Energy Efficiency and Zero Carbon Advice

Holy Trinity Church, Bramley
PCC of Holy Trinity Church

Author	Reviewer	Audit Date	Version
Paul Hamley	Tamsin Hockett	25th April 2022	1.2

Contents

1. Executive Summary

An energy survey of Holy Trinity Church, Bramley was undertaken by ESOS 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.

Holy Trinity Church, Bramley is a stone built Grade II* listed church, consisting of a Mediaeval chancel, tower and south transept with Victorian aisles and vestry. There is an adjoining unlisted modern hall to the south. [Historic England reference 1044581]. Both gas and electricity are supplied to the site.

The church has a number of ways in which it can be more energy efficient. Our key recommendations have been summarised in the table below and are described in more detail later in this report. It is recommended that this table is used as the action plan for the church in implementing these recommendations over the coming years.

Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Payback (years)	Permission needed	CO2 saving (tonnes of CO2e/year)
SHORT TERM						
HW Heater – set timer for hours of use	700	£109	Zero	Immediate	None	0.18
Clean and flush central heating system	7% 1,770	£36	£200	6	List A	0.32
Insulate boiler room pipework	5% 1,260	£26	£20	1	List A	0.23
Install magnetic particle filter	Decreased maintenance costs		£200	N/A	List B	
Complete installation of LED lighting in church	3,000	£467	£2.000	5	Faculty	0.76
Ensure computer equipment is turned off when not in use	20	£3	Zero	Immediate	None	0,05
Door draughtproofing	2%, 500	£10	£50	5	List B	0.09
Install Solar Photovoltaic panels	7,800	£1,214	£13.050	11	Faculty	1.97
MEDIUM TERM						
Install Under Pew convector heaters	25,000 gas	£190 extra	£23,450	Not recovered	Faculty	1.92
OR						
Install Air to Air Heat Pump	25,000 gas	£511	£45,000	88	Faculty	3.06

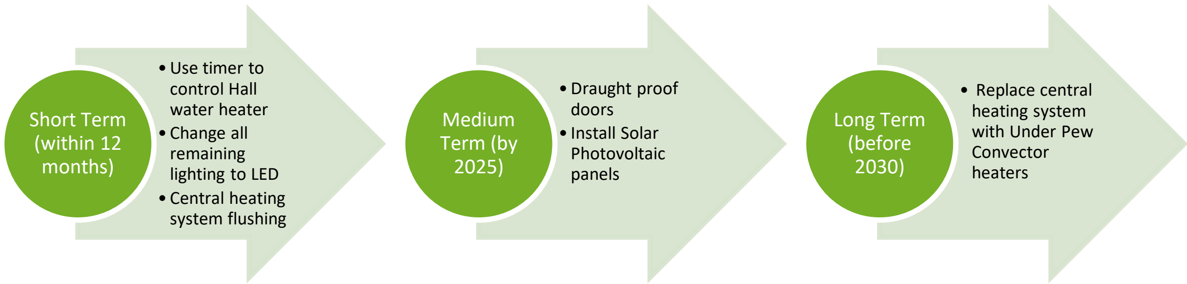
The church should check any faculty requirements with the DAC Secretary at the Diocese before commencing any works.

Based on current contracted prices of 15.5685p/kWh and 2.0497p/kWh for electricity and mains gas respectively. **If all short term measures were implemented this would save the church around £1,865 per year in operating costs.**

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

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 Holy Trinity Church, Bramley to give them advice and guidance as to how the church can be improved to be more energy efficient. In doing so the church will also become more cost effective to run and seek to improve the levels of comfort. Where future church development and reordering plans are known, the recommendations in this report have been aligned with them.

An energy survey of the Holy Trinity Church, Bramley, Hight Street, GU5 0HDwas completed on the 25th April 2022 by Dr. Paul Hamley. Paul is an energy auditor with experience of advising churches and small businesses. He is part of the Church Energy Advisors Network developing advice for the Church of England and authored the "Assessing Energy Use in Churches" report for Historic England. He is a CIBSE affiliate member and a Chartered Scientist, with experience of the faculty process gained from chairing the building committee of a Grade I listed church and has been an assessor for EcoCongregation.

The church was represented by Richard Gates, Treasurer.

Holy Trinity Church, Bramley	CHURCH	HALL
Church Code	617023	
Gross Internal Floor Area	360 m^2	120m^2
Volume	3,350m^3	315m^3
Heat requirement	110kW	6.3kW
Listed Status	Grade II*	Unlisted

The church is typically used for 7 hours per week and the hall for 11 hours per week for the following activities

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	4 hours per week	40
Community Use	1.5 hours per week	School visits and 6 annual concerts
Occasional Offices	1.5 hours per week	100

4. Energy Procurement Review

Energy bills for gas and electricity have been supplied by Holy Trinity Church, Bramley and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single / Blended Rate	15.5685p/kWh	Below current market rates
Standing Charge	22.5797p/day	N/A

Supplier: Total Gas & Power via Parish Buying

The current gas rates are:

Single / Blended Rate	2.0497p/kWh	Below current market rates
Standing Charge	208p/day	N/A

Supplier: Total Gas & Power via Parish Buying

The church is encouraged to continue with a group purchasing scheme and to continue to access 100% renewable electricity.

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.

Whenever monthly electricity consumption exceeds 1,000kWh, or gas consumption exceeds 4,397kWh (52,000kWh per annum), 20% VAT is charged unless the customer has submitted a VAT declaration form. This should always be done when changing supplier.

The church is a charity and therefore can claim VAT exemption status.

Excess VAT paid can be reclaimed for the past three years.

VAT declarations are available from the suppliers website and can usually be found by typing the suppliers name followed by "VAT Declaration Certificate" into most website search engines.

A detailed explanation is available here: https:// perfect-clarity.com/vat-on-church-utility-bills/#:~:text=There%20is%20no%20VAT%20chargeable%20on%20Church%20water%20bills

5. Energy Usage Details

5.1 Annual Consumption

Holy Trinity Church, Bramley uses 6,450 kWh/year of electricity (2020 data), costing in the region of £1,000 per year, and 25,000kWh/year of gas, costing £517. The hall used 1,900kWh of electricity in 2020, costing £296.

This data has been taken from the annual energy invoices provided by the suppliers of the site.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	E20UP 7068	EDMI Atlas Mk7c Three Phase	Yes	Room off entrance, RH lower meter
Electricity - Hall	E19UP 10104	EDMI Atlas Mk10 Three Phase	Yes	Room off entrance, LH upper meter
Gas – Church	E016 K06631 17 D6		No	External gas meter, north side

All the meters are AMR connected and as such an annual energy use profile for the site could be obtained from the supplier.

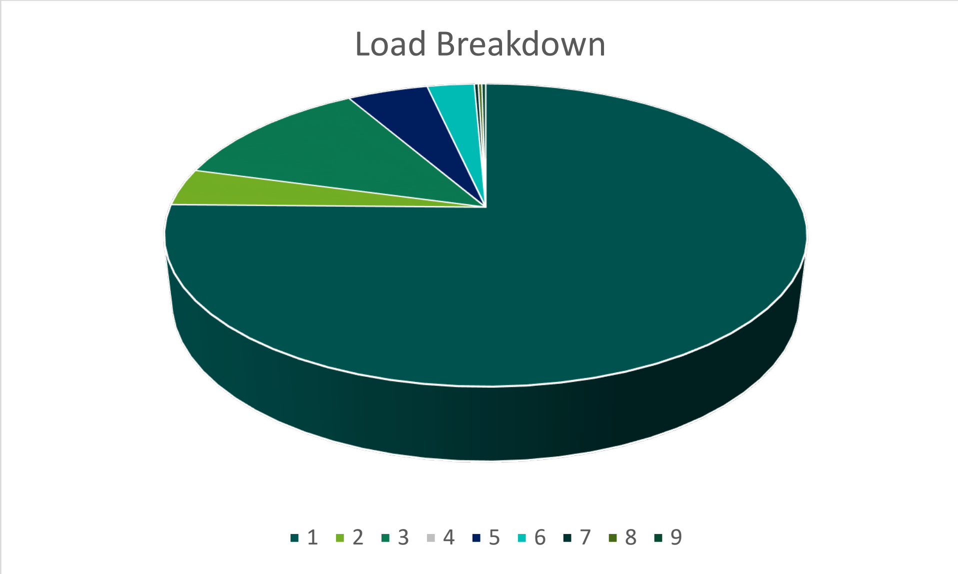
5.2 Energy Profiling

The main energy consuming plant can be summarised as follows:

	Equipment	Power kW	Annual Consumption kWh	Portion
Heating [Gas]	Ideal Concord C Series 2 Sectional Cast Iron boiler	100	25,244	75.1%
Heating [Electric]	CHURCH Vestry 2 kw fan heater Ringing chamber 3kW radiant heater HALL *5 Dimplex convectors* *Toilets – 2 convectors* *Office – 2 convectors*	 2 3 *15* *6* *6*	 50 180 900 50 150 TOTAL 1,330	4.0%
Lighting [Internal]	CHURCH 370 hours use 30 spotlights x 100W 10 floodlights x 500W Children's chapel 1 flood Vestry 2 fluorescent F70W Ringing Chamber 4 bulkhead HALL 600 hours use *45 recessed LEDs x 7W* *6 x fluorescent T8 x F58W* *Office $ x T8 F58W*	 3000W 5000W 500W 140W 160W *315* *348* *232*	 1,500 2,000 100 20 30 *190* *210* *100* TOTAL 4,150	12.3%
Lighting [External]	Not in use	0	0	0%
Hot Water	*Kettle* *Coffee machine* *Urn, 5 hours weekly use* *Dishwasher, monthly use* *Heatrae Sadia 30 litre, (normally kept on)*	*3* *2* *2* *3* *3*	*200* *100* *400* *30* *900* *TOTAL 1,630*	4.9%
Kitchen	*Microwave* *Fridge (on constantly)* *Freezer* *cooker* *Extraction fan*	*1* *0.1* *0.1* *3 + 3* *0.2*	*130* *300* *300* *200* *20* *TOTAL 950*	2.8%
Office	*Computer* *Printer* *Photocopier*	*0.1* *0.2* *0.5*	*50* *10* *20*	0.2%
Sound, Music	Sound system Organ	0.2 0.5	20 50	0.2%
Small Power	Vacuum cleaner	1.5	80	0.2%

Annual CHURCH electricity consumption, 2020 = 6,450kWh

Annual HALL electricity consumption, 2020 = 1,900kWh



KEY *1 Gas heating 2 Electric heating `3 Lighting internal 4 Lighting external*

5 Hot water `6 kitchen 7 Office 8 Sound, music 9 Small power

As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site. The other significant load is lighting.

5.3 Energy Benchmarking

In comparison to national benchmarks for church energy use Holy Trinity Church, Bramley uses 8% less electricity and 64% less heating energy than is average for a church of this size.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
Holy Trinity Church, Bramley (elec)	480	8,350	17.4	19	-8.5%
Holy Trinity Church, Bramley (gas)	480	25,244	52.6	148	-64%
TOTAL	480	33,594	70.0	167	-58%

There is currently no benchmark data available which takes hours of use and footfall into account. [1] CofE Shrinking the Footprint – Energy Audit 2013.

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 of 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 its remaining coal fired power stations. Mains gas does have some potential to reduce its carbon content through the use of bio gas and hydrogen, but these are less developed solutions and will be unable to deliver 'zero carbon mains gas'. It is therefore important to review and plan to make the building 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.

6.1 Heating Strategy

The boiler is an Ideal Concord C Series 2 cast iron sectional boiler which is likely to be over 30 years old. When new, it had a rated output of 76kW for 100kW gas input – only 76% (a new condensing boiler will have an efficiency of around 95%).

The temperature in the church struggles to reach 15°C in mid-winter, with most of the heat concentrated around the sections of finned pipe carried in trenches near the pulpit. There are only two radiators, and the South Aisle is habitually cold.

For a building with low hours of use an electrical heating method such as under pew heating, which delivers heat where and when required, is likely to be the most cost effective.

Should the church wish to remove pews, Air to Air Source Heat Pumps would be recommended. This would also offer lower running costs compared to under pew heaters, but with higher capital costs.

The following options were discussed during the audit:

6.2 Direct Electrical heating methods: 1kW of heat supplied per kW of electricity.

Under Pew mounted convector heaters – this is often the preferred solution for churches with low hours of use which wish to retain fixed bench seating.

Only regularly used pews have to be fitted. With a larger installation, only pews in use need the heaters switched on. Alternatively, the whole array can be run to preheat the building in very cold weather.

Chandelier Mounted Radiant IR Quartz heaters – not recommended; normally suspended from arch centres which do not align well with the seating areas. Visual glow from elements and localised hot spots.

Radiant IR roof mounted panels – not recommended, the roof angle is too steep and much heat would focus on the upper walls. The beams are spaced too closely to insert panels between them.

Wall IR roof mounted panels – not recommended, walls are too far from the nave centre.

6.3 Heat Pumps: delivering more kWh of heat than electricity used

The efficiency advantages of heat pumps mean that in some circumstances they can work out at equivalent or cheaper operating cost than gas despite the higher cost of electricity per kWh. This effect is increased if electricity is generated on site by solar power.

Air Source – the low hours of use of the church, around 6 per week are insufficient for this technology. Also, a new installation of large radiators would be required; the existing two are insufficient.

Ground source, as above, plus would require a borehole

Air to Air Source Heat Pump – this requires an external unit (as do all heat pumps), but would be connected to a network of internal fan units which could provide heating or cooling. The existing underfloor heating pipe trenches would provide a pipework route and could be used to house some small output fan units (which would require a particular manufacturer's product to fit). Other fan heaters would be required above ground, for instance in the present radiator locations.

6.4 Under Pew Electric Convector Heaters

The church is fitted with three rows of pews seating in the nave and south aisle. If these are to be retained, under pew heating is a straightforward solution which can be applied to all pews, or just a selected number if a congregation is normally small.

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 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.

Each have a central support under the seat and full back panels. There are 30 pews with lengths varying from 2.18m (6), 2.27m (8), 2.33m (16) which could be fitted with two BN65 650W 91cm length heaters and 7 pews of 1.55m with one unit each.

This would require 67 heaters giving a maximum output of 43kW

Installed costs (2018 data) of £23,450.

Operating costs: heating for around 1/3 of 370 hours of use = 250 heating hours

43kW x 250 = 10.750kWh. At current rate of 15,5685p/kWh, annual cost = £1,674.

The output is lower than the figure calculated by model for space heating, 110kW – but the model assumes that heat circulates around the whole building – heat from radiators begins by rising to the ceiling. Heat supplied directly to the congregation does not have to fill the volume of the church first.

System advantages include:

Individual switching of each unit – useful for small meetings

The ability to run all units to preheat the building when it is very cold.

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.

6.5 Heat Pump Overview

As the hours of use of a building increase, so do heating costs.

Electrically operated heat pumps can provide between 2.5 times and 5 times the amount of heat in kW which they consume in electricity (This is termed the Coefficient of Performance, CoP). They are compatible with underfloor heating, which typically runs at fairly low water temperatures, but not with high temperature heating systems. When replacing gas boilers directly, sometimes larger radiators are required, or fan assisted radiators, or running the system for longer periods to achieve the same temperature (but at less power input).

With electricity prices now only three times more per kWh than gas (it was about four times), heat pumps are becoming steadily more cost effective. Refrigeration technology is mature and reliable; the units appear to offer lower maintenance costs compared to gas boilers.

Ground source systems are more efficient (since the average ground temperature is higher than the average air temperature), but require either a borehole, or extensive trench digging.

Air source systems deliver between 2.5 and 4 times the amount of heat in kWh to water that they consume. Air to Air systems deliver warm air through indoor fan units and have a CoP rating of up to 5 and they can also provide cooling. The latter would be suitable where there are no radiators, or life expired / poorly sited units and spaces heated intermittently.

Ground Source Heat Pumps supplying water at around 50ºC are more efficient than their Air Source equivalent. Where a site has a daily requirement for heat (and thus high daily expenditure), the lower operating costs of a ground source pump outweigh the higher capital costs. For this site, it is recommended that quotations for Ground Source Heat Pumps be obtained.

Holy Trinity Church only has two radiators and it is likely that the radiator plus finned pipe system would not be suitable for use with either type of heat pump, as the system currently struggles to exceed fifteen degrees and the heat emitter area is small.

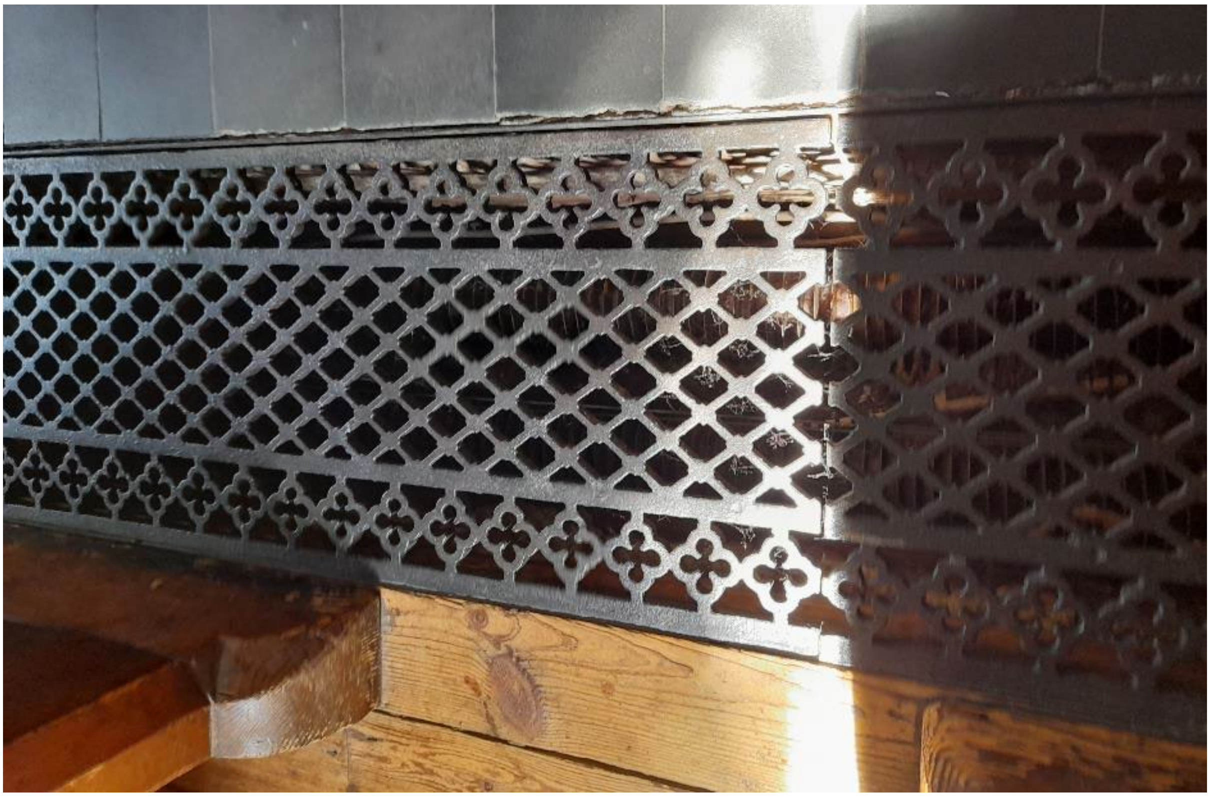
6.6 Air to Air Source Heat Pumps Overview

Air to Air Source heat pumps require internal fan units, blowing warm air, connected to external units – they do not require radiators. Systems provide summer cooling as well as winter heating and can deliver up to 4 to 5 times the amount of heat which they consume in electricity.

The two large units below supply three floors of an office of area 500m^2 with an output of 75kW which is equal to that of the church boiler. Four of the small units below supply one floor of an office of area 165m^2. The CoP is between 3.2 and 3.9 depending on the type of internal unit chosen.

There are a wide variety of internal units for ceiling, high wall and low wall mounting.

The church has a network of underfloor heating ducts where the current finned pipe heaters are located. This could be used to run the heat pump refrigerant pipework and possibly install some internal fan units (although the dimensions of the duct may need to be increased).



External units would need to be found locations which were non viewable or hidden in some way, but need to be well ventilated for this method to be viable. Hedge planting has been used to hide oil tanks at some churches. The recessed location of the current boiler room, below, with pitched lean to roof removed offers a potential location.

6.7 Air to Air Source Heat Pumps Costs

Pumps to supply 100kW of heat (with capital cost estimated at £450 per kW output: £45,000) would deliver the same amount of heat annually, 25,000kWh, as the current system.

The units would require 250 hours of operation at full power to deliver the same amount of heat annually. Church occupancy is around 370 hours so this agrees with the heating season duration.

Operating at a Coefficient of Performance of 4, an 100W heat output requires 25kW of electricity supply – this would require two phases of power, with lighting etc added.

25kW x 250hours = 6,250kWh electricity used annually.

At current rate of 15,5685p/kWh, annual cost = £973

Air to Air source heat pumps do not require water radiators. The external unit(s) can be connected using the existing heating ducts to reach the internal fan units. This is a convection based space heating system which like the existing system requires warm air to fill the building.

6.8 Cost Comparison

Item	Power output kW	Power input kW	Operating cost	Capital Cost
Current gas boiler	76	100	£1,484	N/A
Under Pew Heaters (67 units)	43	43	£1,674	£23,450
Air to Air Source Heat Pump	100	25	£973	£45,000

Heat Pump operating costs are 58% of under pew heaters ; costing £700 per year less

Heat Pump capital costs are 192% of under pew heaters: extra cost of £21,550

This suggests a 31 year payback. This would reduce if hours of use of the church increased.

6.9 Upgrade to 3 Phase Electricity Supply

Three phases of electricity are supplied to the hall and one phase to the church. As the three phase supply is already on site it should be possible to supply the church without major expense.

7. Improve the Existing Heating System

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

7.1 Clean the Existing Heating System

Magnetic sludge forms and prevents the proper and efficient operation of the system by reducing the ability of the boiler to heat up the water and reducing the output of the radiators. It is similar to how scale build up can adversely affect kettles and showers.

It is strongly recommended that the heating system is cleaned to remove this sludge from the system, this is done by using a chemical clean and/or power flush procedure where cleaning chemicals are put into the system which is then turned on and run through a filter consisting of high power magnetics to remove the sludge.

The cleaning of a heating system can be carried out by any competent heating engineer and typically increases the efficiency of a system by between 10 to 15%. This can dramatically improve comfort for the congregation.

7.2 Install a Magnetic Particle Filter

This device is a magnetic trap which collects magnetic sludge which is a corrosion product. It circulates in central heating systems and can cause problems with valve blockages and deposits on heat exchangers and in radiators which reduce their efficiency. None could be seen to be fitted within the boiler room (they are normally positioned close to the boiler on the return pipe).

8. Energy Saving Recommendations

In addition to having a revised 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 large overall energy proportion of the electricity used within the church, and large areas are lit by relatively inefficient halogen spotlights (30) and floodlights (10) within the church. Some of the floodlights appear to be (from ground inspection) to be the 250W variety. The hall lighting (recessed into the suspended ceiling) consists of 45 bulbs, almost all of which are LED.

It is recommended that all the church lighting is changed to 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/

It may be possible to change the bulbs withing the spotlights for LED items and re-use the existing luminaires – this can be ascertained be finding the spare bulbs and identifying the type of fitting used (e.g. bayonet, screw, pin). The floodlights take linear halogen bulbs which come in specific lengths. LED replacements of the correct length can be found – but experience shows they may be too bulky to fit the housing. Complete replacement may be easier.

Where the existing fitting can be made more efficient by simply changing the bulb/lamp within the existing fitting for a new LED bulb/lamp, this can be carried out by competent members of the churches internal team where access is easy, very cost effectively and would be a List A item so no permissions would be required. Hire of access equipment is necessary to reach high fittings.

8.2 Lighting Controls (Internal)

The church is open 9 to 5 daily for visitors. It is recommended that selected lighting circuits are fitted with presence detectors.

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 Power Management Settings on Computers

The computer is used by the staff within the parish office but it was suggested during the audit that the computer is being left on when no one is at the desk and using the computer.

All computers can be shut down or put into a hibernate mode but this is rarely done by users during the day and tends to be limited to an end of day shut down only. This tends to be due to the multi-function process that is required to do this. It is therefore recommended that all computer workstations set to go into hibernate mode after a short period of time of not being used.

This can be set on the computers by going into the Power Options settings on the computers control panel and adjusting the times on the 'change when computer sleeps' option. It is recommended that computers should turn off their display after 2 minutes and put the computer to sleep after 5 minutes. Putting the computer to sleep will not lose any unsaved work but will require the user to power up the computer again when returning to their desk. Having shorter hibernate modes not along helps to save energy but also improves security by reducing the time that computers are left on but unsupervised.

8.4 Fixed Water Heater: Timer or Replacement

The Ariston 30 litre water heater, located in the disabled toilet was found to be on with the timer switch set to "ON" and not used to control its hours of use. Whilst the tank itself is well insulated, the copper pipework is not and was found to be too hot to hold. This is a constant heat loss of at least 100W (incandescent light bulb) and will waste around 900kWh per year, costing £140.

The water heater control clock is set to "clock" (centre) but with all the control segments at "on".

These only need to heat the water to the required temperature when the building is in use.

It is recommended that those managing hall use decide on the settings for the timer and set up the quarter hour segments and control switch appropriately.

If the hall use pattern is so unpredictable that the timer needs to be altered daily, the church is recommended to replace the whole unit with a point of use water heater immediately in advance of the kitchen tap. This will then heat only the water actually required.

Note that a 30 litre tank will only deliver 15 litres of hot water. As the water is drawn, it is replaced by cold, so the second half of the tank will be lukewarm.

8.5 Draught Proof External Doors

There are a number of external doors in the church, wood closing on wooden frames. An old draughtproofing strip was observed which did not appear to work.

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

It may be possible to obtain permission for installation of self-adhesive black rubber "P" cross section strip to be added to doors where it will not be visible.

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 a painted fridge magnet over large keyholes can all be simple DIY measures which are effective.

8.6 Insulation to Roof

The loft void above the suspended ceiling was not inspected as part of this audit.

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 – whilst the hall use at around ten hours per week is not high, having ceiling insulation is the most cost effective method of reducing energy loss since the costs per square metre are lower than cavity wall insulation.

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.

The hall and office have an area of approximately 120m2. At £9.50/m2 installation of full 270mm depth insulation (assuming there is none at present) would cost £1,140.

Many buildings which were fitted with insulation previously only have 100mm depth; it is worth increasing this to the current recommendation of 270mm.

9. Saving Recommendations (Water)

9.1 Tap Flow Regulators

If there is regular use of the hall by children, it is worthwhile installing tap flow regulators, especially where there is a water meter.

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.

These regulators can be self-installed or by any good facilities staff.

9.2 Detergents for Cold Water Hand washing

Use of cold water for hand washing can be just as effective as using hot.

https://www.nhs.uk/news/lifestyle-and-exercise/cold-water-just-as-good-as-hot-for-handwashing/

10. 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	Yes, installation in valleys
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
Biomass	No – not enough heating load as well as air quality issues
Air Source Heat Pump	No – unsuitable radiator network, low hours of use
Ground Source Heat Pump	No – unsuitable radiator network, low hours of use, archaeology in ground
Air to Air Heat Pump	Yes

10.1 Solar Photovoltaic Panels

There is potential for a Photovoltaic array to be located in the valley areas of the roof which are not visible from the ground.

These areas give about 15m of useable length. Because of shading only the top portions of the roof would be suitable, this gives an area estimated at $60m^2$.

Roof suitability would have to be confirmed with your architect for extra weight and wind loading on the structure.

The roofs offer areas of around $60m^2$. This could generate $0.15kWpeak/m^2$ giving a 9kWpeak system. A 1kWpeak system can generate up to 1000kWh annually.

Orientation factor (roof slope and angle from south) is 0.97.

Annual Generation (kWh) = Area x $0.15kWp/m^2$ x K factor x Orientation Factor x Overshading Factor

$$= 60m^2 \times 0.15kWp/m^2 \times 1000kWh/kWp \times 0.97 \times 0.9$$

$$= 7,860kWh$$

This is similar to the annual recent electricity use of church plus hall (8,350kWh).

If a heat pump is installed, solar power greatly enhances its viability, as the pump can run whenever the sun shines. For any type of electrical heating the load will increase and there will be a requirement for grid electricity during evenings and winter.

The Smart Export Guarantee pays about 5p/kWh for electricity generated and exported to the grid (the Feed in Tariff having ended). One of the issues for churches is that most lighting use is at periods when the electricity is not being generated, so installation of a battery to make maximum advantage is possible in future. This is currently expensive, but any solar PV system should be installed with provision for the future addition of a battery.

Using a battery will extend the usefulness of the power generated during the day into the evening, but some exporting of power to the grid in summer, and purchase from the grid for winter evenings will occur.

Battery Storage is not strictly a renewable energy solution but provides a means of storing energy generated from solar PV on site to be able to be used at peak times or later into the day when the PV is no longer generating. It therefore extends the usefulness of the existing PV system. This is a new but fast-growing technology.

Using average 2019 installation costs (£1,450 per kWpeak); a 9kWpeak system would cost £13,050. This does not include cost of any battery.

Sources: Tables H3 & H4, SAP 2009, http://www.bre.co.uk/filelibrary/SAP/2009/SAp-2009_9-90.pdf

11. Funding Sources

There are a variety of charitable grants for churches undertaking works and a comprehensive list of available grants is available at www.parishresources.org.uk/resources-for-treasurers/funding/

This includes a 77 page guide to funders and their criteria:

https://www.parishresources.org.uk/wp-content/uploads/Charitable-Grants-for-Churches-Jan-2020.pdf .

12. 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.

13. Other Observations

The gas meter is located outside and is open to the elements. It is vulnerable to damage. In the short term, a large plastic storage box could be modified to fit over the meter. If gas heating is retained in the medium to long term a more permanent solution is necessary. There are a large variety of gas meter boxes on the market; many for wall mounting. This supplier has a range of floor mounted units which may offer a suitable solution: www.kingsleyplastics.co.uk/grp-products/gas-cabinets/