ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

St Mary Magdalene's Church, Wandsworth
PCC of St Mary Magdalene

Author	Reviewer	Date	Version
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Contents

1. Executive Summary

An energy survey of St Mary Magdalene's Church 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 Magdalene's Church is a brick built late Victorian Grade II listed church built in 1888, with adjoining unlisted hall ["Main Hall"] to the north. Although the listing entry does not describe the east end hall ["Vestry Hall"], this is included within the plan boundary of the listed structure [Historic England reference 1391164]. 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)
Parish Hall (North) nursery entry/exit to become permanently from Wiseton Road to east (energy reduction and safety benefits)	2% of parish Hall 960	£30	Zero	Immediate	None	0.17
Parish Hall (North) Reset boiler controls to deliver lower temperature water to ensure safety of radiator temp with nursery (42C) – run for longer. Will ensure condensing operation.	5% 2,400	£74	Zero	Immediate	None	0.44
Parish Hall flush, clean, bleed radiators. Investigate low pressure 0.4 bar	7% 3,360	£104	£250	2	List A	0.62
Parish Hall install endotherm heat transfer fluid	10% 4,800	£149	£80	0.5	List B	0.88
Parish Hall (North) Double glazing or secondary DG of clerestory windows	10% 4,800	£149	£2,000	15	Faculty	0.88

Secondary Glazing of west end large hall windows						
Nave Hopper window repairs where required	2% of nave 1,080	£33	£3,000	91	Faculty	0.20
External Door draughtproofing where necessary (parish hall)	2% 960	£30	£50	2	List A	0.17
Children's room (East) IR radiant panels To bring back into use	N/A	N/A	£1,200	N/A	List B	N/A
Vestry Hall (East hall) AIM to use building. independently of nursery. PLAN – Infra Red heating, to allow for rapid / variable use.	Less preheating Replace 30,000kWh gas with 25,000kWh electricity	£1,100 gas saving £3,200 electric cost	£6,000	N/A	Faculty	5.53 from gas saved 6.33 extra from electricity (wait until footprint of electricity becomes less than gas)
Lighting – replace 400W R7 bulbs 300W PAR 56 bulbs 100W floodlights with LED bulbs	75% of lighting 3,500	£424	£2,000 including access charges	5	List A	0.88

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

Based on current contracted prices of 12.41 and 12.11p/kWh; 3.099p and 3.442p (vestry hall)/kWh for electricity and mains gas respectively.

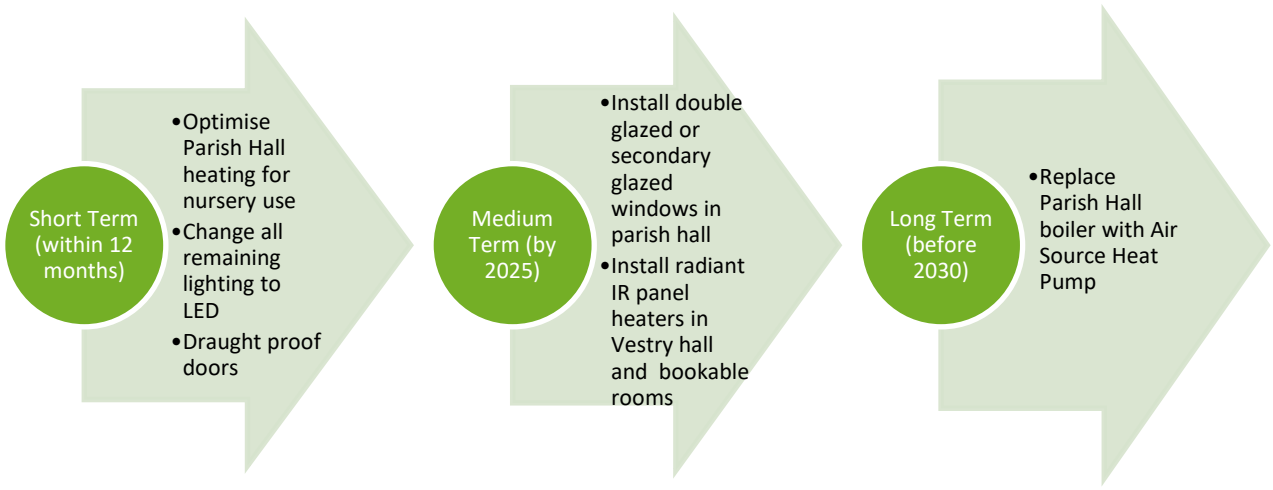
If all measures were implemented this would save the church around £1,000* per year in operating costs.

*The cost saving from the vestry is not included in this total. If the heating in the vestry is moved from gas to electricity, there would be substantial carbon saving, but the cost of the energy required to heat the space would increase.

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 Magdalene's Church 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 St Mary Magdalene's Church, Trinity Road, London SW17 7HP was completed on the 22nd December 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 Congregation assessor.

St Mary Magdalene's Church	
Church Code	637344
Gross Internal Floor Area Including Parish Hall	950 m^2
Listed Status	Grade II [Church only]

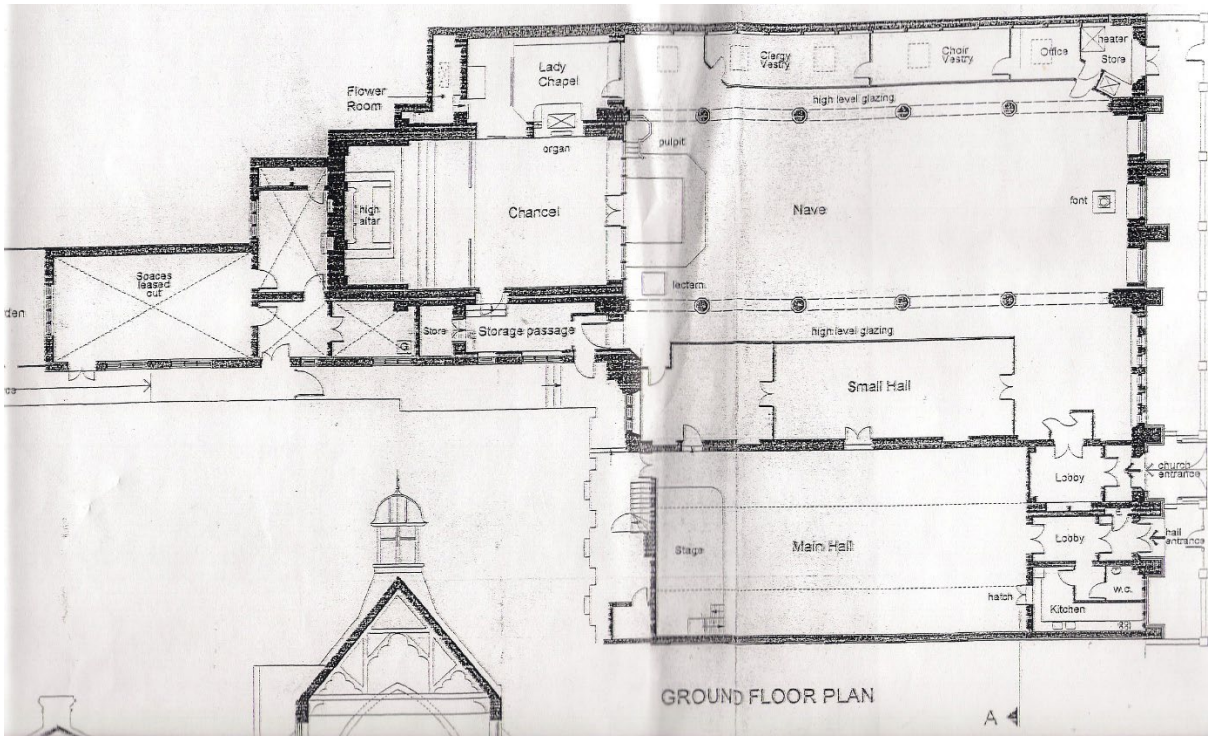
The church and halls are typically used for 54 hours per week for the following activities:

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services (Three weekly)	8 hours per week	200
Community Use	Nursery, daily 40 hours x 36 weeks Drama group, weekly Drama group performances Brownies Guides Hall hires	30 20 30 15
Occasional Offices (annually)	2 weddings 6 funerals 30 baptisms	100 100 50

Occupancy Hours 2,800

Footfall 29,000 [11, 000 services + 18,000 nursery & community]

3.1 Building Layout



Plan view of church site.

The hall to the left (East) is the Vestry Hall, with the church office east of the chancel. The Main Hall at the bottom of the image (North) is the Parish Hall. The small hall, created by dividing the north aisle is also known as the Church or Children's Hall. The office space next to the heater room, South East corner (top right) has recently been converted into a kitchen with new toilets to the left, thus allowing the church and/or Vestry Hall to be used for bookings whilst the Main Hall is used, daily by a nursery.

4. Energy Procurement Review

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

The current electricity rates are:

Meters E11Z02108 / 02109	12.110p/kWh	In line with current market rates
Meters E11Z02838, F78A07793 (Vestry Hall)	12.410p/kWh	In line with current market rates
Standing Charge	25.99p/day (02108/02109) 27.00p/day (02838/07793)	N/A

The current gas rates are:

Church and Parish Hall	3.099p/kWh	Above current market rates
Standing Charge	372p/day	N/A
Vestry Hall	3.442p/kVA	Above current market rates
Standing Charge	20p/day	N/A

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% charged for most bills 20% has been charged where the monthly consumption is over 1,000kWh (electric meter E11Z02109 and high gas consumption months).	The organisation is understood to be a charity and therefore should be benefiting from only be charged a 5% VAT rate. A VAT declaration should be sent to the supplier to adjust this.
CCL	Charged where VAT rate is 20%	As the organisation is being charged the wrong VAT rate they are also being charged CCL which should not be applied as they are a charitable

		organisation, domestic users (including childrens homes/hospices/student accommodation and care homes) or users consuming less the 1,000kWh of elec and/or 4,397kWh gas per month. Sending the supplier a VAT declaration will remove this charge.

The above review has highlighted that VAT and CCL are being charged. The church is a charity and therefore can claim VAT exemption status. As such the PCC of St Mary Magdalene's Church should send the supplier at VAT declaration confirming this and check all supplies on other sites. 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.

5. Energy Usage Details

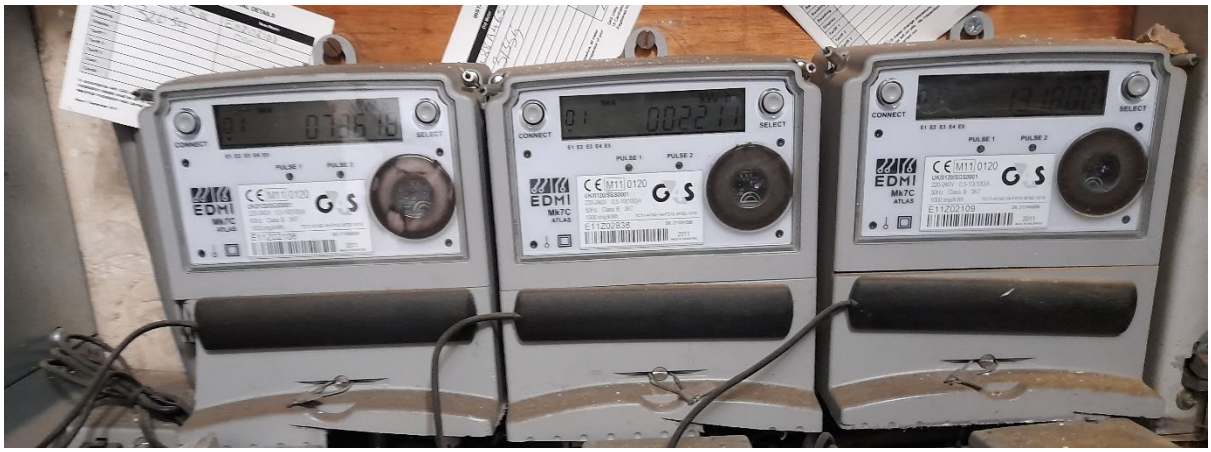
St Mary Magdalene's Church uses around 20,000 kWh/year of electricity, costing in the region of £3,000 per year, and 132,000 kWh/year of gas, costing around £7,500.

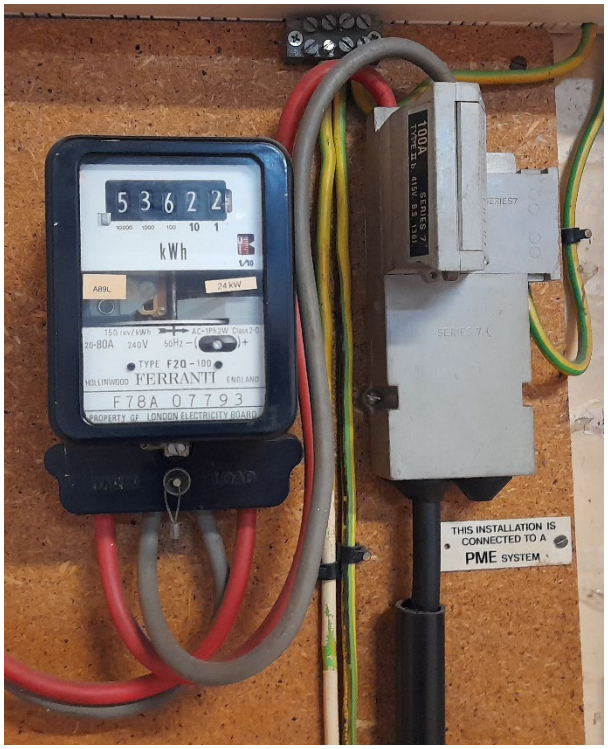
This data has been taken from the annual energy invoices provided by the suppliers of the site. Most data covered twelve continuous months, and is from the pre lockdown period. Minor adjustments have been made to estimate missing data, to arrive at annual figures.

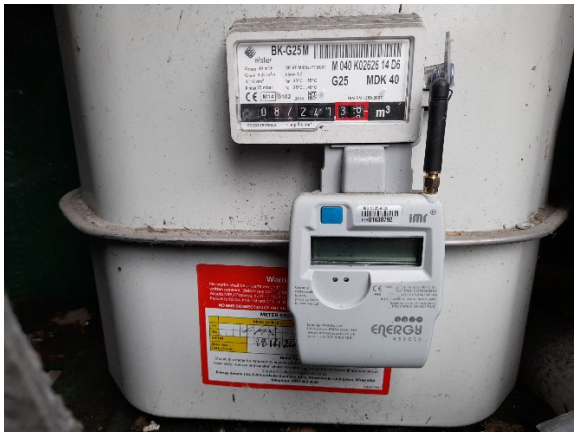
St Mary Magdalene's Church has four electricity meters. There are two gas meters serving the site, detailed below.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church and Parish Hall	E11Z02108 E11Z02109 E11Z02838	EDMI Atlas Mk 7c	Yes	Meter Cupboard, Parish Hall entrance
Electricity – Vestry Hall	F78A07793	Ferranti	No	Wall mounted, east wall of vestry hall
Gas – Church & Parish Hall	M040 K02625 14 D6		Yes	External meter cabinet, south east corner of site curtilage
Gas – Vestry Hall	E025 K00408 16 D6	Elster Thermis BK G16E	Yes	Vestry Hall cleaner's cupboard

Most meters are AMR connected and obtaining an energy profile for the entire energy usage should be possible. The gas meter K02625 did not transmit any readings for several months after the new nave heating system was installed, with the readout remaining at 76012. It then jumped to 83266 on 12th July, aggregating six months use. Apart from the uneven (large!) bill, it has meant no month by month data for use comparison. The meter should be monitored and the supplier asked to replace or repair it if it malfunctions again.







External gas meter; Church and Parish Hall.

Vestry hall gas meter.

5.1 Energy Profiling

The main energy consuming plant can be summarised as follows:

Service	Description	Power kW	Annual Consumption kWh	Estimated Proportion of Usage
Lighting	400W floodlights and 300W PAR 56 spotlighting with smaller fixtures being CFL and LED. Theatre lights (18) installed in Parish Hall; 40 week x 2 hr use 50 days rehearsal/shows x 4 hr use = 280h	6 Theatre 10	4,700 Theatre 2,800	6.1%
Heating	Nave – 189kW consumption gas blown space heating, installed 2019 Parish Hall – Worcester Greenstar AR 25 Mk IV condensing combination boiler, 7 radiators. Nursery 50 heat hours/week, evenings and weekends 30 hours x 30 weeks = 2,400 hours Vestry Hall – Vaillant EcoTec Plus 825 boiler serving hall, office, toilet and corridor. Consumption known. 1500 hours annual use, 20kW average load	189 25 max 25 max	54,000 48,000 30,000 TOTAL 102,000	83.6%
Heating Electric	Air Handling Unit – fan, 450 hours Boiler circulating pumps (2) Nave toilet Dimplex wall heater Choir vestry Dimplex wall heater 3 stored portable heaters (vestry hall)	20 2 x 0.25 2 2	9,000 500 200 200	8.1%
Hot Water	From combination boilers Ariston 2kW under sink heater (Nave kitchen) Instanta WM7 2kW water heater (Parish kitchen)	 2 2	Included in above 100 100	0.1%
Kitchens	Three kitchens, currently light use Commercial dishwasher	summed 5	600 300	0.7%
Small Power	Office – one workstation Organ 4 hpw Vacuum cleaner	0.5 1	500 200	1.2%

	Air compressor	1.5 1	300 500	

Total estimate of annual electricity use, 20,000kWh

The purpose of the air compressor, located in the Parish Hall meter cupboard, was unexplained.

The gas consumption for the church and Parish Hall are estimates based on dividing the overall consumption measured at the external meter. Given the Vestry Hall gas use is around 30,000kWh

5.2 Air Handling Unit

The body of the church is heated by a Reznor Air Handling Unit fitted with a Riello Guliver burner.

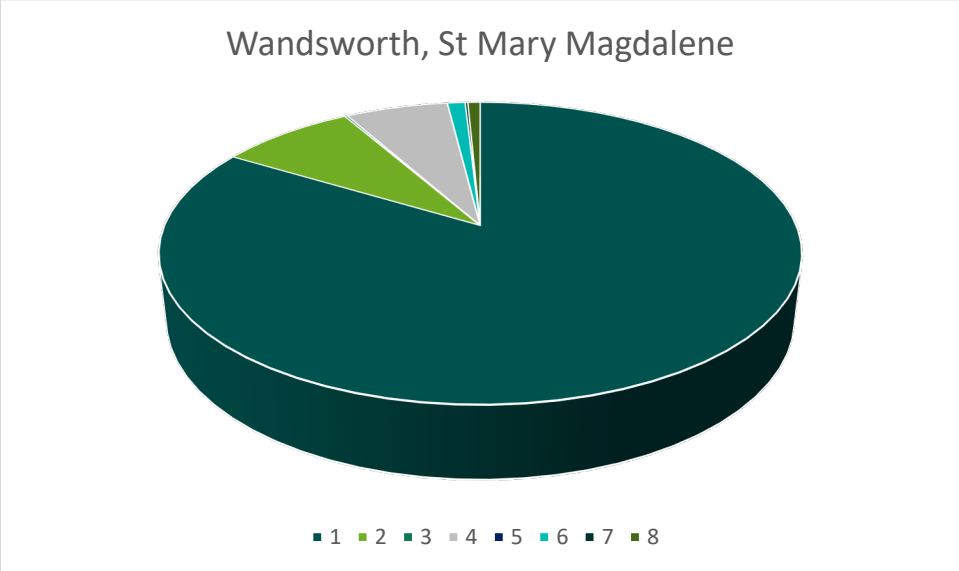
If the electricity meter supplying the AHU (it appears to be the right hand meter of the three, E11Z02109) is not dedicated to the AHU, the church is recommended to install a sub meter to measure the AHU electricity consumption since this is significant, especially if the nave is to be brought into more regular use.

Only very limited data was visible on the equipment. It consumes 189kW gas with an output of 171kW via a heat exchanger. This is able to heat up to 14,000m^3 of air per hour, blown by two electric motor driven fans. Unfortunately, no data for these fans could be found, and it was not possible to read the motor data panels through a screen at floor level. The Reznor website https://www.reznorhvac.com/product/pcdv/ lists many configurations of vertical PCD units with a wide spread of motor sizes. The motors fitted appear to be of the type supplied by Hydraulic Megastore such as the example below 30kW 3 Phase, 2 Pole Electric Motor | Hydraulic Megastore https://hydraulicmegastore.com (note the cable enters at the right of the connection box in the church units, as opposed to left in the supplier's image; probably indicating another power rating.

As neither the hours of use of the unit, or the fan motor power rating are known, it is not possible to calculate an accurate electricity use. However, 450 hours use (based on gas consumption figures and input gas power rating: heating the church from cold would be expected to require full power), and 30kW power requires 13,500kWh. A value of 10kW for each motor has been used for calculations, yielding a consumption of 9,000kWh.

It is very likely that the high electricity use of the building arises from a combination of the AHU fan motors, non LED lighting across the building and theatre lighting in the Parish Hall.

5.3 Load Breakdown



KEY 1 Gas Heating 2 Heating, Fans and electric 3 Hot Water (electric – minimal)

4 Lighting 5 Lighting external – zero 6 Small Power 7 Organ & PA 8 Kitchens

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 loads are heating fans (majority of the green sector) and lighting.

5.4 Energy Benchmarking

In comparison to national benchmarks for church energy use[1] St Mary Magdalene's Church uses 22% less electricity and 32% less heating energy than would be expected for a church of this size. This is probably a result of the nave being used infrequently. There are opportunities for significant further reductions in electricity use, from lighting.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
St Mary Magdalene's Church (elec)	950	20.000	21	27	-22%
St Mary Magdalene's Church (gas)	950	102,000	107	156	-32%
TOTAL	950	122,000	128	183	-30%

1 Church of England Shrinking the Footprint Energy Audit Report, 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 important to review the proposed use of each area of the building and plan for a less carbon intensive future.

6.1 Strategy

The nave is seated with 30 long pews (4.3m), around four of which are moveable.

St Mary Magdalene church has recently invested in a new blown air gas fired heating system for the body of the church, with the Parish Hall and Vestry Hall area each heated by independent domestic gas boilers

The blown air system must be managed carefully as it is capable of using very high amounts of gas and significant amounts of electricity required to run the fans. It is recommended that (post Covid 19), the body of the church is used in a manner which uses energy most efficiently. Clearly, it is very unlikely for the nave to be in regular all day use. Sporadic heating episodes, i.e. heating for only short periods of use will be inefficient as all the heat initially rises to the roof. A church of this size is likely to take 12-24 hours to cool from 20°C to 12°C (depending on the

external temperature and wind); thus planning to use the nave on Saturdays (or Mondays) when some of the residual heat will lessen preheat requirements for the next day is sensible.

The regular daily use of the nursery is compatible with continued use of the current gas fired central heating system (although operated differently). Heat will be retained during the early evening; so the Parish Hall should be considered as the primary location for evening hall hires during the winter.

The Vestry Hall is a suitable location for daytime hiring, possible now that there is access to new toilets independent of the nursery. Currently, this is heated by gas, which requires a significant amount of preheating. It is recommended that the Vestry Hall is heated by radiant far Infra red heaters (non glowing) – these provide heat rapidly and this will allow the hall to be booked for short periods, or at short notice. If the current boiler located in the east kitchen is retained for hot water service, it could also continue to heat the office *if the office is regularly used*. Again, if the office is only used irregularly and for short periods, infra red electric heating should be installed. In this case, when the boiler requires significant repair or replacement it should be replaced with a point of use electric water heater and the rest of the area converted to electric heating.

6.2 Discontinue with Background Heating

It was unclear how the new heating system is being used, because of the faulty electricity meter which stopped transmitting data for several months in early to mid 2020, then submitted a large aggregated total. This means that the changing use per month as spring turns to summer cannot be seen.

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 may require some local background heating specific to that area; 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)

As hot air rises, attempting to keep the church war for periods of non use will be wasteful. 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.

6.3 Install Electric Panel Heaters

It is recommended that the PCC consider installing radiant far infra red electrical panel heaters (non glowing) in the Vestry Hall on a time delay switch and remove the existing radiators.

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.

The office could also be considered for this form of heating if it is in occasional use. (In constant use; as electricity is around four times the cost of gas per kWh this would lead to higher bills. For sporadically used areas, infra red heating avoids the need to preheat as it delivers heat to where it is required, rather than preheating the ceiling.

The East portion of the small hall, in the north aisle area is currently unheated. If it was desired to bring this room back into (winter) use, installation of far infra red electric panels is recommended, as they would enable it to be used for short periods with a minimum of preheating.

7. Improve the Existing Heating System

As the existing heating system is being retained for the Parish Hall (and for as long as the Vestry Hall and/or surrounding areas are heated by gas), the following improvements are recommended to improve the efficiency of the existing heating system, this should include:

7.1 Improve Heating Control Settings

The Parish Hall boiler is currently set to deliver water at maximum temperature (set by left dial).

The radiators in the hall have been covered with material in an attempt to reduce surface temperature to enhance the children's safety. It is recommended that the boiler operating temperature be reduced so that the radiators are at 42°C maximum[2]. This will ensure that the boiler is always operating in condensing mode (below 55°C return water temperature) at

maximum efficiency. The boiler will need to operate for longer to deliver the same amount of heat (so the timings will have to be adjusted for more morning preheating); however this will now require less gas as some heat will be recovered from the exhaust gases. The simple method to do this is to press the “Eco” button.

Note that the boiler pressure is low – this may indicate a system leak, or it might need topping up with water.

2 Managing the risk from hot water and surfaces in health and social care HSIS6 (hse.gov.uk)

https://www.hse.gov.uk/pubns/hsis6.pdf

https://www.specifiedby.com/contour-heating-products-limited/news/radiator-surface-temperature-regulations-for-schools-and-nurseries

7.2 Clean the Existing Heating System

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

It is strongly recommended that the heating systems are 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 and efficiency.

7.3 Endotherm Advanced Heating Fluid

In order to improve the efficiency of the heating system further it is recommended that an advanced heating fluid (http://www.endotherm.co.uk/) is added to the heating system.

This fluid in in addition to, and complements any existing inhibitors in the heating system and is added in a similar way. The fluid works to improve the ability of the boiler to transfer heat into the heating system and for the radiators and other heating elements to give out their heat into the rooms. It does this by reducing the surface tension of the water and increasing its capacity to transfer and hold heat. Case studies have demonstrated that the addition of this fluid into heating systems reduces heating energy consumptions by over 10% as well as helping the building heat up quicker.

Endotherm can be self-installed by someone competent to repressurise the system.

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 large overall energy proportion of the electricity used within the church, and large areas are lit by relatively inefficient fluorescent and halogen fittings.

It is recommended that all lights are replaced by LED bulbs, with 250W (and higher rated) R7 floodlights (7mm diameter linear elements) and 100W (round) spotlights changed first. Fluorescent tubes (mostly of 58W rating) can be replaced by LED strip lighting.

Most of the lighting requiring to be changed is at high level which would require a contractor and access charges. There can be a large difference in quotations between different suppliers.

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)

There are several areas such as the corridor between the nave and vestry hall, and the entrance lobbies which would benefit from presence detectors operating the lighting. Some of these areas are only used occasionally and for a short amount of time and as such, the light does not need to remain on constantly.

It is recommended that a motion sensor is installed on these specific lighting circuits so that the lights come on only when movement is detected in the space and turn off approximately two to five minutes after the last movement has been detected (note that the duration of the time lag after which the light goes off needs to be consider alongside the type of light that is fitted. LED lights are much more suited to being switched off after only a short duration than some fluorescent lights). These movement sensors (commonly called PIRs) also have light sensors integrated into them so they can be used to make sure that the light does not come on if there is already sufficient daylight in the space.

Your existing electrician or any NICEIC registered electrical contractor can install PIR sensors onto existing lighting circuits. This can be carried out without significant disruption to the use of the space.

8.3 Draught Proof External Doors

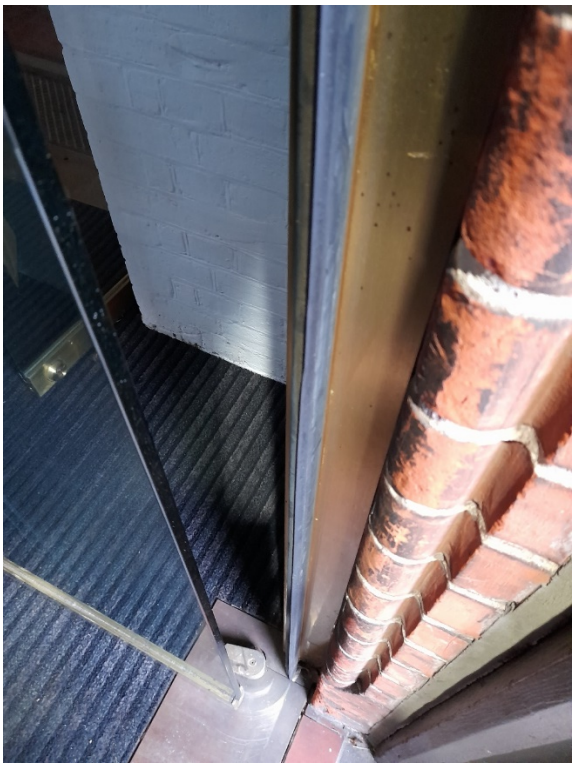
There are a number of external doors in the church. These have the original timber doors on them. Where doors do not close tightly against their frames it allows cold air to enter continually.

It is recommend that the draughtproofing around doors aer improved and draught strips are added where not present. 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 rebatted 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, using plasticine of the right colour to fill gaps where daylight can be seen and putting painted fridge magnetic over large keyholes can all be simple DIY measures which are effective.



Left: The disused door at the south end of the frontage accesses the heater room – if an air intake for the heater is not provided, this gap will have to do! However, the internal door from the nave should be draught proofed.

Right: The main church doors have adequate polymer draught proofing strips installed.

Below: The doors to the Parish Hall do not appear to have any draught proofing strips installed.

Draughtproofing measures should be added, as this building is heated for up to 80 hours per week.

8.4 Secondary Glazing

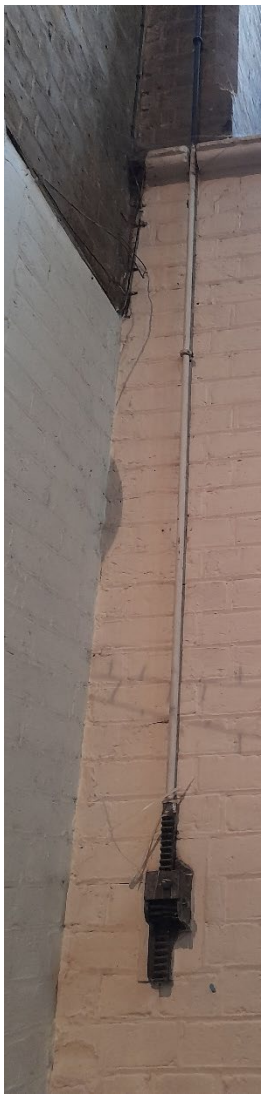
Areas which are in high use and regularly heated will benefit from secondary or double glazing.

It is recommended that the skylight windows in the Parish Hall roof are replaced with double glazed units (the hall is not listed). Removal of the opening window operating mechanisms is required; it is understood that there are separate ventilators in this central roof section (so the windows are never opened). In parallel with this work, the ventilation system could be overhauled (ducts cleaned; grilles maintained, fans installed if necessary).

The office would benefit from secondary glazing of its windows.

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.



The clerestory windows in the nave have opening lights driven by a mechanism. These should be firmly closed (it is understood that they are never opened). When there is an opportunity for access and maintenance, small gaps can be filled with plasticene to ensure air tightness.

The nave west windows include four hopper openings. One opening panel is damaged; this will be allowing cold air into the church constantly, and water damage leading to deterioration of the entire window will be occurring. Repair is recommended.

9. Saving Recommendations (Water)

9.1 Tap Flow Regulators

Where children regularly use toilets and washbasins it is recommended that flow regulators are installed. 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 – listed building with visible roof
Battery Storage	No – no viable PV
Wind	No – no suitable land away from buildings
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Biomass	No – urban air quality issues, lack of space
Air Source Heat Pump	Yes – Parish Hall where there is a regular heating load
Ground Source Heat Pump	No – no land adjacent to building

10.1 Air Source Heat Pump

The recommendation to lower the boiler operating temperature for the Parish Hall in order to increase boiler efficiency and also to ensure the surface temperature of radiators is safe for nursery age children means that the system operating temperature will be equivalent to that provided by a heat pump.

It is recommended that the church plans to install an Air Source Heat Pump [ASHP] when the boiler becomes due for replacement. The equipment, similar to a large air conditioning unit, needs to be located on an external wall in a well ventilated area. The ideal location is probably on the east wall of the Parish Hall. It could also be located where the former external hot air blower for the Parish Hall was situated (as there will be a duct which could be used for pipework). ASHPs work most efficiently when providing constant or semi constant water at around 50oC. They are unsuitable for lightly used buildings or those with a sporadic occupancy pattern.

A 25kW boiler is fitted at present, with an estimated annual use of 48,000kWh.

Various efficiency and fabric insulation improvements (flush system, install heat transfer fluid, double or secondary glazing and door draughtproofing) could deliver up to 35% savings.

Thus a heat pump of lower maximum output is likely to be needed. This would have to be confirmed by detailed heat loss calculations by a supplier. Work conducted in advance to insulate the building will result in a pump of lower power being required, lowering both capital cost and operating cost.

Current heating hours of Parish Hall estimate:

As the room is heated for nursery use, probably from October to April (30 weeks), 07:00-17:00 . 50 hours/week+ 5 evenings x 5 hours + Sunday morning heating = 80 hours per week x 30 weeks =2,400 hours per annum.

The average load (7 radiators) is estimated to be 20kW output x 2,400hours = 48,000kWh

Reduced load following insulation and efficiency improvements: 36,000kWh (25% reduction).

2,400 hours; 15kW average heat requirement.

Capital cost of a 20kW output (max) ASHP = £20,000

Operating cost: average output 15 kW heat at a COP of 2.5, requires 6kW electricity supply.

At current prices; 12.4p/kWh x 6 x 2,400 hours = £1,785 per annum electricity cost.

The existing point of use water heater would then be used for hot water.

11. 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 .

12. Faculty Requirements

It must be noted that all works intended to be undertaken should be discussed with the DAC at the Diocese.

Throughout this report we have indicated our view on what category of permission may be needed to undertake the work. This is for guidance only and must be checked prior to proceeding as views of different DACs can differ.

Under the new faculty rules;

List A is for more minor work which can be undertaken without the need for consultation and would include changing of light bulbs within existing fittings, repair and maintenance works to heating and electrical systems and repairs to the building which do not affect the historic fabric.

List B is for works which can be undertaken without a faculty but must be consulted on with permission sought from the Archdeacon through the DAC. This includes works of adaptation (but not substantial addition or replacement) of heating and electrical systems and also the replacement of existing boilers so long at the same pipe work, fuel source and flues are used. It can also be used to replace heating controls.

All other works will be subject to a full faculty.

Works which affect the external appearance of the church will also require planning permission (but not listed building consent) from the local authority and this will be required for items such as PV installations.

13. Appendix 1 - Annual Consumption Details

Meter details are as follows:

Meter	From	To	Days	kWh	Rate p/kWh	Cost	Total with SC and VAT	Total adjusted to 365 days
Electric								
E11Z02108a	14/01/19	14/01/20d	365	3,525	12.110	£427	£548	£548
E11Z02109a	26/12/19	26/11/20	335	10,497	12.110	£1,271	£1,662	£2,000
E11Z02838a	28/12/18	28/12/19d	365	242	12.410	£30	£135	£135
F78A07793v	31/12/19	22/12/20	356	963	12.410	£119	£213	£221
							TOTAL	£2,904
Gas								
M040 K02625b	07/01/20	16/11/20	314	101,476	3.099	£3,145	£5,491	£6,384
E025 K00408c	12/01/19	17/01/20d	370	30,751	3.442	£1,058	£1,083	£1,068
							TOTAL	£7,452

a Located in Parish hall entrance cupboard. Allocation unknown, may be one phase to each meter; although the Air Handling Unit may require a three phase supply.

b Located in external meter cabinet at front of building

c Located in Vestry Hall cleaner's cupboard

d Data also available throughout 2020

v Located in Vestry Hall, east wall