Energy Efficiency and Zero Carbon Advice

Christ Church, Highbury
PCC of Christ Church

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1. Executive Summary

An energy survey of Christ Church, Highbury was undertaken by ESOS Energy to provide advice to the church on how it can be more energy efficient and provide a sustainable and comfortable environment to support its continued use.

Christ Church, Highbury is a Grade II listed Victorian church. The building has been reordered to create meeting rooms on two levels and a kitchen using the west end of the nave and is in regular use. 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)
Install Quattroseal to External Doors	3% 3263	£79	£800	10 years	List B	0.6
Add or Replace draught strips to external doors	2% 2174	£52	£50	1 year	List A	0.4
Refurbish window ironmongery / draught seals	5% 5437	£131	£300	2.3 years	List A	1.0
Investigate cost effectiveness of adding secondary glazing to windows, ground and first floor meeting rooms	5% 5437	£131	£5,000	38 years	Faculty	1.0
Purchase temperature datalogger	Included in figures below		£50	N/A	None	below
Optimise control system settings	10% 10875	£263	Zero	Immediate	None	2.0
Clean or flush heating system and refill with inhibitor	7% 7609	£184	£400	2.2 years	List A	1.4
Install Endotherm advanced heating fluid into heating system(s)	10% 10875	£263	£200	0.8 years	None	2.0
Insulate exposed pipework and fittings in plantroom	5% 5437	£131	£500	3.8 years	List A	1.0
Install reflective panels behind 24 radiators	2% 2174	£52	£200	3.8 years	List B	0.4

Ensure LED bulbs fitted to all internal lighting	1000 by replacing CFL for LED	£162	£200	2 years	List A	
Replace heating system for electrical based heating solution	108705 gas requiring 10000 electric	£2,336	£13,100	6 years	Faculty	17.5

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

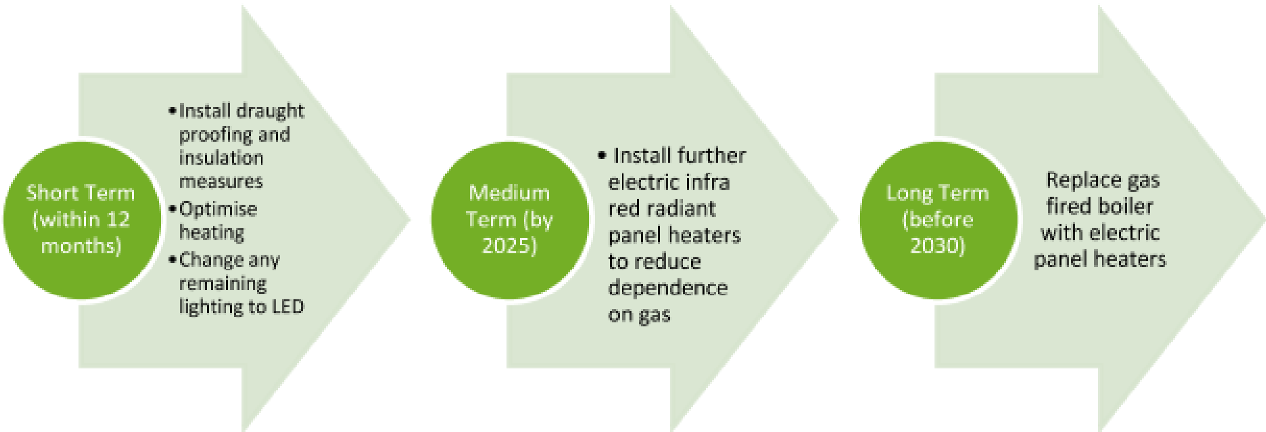
Based on current contracted prices of 16.24p/kWh and 2.42p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church around £3,800 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 2030 by undertaking the following steps:



3. Introduction

This report is provided to the PCC of Christ Church, Highbury 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, Highbury, 155 Highbury Grove, London N5 1SA was completed on the 18th September 2020 by Paul Hamley. Paul is an energy auditor with experience of advising churches and small businesses. He is part of the Diocesan Environment Officers Energy Group 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, and has been an Eco Church assessor.

Christ Church, Highbury	
Church Code	623124
Gross Internal Floor Area	590 m^2
Listed Status	Grade II

The church typically used for around 42 hours per week for the following activities:

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	7 hours per week	180 total for Sunday mornings
Meetings and Church Groups	2 hours per week	
Community Use	31 hours per week	20
Occasional Offices	2 hours per week average	100

Annual building occupancy hours = 2168

Annual footfall estimation = 25,000

4. Energy Procurement Review

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

The current electricity rates are:

Single / Blended Rate	16.24 p/kWh	Above current market rates
Standing Charge	30p/day	N/A

The current gas rates are:

Single / Blended Rate	2.42p/kWh	In line with current market rates
Standing Charge	236.99p/day	N/A

Current Supplier: E.On

The above review has highlighted that there are opportunities to gain cost savings from improved procurement of the energy supplies at this site. We would therefore recommend that the church obtains a quotation for its gas and electricity supplies from the Diocese Supported parish buying scheme, http://www.parishbuying.org.uk/energy-basket. This scheme only offers 100% renewable energy and therefore it is an important part of the process of making churches more sustainable.

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

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

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

5. Energy Usage Details

Christ Church, Highbury used 17,073 kWh/year of electricity during 2019, costing in the region of £2,323 per year, and 108,705kWh/year of gas, costing £3,960.

This data has been taken from information provided by the church. Christ Church, Highbury has one main electricity meter, serial number K74A 12940. There is one gas meter serving the site, serial number 02508379.

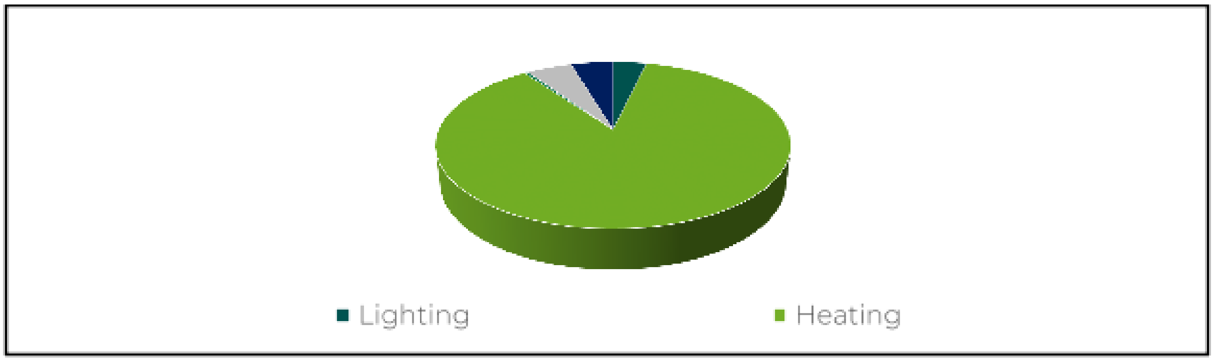
Utility	Meter Serial	Type	Location
Electricity – Church	K07A56231	3 phase	Cabinet in churchyard near east boundary wall
Gas – Church	02508379	-	-

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.

5.1 Energy Profiling

The main energy consuming plant can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting	Estimated 3000kWh internal, 1460kWh external floodlights	3.6%
Heating	Gas fired	86%
Hot Water	Hot water heaters	0.4%
Electric Heating	Infra red panels, first floor	5%
Other Small Power	Includes kitchen appliances	4.6%



As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site. The lighting load is small due to adoption of low energy lighting for most internal fittings.

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use Christ Church, Highbury uses 52% more electricity and 24% more heating energy than would be expected for a church of this size.

This is likely to be due to more hours of use than average.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
Christ Church, Highbury (elec)	590	17,073	28.9	19	152%
Christ Church, Highbury (gas)	590	108,705	184	148	124%
TOTAL	590	125,778	213	167	127%

Benchmark data source: Church of England National 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 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.

The current boiler is described as being at least seven years old; thus it can be expected to require replacement within the next decade. A boiler replacement plan should be put in place.

The church has installed infra red radiant electric panel heaters in the first floor meeting room. This enables the room to be brought quickly into use without having to heat the whole building.

The rest of the church is currently heated using gas fired central heating. Depending on the future use pattern of the building, the route to becoming carbon neutral could be either a complete installation of infra red heating, or the replacement of the gas boiler with a heat pump, retaining the existing radiator network. The latter requires regular use (ideally over 50 hours) to be cost effective – heat pump systems become very inefficient and expensive when asked to warm up a church from cold (often 10-12°C) once or twice per week: they function best maintaining a relatively constant temperature. Electric panel heating systems are best deployed for occasionally used spaces (they require little preheating compared to central heating systems). However, for constantly used buildings or rooms, electric heat delivering the same amount of kWh as gas will be more expensive.

Onsite generation of electricity will help reduce costs for electric heating; but with current regulations the visible roof of Christ Church does not offer a suitable location for solar panels.

Section 7 describes efficiency to optimise the current system.

The ceiling of the area of church used for services (above) is too high for the installation of radiant infra red panels for heating

6.1 Discontinue with Background Heating Strategy

The main church sanctuary area consisting of the crossing, transepts and chancel is described as losing heat rapidly. Therefore, any attempt to maintain a background temperature here will incur rapid loss of this heat to the environment. Money should be spent on draught exclusion measures, which will help to decrease the heat up period and cut heating costs.

Most traditional churches were constructed without any form of heating. The modern additional of heating 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 organ (and other sensitive areas such as historic papers stored in the vestry) may require some local background heating specific to that area. In general, sensitive paper records should be removed for storage in the county archive. Organs can be installed with a local background tube heater such as https://www.dimplex.co.uk/product/ecot-4ft-tubular-heater-thermostat within the organ casing in order to provide the heat where it is required. 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 constant background heating to the church building as a whole is excessive and wasteful of energy. At the very least we would recommend that this background level is reduced to a maximum of 12°C and ideally avoided all together.

6.2 Install Electric Panel Heaters

Unless a heat pump is chosen, installation of further electric heaters in the ground floor room would allow this area to be brought into use more quickly than the present central heating system allows.

It was noted that considerable quantities of chairs were stacked in front of the existing radiators – if this is always to be the case, electric convector heating would be required (or ceiling mounted infra red panels), as any heat from radiant heater fitted in the same locations as the current wet radiators would be blocked by the furniture.

It is recommended that the PCC consider installing electrical panel heaters in this area on a time delay switch and remove the existing radiators.

The church as a whole uses around 108,000kWh of energy annually for heating; around 90% of which arrives at the radiators. With a heating season of six months, 68 hours per week heated gives an average of 61kW split between the sanctuary and meeting room. Much of this heat is lost to the ceiling through convection: to deliver the same amount of effective heat to the congregation requires radiant electric heaters of lower combined power. Installing radiant infra red panel heaters in the approximate locations of the existing radiators arranged around the cruciform shaped space, and installing two rectangular units mounted in portrait format where space permits to deliver a total of almost 20kW.

16 panels, 1.2kW each = 19.2 kW.

Operation times, Sunday 08:30-12:00 & 18:00-19:30 + thrice weekly 08:50-09:30, Weds 10:30-12:00, Fri 10:00-12:30 = 11 hours/ week x 30 weeks = 330 hours use.

Energy required = 6336kWh, cost at present rates, £1,029

If the sanctuary area is only used during these times, and the meetings rooms are heated independently (first floor electrically as at present, ground floor with new electric heating), it offers a considerable potential saving.

This is significantly less than the cost of running a heat pump (Section), but note that the radiant panels are only used to provide heat on demand, whereas a heat pump would be providing constant heat during the heating season (albeit at a lower temperature) - the calculation is for 4400 hours.

Running panels for this amount of time would cost £13,720.

This shows how radiant heating, delivering heat on demand is the most appropriate solution for an occasionally used space, but for a constantly used space, a heat pump becomes more cost effective.

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. This reduces the amount of preheating required before each use of the building and can make electric heating cost competitive with gas. It also means that the building can rapidly be brought into use, economically, for short or unplanned meetings.

7. Improve the Existing Heating System

Two Vaillant Eco Tec condensing boilers, thought to be 37kW each, are fitted in parallel and located in the basement.

The boilers date from c. 2013, so can be expected to require repair or replacement within the next decade. In the years 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 Optimise Boiler Temperature Settings

To obtain maximum efficiency from the boilers, the return water temperature must be below 55°C, (which then allows heat to be recovered from condensing the flue gases). It may be measured using the temperature datalogger on the return pipe. If the output temperature needs to be reduced (which can be done via the boiler control panel), longer operating times will be required, but, a portion of the heat is now coming from the exhaust gases, increasing efficiency.

Modern boilers often have an "Eco" button or setting to automatically set this temperature.

7.2 Optimise Heating Timing Settings

Purchase of a temperature datalogger (such as Easylog USB-1 or similar) would allow the heating on and off times to be optimised. Monitoring of over 50 churches in the Diocese of Lichfield has shown that central heating can be turned off 45 minutes before the end of the service as radiators retain their heat.

7.3 Clean the Existing Heating System

Clean or flush heating system and refill with inhibitor: magnetic sludge 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.

7.4 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.

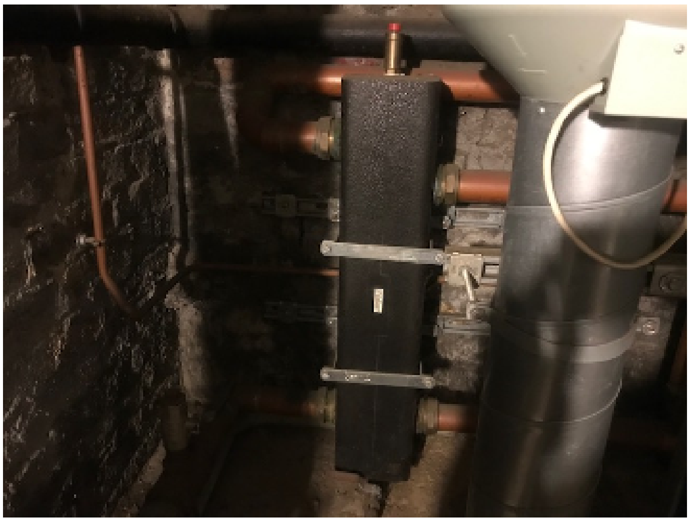
This fluid is in addition to, and complements any existing inhibitors in the heating system and is added in a similar way. The fluid works to improve the ability of the boiler to transfer heat into the heating system and for the radiators and other heating elements to give out their heat into the rooms. 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 self-installed.

7.5 Install lagging on all Unlagged Pipework and Valves

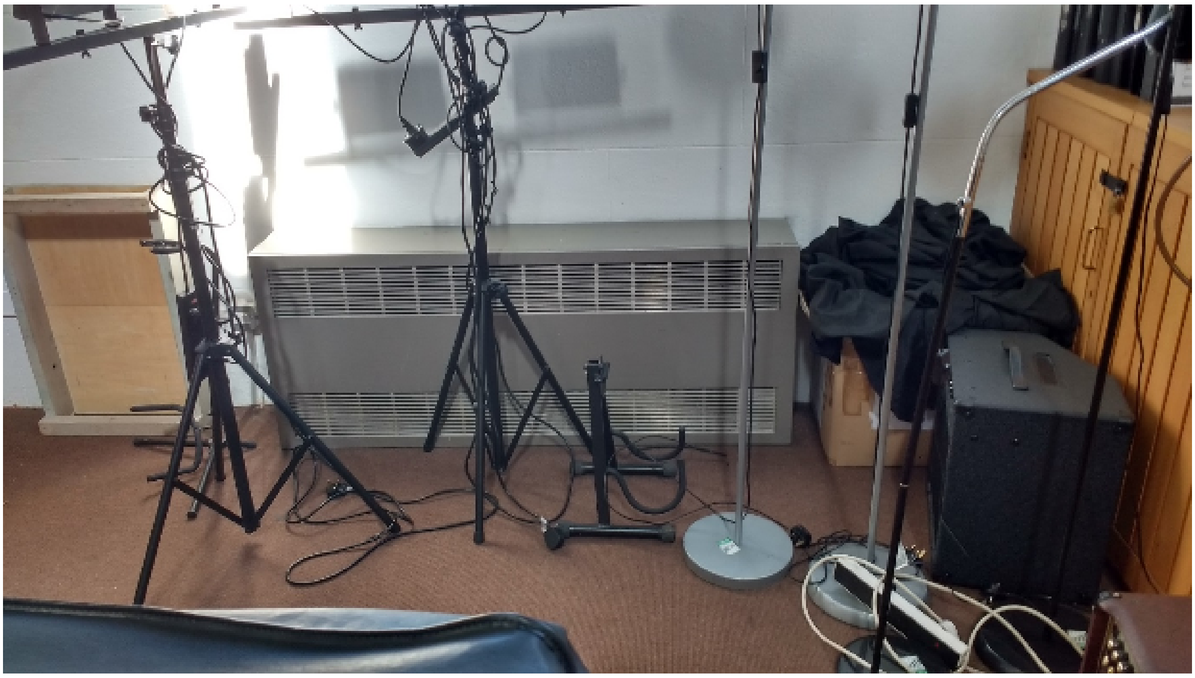
The pipework within the boiler room has some of the straight lengths insulated but the more complex shaped pipework fittings, such as valves, have been left uninsulated. These exposed areas of pipework contribute significantly to wasted heat loss from the system.

It is recommended that these areas of exposed 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.



7.6 Clean Fan Assisted Radiators

Some of the radiators are these grey cased fan assisted models. Inspection with a torch indicated considerable dirt and dust on the heat transfer fins. This should be cleaned off to allow the radiators to work more efficiently and effectively.



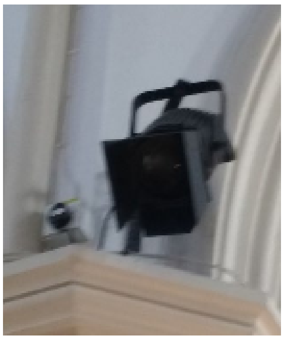
8. Energy Saving Recommendations

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.

8.1 New LED Lighting

The lighting makes up a relatively small part of the overall energy use; most lighting has already been changed to low energy (CFL or LED) bulbs. Future replacements should use LEDs which are typically of 3-5W power rating as opposed to 9-20W for CFLs. Where dimmer controls are fitted, compatible LEDs must be sourced (they are more expensive). If lighting is controlled by a bank of switches, it is often possible to obtain a dimming effect by switching on only selected circuits.

The two theatrical type spotlights mounted on the pillars are too high for inspection – if these contain traditional halogen bulbs they could be 250W or 500W each.



The external floodlight bulb power could not be ascertained. LED floodlights are available at 150W power. Any externally mounted lights must be IP65 rated (waterproof).

8.2 Insulation of Pipework and Fittings

Any exposed pipework, valves and fittings around boilers and tanks should be insulated.

Any 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 areas of exposed 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.

8.3 Reflective Radiator Panels

The church is heated by radiators served from the boiler. These radiators are located on the external, uninsulated walls and have no reflective or insulated surfaces directly behind them at present. They therefore lose much of their heat into the masonry of the wall behind the radiator rather than give out the heat into the body of the church.

In order to improve the insulation directly behind the radiators a reflective panel can be installed, this helps to make sure more of the heat from the radiator goes into the space and requires less overall heating from the boiler to achieve the set point. There are a wide variety of reflective panels for installing behind radiators on the market such as www.heatkeeper.co.uk. It is recommended that these panels are installed behind all radiators within the building

The installation of radiator panels can be carried out by anybody competent in basic DIY and does not require the radiators to be removed.

8.4 Draught Proof External Doors

The main sanctuary has been described as losing heat rapidly. Addressing this should include ensuring that all doors and windows are adequately draught proofed.

Installation of draught proofing strips to the modern glass doors at the transepts, and to the original doors at each corner of the nave (which have noticeable gaps underneath) should be undertaken.

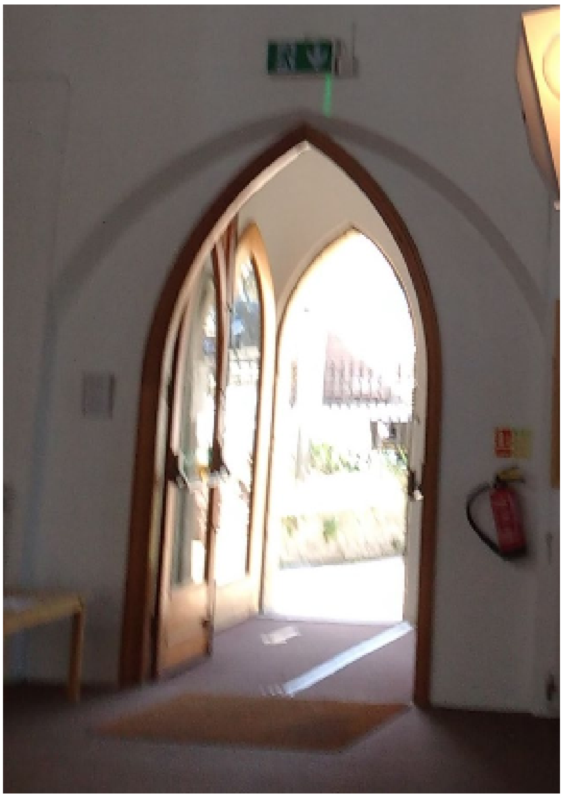
The historic timber doors do not close tightly against the stone surround and hence a large amount of cold air is coming into the church around the side and base of these doors. It is recommended that the draughtproofing around the door is improved and draught strips are added. This could be achieved in a number of ways:

For timber doors that close onto a timber frame a product called QuattroSeal (see link below) is often used in heritage environments to provide appropriate draught proofing.
http://www.theenergysavers.co.uk/application/files/1714/7197/4194/National_Trust_Case_Study.pdf

For timber doors that close onto a stone surround more traditional solutions such brush draught strips rebated into the edge of the door by a skilled joiner. Other traditional methods such as using hessian or felt pads tacked to the door could be used and keeping the door maintained in a good condition is important.

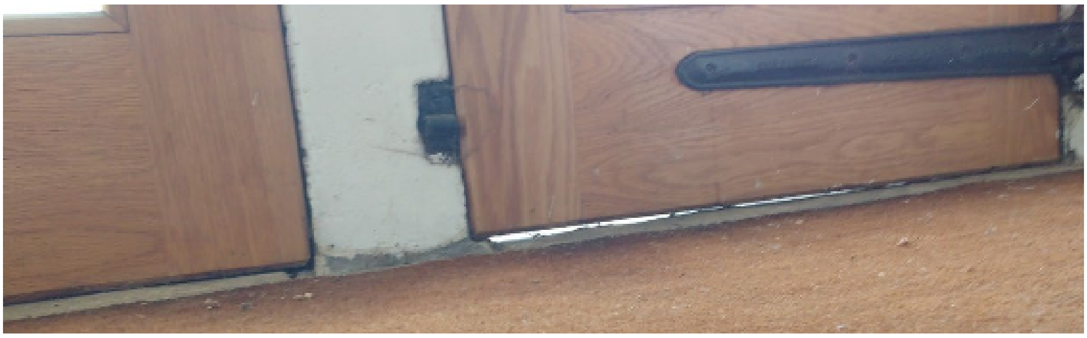
Simple measures such as having a 'sausage dog' style draught excluder laid along the base of a door (it needs to be sufficiently heavy to stay in place), using plasticine of the right colour to fill gaps where daylight can be seen and putting painted fridge magnets over large keyholes can all be simple DIY measures which are effective.

The main doors used for the congregation to enter should be kept closed during cold and windy weather – this will need a coordinated team of two friendly door openers to welcome people, and keep as much warm air in as possible.



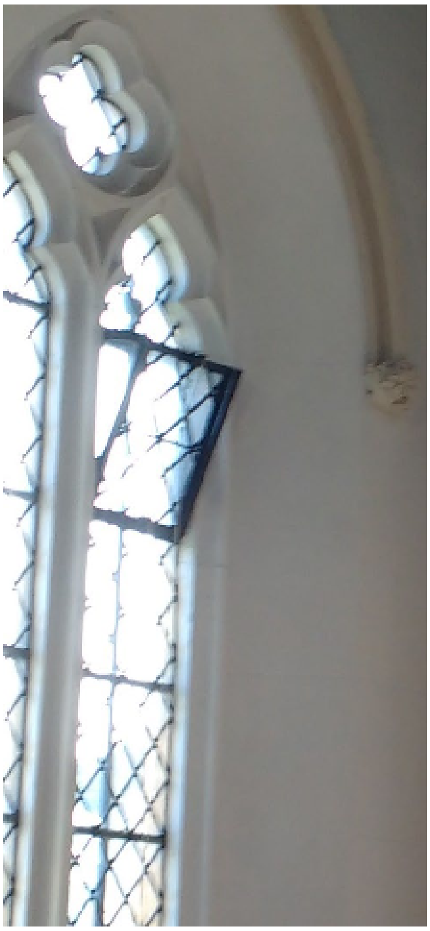
The door at the south east corner, above, is fitted with a draught strip, but it does not reach the ground where the step is worn.

The external east transept door, below, has a clear gap underneath it.



8.5 Windows

There are hopper windows in the transept area; these are very difficult to keep draught free. Any instances of bent or damaged frames, windows which do not close or allow water penetration should be repaired professionally without delay. Any water penetration will cause damage to the building and rusting of ironwork. Small gaps around opening windows can be sealed throughout the winter by the use of black plasticene – it is easy to remove for summer opening.



Both of these windows were noted to be open during the visit and they should be checked to see if they can be closed for the winter period.

8.6 Secondary Glazing

It may be possible to install secondary internal glazing; such as in the ground floor meeting room. This is only worthwhile if the room is to be used regularly, say over 40 hours per week.

The introduction of secondary glazing would considerably reduce the heat loss through the existing windows and improve both thermal comfort and noise levels as well as providing added security.

Any possible installation would need to be carefully specified, and companies such as https://www.selectaglaze.co.uk/heritage-listed-buildings or https://www.stormwindows.co.uk/ can provide very discrete and appropriate systems for all types of spaces.

9. Saving Recommendations (Water)

9.1 Tap Flow Regulators

Fitting flow regulators can prevent taps being left running and excessive use.

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.

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	No – visible roof
Wind	No – no suitable land away from buildings
Battery Storage	No – no viable PV
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Biomass	No – not enough heating load as well as air quality issues
Air Source Heat Pump	No obvious location
Ground Source Heat Pump	Possible but largely unattractive due to major costs

10.1 Solar Photovoltaic Panels

The entire roof is visible from the surroundings of the church which offers no location for solar panels on a listed building under present regulations.

10.2 Electric Vehicle Charging Points

The church has a car park to the side. 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, the PCC may wish to consider installing an electric vehicle charging point, probably on the side of the church 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 organisation control over who is allowed to use the unit with a key operated system. Or given the type of use of the building and control over the usage of the car park as a whole a simple 32 amp type 2 wall pod type charger may be most suitable and these are widely available through many suppliers such as http://www.rolecserv.com/ev-charging/product/EV-Charging-Points-For-The-Home.

Because of the parish office next to the building on the same site is considered as a place of work and as such installation grants are available through the work place charging scheme https://www.gov.uk/government/publications/workplace-charging-scheme-guidance-for-applicants-installers-and-manufacturers which will fund 75% of the installation cost up to £500.

The facility could also be used by church staff.

11. Cost Comparison

Technology	Use Pattern	Annual Hours	Installed Power	kWh	Operating Cost
Radiant IR Panels	Present Demand pattern	330	19.2kW (16 x 1.2kW panels)	6,336	£1,029
GSHP, COP = 3.5	Present Demand pattern	To heat 330, but need to be on more to attain temperature: 1000 or more	40kW max heat delivered, 8.6kW electric load	8,600	£1,396
Radiant IR Panels	9-5, Heating Season	1300 50h/week x 26 weeks (probably more than needed)	19.2kW	24,960	£4,053
GSHP, COP = 3.5	Heating Season	4400	40kW max heat delivered, 8.6kW electric load	37,840	£6,145

COP = Coefficient of Performance (how many kW of heat are produced for each kW of electricity used to run the heat pump)

Costs based on current E.On charge of 16.24p/kWh

In both cases, radiant infra red panels have lower operating costs.   For the present demand pattern of the church (sanctuary only), the heat pump is either having to heat up from cold several times per week - slow and inefficient, or it is running constantly when the building is not in use.

For a building in more regular use, IR panels are not needed to be on constantly.

Capital cost (installed costs including wiring. 3 phase supply required)

Item	Number	Cost Each	Total
IR panel (church, 1.2kW	16	£609	£9,744
IR panel (meeting room), 900W	6	£559	£3,354
IR panel total			£13,098
Ground Source Heat Pump 40kW peak heat supply	1	£40,000	£40,000

In practice, there are extra considerations – a heat pump would also be heating the ground floor rear room, which makes it easier to justify. On the other hand, the church already has electric heating installed on the first floor (useful to obtain experience).

The practicality of heat pump installation (space, drilling a borehole, potential leakages, space in the boiler room) and high capital cost all weigh against it.

The issue with infra red panel heaters is installation location – does replacement of the existing radiators (with some replaced by two IR panels where there is space) give enough kW capacity?

Currently there are about 12 radiators feeding the space, a mix of three types. Three are in the chancel.

Installing the largest IR heaters (or two adjacent) may be the solution, but there is very little wall area available due to the layout of the church, so some detailed thought would be necessary to obtain balanced heating without hot spots, which could occur if two IR heaters were installed close together at right angles, in place of current radiators near the transept corners.

12. Funding Sources

There are a variety of charitable grants for churches undertaking works and a comprehensive list of available grants is available at https://www.parishresources.org.uk/wp-content/uploads/Charitable-Grants-for-Churches-Jan-2019.pdf .

13. 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.