ESOS-ENERGY
Energy efficient solutions

Energy Audit and Survey Report

St Alban's, Westbury Park

PCC of St Alban's

Version Control

Author	Reviewer	Date	Version
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Contents

1. Executive Summary

An energy survey of St Alban's 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.

St Alban's is a Grade II listed church located in the suburbs of Bristol City. Th church was built in 1909, with solid walls and a slate roof. The heating is provided by a gas boiler, and the lighting is a mix of some new LEDs, along with older fluorescent lamps. 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
Contact suppliers to arrange for the meters to be changed to smart meters	None	None	Nil	N/A	None	N/A	N/A
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
Clean floor grills	1,095	£160	Nil	Immediate	None	0.34	N/A
Optimise control settings	9,129	£1,333	£600	0.45	List A	2.80	£213.96

Fit timed fused spurs to hot water heaters	324	£47	£180	3.81	List A	0.10	£1,808.45
Fit Quattroseal draft proofing to historic doors	1,217	£178	£800	4.50	List B	0.37	£2,139.59
Fit 270mm of insulation into the loft	6,086	£889	£5,000	5.63	List B	1.87	£2,674.48
Install Variable Speed Drives (VSD) to fan motor / pumps	521	£76	£462	6.07	List A	0.16	£2,886.96
Install Endotherm advanced heating fluid into heating system	6,086	£274	£1,864	6.81	List A	1.31	£1,428.07
Insulate exposed pipework and fittings in plantrooms	3,043	£106	£800	7.58	List A	0.56	£1,429.18
Replace existing boiler to 2x80kW gas condensing boilers and add greater fan units into heating system and reduce warm up times	9,129	£317	£45,000	142.15	Faculty	1.68	£26,797.16

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

Based on current contracted prices of 14.6p/kWh and 3.47p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church £3,187 per year.

2. Introduction

This report is provided to the PCC of St Alban's 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 Alban's, Bayswater Avenue, BS6 7NU was completed on the 24th January 2020 by Marisa Maitland. Marisa is an experienced energy auditor with over 10 years' experience in sustainability and energy matters in the built environment and a CIBSE Low Carbon Energy Assessor.

St Alban's	
Gross Internal Floor Area	850 m^2
Listed Status	Grade II
Typical Congregation Size	80

The church typically used for 6.5 hours per week for the following activities

Services	4 hours per week
Meetings and Church Groups	2.5 hours per week

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

3. Energy Procurement Review

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

The current electricity rates are:

Day Rate	14.6p/kWh	In line current market rates
Standing Charge	25p/day	N/A

The current gas rates are:

Single / Blended Rate	3.46p/kWh	In line with current market rates
Standing Charge	£104.38 per month	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.

4. Energy Usage Details

St Alban's uses 7,179 kWh/year of electricity, costing in the region of £1,050 per year, and approximately 60,000kWh/year of gas, costing £2,100. The gas boiler is used to heat the church and the church hall next door. There is no sub-metering to establish how much energy each is using, so it has been assumed that the church is using a quarter of the total gas consumption at the site.

This data has been taken from the annual energy invoices provided by the suppliers of the site (see Appendix 2). St Alban's has one main electricity meter, serial number K11D02502. There is one gas meter serving the site, serial number 75146931.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity	K11D02502	Elster	Full AMR Connected	In main entrance porch
Gas	75146931	Elster	Unknown	Boiler room

The electric meter is AMR connected and as such energy profile for the entire energy usage could be possible on request.

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.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Mix of LED and some older fluorescent tubes and spots.	2%
Heating	Gas boiler providing heating to church.	89%
Hot Water	Electric point of use hot water heaters, organ, tea urn, electric heaters.	1%
Other Small Power	Organ, tea urn, electric heaters.	8%

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 load is other small power.

4.2 Energy Benchmarking

In comparison to national benchmarks[1] for Church energy use, St Alban's uses 58% less electricity and 52% less heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	St Alban's use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Alban's (elec)	850	7,179	8.45	20.00	-58%
St Alban's (heating fuel)	850	60,857	71.60	150.00	-52%
TOTAL	850	68,036	80.04	170.00	-53%

[1] CofE Shrinking the Footprint – Energy

5. Energy Saving Recommendations (Electricity)

5.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building. A lighting up-grade to the main nave lights took place in the last 6 months and they are now LED spot lights.

However there still remains the number of other lamps which were not replaced, and can be up-graded to much more efficient lamps. There are a number of T12 fluorescent tube fittings, such as in the vestry, choir room, choir stalls and organ loft. 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.

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 £1,409. The annual cost saving would be £122 resulting in a payback of around 11 years. Many of the lights could be self-installed and therefore cost much less than the supply and fit cost above.

5.2 Lighting (control for internal lights)

There are several lights which can currently remain on all the time that the church is being used in areas such as corridors, organ loft, creche, toilet areas, staircases 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.

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 considered 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.

5.3 Timed Fused Spurs

There are a number of electric point of use water heater in the toilet and vestry to provide hot water for hand washing. 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 its set temperature 24/7.

It is recommended that the heaters are fitted with a 24 hour/7 day timeclock to replace the fused spur switch. 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.

6. Energy Saving Recommendation (Heating)

6.1 Heating System and Strategy

The church is a large church with a wide and open nave with adjacent side aisles. There are no pews on to which to fix heaters nor any available wall space or ceiling space within the nave (the nearest wall space being to the perimeter of the side aisles. The church is used for a limited number of hours each week. Typically, a church of this usage profile would be encouraged to switch to direct electric heating as being the most efficient solution but in this case there is simply no location in which to fix under pew, radiant panel or overhead units which would successfully and acceptably heat the main nave. It is therefore recommended that the church continue with a gas fired heating approach.

The existing boiler dates back to 1979 and is not only old and have reached the end of its serviceable life, but also very inefficient. It is recommended that this is replaced with two wall hung 80kW gas boilers within the next 3 years.

The focus should then be on improving the way in which the heat is emitted into the church and the greater use of fans within the system will help to decrease the warmup times. In addition to cleaning the current heat emitters under the grilles the church should consider installing fan assisted under grille units such as http://www.trenchheating.com/aquafan-2.php under all possible grilles. The greater use of fan convector heaters such as https://www.spc-hvac.co.uk/app/uploads/2018/07/SPC-Fan-Convector-Brochure-Issue-4.pdf in lieu or in addition to radiators will also assist in reducing the warm up times. The controls system should then be revised.

6.2 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 in 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.

6.3 Insulation of Pipework and Fittings

The pipework within the plant room has the majority of its straight lengths insulated and a number of the more complex shaped pipework fittings, such as valves, have been insulated. However, some of the specialist jackets have been removed and not replaced. 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.

6.4 Variable Speed Drives

The existing pumps within the building are fixed speed units meaning that they are either running at full power or they are off. In varying conditions, the pumps and fan motors will only need to operate at part power and can consume less energy in doing so.

It is recommended that the pumps are changed to variable speed drive units which can automatically vary the power they use depending on the conditions at that particular moment in time, for example, how much heat is required into the heating system or how much air is required into the building bases on factors such as CO2 levels.

The installation of variable speed units will require the removal of the existing pump and the installation of a new unit with integration back into the controls system. As such this should be carried out by a competent mechanical engineer.

6.5 Controls

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

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:

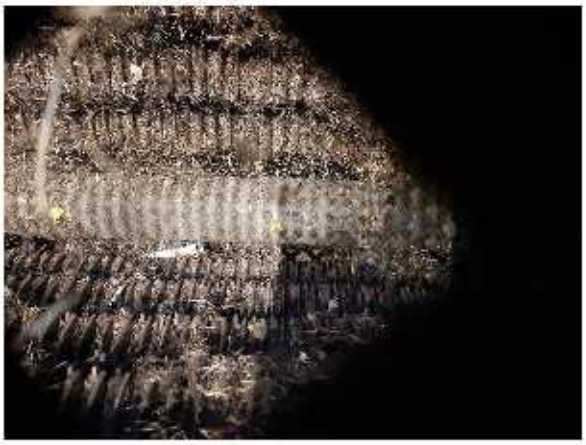
- The timings for heating the church are currently on from 8am Friday until 12pm Sunday. This should be reduced, and perhaps set to start at 12pm on Saturday until 12pm on Sunday.
- The control system has an optimised start/stop which is not being used correctly. This brings the heating on in time to be up to temperature for the time period selected, therefor, the boiler control is trying to get the church up to temperature for 8am on Friday morning.
- The time on the clock on the controller is incorrect, it was running 1hr 15 mins ahead of time at the time of the site visit.

It is likely that a more detailed forensic review of the control system settings and strategy will yield further opportunities for improvement.

It is therefore strongly 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.

6.6 Clean Heating Floor Grills

The main heat emitters to the church nave is via floor grills. Looking through them, the pipes are very dirty and covered in a lot of dust. This will be providing a nice layer of insulation over the pipes and making them less effective at heating the air around them. It is recommended that the grills a cleaned regularly to enable them to be as efficient as possible.



7. Energy Saving Measures (Building Fabric)

7.1 Roof Insulation

The loft void above the ceiling was not inspected as part of this audit, however it was reported that there is little or no insulation present. In all cases where there is 100mm or less of insulation within accessible roof spaces it is recommended that insulation be added to prevent heat loss and create a more comfortable environment for the occupants of the building.

The ceiling/roof of a building is the largest contributing area to heat loss from a building as heat rises. The insulation of such spaces can therefore have a dramatic impact on both the efficiency of the heating system and the temperature of the space below. Insulation measures such as this also need to be combined with control measures such as TRV's or room sensors to ensure that the space does not overheat because of the additional insulation.

A free survey and quotation for the supply and installation of insulation to the loft spaces can be arranged through ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com).

7.2 Draught Proofing to Doors

There are a number of external 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, such as the side doors from the nave, 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.

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
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.

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-Nov-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.

11. 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.

    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
Choir room	3	5ft Single LED	£8	£281	35.10
Vestry	2	4ft Single LED	£6	£144	23.64
Organ loft	1	LED GLS	£1	£11	8.58
Organ loft	1	4ft Single LED	£3	£72	23.64
Organ loft	1	4ft Single LED	£1	£72	63.41
Choir	3	5ft Single LED	£10	£281	28.99
Lady Chapel	3	LED GLS	£13	£32	2.34
Disabled WC	1	PLL LED	£4	£35	8.44
Flower cupboard	1	PLL LED	£4	£35	8.44
Main entrance porch	1	5ft Double LED	£5	£129	25.23
External	2	LED GLS	£27	£21	0.77