ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

St Helen's, Hastings
PCC of St Helen's

Author	Reviewer	Date	Version
David Legge	Marisa Maitland	22nd February 2021	1.0

Contents

1. Executive Summary

An energy survey of St Helen's was undertaken by Inspired Efficiency Ltd to provide advice to the church on how it can be more energy efficient, provide a sustainable and comfortable environment to support its continued use, and move towards net zero.

St Helen's was built in 1869 to replace the original 12th Century church. The church is built of local brown stone with brick end walls and has gabled aisles and a tower to the SE corner. The church is heated by a gas fired boiler (installed in 2019) to radiators around the perimeter and under pew, and the lighting is a mixture of fluorescent and SON lamps in floodlight fittings. The church is only currently used for Sunday worship, with the neighbouring hall more frequently used (but not surveyed). 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 and the route to net zero carbon are 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)
Insulate exposed pipework and fittings in plantrooms	2,330	£95	£100	1.06	List A (None)	0.43
Install Endotherm advanced heating fluid into heating system(s)	4,661	£189	£480	2.54	List A (None)	0.86
Install PIR motion sensors on selected lighting circuits	4	£1	£18	29.24	List B	0.00
Install Draughtproofing to External Doors	1,398	£57	£2,400	42.32	List B	0.26
Add secondary glazing to windows	4,661	£189	£10,800	57.14	Faculty	0.86
Change existing lighting for low energy lamps/fittings	995	£170	£21,660	127.76	Faculty	0.25

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

Based on current market prices of 17.03p/kWh and 4.05p/kWh for electricity and mains gas respectively (due to age of utility prices provided from 2019).

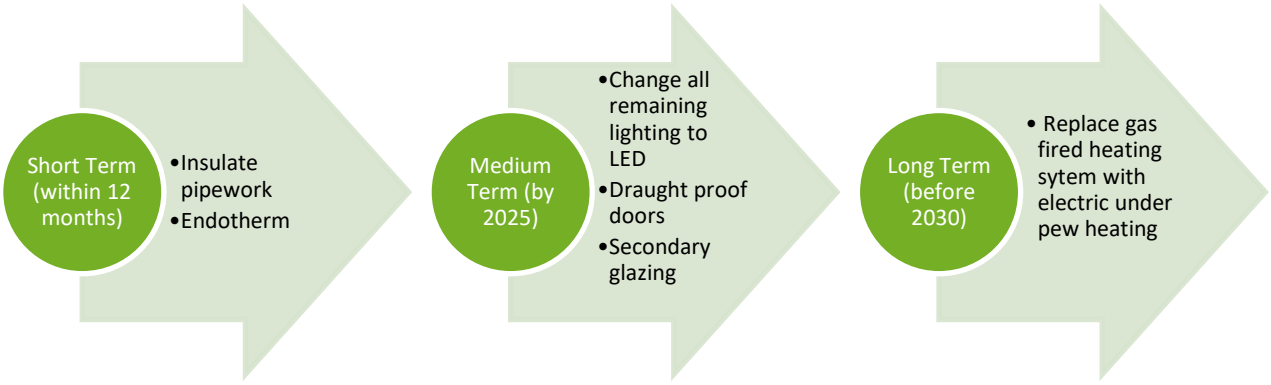
If all measures were implemented this would save the church £699 per year and reduce its carbon footprint by 2.66 tonnes (27%).

2. The Route to Net Zero Carbon

Our Government has committed to move towards Net Zero Carbon – the point at which we have reduced emissions as much as we can and then balanced any residual emissions through removal of carbon from the atmosphere. They have done this as part of a worldwide agreement which aims to limit global warming to well under 2 degrees Celsius, with an aim of keeping it below 1.5 degrees Celsius. This will help protect all of us from the impacts of climate change.

In February 2020, the Church of England's General Synod set its own Net Zero Carbon target. The first stage of this target covers energy used by churches, cathedrals, schools, vicarages, other church buildings, as well as emissions caused by reimbursed transport. The target date is 2030.

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 St Helen's 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 St Helen's Church, 311 The Ridge, Hastings TN34 2RA was completed on the 29th of 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.

St Helen's	
Church Code	610419
Gross Internal Floor Area	290 m^2
Listed Status	Unlisted

The church typically used for 2.5 hours per week for the following activities

Type of Use	**Hours Per Week (Typical)**
Services	2.5 hours per week
Meetings and Church Groups	0 hours per week
Community Use	0 hour per week

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

4. Energy Procurement Review

Energy bills for gas and electricity have been supplied by St Helen's and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	13.32p/kWh	Below current market rates
Night Rate	11.27p/kWh	Below current market rates
Standing Charge	21.38p/day	N/A

The current gas rates are:

Single / Blended Rate	2.109p/kWh	Below 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 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%	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.

5. Energy Usage Details

St Helen's uses 5,679 kWh/year of electricity, costing in the region of £967 per year, and 46,607 kWh/year of gas, costing £1,890. The total carbon emissions associated with this energy use are XXXXX CO_2e tonnes/year.

This data has been taken from the annual energy invoices provided by the suppliers of the site. St Helen's has two main electricity meters, serial number E13UP01698 and E14UP09236. There is one gas meter serving the site, serial number A0065315A6.

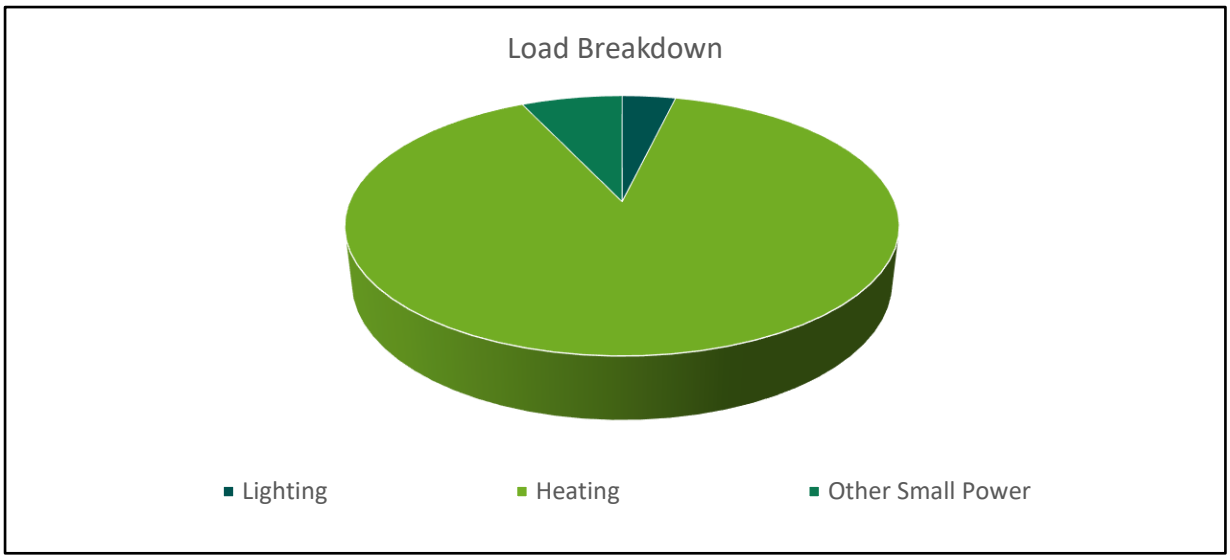
Utility	Meter Serial	Type	Pulsed output
Electricity – Church	E13UP01698	EDMI	Yes, but not fully AMR connected
Electricity – Church	E14UP09236	EDMI	Yes, but not fully AMR connected
Gas – Church	A0065315A6	Not accessible	N/A

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.

5.1 Energy Profiling

The main energy consuming plant can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting	Fluorescent lamps in floodlight fittings with inefficient SON floodlights to the altar and an LED to the vestry	4%
Heating	Gas fired condensing boiler providing heating to perimeter and under pew radiators.	89%
Other Small Power	Heating pumps, organ and sound system, alarms and other small power and plug in loads.	7%



As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site due to the low usage of the church.

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use St Helen's uses 2% less electricity and 7% more heating energy than would be expected for a church of this size. The utility bills suggest that the heating remains on for longer periods than the 3.5 hours on a Sunday, most likely due to the background heating levels being set at 12°C.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
St Helen's (elec)	290	5,679	19.58	20.00	-2%
St Helen's (gas)	290	46,607	160.68	150.00	7%
TOTAL	290	52,286	180.26	170.00	6%

6. Efficient / Low Carbon Heating Strategy

The energy used for heating a church typically makes up around 80% to 90% of the overall energy consumption. Putting in place a heating strategy that is energy efficient and low carbon is, therefore, of the highest priority

The Church of England is in the process of reviewing its heating guidelines. The process has already established some principles for heating that can help churches as they seek an acceptable combination of comfort, conservation, affordability, and environmental care. The principles can be found at https://www.churchofengland.org/sites/default/files/2020-04/CBC%20Heating%20guidance%20principles%20FINAL%20issued.pdf

As the principles make clear, every church's strategy will be unique to it, informed by many factors, including the nature of its usage, the system it's starting from, the conservation needs of the building, and the resources available. The strategies in this audit are designed specifically for your church.

Our recommendations on heating generally fall within three major areas. Firstly, for all churches we make recommendations that will help to reduce energy wastage and, as a starting point, to optimise the system that you already have

Secondly, we recommend options for many churches that focus on heating people rather than the full volume of the church. Some of the changes that can help with this will be 'soft' changes – others will relate to the heating system itself.

Finally, we make recommendations about moving away from fossil fuels. Moves away from fossil fuels are key to cutting emissions. For most churches, this will involve moving from gas, oil or LPG to electricity. Electricity currently creates carbon emissions around the same level as mains gas, but the carbon emissions associated with it are reducing rapidly as the UK builds more renewable energy and decommissions its remaining oil and 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'. Some local areas may also be considering the option of district heating networks.

While moving away from fossil fuels may not always be possible, as the principles state, "churches should be expected to have at least carefully considered the option of moving away from fossil-fuel based heating (gas and oil boilers) towards electric-based heating." And if such options are not viable now, the churches "can try to be ready for a future retro-fit when technology and the grid has progressed."

The current heating system has been recently upgraded with the installation of a new gas fired boiler in 2019. In future, it would be suggested to move to an all-electric heating solution; within 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 external walls (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.

Current heating is gas boiler (installed 2019) to under pew wet radiators. Pews throughout church. Long term (i.e. at end of life of boiler) would be to either replace with elec under pew heaters or if pews removed and church used more frequently, GSHP/ASHP to UFH. Intermediate solution if rear sets of pews removed would be to relocate the under pew rads to perimeter walls and separately zone (if possible) and oversize pipework in trenches to middle aisle or add in trench heating and add additional trench heaters if required.

7. Improve the Existing Heating System

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

7.1 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.

7.2 Insulation of Pipework and Fittings

The pipework within the boiler '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 area warm when it does not require heating. 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 arranged through ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com).

8. 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.

8.1 New LED Lighting

The lighting makes up a relatively small overall energy proportion of the electricity used within the church. There is an LED light installed the vestry but there still remains a large number of inefficient fluorescent and SON fittings within the church and alter.

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/

The suggested lighting change is not on a like-for-like basis, but to up-grade the lighting in the church for a track lighting system to allow for greater flexibility of lighting. The lighting track could be located at the top of the wall plate to be discreet and to allow both uplighting of the exposed ceiling and down lighting to the church pews as required. The total capital cost (supplied and fitted) would be £21,600. The annual cost saving would be £170 resulting in a payback of around 127 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. Guidance on lighting, produced by Historic England for churches, can be found at https://historicengland.org.uk/advice/caring-for-heritage/places-of-worship/making-changes-to-your-place-of-worship/advice-by-topic/lighting/

8.2 Lighting Controls (Internal)

There is a light which currently remains on all the time (when occupied) in the vestry. This area is 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.

8.3 Draught Proof External Doors

There are a number of external doors in the church. 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 in to the church around the side and base of these doors.

It is recommended that the draughtproofing around the door is improved and draught strips are added. This could be achieved in a number of ways.

For timber doors that close onto a timber frame 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 timber doors that close onto a stone surround more traditional solutions such brush draught strips re-batted into the edge of the door by a skilled joiner. Other traditional methods such as using hessian or felt pads tacked to the door could be used and keeping the door maintained in a good condition is important.

Simple measures such as having a 'sausage dog' style draught excluder laid along the base of a door, using plasticine of the right colour to fill gaps where daylight can be seen and putting painted fridge magnetic over large keyholes can all be simple DIY measures which are effective.

8.4 Secondary Glazing

The windows of the church are singled glazed with metal frames set into the stone mullions. It is not possible or desirable to change the windows. Given the windows to these area(s) are relatively small and have a more simple gothic style surround they would be suitable to have secondary glazing installed and the primary or important windows within the church could also be secondary glazed but would require discussion with the PCC before considering further.

The introduction of secondary glazing would considerably reduce the heat loss through the existing windows and improve both thermal comfort and noise levels as well as providing added security.

Any possible installation would need to be carefully specified, and companies such as https://www.selectaglaze.co.uk/heritage-listed-buildings or https://www.stormwindows.co.uk/ can provide very discrete and appropriate systems for all types of spaces.

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	No – shading from trees and steep pitch to roof
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

Having reviewed the site it is not considered that there is good viability for any renewables and instead a good clear focus on reducing the energy demand of the building should continue with a targeted approach on reducing the heating energy.

10. 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 on this Parish Resources page:
https://www.parishresources.org.uk/resources-for-treasurers/funding/

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. Offsetting

As you take action to reduce your emissions, you may also wish to offset those that you cannot yet reduce. If you would like to engage in offsetting, it is important to use a reputable scheme. The Church of England recommends Climate Stewards, which has a simple calculator that can help you to work out how much you would need to offset. https://www.climatestewards.org/

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Church	18	3 Spot Track lights	-£52	£18,000	-343.53
Altar	6	AR111 LED	£65	£255	3.92
External	3	LED GLS	£68	£36	0.53
External	1	50W LED Flood	£89	£120	1.34