms (all cabling should be in armoured cable or FP200 Gold when above ground) to all rows of pews. Each pew heater to be switched with a neon indicated fused spur located underneath the pew seat.

The under pew (see photo below) and panel heaters have been recently installed at several churches including St Andrews Church, Chedworth, Gloucestershire, GL54 4AJ, which is open in daylight hours and can be viewed at any time.

The table below summarises the electric heating recommendations for this church.

Area	Type/ Size	Watts	Number Required
Lady chapel	Near IR Overhead Heater 3kW	3000	4
Side aisles	Electric Far IR Wall Panel 900W	900	8
Door	Overdoor air heater 6kW	6000	1
Nave - if pews are retained	Electric Under Pew 450W	450	36
Vestry	Electric Far IR Wall Panel 1200W	1200	1
Upstairs room	Far IR Overhead Bar Heater 1.5kW	1500	2
Creche	Far IR Overhead Bar Heater 1.5kW	1500	1

6. Improve the Existing Heating System

In the period before the replacement of the existing heating system, it is recommended that measures are taken to improve the efficiency of the existing heating system, this should include:

6.1 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 is 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.

7. Energy Saving Recommendations

In addition to having a revise heating strategy there are also a number of other measures that can be taken to reduce the amount of energy used within the church.

7.1 New LED Lighting

The lighting makes up a relatively small overall energy proportion of the electricity used within the church, and a few areas are lit by relatively inefficient fluorescent fittings.

It is recommended that the fittings scheduled in Appendix 1 are all changed for LED. 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/.

If all the lights were changed on a simple "like for like" the total capital cost (supplied and fitted) would be £1,082. The annual cost saving would be £46 resulting in a payback of around 23 years. This estimate includes for the supply of the lights, the labour to install them and the access required. It does not include for any upgrade to the wiring or a new lighting design both of which the church may wish to consider.

There are some fittings such as WC and store room where the existing fitting can be made more efficient by simply changing the bulb/lamp within the existing fitting to a new LED bulb/lamp. This could be carried out by competent members of the churches internal team, very cost effectively and would be a List A item, so no permissions would be required.

7.2 Lighting Controls (Internal)

There are several lights which currently remain on all the time in areas such as vestry, toilet areas, store room and the like. Some of these areas are only used occasionally and for a short amount of time and as such, the light does not need to remain on constantly. There are also spaces which benefit from a good amount of natural daylight coming in through the windows where artificial lighting is not required for much of the year during the day.

It is recommended that a motion sensor is installed on these specific lighting circuits so that the lights come on only when movement is detected in the space and turn off approximately two to five minutes after the last movement has been detected (note that the duration of the time lag after which the light goes off needs to be consider alongside the type of light that is fitted. LED lights are much more suited to being switched off after only a short duration than some fluorescent lights). These movement sensors (commonly called PIRs) also have light sensors integrated into them so they can be used to make sure that the light does not come on if there is already sufficient daylight in the space.

Your existing electrician or any NICEIC registered electrical contractor can install PIR sensors onto existing lighting circuits. This can be carried out without significant disruption to the use of the space.

7.3 External Lighting Controls

The external flood lights are currently on from 7pm to half past midnight. For efficient operation and to reduce light pollution and nuisance to neighbours it is generally recommended that external lighting is turned off between 11pm and 6am unless required for specific purposes.

It is therefore recommended that the existing timer is adjusted to switch off the external lights after 11pm also over the weekend if not required.

8. 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 – not sufficient demand, visible roof on a listed building
Wind	No – no suitable land away from buildings
Battery Storage	No – no viable PV
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Biomass	No – not enough heating load as well as air quality issues
Air Source Heat Pump	No – insufficient electricity supply
Ground Source Heat Pump	No – archaeology in ground and radiator system

9. 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 .

10. 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
Vestry	2	5ft Single LED	£15	£233	15.56
WC	3	LED GLS	£10	£36	3.43
Upstairs store	3	5ft Single LED	£12	£321	26.31
Upstairs store	4	PAR38 LED	£3	£68	21.02
creche	6	Virgo 15W (190mm dia)	£5	£278	55.30