ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

St Mary's Church, Feltham
PCC of St Mary's Church

Author	Reviewer	Audit Date	Version
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Contents

1. Executive Summary

An energy survey of St Mary's Church, Feltham 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.

St Mary's Church, Feltham is a Grade II listed church with Norman chancel and nave. The large north transept is early 19th century with the western extension to the nave, tower and porch from 1865. Rooms to the north forming a vestry, office and sacristy date from 1954.

The unlisted mid 20th century church hall is to the NW on the opposite side of the road. There is both gas and electricity supplied to the site. This building offers greater opportunities for energy saving.

The church has a number of ways in which it can become 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						
Door repair and draughtproofing works	1% 380	£58	<£30 Repair £500		List B	0.09
Install ceiling insulation in north transept	3% 1100	£177	£720	4	Faculty	0.28
Install secondary plastic double glazing to Victorian windows	5% 1900	£295	Unknown	Unknown	Faculty	0.48
MEDIUM TERM						
Install solar photovoltaic tiles on 1954 roof sections	9,800	£1,500	£18,000	12	Faculty	2.48
LONG TERM						
Replace Underfloor electric water heater with Heat Pump	22,800 (60%)	£3,500	£9,600	3	Faculty	5.77
HALL						
Install ceiling insulation in hall	10% 750	£114	£1,900	17	List B	0.19
Install cavity wall insulation in hall (if not already fitted)	8% 600	£92	£7,500 whole building £2,250 central section	Not recovered	List B	0.15
Replace electric heaters with Air to Air Heat Pumps	5600	£860	£8,100	10	Faculty	1.42
Install Solar photovoltaic panels	5000 +	£765 +	£8,700	11.5	Faculty	1.26

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

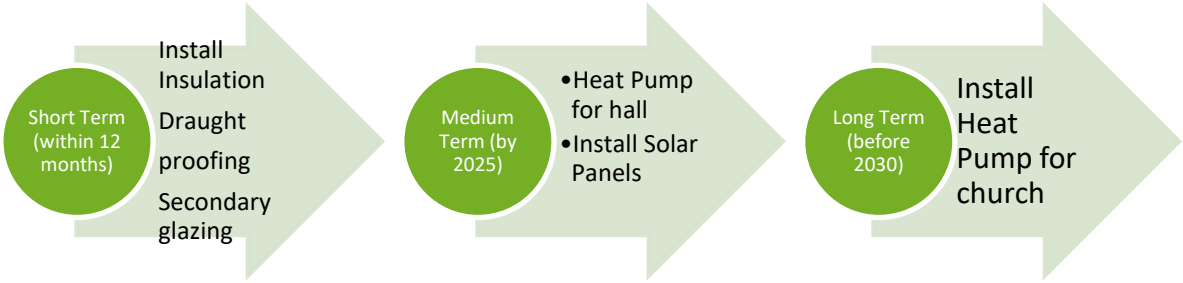
Based on current contracted prices of 15.28p/kWh for electricity.

If all measures were implemented this would save the church around £7,000 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 St Mary's Church, Feltham 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 with improvements in the levels of comfort. Where future church development and reordering plans are known, the recommendations in this report have been aligned with them.

An energy survey of the St Mary's Church, Feltham, Bedfont Green, TW14 8JR was completed on the 30th June 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 Joan Broughton, Church Warden and Cliff Watson, Head of Environment Group.

St Mary's Church, Feltham	CHURCH	HALL
Church Code	623223	
Gross Internal Floor Area	280m^2	340m^2
Volume	1460m^3	1290m^3
Space Heating requirement	48kW Underfloor area 38kW	38kW Main hall 30kW
Listed Status	Grade II	Unlisted

The church is typically used for 13 hours per week, and the hall for over 25 hours per week for the following activities:

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	6 hours per week	180
Church Meetings and Groups	1.5 hours per week	
Community Use	4 hours per week	Daily use by various groups School visits and 6 annual concerts
Occasional Offices	6 weddings 30 funerals 12 baptisms	100 100 50

Annual Occupancy Hours: Church 670 Hall 1200 regular events + extra bookings

Estimated Footfall: Church 11,000 Hall 10,000 regular events

4. Energy Procurement Review

Annual energy expenditure for gas and electricity has been supplied by St Mary's Church, Feltham and have been reviewed against the current market rates for energy.

The current electricity rates are:

	Church	Hall	
Single Rate	15.282p/kWh	15.287p/kWh	Below current market rates
Standing Charge	145.29p/day	65.23p/day	N/A

The church currently obtains its electricity via the Parish Buying scheme.

We recommend that the church continues to use a group purchase scheme offering a 100% renewable tariff and obtains future quotations for its electricity supplies from group purchasing schemes such as the Charity Buying Group, the Big Church Switch scheme and the Diocese Supported parish buying scheme, http://www.parishbuying.org.uk/energy-basket.

These scheme offers 100% renewable electricity and therefore are an important part of the process of making churches more sustainable.

As utility bills were not presented for review, the taxation and other levies applied to the bills have not been assessed. The church treasurer is advised to ensure that a Charity Declaration Form has been submitted to the supplier.

Whenever monthly electricity consumption exceeds 1,000kWh, 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

St Mary's Church, Feltham used 41,629 kWh/year of electricity in the year from 1st December 2020, costing £6,354 per year. The church hall used 9,375kWh of electricity over the same period, costing £1,562.

This data has been taken from a list of monthly electricity expenditure provided by the church.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity - Church	E16UP 05411	EDMI Atlas Mk10D	Yes	Tower, south wall

The meter is AMR connected and as such an annual energy use profile for the site could be obtained from the supplier.

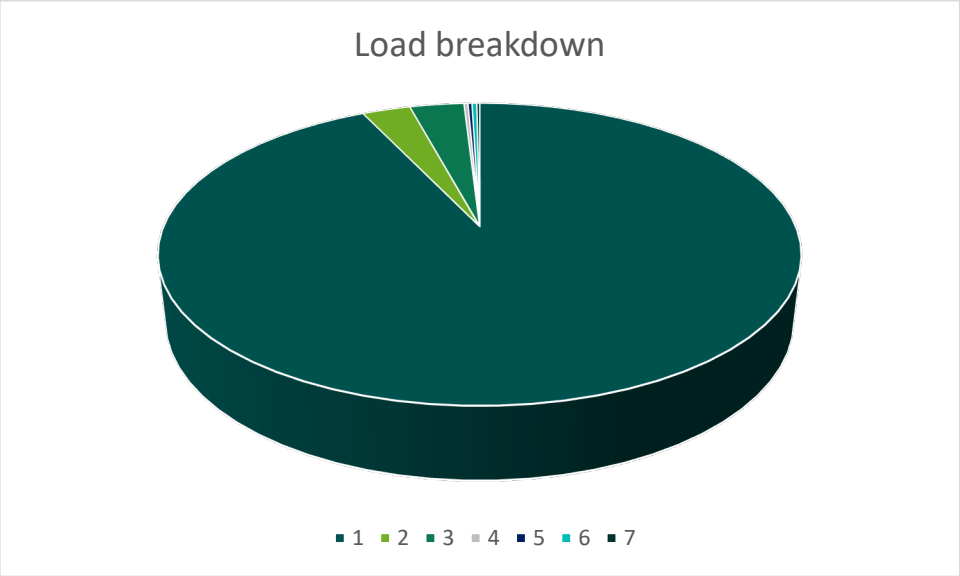
5.2 Energy Profiling [Church]

The main energy consuming plant can be summarised as follows:

	Equipment	Power kW	Annual Consumption kWh	Portion
Heating [Electric]	CHURCH Underfloor heating (water) supplied by 2 x Heatrae Sadia 12kW units 2 x Water circulating pumps Vicar's Office, wall mounted convector Vestry, wall mounted convector Toilet, combined heat and light bulb	 24 200W 2 3 0.5	 38,000 180 100 280 40 TOTAL 38,600	 92.7%
Lighting [Internal]	CHURCH 670 hours use 29 x 18W CFL, mostly chandelier mounted 5 x LED, chandelier mounted 4 x CFL uplights 4 chandeliers with candles Chancel; Large spotlights, 100W Vestry, office, sacristy 8 x T8 F58W, 2 x F70W	 522W 30W 72 24 candlepower 200W 604W	 800 200 200 TOTAL 1200	 2.9%
Lighting [External]	3 Floodlights, 250W 5 hours/night	2	1350	3.2%
Hot Water	Kettle Urn	3 3	60 40	 0.2%
Office	Printer, weekly use Photocopier weekly use	0.5 0.5	50 50	 0.2%
Sound, Music	Organ	0.5	120	 0.3%
Small Power	Vacuum cleaner TV, video player	1.5 0.6	40 25	 0.2%

Sum of estimates: 41,535kWh

Annual site electricity consumption, 2021: 41,629kWh



KEY 1 electric heating 2 Lighting internal 3 Lighting external

4 Hot water 5 Office 6 Organ 7 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 St Mary's Church, Feltham uses 23% less electricity and 5% less heating energy than is average for a church of this size.

Lower than average hours of use are reflected in the lower (non heat) electricity use. The underfloor system uses a similar amount of energy as a gas space heating system.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
St Mary's Church, Feltham (elec)	280	3,029	10.8	14	-23%
St Mary's Church, Feltham (electricity for heating	280	38,600	138	145	-5%
TOTAL	280	41,629	149	159	-6%

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

5.4 Energy Profiling [Hall]

The main energy consuming plant can be summarised as follows:

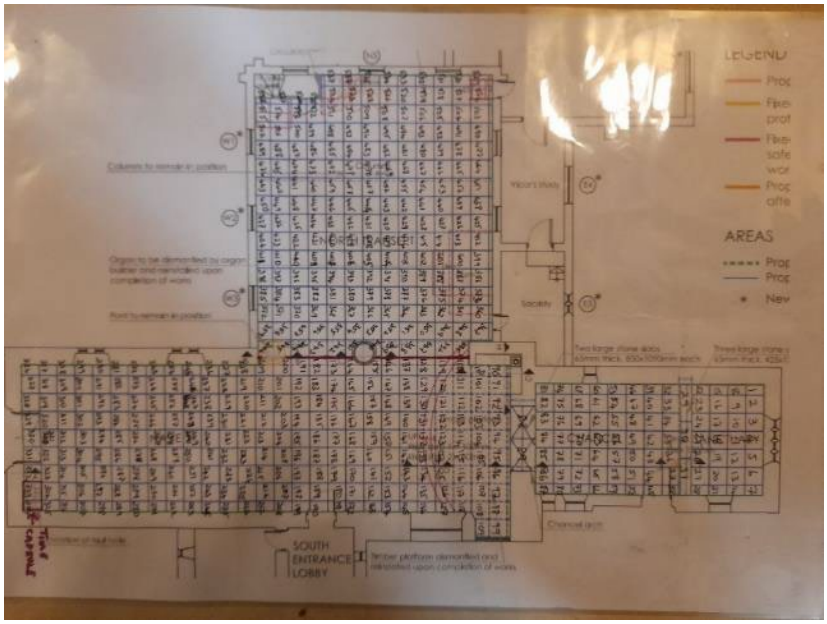
	Equipment	Power kW	Annual Consumption kWh
Heating [Electric]	8 x wall mounted convectors 600 hours heating season	24	 7,500
Lighting [Internal]	1200 + hours use 6 x fluorescent T8 x F70W Various CFL ~ 12 x 18W 4 x Stage lights (disconnected)	 420W 216W 1kW	 500 250 TOTAL 750
Hot Water	Kettle Coffee machine Urn	3 3 2	200 100 200 TOTAL 500
Kitchen	Light use		TOTAL 500
Small Power	Vacuum cleaner	1.5	100

Sum of estimates 9,350kWh

Annual site electricity consumption, 2021: 9,375kWh

2 x 12kW Heatrae Sadia electric water heaters


Underfloor heating manifold



Church layout (flooring plan)

6. Efficient / Low Carbon Heating Strategy

6.1 Forward Planning [Church]

The church underfloor system (mark 2) has been recently installed. This is the main contributor to the electricity bill, with an estimated 38,000kWh use by the 24kW electric heating system (which heats water). At the present contract pricing of 15.28p/kWh, this is costing around £5,800 annually. When the current contract expires, an increase of rate to 28p or more can be expected, approximately doubling electricity expenditure.

In the medium or long term (when the Heatrae Sadia underfloor heating units require replacement), the use of a heat pump is recommended. This will cut the consumption in kWh by between a factor of 2 and 4, dependent on the type of technology installed. Financial considerations may accelerate adoption of this technology.

In the short term, heat loss can be reduced by repair of the vestry door, installation of more insulation over the transept ceiling and secondary double glazing of the Victorian windows.

6.2 Forward Planning [Hall]

The hall, with its greater hours of use than the church is suitable for investment into insulation and a new heating system. The existing heating is described as ineffective.

There are relatively few lights (which could be replaced by LED units).

Insulating the barrel ceiling (and installing cavity wall insulation if not present) will reduce heat loss. Double glazing is already installed. With a reduced heat requirement resulting from increased insulation, the output required from new heat pumps will be reduced (thus lowering capital and operational expenditure). This will also lower the amount required from solar panels, again with reduction of capital expenditure.

Installation of Air to Air Source Heat Pumps, with external units located directly outside the internal fan units can also provide summer cooling; a useful facility for a building which is used weekly by the Local Authority for delivery of a Respiratory Clinic.

With installation of a new heating (and cooling) system which will be four times cheaper to operate than the existing direct electric heating system, the church will be in a good position to host more community events in its hall.

6.3 Site Heat Demand

The Centre for Sustainable Energy model[2] can be used to estimate heat load for the building.

Heat Load (kW) = Volume V (m^3) x Insulation Factor

Condition	Factor kW/m^3
Poorly insulated with open or broken windows, draughty doors (add 5%)	0.034
Poorly insulated (assume no interventions)	0.033
Some insulating features	Estimate value
Well insulated	0.022
Insulated to 2010 regulations	0.013

Area	Volume m^3	Insulation Factor kW/m^3	Heat Required (Space heating) kW
Church Underfloor heated area	1150	0.033	38
Church, total	1450	0.033	48
Hall Main room	840	0.03	25
Hall, total	1200	0.03	36
Hall, main room well insulated	840	0.022	18

2 www.cse.org.uk/local-energy/download/estimating-the-heat-demand-of-a-hypothetical-community-building-79

7. Future Heating Options

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

Heat pumps use refrigeration technology to extract heat from the air, ground or water (large amounts of which are cooled slightly as refrigerant evaporates). By compressing the working fluid, the heat is recovered.

The efficiency advantages of heat pumps mean that they consume between 2 and 4 times less electricity to provide heat than direct electric heaters (the Coefficient of Performance, CoP). With electricity prices rising, 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. Fridges are reliable.

Air Source – the hours of use of the church, around 13 per week are low. For this technology, the underfloor heating would probably need to be run for longer periods – but at less cost than present. Approximately 2.5kW of heat is provided per kW of electricity used.

Ground source: this would give lower operating cost, but at higher capital expense, requiring a borehole. Approximately 4kW of heat is produced per kW of electricity used.

Air to Air Source Heat Pumps (for the hall) – this requires an external unit (as do all heat pumps), connected to a network of internal fan units which could provide heating or cooling. In the main hall space, external units located under the windows could serve internal fan units located in present radiator positions. 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.

Some of the extra electricity required to run heat pumps can be obtained from solar PV panels. Some types of heat pump can provide cooling – solar powered cooling in summer is very efficient.

7.2 Air Source Heat Pump [Church]

ASHPs offer lower capital costs than Ground Source. A GSHP could only be installed with a borehole, due to the burials in the churchyard. A 24kW output GSHP unit would be around £24,000, compared to a capital cost estimate of around £9,600 for an ASHP.

The location for an ASHP external unit is suggested to be on top of the existing flat toilet and kitchen roof. This is an area of approximately 2m x 7m, with a parapet wall approximately 40cm high. This wall is probably not deep enough to hide the ASHP plant and should be extended upwards to hide it – using bricks of matching colour (possibly sourced from a reclaim site).

If the flat roof is of insufficient strength, the plant could be installed on rolled steel joists or aluminium extrusions supported at their outer ends by the existing external wall and the internal wall which supports the pitched roof.

The location is within 3 metres, vertically, from the Underfloor Heating electric heating cabinet.

If the vestry and vicar's office are only used for a small number of hours weekly, it is recommended to continue with direct electric heating.

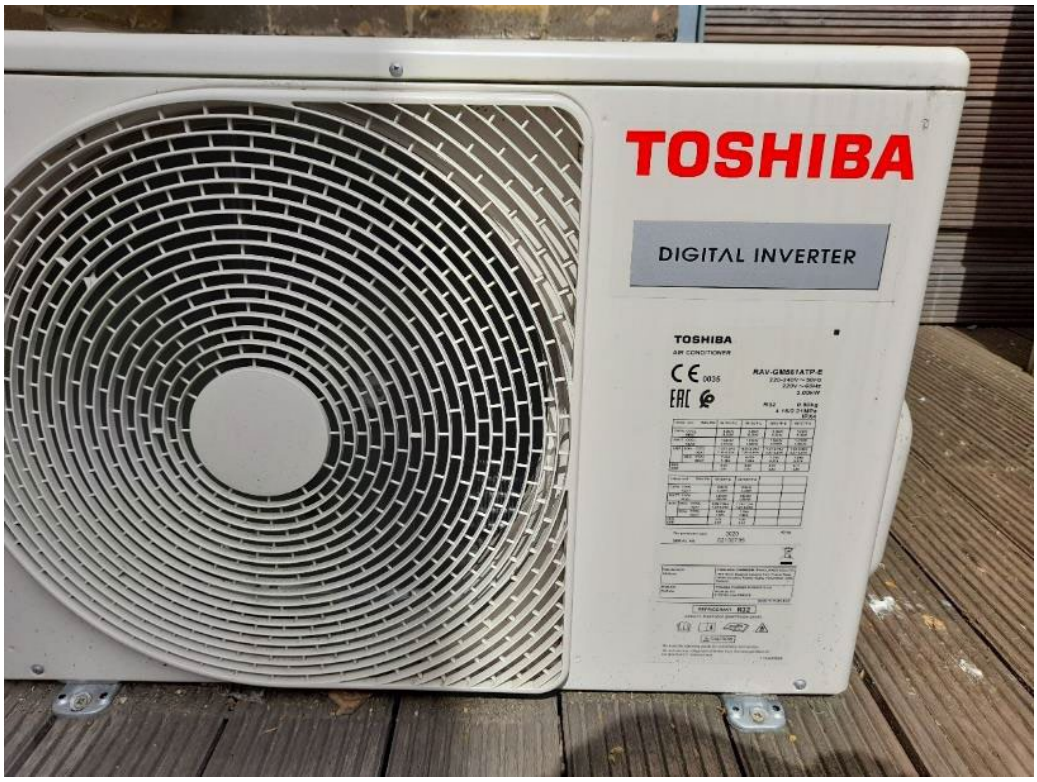
7.3 Air to Air Source Heat Pumps [Hall]

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.

It is probable that the heat requirements of the main hall can be met by units located in the same positions as the existing heaters under the windows.

Four of the units pictured below supply one floor of an office of area 165m^2. This gives a heating capacity of 21kW for an electrical load of around 1.5kW. The CoP is between 3.2 and 3.9 depending on the type of internal unit chosen.

St Mary's church hall is 210m^2. With extra insulation added, the hall heat loss value reduces to 18kW – this is a figure for space heating with radiators sending warm air up to the ceiling first. Having fan units directing heat across the floor first should reduce this requirement further.



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

7.4 Air to Air Source Heat Pumps Costs

Pumps to supply 18kW of heat (with capital cost estimated at £450 per kW output: £8,100) would deliver the same amount of heat annually as the current system.

Costs may be less as only direct connections through the wall between external and internal units are likely, minimising piping costs. Heating for the toilet and entrance areas may involve some pipework installation.

Operating at a Coefficient of Performance of 4, an 18kW heat output requires 4.5kW of electricity supply.

4.5kW x 600 heating hours (present estimate) = 2,700kWh electricity used annually.

At current costs of 15.287p/kWh, annual cost = £413

8. Energy Saving Recommendations - Equipment

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

It is recommended that the lighting in church is changed from CFL to LED bulbs as the bulbs require replacement. The chandelier mounted lights are at relatively low height so could be changed by a competent volunteer. Around 30 bulbs could be sourced for around £300.

The fluorescent strip lighting in the hall consists of six tubes at 5m height. These are probably 70W units. They require to be changed using access equipment such as a scissor lift or cherry picker. It is recommended that these units are changed by contractor before any insulation work is done over the barrel ceiling above as access may be required for cabling.

430W of fluorescent lighting would be replaced by (approximately) 150W of LED.

Capital costs of around £500 plus access equipment should be expected.

Other low level non LED bulbs in the hall could be changed by volunteers.

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/

8.2 Lighting Controls (Internal)

In areas such as the hall foyer and toilets, areas which are only used occasionally and for a short amount of time, the lighting does not need to remain on constantly.

It is recommended that a motion sensor is installed on these specific lighting circuits so that the lights come on only when movement is detected in the space and turn off approximately two 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.

9. Energy Saving Recommendations – Building Fabric

9.1 Draught Proof External Doors

The main entrance porch has external double doors and an internal single leaf. The inner door has some fibre attached to the frame on one side to seal the gap. It is recommended that someone in the church with basic sewing skills produces some draught “pads” using hardwearing material (brown or grey) which can be filled with such soft flexible material to create a good seal all around this inner door.

9.2 Repair rear door Urgently

The rear vestry door in the 1954 building is in a poor state of repair. This door has been oiled or varnished, and is suffering from weathering, with the vertical planks separating in places where the tongues are detaching from the groove, the inner plank of the left door is bowed. Sections of surface wood are delaminating.

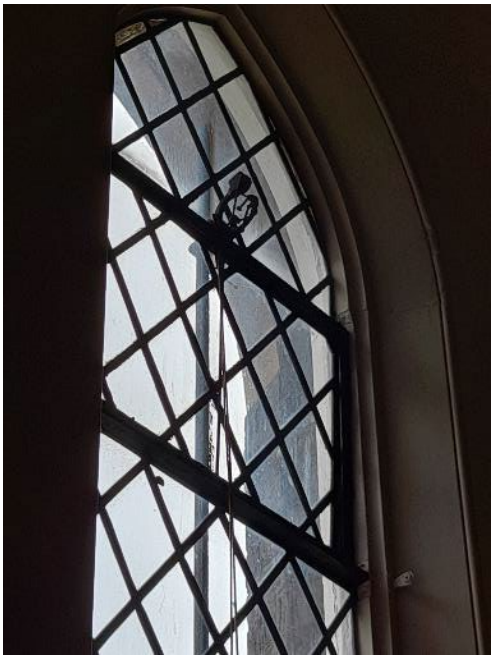
It is recommended that your DAC and / or Inspecting Architect are contacted to recommend a suitable company to refurbish the doors (preferably in situ). Light can be seen passing through in several places and water ingress will result in further rapid deterioration (and heat loss).

One possible product is “Osmo” UV protection oil which soaks into the wood. The door is suggested to need some structural repair in addition to oiling.

The doors are closed in the left image, but there are obvious large gaps.

9.3 Windows

The leaded lancet windows in the Victorian north transept have hinged opening panels which are not in use for ventilation. It is recommended that any damage such as rust is repaired before further deterioration occurs. Any small gaps leading to draughts can be filled with Plasticene (recommended by Historic England – it is easily removable).



9.4 Secondary Glazing

One window to the north of the north transept has been fitted with a removable secondary glazing panel using flexible 2mm thick polycarbonate sheet, attached using a flexible magnetic strip glued to both the plastic and window frame.

This material is lighter than heavy duty polycarbonate which is sometimes used to protect the outside of windows from damage. It is much more robust than transparent polystyrene which can crack easily, or Perspex, (polymethylmethacrylate). This offers a better solution than the use of seasonal double glazing film (which is tricky to install and is easily punctured). It can be removed and replaced as necessary, e.g. to open a window for ventilation.

9.5 Cavity Wall Insulation [Hall]

The church hall facades are entirely covered with pebbledash so it was not possible to ascertain the form of construction.

There are no indications of retrofitting of CWI (brown studs low in the walls). This information may be accessible from architect's drawings which should be available.

Prior to the early 1990's, building regulations did not require walls to be fully insulated and therefore it is likely that there is no insulation present. It could be added through injecting it into the cavity walls. This becomes worthwhile as the building use rises and will also cut heating energy use.

9.6 Insulation to Roof

The loft void above the north transept was inspected as part of this audit and found to have little insulation present, perhaps 50 to 100 mm maximum. There is roofing felt under the slates.

In all cases where there is 100mm or less of insulation within accessible roof spaces it is recommended that insulation be added to prevent heat loss and create a more comfortable environment for the occupants of the building.

The ceiling/roof of a building is the largest contributing area to heat loss from a building as heat rises. The insulation of such spaces can therefore have a dramatic impact on both the efficiency of the heating system and the temperature of the space below.

Ceiling insulation for an area of 76m^2 would cost approximately £720.

Cost £9.50/m^2

There is an accessible loft space (not viewed) above the arched hall roof, which would benefit from insulation.

Ceiling insulation for an area of 200m^2 would cost approximately £1,900.

10. Other Recommendations

11.1 Electric Vehicle Charging Points

The church hall has a large car park on the north side of the site with space for over 30 vehicles. In order to make a visible statement on the churches mission of stewardship and to facilitate more sustainable transport choices by those both visiting the church and using the hall, the church may wish to consider installing an electric vehicle charging point, probably on the side of the church hall to allow visitors to charge their electric car.

Installing a unit such as a Rolec Securi-Charge http://www.rolecserv.com/ev-charging/news/view/Robust-EV-Charging-With-Rolecs-SecuriCharge-EV-Wall-Unit-Coin-Token-PAYG would allow the 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.

11. 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 – hall Possible – church using solar tiles
Battery Storage	Future potential
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	Possible - church
Ground Source Heat Pump	Technically possible
Air to Air Source Heat Pump	Yes - hall

12.1 Solar Photovoltaic Panels

The church is early Norman and stated to be the oldest building in Middlesex. The roof is entirely visible, so the church itself will not receive permission for panels.

The 1954 constructed buildings which include metal grille covered windows do not visually complement the historic church; a case can be made for re-roofing parts of these roofs and incorporating solar tiles which will have a low visual impact (if non shiny tiles are chosen).

The church hall has a large south facing roof, but with some shading by trees. Installation of Air to Air heat pumps is recommended for this regularly used building which is currently poorly heated. This will cut energy consumption and solar panels can then be sized appropriately for the new lower electricity use, at lower capital cost.

The sections of church vestry and north transept roofs offer areas of around 35m^2 (both faces) and 50m^2 (both faces). This could generate 0.15kWpeak/m^2 giving a 12.5kWpeak system.

The hall roof offers an area of 120m^2 (south facing).

The angle of the church and hall roofs is approximately 40^o.

Assuming that the maximum amount of roof space could be, and was used for panels, the following formula calculates annual generation:

Annual Generation (kWh) = Area x 0.15kWp/m^2 x 1000kWh/kWp x Orientation Factor x Overshading Factor.

Roof Section	Useable area / m^2	System Size / kW peak	Orientation factor	Shading factor	Annual Generation, kWh
Church Vestry	35	5	90 & 270 degrees / 40^0 0.76	1	3,800
Church North transept	50	7.5	90 & 270 degrees / 30^o 0.80	1	6,000
Total	85	12.5			9,800
Hall South facing	120	18	180 degrees / 45^o 0.98	0.9 (trees)	15.900

This is the maximum likely figure, which may be reduced by factors such as the weight of panels (due to roof strength), and access space between panels. The ability of the roof structures to support the extra loads should be discussed with the church's inspecting architect.

The maximum potential generation is less than the church centre's annual recent electricity use and would make a useful input towards running the underfloor heating.

The hall roof is capable of generating much more than the current hall use. **The hall SPV system should be sized once Air to Air source heat pumps have been installed which will cut the current annual consumption.** The likely future hours of use should be taken into account.

Current hall use is around 9,400kWh. Installation of heat pumps could cut heating electricity requirement to one quarter, so annual use could be less than 5,000kWh – clearly installing the largest possible solar PV system would overgenerate and waste capital expense.

At present, electricity fed into the grid attracts only small payments of around 5p/kWh

The system should be specified for future addition of a battery, when battery costs reduce as this would extend system usefulness into the evening.

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 12.5 kWpeak system would cost £18,125. [Costs are not available for solar tiles].

a 18 kWpeak system would cost £26,100.

a 6 kWpeak system would cost £8,700. (about 5,000kWh generated)

12. 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 .

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.