ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

Christ Church, Ottershaw
PCC of Christ Church

Author	Reviewer	Date	Version
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Contents

1. Executive Summary

An energy survey of Christ Church, Ottershaw was undertaken by Inspired Efficiency 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.

Christ Church, Ottershaw is a brick built late Victorian Grade II listed church built in 1863 by George Gilbert Scott (with tower added in 1885), with an adjoining unlisted 1990s hall to the south. Listing register number 1260037. There is both gas and electricity supplied to the site.

The church has a number of ways in which it can be more energy efficient. Our key recommendations have been summarised in the table below and are described in more detail later in this report. It is recommended that this table 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)
Draught Proofing – entrance doors	5% of electric heating 1000	£148	£100	1	List A	0.25
Replace external floodlights with LEDs	3000	£445	£500	1	List A	0.75
Top up roof insulation, as necessary to 270mm, Parish Centre	5% of electric heating 1000	£148	£2,500	14	List B	0.25
Solar Photovoltaic panels on Parish Centre roof	10,800	£1,600	£18,980	12	Faculty	2.73
Install Air to Air Source heat pump (Parish centre main room)	Replace 11,340 storage heater use by 3,000; save 8,340	£1,237	£3,000	3	Faculty	2.11
Install Air to Air Source heat pump (church)	All of gas use, 24,500 Use 6,300 electricity	£933 gas All electric is solar	£13,000	14	Faculty	4.52
OR						
Install under pew heating	All of gas use, 24,500 Use 13,000 electricity	£933 gas Spend 330 grid electric, with solar PV	£18,750	31	Faculty	5.08

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

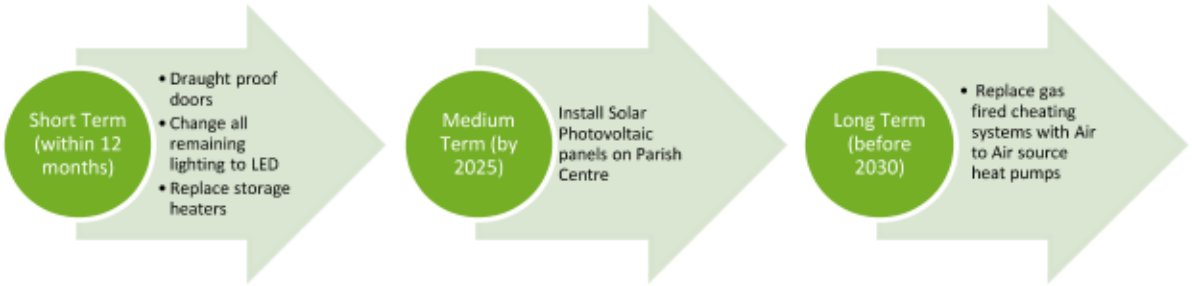
Based on current contracted prices of 14.83p/kWh (day) and 10.7691p/kWh (night) for electricity and 1.8392p/kWh for mains gas.

If all measures were implemented this would save the church in the region of £3,200 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 become a net zero building in the next 10 years. Furthermore, the PCC of Christ Church has received a bronze EcoChurch award.

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 Christ Church, Ottershaw 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 Christ Church, Ottershaw, Guildford Road, KT16 0PB was completed on the 15th March 2021 by 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 Associate member and a Chartered Scientist, with experience of the faculty process gained from chairing the building committee of a Grade I listed church. He has been an assessor for EcoCongregation.

Christ Church, Ottershaw	
Church Code	617196
Gross Internal Floor Area	Church 200m^2 Parish Centre 250m^2
Listed Status	Grade II

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

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	4 hours per week	75 weekly
Meetings and Church Groups	2.5 hours per week	900 annually, includes school visits
Community Use	0 hour per week Parish Centre used	
Occasional Offices	5 weddings p.a. 5 funerals p.a.	100 per ceremony

Church annual use: 350 hours

Heating hours: Church: 370 hours (24,345kWh / 66kW plant)

Heating hours: Hall: 1000 hours, estimated

Estimated footfall (church): 5,800 people

The adjacent hall is used by two main groups.

4. Energy Procurement Review

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

The current electricity rates are:

Day Rate	14.83p/kWh	Similar to market rates
Night Rate	10.769p/kWh	Below current market rates
Standing Charge	52.12p/day	N/A

The current gas rates are:

Single / Blended Rate	1.8392p/kWh	Below current market rates
Standing Charge	121p/day	N/A

The church has obtained its electricity and gas supplies from the Diocese Supported parish buying scheme, http://www.parishbuying.org.uk/energy-basket since October 2015. This scheme only offers 100% renewable energy and therefore it is an important part of the process of making churches more sustainable.

The above review has highlighted that the current rates being paid are in line or below current market levels and the organisation can be confident it is receiving good rates and should continue with their current procurement practices.

A review has also been carried out of the taxation and other levies which are being applied to the bills. These are:

VAT	5%	The correct VAT rate is being applied.
CCL	not charged	The correct CCL rate is being applied.

The above review confirmed that the correct taxation and levy rates are being charged.

5. Energy Usage Details

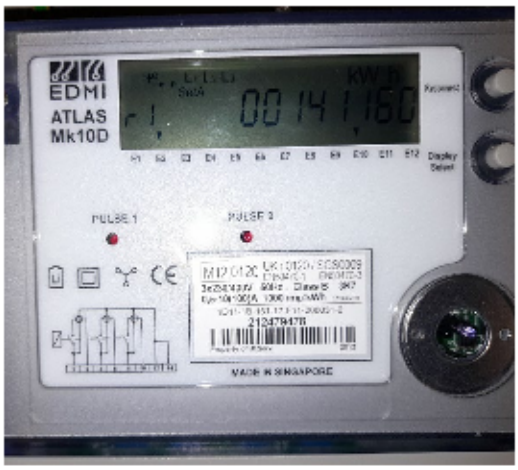
Christ Church, Ottershaw used 25,561kWh/year of electricity in the calendar year 2019, costing in the region of £3,900 per year, and 24,345kWh/year of gas, costing £630.

This data has been taken from monthly records kept by the church since 2009. These show that annual electricity consumption has fallen from around 31,000kWh in 2010, with a larger drop of 3,500kWh between 2018 and 2019. It is not known if this represents a fall in use of the building or increasing efficiency as a result of installing LED lighting around this time. Gas use was highest in 2010 at 38,650kWh, and normally between 20,000kWh and 29,000kWh thereafter.

Christ Church, Ottershaw has one main electricity meter, serial number 212479478. There is one gas meter serving the site.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church and hall	212479478	EDMI Atlas Mk10D	Yes	
Gas – Church	CD 34032		Device added	Gas meter box adjacent to churchyard boundary wall, ease end of site.

All the meters are AMR connected and as such an energy profile for the entire energy usage could be obtained.

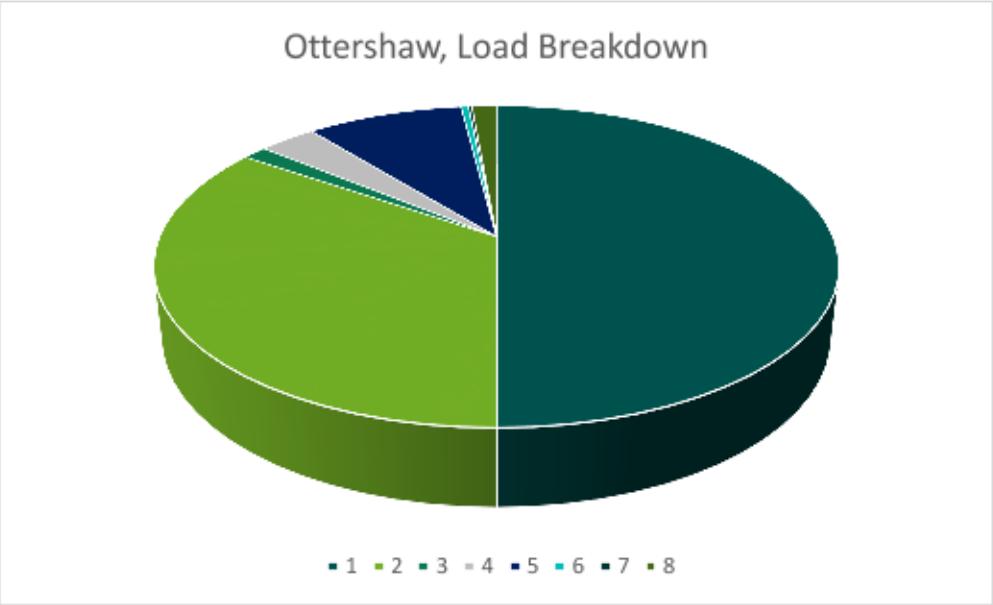


5.1 Energy Profiling

Service	Description	Annual Use kWh	Estimated Proportion of Usage
Heating (Gas)	Church - Gas fired blown air (e.g. 1000 hours, 25kW)	24,500 (to 31,000)	51%
Heating (electrical)	Fan for above heater 1kW Centre – storage heaters (3 at 3kW = 9kW) Run for 6 hours per night for 7 months/210 days Centre – convector heaters (15 at 2kW = 30kW Centre – portable heaters 2kW Hand driers 2 at 1.1kW = 2.2kW Estimated use over 210 days, mostly small numbers of hours per heater	1000 11,340 5300	35%
Hot Water	Water heater (Lincat), 2 hrs per week, 2kW Coffee machine (Technivorm), 2kW Point of use water heater, Ariston, 2kW Kettles	200 200 100 200	1.4%
Lighting (Internal)	Lighting mostly changed to LED Church 10 LED floodlights 500W 4 small downlights 40W 6 uplights (not visible) 30W Lady chapel 4 LED floodlights 200W TOTAL estimate 770W (350 hours) Centre, totalled 5 reflector spotlights 350W 14 circular diffuser CFL 560W 1 pendant CFL 10W 3 x T8 Fluorescent, 1m 174W 4 x T8 fluorescent, 1.5m 280W TOTAL estimate 1375W (1000 hours)	Church 270 Centre 1375	3.3%
Lighting (external)	Floodlights, non LED. 2kW Assume 6 hours per night Pedestal lights, PIR Door external light, PIR	4380 100 20	9%
Small Power	Vacuum cleaner, 1.5kW Photocopier, 500W Computer	80 30 100	0.4%
Organ	2 hours / week, 1kW	100	0.2%
Kitchen	Electric oven and hob (warming, not preparation) Extraction hood Microwave 1kW Fridge 150W	150 10 100 450	1.4%

Sum of estimates = 25,500kWh

Annual electricity use 2019 = 25,561kWh



KEY 1 Gas heating (church) 2 Electric Heating (Parish Centre) 3 Hot Water

4 Lighting (internal) 5 Lighting (external) 6 Small Power 7 Organ

8 Kitchen

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 where non LED bulbs of high power are used.

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use Christ Church, Ottershaw uses 41% more electricity and 16% less heating energy than would be expected for a church of this size. The low hours of church use, with this building only being gas heated is the reason for the lower than average use. For electricity, storage heaters are likely to be the main factor.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
Christ Church, Ottershaw (elec)	Church plus hall 450	25,500	56.7	40 where heating is electric	+41%
Christ Church, Ottershaw (gas)	Church 200	24,500	122.5	145	-16%
TOTAL	200	50,000	250	185	+35%

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 a 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 bio gas 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.

6.1 Heating Strategy

The site electricity use is higher than expected for the internal area. There are two factors, the presence of external floodlights which were described as non LED and appear to be large, and the use of storage heaters in the Parish Centre.

Storage heaters will only deliver benefit when there is a cheap overnight electricity tariff, and when their heat is required during the day, i.e. immediately after they have been charged.

Historically, the church has benefitted from very low night rate electricity (6.69p/kWh) but this rate is now 10.769p/kWh, about 1p/unit lower than the lowest 24 hour rates. Although they are

charged relatively cheaply, the heat stored will very slowly leak out during the day, and the amount left to be exported by evening is less than optimum. It was noted that the heating instruction sheet next to the main door allows for use of a toggle switch for boosting evening heating. It is unknown whether the model of storage heater fitted allows for *convection only* heating using this switch, or if you are actually warming up the storage bricks on full rate electricity *plus* exporting heat at the same time – if so, this is an extremely expensive method of heating.

There are two electric heating options for the Parish Centre, the most appropriate will depend on the use hours:

If the pattern of use of the main Parish Centre room is to be occasional, with short duration meetings which may be held at short notice, it is recommended to replace the storage heaters with electric radiant near infra-red panel heaters (non glowing). These will deliver almost instantaneous heat.

However, if hours of use of the Parish Centre are high, Air to Air source heat pumps (AASHP) will deliver twice (or more) the amount of heat than the electricity consumed, which will give financial advantages increasing the more the centre is heated. They offer heat up times significantly faster than water based radiator systems. Capital cost will be greater than infra red panel heaters, and installation space may be an issue as the outside units project from the walls where there is limited space at the side of the building. An example of a church hall fitted with AASHP is St Leonard's, Wollaton, Nottingham.

The church is heated with a blown air space heating system, opportunities for making it more energy efficient consist of replacement with a larger Air to Air Source Heat Pump [AASHP] which may require more plant room space, or electric under pew heating.

The latter is straightforward and offers the advantages of instantaneous heat where the people are, and individual switching under each pew. However, the church will need to consider if it wishes to retain bench seating, and if so, are they required to be moveable.

6.2 Parish Centre – extra evening heating requirement

When there is a need for extra evening heating, this should be supplied by using the convector heaters and not the storage heaters, as the latter will also be taking heat to charge the storage bricks.

6.3 Church - Install Electric Under Pew Heaters

Pew heaters allow heating to be easily optimised close to the congregation – there is very little waste heat as occurs with any space heating system where hot air rises to the ceiling first. Switching of different zones can be arranged – maybe with normally only the front half of the pews being heated for small congregations. Another option is to arrange control so either half or all of the heaters under a pew (where there are two fitted) are on, to address different weather. It is normal for pew heaters to each have an individual switch so they can be turned off if people are becoming too warm.

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:

North side, 12 rows of two PH65 heaters in each row, three rows of one (short pews)

South side, 9 + 5 rows of two PH65 heaters.

Total 26 x 2 + 3 = 55 locations.

If the pews are to be movable, then low level sockets will be required. Surface mounted sockets could easily be damaged when moving heavy pews, so they would need to be recessed into wooden trunking at the floor/wall interface which would carry the cables.

Each pew heater to be switched with a neon indicated fused spur located underneath the pew seat.

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.

Alternative types include these fabric covered Cooltouch Ltd, 320W pew heaters (St Catherine's, Towersey, Oxfordshire), a design requiring attachment to a vertical surface.

The model below appears to be longer than one metre so will not fit due to the pew centre supports, also they are fitted to pews with solid backs.

Costs

Assumptions –

- Fit to each pew (not all would need to be on, variable according to weather)
- Current boiler of 66kW, if heating from cold and running at maximum power; 24,345kWh annual consumption = 369 heating hours. Operating costs quoted for 370 heating hours. With a lower total kWh rating, this is less overall heat, but it is delivered directly to the congregation and not to the ceiling first.
- Sufficient space is available between the pew legs for a BN65 (a tight fit).

BN Thermic BN65 650W heaters – 948mm length. £116 each, installed cost estimate £341 each

BH Thermic BN45 450W heaters – 702mm length, £88 each, installed cost estimate £313 each

Capital costs

55 X £341 = £18,755

Operating cost.

55 x 0.65kW x 370 hours = 13,227kWh x 14.83p/kWh = £1,961

This supplies 54% of heat compared to the warm air gas heating system, but to the place of need.

Operating cost for gas currently £934 plus annual servicing and safety certification.

6.4 Church – Install Air to Air Source Heat Pump

This would replace the current gas fired warm air blower in approximately the same location.

There is space below the current ducting if a larger area for plant is required.

AASHPs are quoted as cheaper than ASHPs (which supply a warm water network) by a factor of four. Good Coefficients of Performance are quoted of 4 and above for them: 4x more heat

energy in kWh is extracted from the outside air for each kW of electricity used to drive the system.

Technical issues to discuss with an equipment supplier include plant power rating.

A system delivering 66kW (and consuming around 17kW of electricity) to run for similar hours as the present gas system may be too large and incur a larger capital cost than necessary.

Installing a smaller plant will reduce capital cost – but will require to be operated for more hours to deliver the same amount of heat. This will influence how the church is heated.

A sufficiently large air intake will be required which may involve extra ducting in the boiler room area to supplement the current intake.

Costs

Capital: Unknown but cheaper than wet system ASHP (which would cost £26k for a 66kW system)

Scaling up price range quoted for 12kW output domestic AASHP units gives £8-15k.

Operating. 17kW electricity x 370 hours = 6,290kWh x 14.83p/kWh = £933

Current gas operating cost 24,345kWh x 14.83p = £449. Plus Standing charge and VAT = £934, plus annual safety certification and servicing. Moving away from gas would remove the standing charge too, and the electricity standing charge will be paid anyway for the whole site.

The existing air intake duct may need to be supplemented for an AASHP. One option may be to replace the door with a hinged grille.

6.5 Parish Centre – Option 1 Install Air to Air Source heat Pump

If this room was to be used regularly, an AASHP would provide the heat more economically than direct electric heating from the existing storage heaters (which no longer benefit from a very cheap overnight rate) or direct electric heating

Parish Centre main room. AASHPs could be installed on the external wall to the left.

Cost

Capital cost, one domestic 12kW output AASHP (estimates £1,600-3,000)

Operating cost. 12kW output / 4 (COP value) = 3kW electricity required.

3kW x 1000 hours = 3,000kWh, x 14.83p/kWh = £445

12kW is four large electric heaters or six normal sized ones and would be overcapacity if the other non storage electric heaters remained in use.

Here, with 3kW electricity generating up to 12kW heat, the entire heat load for the room could be supplied by an AASHP unit for the same cost as the three IR panel heaters plus convector heaters above – which, generating 3.6kW would probably need to be supplemented by the other existing electric convector heaters.

6.6 Parish Centre Option 2 - Install Electric Panel Heaters

It is recommended that the storage heaters in the main room are replaced by either far infra red panel heaters (non glowing) if the room is to be normally used for short periods, or a low number of hours during the week. Alternatively, as use rises, Air Source Heat pumps (with higher capital cost) become more economic. With no existing wet radiator network, a domestic sized air to air source pump would be suitable for this room of area 70m^2.

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

Capital cost

3 x 1200W units at £400 each / £600 installed cost = £1,800

Operating cost

3.6kW x 1000 hours = 3,600Kwh. X 14.83p/kWh = £534 plus use of the two existing convector heaters when required.

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 External Floodlights

The floodlights installed could not be inspected due to the height of installation. If they are not LED (which is probable) they will consume relatively large amounts of power, so should be changed for suitable LED floodlights.

7.2 LED Lighting

The remainder of the lighting in the church , believed to be high level fittings only, should be changed to LED bulbs.

7.3 Lighting Controls (Internal)

There are lights in several areas such as the entrance foyer, toilets and kitchen which would benefit from presence detector control. 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 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.

7.4 Draught Proof External Doors

The pair of metal framed main entrance doors have a draught seal where they meet, but this is missing at top and bottom (light can be seen – 3 to 5mm gaps). As draughts will blow continually, this represents a constant loss of heat from the building which may contribute to as much as 10% of energy loss.

The church may possess maintenance manuals and/or specifications from when the Parish Centre was constructed which will specify the type of door and where spare parts may be obtained. Your architect may be of help.

All external doors will benefit from ensuring that draughts are excluded.

7.5 Insulation to Roof

The Parish centre was built with 50mm of cavity wall insulation, but may not have the current standard of 270mm insulation in the loft areas / under the roof.

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.

7.6 Gutter Maintenance

Discolouration to the bricks evidences leaks in the gutter jointing above. Although minor, it could lead to water ingress into the walls and consequently higher heating bills.

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	On Parish Centre
Battery Storage	Yes
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	Yes; Air to air
Ground Source Heat Pump	No – archaeology in ground and no radiator system

There is potential for a PV array on the roof of the Parish Centre. The current arrangements around solar panels mean that to be financially viable the building on which they are mounted needs to consume the vast majority of the energy that they produce.

Installation of electric heating to replace gas increases the viability of installing solar panels.

Battery Storage is not strictly a renewable energy solution, but battery storage does however provide 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 particularly in this sort of church. This is a new but fast-growing technology with prices expected to fall substantial over the next 2 to 3 years.

Heat Pumps are a low carbon method of creating heat, their use and suitability for this church has been review in the section earlier on in this report on Efficient and Low Carbon Heating Strategies.

Biomass is an alternative boiler and fuel to oil or gas. It requires wood chips or pellets to be delivered on site, stored and then fed into a large boiler for burning. While the fuel is not a fossil fuel there are emissions from the burning of wood and these can be detrimental to local air quality particularly in more built up areas for all these reasons it is not considered a viable recommendation for this site. It is a maintenance intensive technology.

8.1 Solar Photovoltaic Array

The Parish Centre has a south facing roof area of approximately 90m^2 (including the flat central roof section). This is sufficient to install a 13kWpeak system. At average May 2020 costs of £1,460 per kWpeak, this totals £18,980.

The "Smart Export Guarantee" would pay around 5p/kWh for electricity generated and exported to the grid (the Feed in Tariff having ended).

The hours of hall use mean that most of the generated electricity could be used, with battery storage extending the usefulness of the system into the evening.

Furthermore, installation of a heat pump – which can run at any time, would ensure that no electricity generated is wasted as electricity unused for lighting and heating the hall could be used to maintain the church temperature, or exported to the grid.

The south facing Parish Centre roof is partially shaded by trees. It offers an area of around 18m length x 5m height = 90m^2. This could generate 0.15kWpeak/m^2 giving a 13kWpeak system.

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

= 90m^2 x 0.15kWp/m^2 x 1000kWh/kWp x 1 x 0.8

= 10,800kWh

This is smaller than the sites current annual electricity use (25,500kWh), which suggests that all of the generated power could be used if a battery were installed.

The trees to the south of the roof provide some shading, so exploiting the top of the roof too is recommended.

9. 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.

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.