ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

St Michaels

PCC of St Michaels

THE CHURCH OF ENGLAND
Diocese of Chester

Author	Reviewer	Date	Version
Tamsin Hockett	David Legge	8th June 2021	1.0

Contents

1. Executive Summary

An energy survey of St Michaels was undertaken by ESOS Energy to provide advice to the church on how it can be more energy efficient and provide a sustainable and comfortable environment to support its continued use. This audit has been provided in conjunction with 2buy2, the Church of England's Parish Buying scheme provider and is subsidised from Total Gas & Power, the Parish Buying schemes principal energy suppliers.

St Michaels was built in 1910 and is constructed of solid stone with single glazed decorative windows. An additional aisle was added in 1938 and the brick tower was built in 1963. The church is heated by gas fired boilers to perimeter radiators as well as fan convector heaters in the main hall and storage rooms. The hot water is provided by point of use hot water heaters in the kitchen and WCs. The lighting in the church is predominantly LED lighting, the parish centre is a mix of fluorescent tubes and LED. There is a range of small power use from the sound system, organ, TV monitors, kitchen appliances and other plug-in loads. There is both gas and electricity supplied to the site.

The church has a number of ways in which it can be more energy efficient. Our key recommendations have been summarised in the table below and are described in more detail later in this report. It is recommended that this table is used as the action plan for the church in implementing these recommendations over the coming years.

Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Payback (years)	Permission needed	CO2 saving (tonnes of CO2e/year)
Install an Air Source Heat Pump into the building to replace existing heating system	77,796	-£1,255	£32,000	n/a	Faculty	12.07
Replace heating system for electrical based heating solution	111,443	-£12,574	£52,281	n/a	Faculty	10.10
Consider install Electric Vehicle Charging Points	0	N/A	N/A	N/A	Faculty	-
Install thermostatic radiator valves (TRVs)	15,837	£443	£990	2.24	List A (None)	2.92
Insulate exposed pipework and fittings in plantrooms	7,641	£214	£500	2.34	List A (None)	1.41
Install SavaWatt devices on fridges and freezers	140	£18	£50	2.73	List A (None)	0.04

Install reflective panels behind radiators	5,279	£148	£540	3.66	List B	0.97
Fit timed fused spurs to hot water heaters	324	£42	£180	4.25	List A (None)	0.08
Install PIR motion sensors on selected lighting circuits	1,814	£237	£1,275	5.37	List B	0.46
Fit 270mm of insulation into the roof space	26,395	£738	£7,040	9.54	Faculty	4.87
Change existing lighting for low energy lamps/fittings	8,242	£1,078	£11,972	11.10	Faculty	2.09
Inject cavity wall insulation into walls of parish centre	21,116	£590	£8,280	14.02	Faculty	3.90
Install a Solar PV array to roof of building (assumed 100% of energy generated used in building)	6,446	£843	£17,266	20.47	Faculty	1.63
Add secondary glazing to windows	26,395	£738	£60,000	81.30	Faculty	4.87

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

Based on current contracted prices of 13.08 p/kWh and 2.8p/kWh for electricity and mains gas respectively.

Excluding the move to an electrical/ASHP heating system, it measures were implemented this would save the church £4,638 per year and reduce its carbon footprint by 23.24 tonnes (44%).

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 Michaels has also declared a climate emergency and has an ambition to be carbon neutral by 2035 and has recently implemented a policy that will not allow the replacement of oil heating systems.

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 Michaels 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 Michaels, St Michael's Avenue, Bramhall SK7 2PG was completed on the 23rd March 2021by David Legge. David is an experienced energy auditor with over 10 years' experience in sustainability and energy matters in the built environment. David is a fully qualified ESOS lead assessor with CIBSE and a CIBSE Low Carbon Consultant and a fully qualified ISO50001 lead auditor.

St Michaels	
Church Code	609351
Gross Internal Floor Area	541 m^2
Listed Status	Unlisted

The church typically used for 62 hours per week for the following activities:

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	5.5 hours per week	146
Community Use	20 hour per week	44
Other-Parish Centre	36 hours per week	

There is additional usage over and above these times for festivals, weddings, funerals and the like.

4. Energy Procurement Review

Energy bills for gas and electricity have been supplied by St Michaels and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single	13.08p/kWh	In line with current market rates
Standing Charge	36.00p/day	N/A

The current gas rates are:

Single	2.80p/kWh	In line with current market rates

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

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

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

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

5. Energy Usage Details

St Michaels uses 16,738 kWh/year of electricity, costing in the region of £2,190 per year, and 263,951 kWh/year of gas, costing £7,380.

This data has been taken from the annual energy invoices provided by the suppliers of the site. St Michaels has one main electricity meter, serial number E10BG30607. There is one gas meter serving the site, serial number one M040K01126 10D6.

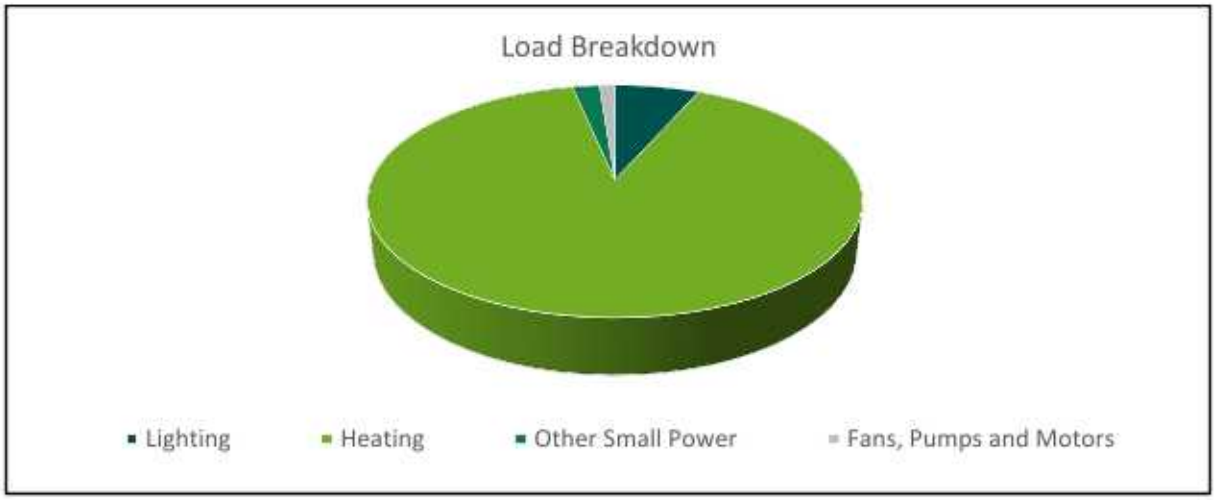
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	E10BG30607	EDMI Atlas Mk10D	Pulse output, no AMR connected	Boiler room in Crypt
Gas – Church	M040K0112610D6	Honeywell	Full AMR connected	Corner of car park near road

It is recommended that the church consider asking their electricity supplier to install a smart meter so that the usage can be monitored more closely, and the patterns of usage reviewed against the times the building is used.

5.1 Energy Profiling

The main energy consuming plant can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting	Church is predominantly LED lighting; parish centre is a mix of fluorescent tubes and LED	4%
Heating	Heating to the church is provided by two Keston gas fired boilers serving perimeter column radiators. The hall is heated via night storage heaters and the ancillary spaces by two Vaillant gas fired boilers to perimeter panel radiators.	94%
Other Small Power	Hot water heaters, sound system, organ, TV monitors, kitchen appliances and other plug-in loads	1%
Fans, Pumps and Motors	Heating Pumps	1%



As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site.

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use St Michaels uses 6% less electricity and 99% more heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	Annual Energy Usage (kWh)	Actual kWh/m^2	Benchmark kWh/m^2	Variance from Benchmark
St Michaels (elec)	886	16,738	18.89	20.00	-6%
St Michaels (gas)	886	263,951	297.91	150.00	99%
TOTAL	886	280,689	316.80	170.00	86%

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. Putting in place a heating strategy that is energy efficient and low carbon is, therefore, of the highest priority.

The Church of England is in the process of reviewing its heating guidelines. The process has already established some principles for heating that can help churches as they seek an acceptable combination of comfort, conservation, affordability, and environmental care. The principles can be found at https://www.churchofengland.org/sites/default/files/2020-04/CBC%20Heating%20guidance%20principles%20FINAL%20issued.pdf

As the principles make clear, every church's strategy will be unique to it, informed by many factors, including the nature of its usage, the system it's starting from, the conservation needs of the building, and the resources available. The strategies in this audit are designed specifically for your church.

Our recommendations on heating generally fall within three major areas. Firstly, for all churches we make recommendations that will help to reduce energy wastage and, as a starting point, to optimise the system that you already have.

Secondly, we recommend options for many churches that focus on heating people rather than the full volume of the church. Some of the changes that can help with this will be 'soft' changes – others will relate to the heating system itself.

Finally, we make recommendations about moving away from fossil fuels. Moves away from fossil fuels are key to cutting emissions. For most churches, this will involve moving from gas, oil or LPG to electricity. Electricity currently creates carbon emissions around the same level as mains gas, but the carbon emissions associated with it are reducing rapidly as the UK builds more renewable energy and decommissions its remaining oil and 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'. Some local areas may also be considering the option of district heating networks.

While moving away from fossil fuels may not always be possible, as the principles state, "churches should be expected to have at least carefully considered the option of moving away from fossil-fuel based heating (gas and oil boilers) towards electric-based heating." And if such options are not viable now, the churches "can try to be ready for a future retro-fit when technology and the grid has progressed."

The following strategy for the efficient heating of the church is provided in further detail in the coming sections. At present, a large percentage of the gas consumption is being used for continually heating the church to 18 degrees C, which would be suggested is a temperature for personal comfort. The background heating should be discontinued and the church only heated during occupied times. The heating controller did not appear to be in use during the survey, but this can be easily adjusted so that the heating only comes on when required.

The boilers are fairly new and therefore are not expected to reach the end of their serviceable life until around 2040 and should be used for this time. Prior to the replacement of the gas

heating system with an electrical heating solution as outlined below, the PCC can take some further steps to reduce the heating energy consumption.

The church itself is a very open space and there are no obvious smaller areas for which to hold mid-week services when the congregation sizes are smaller. It is suggested that in winter, mid-week services and smaller meetings could be held in the parish centre which is better insulated. This would avoid the need to attempt to heat the entire air volume of the church for a short occupied period.

The design of the tower is meant to allow natural light through and whilst there is no ceiling at a lower height, this does mean that the heating system is also trying to heat this air volume as well. One consideration could be to partition the nave from the tower with glass panels to allow the natural light through but create a thermal barrier. This would require proprietary glazing, so local quotations should be sought for this work. It is considered that the barrelled ceiling will have a void and therefore could benefit from loft insulation as well.

When the boilers do require replacement, perimeter far IR panel heaters and pulsar heaters could be hung within the central aisle (as lights are already hanging in chandeliers). The table below provides some further detail on one proposed route to decarbonised heating. Alternatively the existing heating distribution system could remain or be adjusted to support an air source heat pump.

Area	Type/ Size	Length (mm)	Watts	Number (or m) Required
Parish Centre				
Vicar's office	Electric Far IR Wall Panel 1200W	1200	1200	1
Meeting room	Electric Far IR Wall Panel 1200W	1200	1200	2
Lobby	Electric Far IR Wall Panel 700W	1200	700	3
WC	Pulsar 2400W	-	1800	3
Reception (Parish Centre)	Pulsar 2400W	-	1800	3
Storage room (off hall)	Electric Far IR Wall Panel 1200W	1200	1200	2
Church				
Chancel	Electric Far IR Wall Panel 1200W	1200	1200	4
Nave	Pulsar 2400W	-	1800	12
Aisles	Electric Far IR Wall Panel 1200W	1200	1200	10
Tower	Electric Far IR Wall Panel 1200W	1200	1200	4
Vestry	Electric Far IR Wall Panel 1200W	1200	1200	3

6.1 Discontinue with Background Heating Strategy

Most traditional churches were constructed without any form of heating. The modern addition of heating is not needed to preserve the fabric but only to provide thermal comfort to occupants. The previous trend of 'conservation heating' for fabric issues is now largely considered to be unnecessary and is being avoided by the likes of National Trust and English Heritage. The only times when background heating may be required is if there are historic wall paintings or to for

the preservation of large artefacts such as tapestries. The organ (and other sensitive areas such as historic papers stored in the vestry) may require some local background heating specific to that area. In general, sensitive paper records should be removed for storage in the county archive. Organs can be installed with a local background tube heater such as https://www.dimplex.co.uk/product/ecot-4ft-tubular-heater-thermostat within the organ casing in order to provide the heat where it is required. The fabric is often subject to the greatest damage by humidity (which is naturally higher when the air is warmer as warmer air has greater capacity for holding more moisture), as a result of large temperature swings (from central heating systems turning on and off) and from the excessive drying out/baking of timbers where high temperature heating units have been fixed to them (such as overhead heaters fixed to timber wall plates).

Providing constant background heating to the church building as a whole is excessive and wasteful of energy. At the very least we would recommend that this background level is reduced to a maximum of 12°C and ideally avoided all together.

6.2 Install Electric Panel Heaters

At the end of the serviceable life of the boiler, it is recommended that the PCC consider installing electrical panel heaters in the church 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- . Suitable pulsar heaters such as https://www.herschel-infrared.co.uk/product/pulsar/ could also be installed. 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

7. Energy Saving Recommendations

In addition to having a revise heating strategy there are also a number of other measures that can be taken to reduce the amount of energy used within the church.

7.1 New LED Lighting

The lighting makes up a relatively large overall energy proportion of the electricity used within the church, and some areas are lit by relatively inefficient fluorescent and SON fittings within the Church.

It is recommended that the fittings scheduled in Appendix 1 are all changed for LED. 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/.

If all the lights were changed, some on a simple "like for like" and a change to track lighting in the chancel, the total capital cost (supplied and fitted) this would be £11,972. The annual cost saving would be £1,078 resulting in a payback of around 11 years. This estimate includes for the supply of the lights, the labour to install them and the access required. It does not include for any upgrade to the wiring or a new lighting design both of which the church may wish to consider.

There are some fittings such as 2D where the existing fitting can be made more efficient by simply changing the bulb/lamp within the existing fitting to new LED bulb/lamp. This could be carried out by competent members of the churches internal team, very cost effectively and would be a List A item so no permissions would be required.

7.2 Lighting Controls (Internal)

There are several lights which currently remain on all the time in areas such as corridors, toilet areas, staircases, and the like. Some of these areas are only used occasionally and for a short amount of time so that, in actuality, the light does not need to remain on constantly. There are also spaces which benefit from a good amount of natural daylight coming in through the windows, such that artificial lighting is not required for much use during the year.

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 considered alongside the type of light that is fitted. LED lights are much more suited to being switched off after only a short duration than some fluorescent lights). These movement sensors, commonly called PIRs, also have light sensors integrated into them so they can be used to make sure that the light does not come on if there is already sufficient daylight in the space.

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

7.3 Refrigeration Controls

There is a fridge-freezer within the parish centre for storage of milk and staff food. These units run 24/7 and contribute to the baseload electrical consumption of the building.

To reduce the electrical consumption of these appliances it is recommended that they are all fitted with a Sava Control unit. These units work by automatically detecting the load of the compressor and turning down the power when it is not in full load. This reduces the energy consumption of the refrigeration unit by around 18% while maintaining the cooling of the appliance. It does this by reducing the voltage delivered to the unit when it is idling but allowing the full energy to the unit when it is required.

Supply and installation and further details can be undertaken by SavaWatt directly http://savawatt.com/. The installation does not cause any significant disruption to operations and can be undertaken during normal operating times.

7.4 Insulation of Pipework and Fittings

The pipework within the plant room has the majority of its straight lengths insulated but the more complex shaped pipework fittings, such as flanges and valves, have been left uninsulated. These exposed areas of pipework contribute significantly to heat loss from the system and make the plant room unnecessarily warm. The exposed hot surfaces also represent a health and safety risk of burns for those working in the area.

It is recommended that these areas of exposed pipework and fittings are insulated with bespoke flexible insulation jackets. These wrap around the various elements but can be removed and then replaced for any servicing activities.

A free survey and quotation for the supply and installation of insulation of pipework fittings can be arranged through ESOS Energy Ltd (contact Adrian Newton 0117 930 9689, adrian@esos-energy.com).

7.5 Reflective Radiator Panels

The church is heated by radiators served from the boiler. They therefore lose much of their heat into the masonry of the wall behind the radiator (where they are sited against an external wall) rather than giving it out into the building.

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

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

7.6 Thermostatic Radiator Valves (TRVs)

The church is heated by radiators and not all of these have thermostatic radiator valves (TRVs) installed on them.

TRV's can be installed on the existing radiator and allow the users of the room to have some element of control over the temperature in the room. They prevent over-heating and hence situations where the heating is on and the windows are open. They also allow unused spaces to have the heating in them turned down.

It is recommended that TRVs are installed on all radiators and users advised as to the best way to operate these once they have been installed. TRV's can be supplied and installed by any good heating engineer.

7.7 Timers on Fused Spurs to Water Heaters

There is an electric hot water heater/water boiler (for tea making and the like) at the church. These only need to heat the water to the required temperature when the building is in occupation but at the moment these heaters are directly wired in without any form of time control and therefore maintain their set temperature 24/7.

It is recommended that the heaters are fitted with a 24 hour/7 day timeclock to replace the fused spur switch. An example of such a unit would be a Time Guard FST77. They should be set up with times to match the times that the building is occupied. This will prevent the standing losses from the unit wasting energy during periods when the building is not occupied.

Such units can be purchased at any electrical wholesaler and fitted by your existing electrician or any NICEIC registered electrical contractor.

7.8 Draught Proof External Doors

There are a number of external doors in the building. These have the original historic timber doors on them, but these do not close tightly against the stone surround and hence a large amount of cold air is coming into the building around the side and base of these doors.

It is recommended that draught proofing is fitted to all external doors where there is timber doors closing onto a timber frame. A product called Quattro Seal (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

7.9 Secondary Glazing

Some of the windows of the building are singled glazed with metal frames in stone mullions and whilst double glazing could be installed, it is not considered that this would offer a financially viable measure and would also be a significant disruption to operations.

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 can provide very discrete and appropriate systems for all types of spaces.

7.10 Cavity Wall Insulation

The parish centre is constructed with a cavity wall method, and the inspection of the wall showed no signs that insulation has been added. 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, however, be added through injection into the cavity walls.

It is recommended that cavity wall insulation is considered and added to the walls where appropriate. A survey to check the width of the cavity, exposure of the wall and condition of the cavity should be carried out by a CIGA-approved installer who will then be able to provide you with a quotation to undertake the works. Installing cavity wall insulation will help to reduce heat loss and improve the comfort of the space, but needs to be considered alongside other control measures such as TRV's or room sensors to ensure that the space does not overheat because of the additional insulation.

A free survey and quotation for the supply and installation of insulation to the cavity wall of the parish centre can be arranged through ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com

7.11 Insulation to Roof

The loft void above the barrel ceiling within the church was reported to have little or no insulation present. 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.

Because heat rises, the ceiling/roof of a building is the largest contributing area to heat loss from a building. 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. Insulation measures such as this also need to be combined with control measures such as TRV's or room sensors to ensure that the space does not overheat because of the additional insulation.

A free survey and quotation for the supply and installation of insulation to the loft spaces can be arranged through ESOS Energy Ltd (contact Adrian Newton 0117 930 9689, adrian@esos-energy.com).

8. Saving Recommendations (Water)

8.1 Tap Flow Regulators

The taps to the wash hand basins within the building have been checked as part of the audit and the average flow rate within these has been estimated to be over 8l/min based on the fitting types. The recommended flow rate for hand washing is 4.8l/min and therefore the taps are providing around double the amount of water that is necessary.

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.

9. Other Recommendations

9.1 Electric Vehicle Charging Points

There is a parking area located to the side of the building. In order to facilitate sustainable transport choices, it is recommended that an electric vehicle charging point is fitted. This would enable any staff and visitors that have an electric car to be able to charge while at the building and it would also facilitate staff and other visitors to transition to electric vehicles over time.

Installing a unit such as a Rolec Securi-Charge http://assets.rolecserv.com/files/products_document/82cbbabab48b10b5894a059cd32776db/SecuriCharge%20EV%20Charge.Online%20(GPRS)%20Data%20Sheet%20-%2003.pdf would allow the organisation control over who is allowed to use the unit with simple mobile phone 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 without the need for a key may be most suitable. These are widely available through many suppliers such as http://www.rolecserv.com/ev-charging/product/EV-Charging-Points-For-The-Home.

As the building is a place of work installation grants are available through the work place charging scheme https://www.gov.uk/government/publications/workplace-charging-scheme-guidance-for-applicants-installers-and-manufacturers which will fund 75% of the installation cost up to £500.

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	Yes - South main roof visible but unlisted, some shading from trees
Wind	No – no suitable land away from buildings
Battery Storage	No – no viable PV
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Biomass	No – not enough heating load as well as air quality issues
Air Source Heat Pump	Yes -
Ground Source Heat Pump	No – archaeology in ground and radiator system

10.1 Photovoltaics

There is potential for a small PV array on the main church South 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 church's energy consumption is already very small and the consumption during the daytime when the sun is shining is likely to be very low indeed, therefore while technically viable, only a very small number of panels would be worth considering unless these were combined with battery storage or the electrical demand increased significantly, such as with the installation of electric heating or an ASHP.

Battery Storage is not strictly a renewable energy solution, but battery storage does however provide a means of storing energy generated from solar PV on site to be able to be used at peak times or later into the day when the PV is no longer generating. It therefore extends the usefulness of the existing PV system particularly in this sort of church. This is a new but fast-growing technology with prices expected to fall substantial over the next 2 to 3 years.

10.2 Air Source Heat Pump

Depending on how the church is used in the next 15 years, when the gas boilers reach the end of life, consideration could be given to an air source heat pump instead of direct electrical heating. The use of an ASHP would best suit a well used church with well insulated building fabric to support the efficient an ASHP provides. Intermittently used spaces would better be heated using responsive direct electric heating described earlier in the report.

The building is currently heated from a gas boiler which provides hot water into the heating system. The use of fossil fuels for heating means that it will not be possible for the building to become zero carbon without changing the heating system. A boiler also has heat and other efficiency losses within it, which means that the efficiency of a boiler in converting the gas into the heat is typically around 80 to 95% (depending on the age and type of boiler). Air source heat pumps use electricity to power the heat pump which takes heat from the air and puts this into water which can then go into the heating system. A heat pump can create around 3 units of heat for every one unit of electricity.

A new air source heat pump is likely to need a heating capacity of around 80kW and could be located in the current boiler room with adequate ventilation. As heat pumps operate on a low temperature basis some of the radiators and other heat emitters around the site may require upgrading. 3 phase electrical power (already on site) may also be required to power the units.

Good local renewable companies can be contacted for further detailed assessment of heat pumps and quotes or contact www.yourfutureenergy.co.uk

There are currently government incentives available for installing air to water heat pumps, but these are subject to future change and adaption so should be reviewed at the time of implementation.

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.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Tower	31	2D LED 11W	£124	£1,823	14.64
Chancel	8	AR111 LED	£243	£340	1.40
Chancel	6	3 Spot Track lights	-£53	£6,000	-113.97
Vestry corridor	2	2D LED 11W	£18	£118	6.66
Vestry	5	LED GLS	£128	£60	0.47
Tower	6	R63 LED	£78	£129	1.65
Link corridor	2	2D LED 11W	£8	£118	14.64
Lobby	6	2D LED 11W	£122	£353	2.89
WC	10	2D LED 11W	£204	£588	2.89
Kitchenette	2	5ft Single LED	£39	£176	4.51
Storage room	3	5ft Single LED	£58	£263	4.51
Meeting room / chair store	6	2D LED 11W	£53	£353	6.66