ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

All Saints, Barton Stacey
PCC of All Saints

Author	Reviewer	Date	Version
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1. Executive Summary

An energy survey of All Saints 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.

All Saints dates back over 1,000 years, there was a major rebuild in the 13th Century and there were numerous changes over the centuries since then, with the addition of the tower in 1510. The church building is stone work, with a tiled roof. It is heated from two oil boilers, with hot water from an electric point of use heater. The lighting is generally fluorescent lamps. There is 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)	Permissio n needed	CO2 saving (tonnes of CO2e/year)
Change electricity to a 100% renewable supplier	N/A	£45	Nil	Immediate	None	N/A
Adjust existing timer on external lighting	344	£66	Nil	Immediate	List A (None)	0.09
Add or Replace draught strips to external doors	300	£18	£300	16.69	List A (None)	0.08
Change existing lighting for low energy lamps/fittings	585	£112	£2,765	24.73	Faculty	0.15
Replace oil heating system for electrical based heating solution	10,423	£28	£19,535	685.68	Faculty	2.86

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

The cost savings are based on the following prices. Current contracted price of electricity at 19.1p/kWh and the market price for oil at 6p/kWh.

If all measures were implemented this would save the church £224 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 All Saints has also declared a climate emergency and has an ambition to be carbon neutral by 2035 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 2035 by undertaking the following steps:

3. Introduction

This report is provided to the PCC of All Saints 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 All Saints, Barton Stacey, SO21 3RL, was completed on the <date of audit from spreadsheet> 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.

All Saints	
Church Code	641141
Gross Internal Floor Area	260 m^2
Listed Status	Grade II*

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

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	2 hours per week	104
Community Use	1 hour per week	54

There is additional usage over and above these times for festivals, weddings, funerals and the like which takes the typically weekly usage up to around 6 hours a week.

4. Energy Procurement Review

Energy bills for oil and electricity have been supplied by All Saints and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	19.1p/kWh	Above current market rates
Standing Charge	42.4p/day	N/A

We were not provided with the current rate for the oil use at the church, so are unable to comment.

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 Diocese Supported parish buying scheme, http://www.parishbuying.org.uk/energy-basket. This scheme only offers 100% renewable 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.

5. Energy Usage Details

All Saints uses 2,234 kWh/year of electricity, costing in the region of £426 per year, and 14,980 kWh/year of oil, costing £898.

This data has been taken from the annual energy invoices provided by the suppliers of the site. All Saints has one main electricity meter, serial number D01C28392.

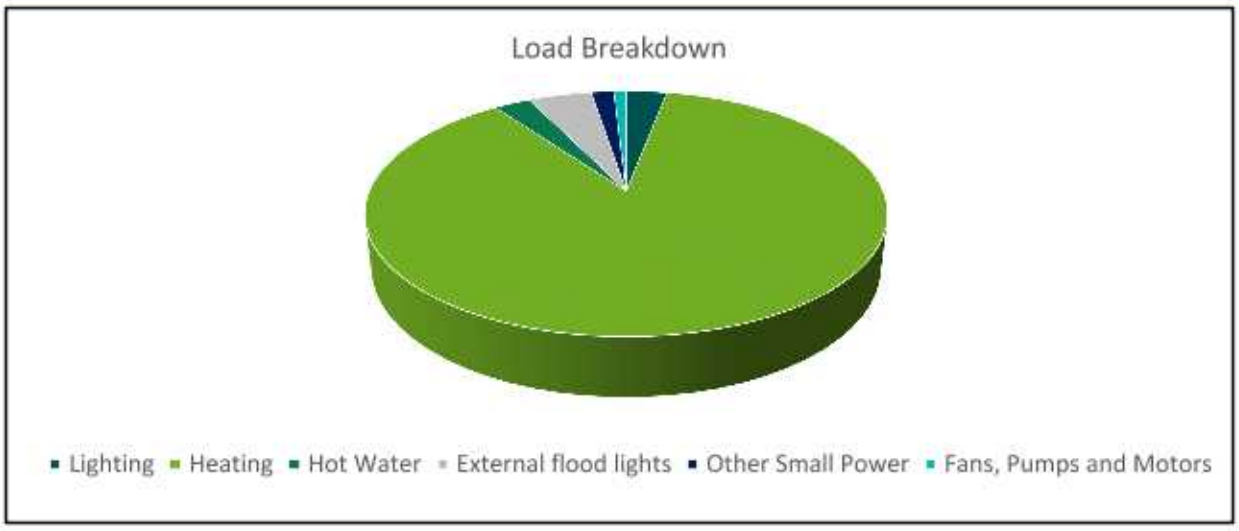
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	D01C28392	3 phase 100A	Y/N/N but capable	GF elec switch room

The electricity meter is AMR connected and as such energy profile for the entire energy usage should be possible. It is recommended that the church ask their supplier for the full half hourly energy data 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	Limited lighting, CFL in nave, some floods and PAR 38s in chancel	3%
Heating	Oil fired electric heating via two 20year old oil boilers	87%
Hot Water	Electric hot water unit to WC	3%
External flood lights	External flood lights to church (3 sides)	5%
Other Small Power	Wall mounted heaters to vestry, school room, ringing floor, organ and other ancillary devices	2%
Fans, Pumps and Motors	Heating circulation pump	1%



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

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use All Saints uses 57% less electricity and 67% 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
All Saints (elec)	260	2,234	8.59	20.00	-57%
All Saints (gas)	260	14,980	57.62	150.00	-62%
TOTAL	260	17,214	66.21	170.00	-61%

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. 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 carbon emissions 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 biogas 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..

The current heating for the church is supplied from two, 20 year old oil boilers. These are now at the end of their life and also represent a high source of carbon emissions which need to be avoided. Given the low usage hours of the church and the presence of pews this church would be extremely well suited to having and electric under pew heating solution. There is already 3 phase electricity supplied to the church and therefore this would be relatively straight forward to implement (in phases if so required) and would also deliver costs savings as well as allow the church to become zero carbon through the avoidance of the use of oil and using electricity procured from 100% renewable supplies.

6.1 Install Electric Under Pew Heaters

For replacement, 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.

We would therefore suggest that the following works could be considered:

Install BN Thermic Under Pew Heaters suspended from brackets from the underside of the pew seat as follows:

Choir, Eight PH65 heaters in between uprights

Priest Stool, One PH30 under seat

Nave, 36 PH45 heaters between uprights

Cable runs to the pew heaters should run along the along the existing routes (all cabling should be in armoured cable or FP200 Gold when above ground) to both rows of pews. Each pew heater to be switched with a neon indicated fused spur located underneath the pew seat.

The high level radiant heaters within the school room can be retained to provide heating in that area.

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

6.2 Install Electric Panel Heaters

To provide thermal comfort to those areas which do not have pews it is suggested that electric panel heaters could be installed. It is recommended that the PCC consider installing electrical panel heaters to either side of the communion rail, to the external walls of the north and south aisles and to the school room if the overhead units are wished to be changed. These should be installed on a time delay switch and the existing radiators removed.

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.

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

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 large areas are lit by relatively inefficient fluorescent, PAR38 and SON fittings within the church.

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 £2,765. The annual cost saving would be £112 resulting in a payback of around 24 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 the PAR 38 units in the Chancel where the existing fitting can be made more efficient by simply changing the bulb/lamp within the existing fitting to w 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 External Lighting Controls

The external flood lights are currently on from 6.45pm to midnight. For efficient operation and to

reduce light pollution and nuisance to neighbours it is generally recommended that external lighting is turned off between 10pm and 6am unless required for specific purposes.

It is therefore recommended that the existing timer is adjusted to switch off the external lights between 10pm and 6am daily and also over the weekend if not required. A timeclock with a time and day capacity is recommended over those that only have time of day capacity. Sangamo (http://sangamo.co.uk/) make a wide range of commonly used timeclocks which any qualified electrician can install.

7.3 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 into the church around the side and base of these doors.

It is recommend 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 rebatted 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. 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
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.

9. 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 .

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
Bell ringing	2	2D LED 11W	£2	£118	47.17
Base of tower	1	5ft Single LED	£3	£88	26.59
School room	1	3 Spot Track lights	£4	£1,000	233.07
Chancel	2	PAR38 LED	£15	£34	2.31
Altar	2	50W LED Flood	£15	£240	16.24
WC	2	2D LED 11W	£2	£118	47.17
Kitchenette	1	4ft Single LED	£1	£72	52.15
External	6	50W LED Flood	£68	£720	10.54
Bell ringing	2	2D LED 11W	£2	£118	47.17