Energy Audit and Survey Report

All Saints Church

PCC of All Saints, Sidmouth

Version Control

Author	Reviewer	Date	Version
David Legge	Matt Fulford	10th August 2020	3.0

Contents

1. Executive Summary

An energy survey of All Saints Church 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.

All Saints Church was built in the late 1830s, with the parish rooms and main hall added in 1970 and the link building in 2008, connecting the main hall and church. The church has underfloor heating (carpeted) and oversized radiators and the seating arrangement is moveable chairs. The main hall has perimeter panel radiators served by the single gas fired boiler which serves three zones and controlled by Honeywell timeclocks and room thermostats. 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.

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)	£/tonne of CO2
Switch electricity (and gas) suppliers to ones which provide 100% renewable (or green gas) supplies	None	None	Nil	N/A	None	N/A	N/A
Optimise control settings	12,864	£446	Nil	Immediate	None	2.37	N/A
Fit flow regulators onto existing taps	2,573	£376	£15	0.04	None	0.66	£23
Install SavaWatt devices on fridges and freezers	140	£20	£50	2.45	None	0.04	£1,397

Insulate exposed pipework and fittings in plantrooms	4,288	£149	£500	3.36	List A	0.79	£634
Tune the boiler to more efficient combustions settings	4,288	£149	£500	3.36	None	0.79	£634
Fit timed fused spurs to hot water heaters	324	£47	£180	3.81	None	0.08	£2,174
Change existing lighting for low energy lamps/fittings	5,678	£829	£5,104	6.16	List B / Faculty	1.45	£3,516
Install Endotherm advanced heating fluid into heating system(s)	7,290	£253	£1,600	6.33	None	1.34	£1,194
Use electric panels to heat side chapel	3,645	£126	£1,500	11.87	Faculty	0.67	£2,239
Fit Quattroseal draft proofing to historic doors	1,458	£51	£800	15.82	List B	0.27	£2,985
Adjust and install PIR motion sensors on selected lighting circuits	76	£11	£424	38.24	List A	0.02	£21,845

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

Based on current market prices of 14.6p/kWh and 3.468p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church £2,457 per year.

2. Introduction

This report is provided to the PCC of All Saints Church 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 All Saints Church, All Saints Road, Sidmouth EX10 8ES was completed on the 21st January 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, a CIBSE Low Carbon Consultant and a fully qualified ISO50001 lead auditor.

All Saints Church	
Gross Internal Floor Area	650 m^2
Listed Status	Grade II
Typical Congregation Size	200

The church typically used for 10 hours, and the main hall for 35 hours per week for the following activities.

Services (church)	10 hours per week
Meetings and Church Groups	Ad hoc use only
Community Use (hall)	35 hours per week

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

3. Energy Usage Details

All Saints Church uses 17,377 kWh/year of electricity, costing in the region of £2,537 per year, and 85,759 kWh/year of gas, costing £2,974.

This data has been taken from a summary of consumption provided by the PCC. All Saints Church has one main electricity meter, serial number E17BG05907. There is one gas meter serving the site which was not accessed during the survey.

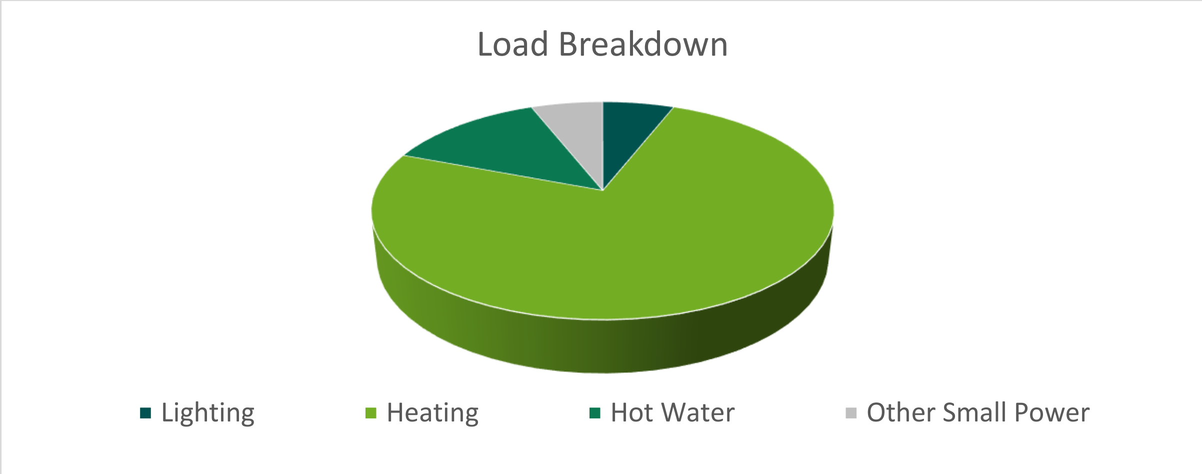
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	E17BG05907	3 phase 100A	Yes but no AMR connectivity	Elec switch room adjacent to WCs

The church and hall electric meter have a smart meter however SSE does not seem to be able to read it remotely. It is recommended that a request is made from SSE the usage values if available, and then for the patterns of usage to be reviewed against the times the building is used.

3.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Main hall and ancillary areas are efficient LED fittings whereas the church is lit by inefficient halogen spotlights and SON floodlights. There are inefficient T8 fluorescent tube fittings in the vestry and store.	6%
Heating	Heating is provided via a gas fired boiler distributing to oversized radiators and underfloor manifolds in the church and perimeter panel radiators in the main hall and link building.	75%
Hot Water	Hot water is provided from stored hot water with electric immersion (due to be replaced like for like) in the main kitchen.	13%
Other Small Power	CCTV, sound system, alarms and other small plug in loads.	6%



As can be seen from this data, the heating makes up by far the largest proportion of the energy usage on site. The other significant loads are hot water and lighting.

3.2 Energy Benchmarking

In comparison to national benchmarks[1] for Church energy use, All Saints Church uses 34% more electricity and 12% less heating energy than would be expected for a church of this size. This is likely due to the combined church, hall and link building, the inefficient church lighting and the high usage of the building for rental.

	Size (m^2 GIA)	All Saints Church use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
All Saints Church (elec)	650	26.7	20	10	34%
All Saints Church (heating fuel)	650	131.9	150	80	-12%
TOTAL	650	158.7	170	90	-7%

[1] CofE Shrinking the Footprint – Energy

4. Energy Saving Recommendations (Electricity)

4.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building, and the church is lit by inefficient fittings, whereas the hall is lit by efficient LED. The main hall, kitchen and WCs have been converted to LED fittings whilst the lighting within the church is predominantly inefficient AR111 spotlights, GLS lamps and SON lamps in the wall washers. These fittings are widely available on the market and it is suggested that the complete fitting (not just the lamp) is replaced. Any new LED fitting would have a much longer life and hence reduce the need to replace the lamps in the ceiling.

The spotlights in the chancel are AR111 halogen spotlights to highlight the altar. 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 are changed for LED. This could be undertaken in a direct like for like basis, which is what has been costing earlier in this report but the church may wish to consider using the opportunity to improve the lighting and consider a track lighting solution, fixed to the wall plate, which would provide greater flexibility and ability to create lighting effects. Track fittings such as https://www.sylvania-lighting.com/product/en-GB/products/2059568/ are regularly used to light churches such as this.

If all the lights were changed on a like for like basis, the total capital cost (supplied and fitted) would be £5,104. The annual cost saving would be £829 resulting in a payback of around 6.2 years. Many of the lights could be self-installed and therefore cost much less than the supply and fit cost above.

4.2 Lighting (control for internal lights)

There are several lights which currently remain on all the time the building is occupied in areas such as the link building, WC's and vestry's 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 where one is not already installed, 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.

Where lighting motion sensors are already installed, it was noted during the audit that these sensors are not currently set up to work to their full potential.

It is recommended that the existing lighting sensors installed within the building are reviewed and optimised so that the time lag before they turn off the lights, and the light level at which they allow the artificial light to be turned on is adjusted so that it is suitable for the space. Depending on the type of light fitting installed it is normally recommended that areas such as storerooms and cleaners' cupboards switch off after just 1 minute, corridors and stair lobbies after 2 minutes and WCs after 5 minutes. Generally lighting levels should be around 300lux but it is highly dependent on the use of the space.

4.3 Refrigeration Controls

Within the kitchen there is a domestic refrigeration unit for storage of milk and food. These units run 24/7 and contribute to the baseload electrical consumption of the building.

To reduce the electrical consumption of these appliances it is recommended that they are all fitted with a SavaWatt unit. These units work by automatically detecting the load of the compressor and turning down the power when it is not in full load. This reduces the energy consumption of the refrigeration unit by around 18% while maintaining the cooling of the appliance. It does this by reducing the voltage delivered to the unit when it is idling but allowing the full energy to the unit when it is required.

The supply and installation of these units and further details can only be undertaken by SavaWatt directly http://savawatt.com/. The installation does not cause any significant disruption to operations and can be undertaken during normal operating times.

4.4 Water Heater Timeclock

There is an electric point of use water heater in the kitchenette to provide hot water. This only needs to heat the water to the required temperature when the building is in occupation but at the moment this heater is directly wired in without any form of time control and therefore maintains it set temperature 24/7. It is understood that the main hot water heater is to be replaced shortly and the hot water boiler (for tea making and the like) will remain in situ.

It is recommended that both of these heaters are fitted with either a boost time such as https://www.timeguard.com/products/time/immersion-and-general-purpose-timeswitches/fbt4-2-hour-electronic-boost-timer-fused-spur or alternatively a 24 hour/7-day timeclock to replace the fused spur switch, depending on which option would best suit the use of the church. An example of such a unit would be a TimeGuard FST77. They should be set up with times to match the times that the building is occupied and this will prevent the standing losses from the unit wasting energy during periods when the building is not occupied.

Such units can be purchased at any electrical wholesaler and fitted by your existing electrician or any NICEIC registered electrical contractor.

5. Energy Saving Recommendation (Heating)

5.1 Heating System and Strategy

The church currently uses a combination of underfloor heating and oversized wall mounted radiators 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 improvements.

It was noted during the survey that throughout the main hall, chairs are placed tight against the radiators and perimeter pipework reducing the ability of the radiators to convect heat to the space. Chairs and other items should be moved away from all radiators to allow free air movement and for the radiator to work effectively to convect hot air into the space.

5.2 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 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 supplied and self-installed.

5.3 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 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).

5.4 Tune Boiler

The existing boilers on site are serviced at least annually during which time the flue gas is analysed and the results from this are displayed on the front of the boiler. The main purpose of this analysis is to make sure that the boiler is combusting the gas properly and not releasing too many toxic gases into the atmosphere. The flue gas analysis also provides an indication as to the efficiency of the boilers.

It was noted from the results of this flue gas analysis that while the flue gases are within the permitted limits there is more scope to adjust the burner to increase the efficiency of combustion. It is therefore recommended that the boiler engineer is requested to maximise the burner efficiencies during their next service visit.

5.5 Controls

The buildings main heating, hot water and ventilation plant is controlled by a centralised building management system (BMS), operated from a control panel located in the boiler house.

A high level review of the settings within this control system highlighted a number of areas where the way in which it operates the building can be optimised to both reduce energy consumption and improve comfort. For example:

- The time schedules do not match the occupancy of the church and hall; as an example the heating is set to turn on in the church daily between 0830 and 1030 (see Appendix 2 for more details)
- The original control strategy has been superseded by new Honeywell timeclock control and local Uponor room thermostats; the original BMS control offered weather compensated variable

temperature flow. It is suggested that the church review the possibility of reinstating this level of control to reduce gas consumption.

- The local Uponor thermostats are currently configured to a set point of 30°C, which would be far in excess of the suggested 20-21°C for occupation.

The modern central and underfloor heating system is not needed to preserve the fabric but only to provide thermal comfort to occupants. The previous trend of 'conservation heating' for fabric issues is now largely considered to be unnecessary and is being avoided by the likes of National Trust and English Heritage. The only times when background heating may be required is if there are historic wall paintings or to for the preservation of large artefacts such as tapestries. The fabric is often subject to the greatest damage by humidity (which is naturally higher when the air is warmer as warmer air has greater capacity for holding more moisture), as a result of large temperature swings (from central heating systems turning on and off) and from the excessive drying out/baking of timbers where high temperature heating units have been fixed to them (such as overhead heaters fixed to timber wall plates)

Providing intermittent background heating to the church building as a whole at any level is excessive and wasteful of energy. At the very least we would recommend that the heating is reduced to those times when the church is occupied.

It is also recommended that more than one person understands the heating system and associated controllers and how to use them in the event of holidays or other absence.

It is therefore recommended that a detailed control optimisation process is conducted, this can be run alongside and with the full support of any existing controls maintenance company that may be used, or as a separate independent exercise.

5.6 Use of Electric Panels for Heating Specific Areas only

The heating within the side chapel is currently an oversized radiator which is run from the main heating circuit. Therefore, when this area is used for the mid-week services, the whole of the church has to be heated. To avoid having to heat up the entire church building for these smaller mid-week services it is recommended that the PCC consider installing electrical panel heaters in this area on a time delay switch.

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 can not be left on accidently after use.

6. Energy Saving Measures (Building Fabric)

6.1 Draught Proofing to Doors

The link building serves as the main access point to the church and hall during the week, with this entrance also being used on Sunday as well as the churches West door. As this is a relatively recent building, the doors are fully glazed and mounted to a timber frame. There is no draft stripping around the timber frame and as such there is significant air change in this area, which is also heated by perimeter radiators.

It is recommended that brush seals (or equivalent) are fitted around all four edges of both glass doors within the link building to reduce cold air ingress. Reducing the air volume that requires heating will reduce the requirement for heating and therefore reduce gas consumption.

There are also a number of external wooden 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.

7. Saving Recommendations (Water)

7.1 Tap Flow Regulators

The taps to the wash hand basins within the building have been checked as part of the audit and the average flow rate within these has been measured to be 12l/min. The recommended flow rate for hand washing is 4.8l/min and therefore the taps are providing around double the amount of water that is necessary.

The over provision of water for hand washing is not only a source of excessive water use, but in the case of hot water, it is also a source of wasted energy in the heating that has to go into providing the hot water.

The flow rate of the taps can be easily regulated by fitting flow regulators within the taps. It is recommended that flow regulators such as those manufactured by neoperl (http://www.neoperl.net/en/) are fitted into all the viable hand wash basin taps to save on both water and heating of the hot water.

8. Other Recommendations

8.1 Electric Vehicle Charging Points

The church has a car park to the side and rear of it which serves the church and also the frequently used church hall and nursery. In order to make a visible statement on the churches mission of stewardship and to facilitate more sustainable transport choices by those both visiting the church and using the hall, the church may wish to consider installing an electric vehicle charging point, probably on the side of the church hall to allow visitors to charge their electric car.

Installing a unit such as a Rolec Securi-Charge http://www.rolecserv.com/ev-charging/news/view/Robust-EV-Charging-With-Rolecs-SecuriCharge-EV-Wall-Unit-Coin-Token-PAYG would allow the church to be able to sell tokens or have a coin operated device that would at least cover the costs of the electricity use and could make a small income. As the hall is a place of work for the pre-school users it may be able to benefit from a grant to part cover the installation costs of a charger from https://www.gov.uk/government/publications/workplace-charging-scheme-guidance-for-applicants-installers-and-manufacturers

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 – not sufficient 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 – archaeology in ground and radiator system
Air Source Heat Pump	No – insufficient electricity supply
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.

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

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-Nov-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
Church Uplighters	36	AR111 LED	£302.75	£1,603.44	5.30
Church downlighters	16	50W LED Flood	£231.73	£1,460.80	6.30
Church spotlights	14	AR111 LED	£117.73	£623.56	5.30
West room	20	GU10 LED	£119.14	£236.00	1.98
Church gallery	5	LED GLS	£15.07	£52.50	3.48
Vestry	1	5ft Single LED	£29.50	£93.70	3.18
Store	1	5ft Single LED	£13.11	£93.70	7.15

Burn hours are assumed to be 800 hours per year.

Appendix 2 – Schedule Heating Times (taken on date of survey)

M	off	0630-0830	1300-1400, 1500-1600, 1830-2130
T	0500 - 1030, 1600-2100	0500-1000, 1600-2100	0830-1130, 1630-2030
W	off	0630-0830	0900-1100, 1830-2130
Th	off	0630-0830	0830-1130, 1400-2000
F	0630-0830, 1500-1800	0630-0830, 1500-1830	0830-1130
S	off	0630-0830	0730-1000
S	0500-1220,	0400-1230	0830-1240, 1700-2000