Energy Efficiency and Zero Carbon Advice

St Mark's Church Hall Complex, Battersea Rise

PCC of St Mark's Church

Author	Reviewer	Date	Version
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Contents

1. Executive Summary

An energy survey of St Mark's Church Hall Complex, Battersea Rise was undertaken by Inspired Efficiency Ltd to provide advice to the church on how the building can be more energy efficient whilst providing a sustainable and comfortable environment.

St Mark's Church Hall Complex, Battersea Rise is a modern brick faced building consisting of offices and meeting rooms over three storeys, with a glass fronted atrium encompassing a foyer, reception area and a large hall which adjoins the church. It was constructed in 2007.

There is both gas and electricity supplied to the site.

The PCC have a number of ways in which the building can be made 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)
Read Submeters to understand church/centre energy use split	-	-	-	-	-	-
Office energy efficiency measures	Standby time and switch off 10% 1,500	£316	None	Immediate	None	0.38
Replace CFL lighting with LED	9,000	£1,900	£12,800	7	None	2.28
Reduce boiler output temperature	5% 3,640	£149	None	Immediate	None	0.67
Install Endotherm heat transfer fluid to boiler	10% 7,280	£299	£120	1	List A	1.34
Replace heating boilers with Air Source Heat Pump	72,800 gas Use 29,100 electricity without solar	£2,992	£16,000	5.4	Faculty	13.44 From gas
Install solar photovoltaic panels	29,100	£6,137 grid costs	£54,375	9	Faculty	Offsets gas use above
Combined costs ASHP + Solar PV	72,800 gas	£2,992 gas (electric equal)	£70,375	23		As above

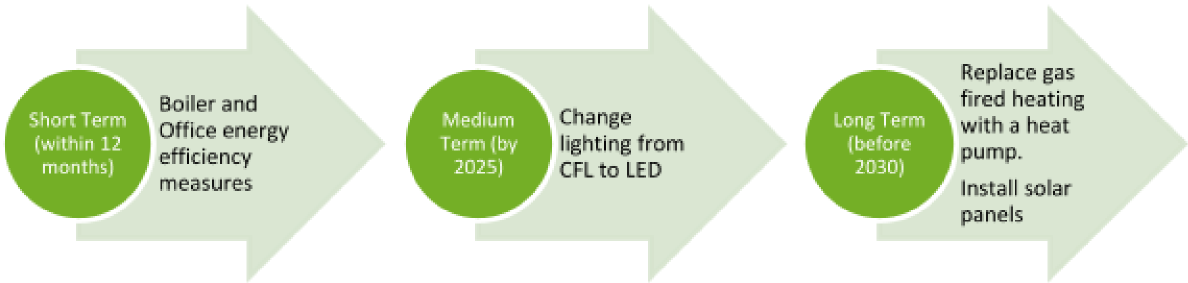
The church should check any faculty requirements with the DAC Secretary at the Diocese before commencing any works. Estimates are based on current contracted prices of 21.09p/kWh and 4.11p/kWh for electricity and mains gas respectively.

If efficiency measures were implemented this would save the church around £2,600 per year in operating costs, with a further £3,000 from installation of a solar power driven heat pump.

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. Furthermore, the PCC of St Mark's Church has joined the Eco Church scheme.

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 Mark's Church Hall Complex, Battersea Rise to give them advice and guidance as to how the building can be improved to be more energy efficient. In doing it will also become more cost effective to run. 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 Mark's Church Hall Complex, Battersea Rise, London SW11 1EJ was completed on the 20th May 2021 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 Chu Yee Ong, Operations Manager.

St Mark's Church Hall Complex, Battersea Rise	
Church Code	637286
Gross Internal Floor Area	820 m^2
Listed Status	Unlisted

The building is typically used for 60 hours per week for the following activities. All figures refer to before March 2020.

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Office use	40 hours per week	12
Daytime use	2 hours per week (toddler group)	90
Meetings and Church Groups In evenings	20 hours per week Weekly: Alpha group, 2 courses, 3 meetings	100 between groups
Community Use	Winter night shelter, 250 hours per year	15 per week

Annual use 3,500 hours

Footfall 15,000

4. Energy Procurement Review

Energy bills for gas and electricity have been supplied for St Mark's Church Hall Complex, Battersea Rise and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single / Blended Rate	21.09p/kWh	Above current market rates
Standing Charge	44.64p/day	N/A

Supplier: E On

The current gas rates are:

Single / Blended Rate	4.11p/kWh	Above current market rates
Standing Charge	24.00p/day	N/A

Supplier: n Power; contract to 22 January 2022, flexible with 30 days notice.

The electricity rate is the highest observed from 80 churches. Three higher gas rates were seen.

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 looks into 100% renewable tariffs and obtains quotations for its gas and electricity supplies from the Big Church Switch scheme: www.bigchurchswitch.org.uk, and the Diocese Supported parish buying scheme, http://www.parishbuying.org.uk/energy-basket.

These schemes offers 100% renewable electricity and a proportion of renewable gas and therefore are 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 currently:

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.

Between March and September 2019 following a change of supplier from EOn to nPower in March, 20% VAT was charged for gas. This was noted on a bill, and the VAT rate reduced to 5%.

If the excess VAT was not reclaimed, then this should be followed up as it can be reclaimed over the past three-year period.

Whenever monthly gas consumption exceeds 4,397kWh (52,000kWh per annum), 20% VAT is charged unless the customer has submitted a VAT declaration form. This was the case for most winter months including January to March 2020.

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

The whole site has recently used around 40,000 kWh/year of electricity, which has cost in the region of £6,400 per year. The centre is likely to use around 34,000kWh per year. The electricity data is mostly from 2020, so the likely annual consumption of the centre could be in the region of 40,000kWh due to higher office use. Although reduced evening bookings occurred from March 2020 onwards, there was greater use of the buildings by the food bank throughout the day.

145,000 kWh/year of gas are used, costing around £5,000 p.a. It should be noted that both utility rates per kWh have increased significantly over the past three years. This may be due to one supplier being superseded by another without a new contract being negotiated. This gives a projected annual utility spend of over £15,000. These costs may be significantly reduced by joining a group purchasing scheme.

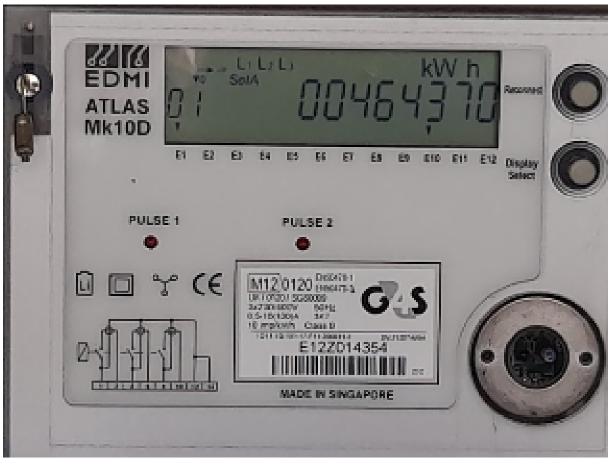
The supply to the whole site is measured by meters adjacent to the church centre. There are two sub meters installed in the church; these are neither billed or read, so there is no accurate data split between the two buildings.

It is recommended that church staff read the sub meters regularly to develop an understanding of church / centre energy use split.

Utility	Annual Consumption/kWh	from	to	cost
Electricity TOTAL	40,000 (2020) Average over 12 months	23/10/19	19/01/21	£6,440 (at previous rate of 15.09p/kWh)
Electric – Church	Est 7,300			
Electricity – Centre	**Est 32,700**			
Electricity Projected	Increase due to greater office use, but less hours than pre pandemic		Estimated cost at 2021 rates including standing change and VAT	£9,028 at 21.09p/kWh
Gas TOTAL	145,300 Average consumption calculated from two years data	05/01/18	03/01/20	£4,775 (at previous rate of 3.07p/kWh)
Gas – Church	Est 72,500			
Gas - Centre	**Est 72,800**			
Gas Projected	Amounts as above		Estimated cost at 2021 rates including standing change and VAT	£6,362 at 4.11p/kWh

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Billed meter	E12Z 014354	EDMI Atlas Mk10D	Yes	External meter cupboard
Electricity – Church sub meter	K81A 12617	GEC, London Electric Board	No	Plant room off crypt kitchen
Gas – Billed Meter	E040 K00087 20 D6	Bk-G25E	Yes	External meter cupboard
Gas – Church sub meter	434422	Not known	No	Cupboard in gents toilet in crypt

The two billed meters are AMR connected and as such energy profile for the entire energy usage should be possible. Daily use data has been included in the most recent bill.



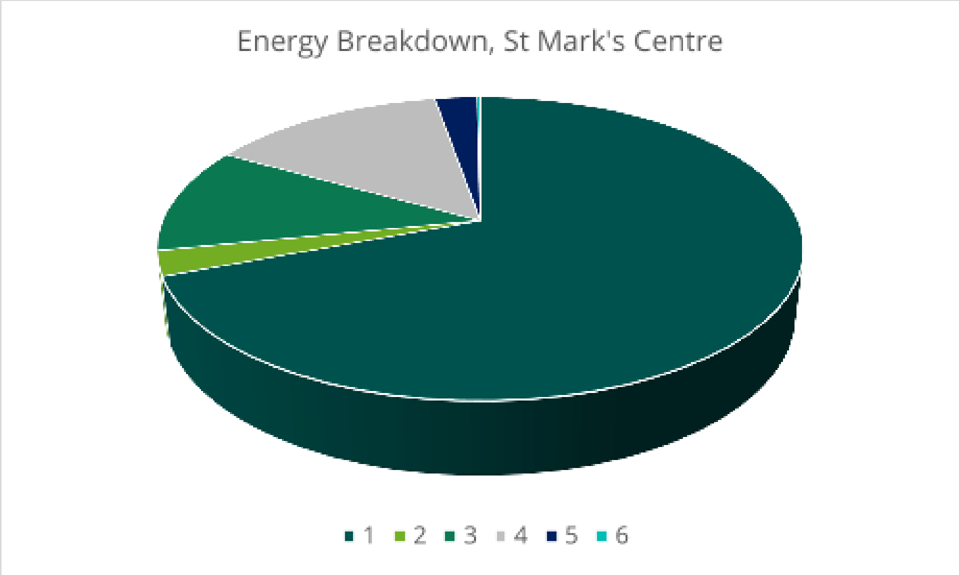
5.1 Energy Profiling

The main energy consuming plant can be summarised as follows:

Service	Description	Annual use kWh	Estimated Proportion of Usage
Gas Heating	2 MHS Boilers Estimated hours of use 2000 plus 5000 (30 weeks) for underfloor heating, Durie room Average load ~ 35 kW	72,800	69%
Electric Heating & Ventilation	Pumps for boilers: 4, totalling 640W Air handling unit. Estimate 1kW fans 50 hours/week x 30 weeks = 1500hrs	600 2,200	2.6%
Hot Water	1 x MHS electric immersion heater 3kW [Noted turned off]	Assume 0	
Lighting internal	Recessed CFL bulbs, each 18W x 90 = 1620W T5 Fluorescent 1.2m 54W x 70 = 3780W Bulkhead 40W x 4 = 160W TOTAL = 5500W Assume 50 hours per week use, all on	12,000	11%
Lighting external	0		
Small Power	Vacuum 1.5kW	200	0.2%
Office equipment	12 desk positions in main office, 3 in adjacent office. 15 x 600W x 30hpw x 52	15,000	14%
Kitchen	Used daily for various events and regular hot food preparation Microwave 1kW 2 coffee machines, 2kW each Plumbed urn 2KW Fridge / freezer 250W Commercial dishwasher 5kW Kitchenette, second floor - Kettle	 70 1000 100 730 700 100	3.2%

Annual electricity use allocation to Centre, estimate 32,700kWh

Total site annual electricity use (2020) 40,000kWh



KEY 1 Gas heating 2 Electric heating, ventilation, air conditioning

3 Lighting 4 Office equipment 5 Kitchen 6 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 loads are lighting and office equipment.

The estimate considers building use and office occupancy during normal times when the building is at full use.

5.2 Energy Benchmarking

In comparison to national benchmarks for building energy use, St Mark's Church Hall Complex, Battersea Rise uses 20% less electricity and 9% less heating energy than would be expected for an office building of this size adhering to current good practice. This is due to the recent (2011) construction of the building which will be to recent standards of insulation. It is also close to the benchmarks for offices as it has a similar structure and use pattern to many offices, being a mix of open plan areas and smaller meeting rooms, and hosting several staff working during office hours. There is of course, room for improvement, and the benchmark data are not set to reflect the need for zero carbon emissions.

1 CIBSE data, (2017): Energy Consumption Guide; Office benchmark data for air conditioned offices, collected in the late 1990's. [very little data has been published in this field].

	Size (m² GIA)	Annual Energy Usage (kWh)	Actual kWh/m²	Benchmark kWh/m²	Variance from Benchmark Good Practice
St Mark's Church Hall Complex, Battersea Rise (elec)	820	32,700	40	Good practice 50 Typical 90	-20%
St Mark's Church Hall Complex, Battersea Rise (gas)	820	72,800	89	Good practice 97 Typical 178	-9%
TOTAL	820	105,500	128	Good practice 147 Typical 268	-13%

6. Building Overview

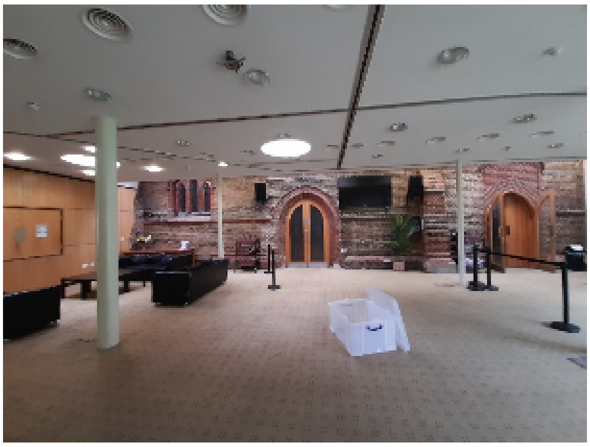
St Mark's Centre consists of two areas: a glass fronted atrium, foyer and reception area leading to a large meeting area at the rear, which adjoins and leads to the church on the left (South). The upper floor hosts a large open plan office with two meeting rooms to the rear. There is a plant room in the gabled roof. To the right are small meeting rooms / offices on three storeys in brick with a tiled roof to match that of the church. Each floor has three meeting rooms, in addition there is a further small office at ground floor level on the elevation facing the road. A lift provides access to all levels.

This gives a total of one large meeting area/Exhibition space, communal office, small office, 8 meeting rooms, commercial kitchen, kitchenette and toilets.

The land adjacent to the church is part of Wandsworth Common (which is heavily fragmented).

It may offer the potential of Ground Source Heat Pump boreholes being drilled underneath it from within the church boundary.   Alternatively, the flat roof above the Centre main space offers a location for Air Source Heat Pumps.

The Durie Hall, above, forms an open plan meeting and exhibition area between the two floors of small meeting rooms to the left and church to the right. To the fore is the foyer and entrance, above left the office and further meeting rooms, directly above a section of flat roof.



A commercial specification kitchen is in regular use for preparing hot food.

Above right; ground floor meeting room.

Above – second floor meeting room

Below - Office on top floor providing accommodation for 12 staff. Two further meeting rooms are accessed from the corridor to the rear.

7. Efficient / Low Carbon Heating Strategy

The building is modern and benefits from a good level of insulation and it is fully double glazed.

The building is heated by a network of modern pressed steel radiators with underfloor heating in the Durie room.

The church should develop a boiler replacement plan, by obtaining detailed quotations for the options presented in this report.

Electricity currently has a carbon emissions of around the same level as mains gas but they are reducing rapidly as the UK builds more renewable energy and decommissions the remaining coal fired power stations by 2025. Mains gas does have some potential to reduce its carbon content through the use of bio gas and hydrogen but these are less developed solutions and will be unable to deliver 'zero carbon mains gas'.

It is therefore important to review and set out a plan to make the building less carbon intensive. One way to achieve this is to consider a transition to electrical heating where this represents a more efficient solution.

Alternatives to gas fired boilers as a heat source are Air Source or Ground Source Heat Pumps.

7.1 Gas Boilers

The boilers date from 2007, so it is likely that they will require repair or replacement by 2027.

If the gas boilers are replaced, new boilers will need to be hydrogen ready. Some hydrogen is due to be added to the gas grid over the next five year period. If plans to decarbonise the gas grid are implemented; the hydrogen mix will eventually exceed 20% and a hydrogen compatible boiler will be required. The transition will be overseen by the regulatory bodies in a similar way to that between town gas and north sea gas.

Whilst there are plans to add hydrogen to the network, and "green" gas from anerobic digestion; the majority of the gas supply will continue to be fossil fuel for the next decade. The economics of hydrogen production and the need to replace some distribution pipework make full decarbonisation of the gas supply unlikely.

7.2 Air Source Heat Pump

Heat pumps use refrigeration technology to upgrade heat from the air or ground, delivering more heat energy than the electrical energy they consume. The ratio is the Coefficient of Performance [CoP]. Heat pumps generally deliver water at around 55ºC (although there are higher temperature ones on the market which require more energy to run, and Air to Air Source Heat Exchangers for buildings which do not have a radiator network). They are compatible with a building which is regularly used and can be supplied with constant, medium heat.

Air Source Heat Pumps [ASHP] have CoP values between 2 and 3, which are weather dependent. They are least efficient when required to deliver large amounts of heat when the air is cold, so are incompatible with heating a church once a week from cold.

ASHP systems are suited to buildings in regular use, such as offices, and systems where low grade heat is supplied (water at 40 to 50ºC). The external units could be located on the flat roof immediately adjacent to the south side of the plant room, or perhaps built into the plant room on this side replacing the louvres.

Section 8.1 suggests that the boiler output temperature could be reduced for greater efficiency. ASHP systems are intended to operate for longer hours than boilers outputting water at 70-80ºC. Sometimes they may require installation of larger radiators – a larger area is required to deliver the same amount of heat with warm water, whereas a small radiator will suffice with hot water. Detailed calculations would be required from an ASHP installer, based on the plant output.

Assuming that the same amount of heat is to be supplied per year to the centre (72,800kWh), and that a CoP of 2.5 is obtained, this would require 29,120kWh of electricity to run.

The average load of the existing boilers is 35kW, likely maximum load 90kW. It is suggested that heat pumps are installed at just above the average load, with a back up boiler retained for the coldest weather – this arrangement is often recommended as it avoids having to install oversized heat pumps.

ASHP

Capital cost, 40kW output unit: £16,000

Operating cost: 72,800kWh output/COP2.5 = 29,120kWh.

Without solar, x 21.09p/kWh = £6,141

With solar, assume half of needs from grid during winter; 15,000kWh = ~ £3,163, offset by some sale of surplus electricity generated during summer.

7.3 Ground Source Heat Pump

Ground Source Heat Pumps [GSHP] deliver more heat per kW of electricity consumed than for Air Source. (This is measured by the Coefficient of Performance, or COP, 4 is a reliable assumption).

They require either a sufficient area of land to lay subsurface pipes (not enough is available from the car park and small area of grass), or a borehole.

If there were sufficient land to install a borehole, this would deliver the lowest operating cost, although connection to the plant room could be difficult.

Assuming that the same amount of heat is to be supplied per year (145,000kWh), and that a CoP of 4 is obtained, this would require 36,250kWh of electricity to run.

GSHP

Capital cost, 40kW output unit £40,000

Operating cost: 72,800kWh output/COP4 = 18,200kWh.

Without solar, x 21.09p/kWh = £3,838

With solar assume half of needs from grid during winter; 10,000kWh = ~ £2,109, offset by some sale of surplus electricity generated during summer.

Note that these very high electricity rates can be considerably reduced through a group purchasing scheme.

Further costings taking into account on site generation of solar power are presented in Section 12.2.

8. Improve the Existing Heating System

Heating is provided by two MHS boilers of unspecified output installed during building construction in 2007. There are five sizes of boiler in the range. With an annual heat output in the order of 145,000kWh over around 2000 hours, and 5000 hours (continuous for 7 months) use of the underfloor heating in the Durie room, an average output of 35kW is calculated. The boilers are therefore probably the smaller model 45.

As the existing heating system is being retained it is recommended that measures are taken to improve the efficiency of the existing heating system. This should include:

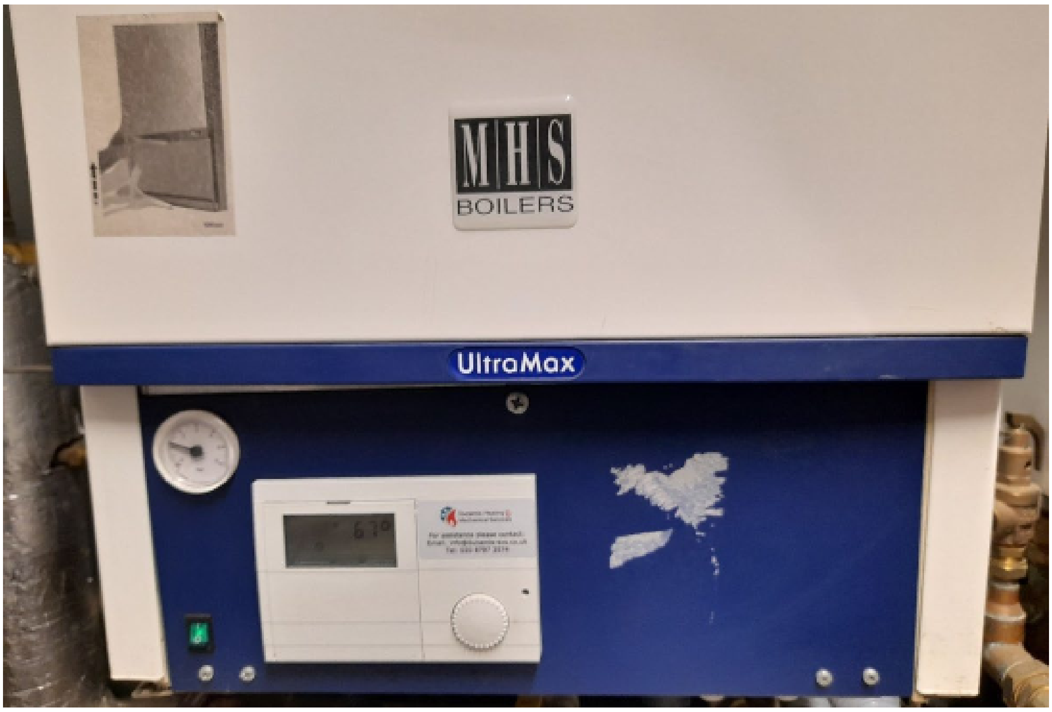
8.1 Reduce Boiler Output Temperature

The boiler output temperatures were observed to be 65 and 67ºC. This may be too high to guarantee a return water temperature of below 55ºC which is needed to condense the exhaust gases and recover the heat. Manufacturer's data [2] indicates an increase in efficiency of 10% from 39kW output to 43kW heat output for the smaller boiler model in the range.

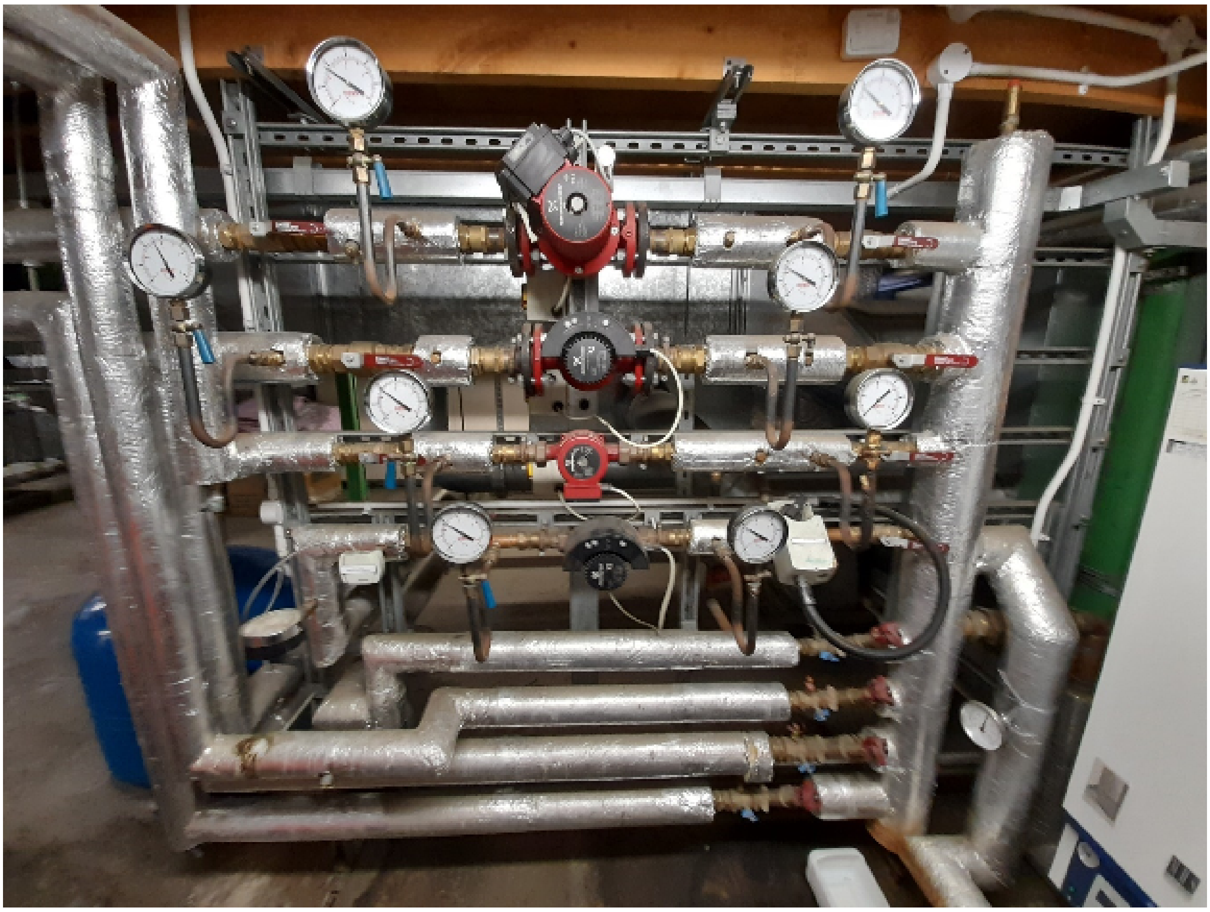
The effect of running at lower water output temperature would be:

1) Increased efficiency – recovering some waste heat which results in burning less gas.
2) Lower radiator temperatures, requiring longer hours of operation – but this is offset by both operating at lower temperature and recovering waste heat, so there is an overall gain.
3) Lower operating costs (5 to 10%)

2 - Data in downloadable manual from manualslib,com MHS untramax 45, page 4.



8.2 Install Magnetic Particle Filter



The pipework manifold including four circulating pumps and no magnetic particle filter was observed in the plant room. These devices trap magnetic sludge which develops as a result of corrosion and will reduce efficiency of boilers and can block radiator valves.

8.3 Install Heat Transfer 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 by anyone competent to depressurise and repressurise the system.

Calculation: 35kW average load

35kW x 8 = estimated system volume = 280Litres.   Divide by 100: 2.8litres = 6 x 500ml bottles @ £20ea.

8.4 Hot Water Supply

Hot Water heater: MHS Boilers Ltd. Gemini HSC calorifier; single phase, 3kW maximum.

This device provides hot water by means of an electric immersion heater when the boilers are turned off. The boilers are understood to run constantly during the heating season so it is not required and was found to be turned off. If the boilers are off or on standby over the summer, it will be required. If boilers are replaced by a heat pump, it will be required.

9. 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.

9.1 Replace CFL Lighting with LED

The lighting probably dates from building construction when Compact Fluorescent tubes (CFL) were the most efficient lighting ion the market. Introduction of LEDs has occurred, with prices falling significantly. The lighting demand makes up around 11% of electrical energy demand.

Approximately 90 CFL bulbs of 18W or 25W are fitted

LED replacement: Virgo 8W units; installed cost £43.17 each; total £3,885.
www.qvisled.com/virgo

Approximately 70 Fluorescent tubes, mostly T5 diameter, approximately 1.2m length are fitted.

These are normally 28W or 54W tubes and can be replaced by 17W LED units of equal length, the recommendation is that the complete light fitting; bulb and housing to be replaced.

LED replacement: Proteus (by Kemps Architectural Lighting); installed cost £127.30 each; total £8,911. The Proteus strip lights are dimmable. www.kempsarchitecturallighting.com

Replacement of all the lighting with LED will offer a reduction of lighting energy consumption of around 9,000kWh, saving £1,900 annually.

If the CFL lighting is required to be dimmed, then LED bulbs which are compatible with the expensive dimmer controls (costing around £5,000) are required. 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/

9.2 Lighting Controls (Internal)

Areas such as corridors and toilets are only used occasionally and for a short amount of time and as such, lighting does not need to remain on constantly. Where PIR sensors are not fitted, it is recommended that motion sensors are 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.

9.3 Power Management Settings on Computers

The computers within the building should be shut down or put into a hibernate mode.

It is recommended that all computer workstations set to go into hibernate mode after a short period of time of not being used.

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

10. Saving Recommendations (Water)

10.1 Tap Flow Regulators

Regular use of the building by a toddler's group recommends installation of tap flow regulators in washrooms where not already fitted.

The over provision of water for hand washing is not only a source of excessive water use, but in the case of hot water, it is also a source of wasted energy in the heating that has to go into providing the hot water.

The flow rate of the taps can be easily regulated by fitting flow regulators within the taps. It is recommended that flow regulators such as those manufactured by neoperl (http://www.neoperl.net/en/) are fitted into all the viable hand wash basin taps to save on both water and heating of the hot water.

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

10.2 Detergents for Cold Water Hand washing

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

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

11. Other Recommendations

11.1 Health and Safety – Access to Plant Room.

The plant room has been poorly designed in that access for maintenance has not been addressed. In addition to the only access being by vertical ladder, it is necessary to climb over the ducting whilst crouching underneath the upper ducting. This could be partly alleviated by adding some simple steps.

The insulation surrounding the upper ductwork, which appears to be rockwool, is coming adrift as a result of being used as a handhold. This should be repaired with duct tape before it falls off and before fibres start to break off and spread across the room.

The boilers are located in the opposite corner of the room – the Hot Water boiler is the orange item in the centre of the image.   Access involves squeezing into the gap between the ductwork in the centre and avoiding cables and the loose insulation to the left, before ducking under the 1.2m clearance under the duct. Again, installing some simple steps here would help.

There is a door in the bulkhead into the roof space just to the right of the orange boiler, with a trapdoor in the office space ceiling. It is recommended that a folding loft ladder be installed here to allow easier access to the boilers, which might be required rapidly if there is a leak or breakdown.

12. 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
Battery Storage	Yes
Wind	No – no suitable land away from buildings
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Biomass	No – air quality issues, no storage space
Air Source Heat Pump	Yes
Ground Source Heat Pump	Possibly, dependent on borehole location

12.1 Solar Photovoltaic Panels

There is potential for a PV array on both the pitched and flat portions of the centre roof.

The current arrangements around solar panels mean that to be financially viable the building on which they are mounted needs to consume the vast majority of the energy that they produce.

The roofs offer an area of around 250m^2. This could generate 0.15kWpeak/m^2 giving a 37.5kWpeak system. A 1kWpeak system can generate up to 1000kWh annually, giving a total annual generation of around 20,000kWh. Orientation factor (roof slope and angle from south around 37^o of the pitched roof) is 0.95. Half of the system would be located on the flat roof, supported on trestles and aligned optimally. There would be shading form the church roof at low sun angles.

Annual Generation (kWh) = Area x 0.15kWp/m^2 x K factor x Orientation Factor x Overshading Factor = 250m^2 x 0.15kWp/m^2 x 1000kWh/kWp x 0.97 x 0.8

= 29,100kWh

This is approaching three quarters of recent annual electricity use.

Peak generation of around 37kW is greater than average load (32,700kWh/ 3500 hours = ~10kW) so adding battery storage would be cost effective and extend the usefulness of the solar PV system into the evenings. 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, extending the usefulness of the power generated during the day into the evening. Some exporting of power to the grid in summer, and purchase from the grid for winter evenings will occur.

The Smart Export Guarantee pays about 5p/kWh for electricity generated and exported to the grid (the Feed in Tariff having ended). One of the issues for churches is that most lighting use is at periods when the electricity is not being generated, so installation of a battery to make maximum advantage is recommended. This is a new but fast-growing technology.

Using average 2019 installation costs (£1,450 per kWpeak); a 37.5kWpeak system would cost £54,375. This does not include cost of any battery.

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

12.2 Heat Pump Electricity Requirements

Heat Pumps are a low carbon method of creating heat, their use and suitability for this church is reviewed in Section 7, Efficient / Low Carbon Heating Strategy.

Electricity needs of a heat pump are estimated at 18,200kWh (GSHP) or 29,120kWh (ASHP).

Costs based on p/kWh, not including VAT and standing charges:

Heat Source	Heating electricity requirement/ kWh	Current electricity Whole site demand/ kWh	Total electricity demand/ kWh	Annual grid requirement With solar generation/ kWh	Annual grid electricity cost after solar/ £ Note 4
Gas	600 (pumps)	40,000	40,000	10,000	£2,109
GSHP	18,200	40,000	58,200	29,100	£6,137
ASHP	29,120	40,000	69,120	40,020	£8,440

4: This does not take into account any savings made by sale of excess solar generated electricity to the grid during summer, and is calculated at the current very high price of 21.09p/kWh.

Current annual electricity expenditure is estimated as £6,896 for the church centre, based on 32,700kWh use out of a total of 40,000kWh costing £8,436 annually for the entire site.

Installing an Air Source Heat Pump plus solar panels would result in approximately the same annual electricity operating costs as at present, (because the solar array is only large enough to supply the heat pump and not the whole requirement). But this cost of £8,440 will be reduced by several factors (1) there would be no centre gas costs, which are estimated at £2,992 annually (not including VAT) and (2) sales of excess power to the grid during the summer, a potential income of £500, (3) energy efficiencies from LED lighting, c. £1,200 and reduced electricity price from group buying. Together there is potential for the bill to be reduced to £3-4k.

Detailed figures from various installers of solar and heat pump technology will be required to conform these initial estimates.

13. 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-2019.pdf .

14. 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.