Energy Efficiency and Zero Carbon Advice

St Mary the Virgin, Stebbing
PCC of St Mary the Virgin

Author	Reviewer	Date	Version
Paul Hamley	Marisa Maitland	12th March 2021	1.0

Contents

1. Executive Summary

An energy survey of St Mary the Virgin 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 the Virgin is a Medieval Grade I listed church built in 1324 [Historic England reference 1112777]. There is electricity supplied to the site.

The church is on the "Heritage at Risk" register. The PCC are about to begin a substantial process of reordering with significant discussions having already occurred with the DAC and Church Buildings Council, with costed estimations supplied by a heating engineer. Options for a future phase involving construction of a new kitchen and toilet building are presented.

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)
Relighting of nave using LED lighting	2,000	£280	£3,000	11	Faculty	0.50
Install new porch glass doors to curtail draughts	10% of heating 8,000	£370	£5,000	14	Faculty	2.14
Draughtproofing of tower doors	5% of heating 4,000	£185	£400	3	List B	1.07
Installation of underfloor heating with switch from oil to gas	N/A	N/A	£500k for project	N/A	Faculty	
Install solar photovoltaic panels on flat areas of nave and south aisle roof	4,700 25,000 if heat pump installed	£800 £3,500	£36,000 largest system	11 if heat pump installed	Faculty	1.18 6.33
Future phase – installation of Ground Source Heat Pump to drive underfloor heating	66 to 75% of total heating load; 55,000 to 63,000kWh	Dependent on source of electricity			Faculty	22.41 tons saved, 2.53 contributed from grid electricity. Net saving of 19.8 tons

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

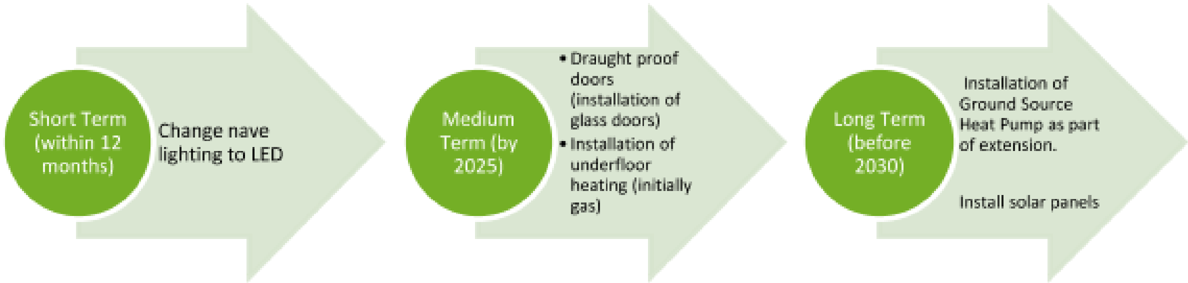
Based on current contracted prices of 13.94 p/kWh (day), 12.09 p/day (night) for electricity.

If all measures were implemented this would save the church in the order of £3,000 per year in operating costs by replacing oil with a heat pump supplied (mostly) by a large solar panel array.

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. The PCC of St Mary the Virgin intends to replace the current oil heating system.

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 the Virgin 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 the Virgin, Essex, CM6 3SW was completed on the 11th March 2021 by 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 2018 "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.

St Mary the Virgin	
Church Code	**628526**
Gross Internal Floor Area	500 m^2 [External footprint 630m^2]
Listed Status	Grade I

The church is typically used for 17 hours per week for the following activities

Type of Use	Hours Per Week (Typical)	Average Number of Attendees
Services	4 hours per week	50
Meetings and Church Groups	6 hours per week	Discussed
Community Use	6 hour per week	Includes school use at harvest and Christmas.
Occasional Offices Around 5 weddings and 5 funerals annually	1 hour per week average	100

Annual Occupancy Hours: 910

Annual Footfall 7,800

4. Energy Procurement Review

Energy bills for oil and electricity have been supplied by St Mary the Virgin and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	13.94p/kWh	At lower end of current market rates
Night Rate	12.09p/kWh	Below current market rates
Standing Charge	22.36p/day	N/A

The Electricity supplier is Total Gas and Power, procured through Parish Buying.

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 Mary the Virgin uses around 4,500 kWh/year of electricity, costing in the region of £700 per year, and 84,000kWh/year of oil, costing £3,700.

This data has been taken from energy invoices provided by the suppliers of the site.

St Mary the Virgin has one electricity meter, serial number K09EM00239. Three phases of power are supplied

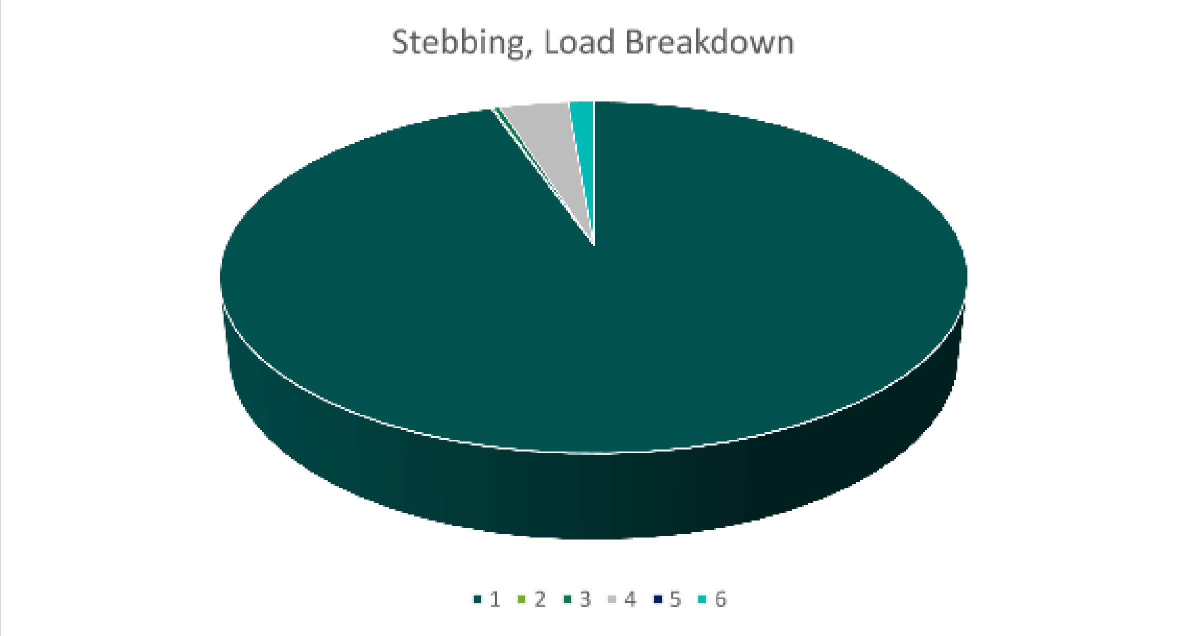
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	K09EM00239	Elster A1120	Yes	Cupboard in tower, south of tower door.

The meter is AMR connected and as such obtaining an energy profile for the electricity usage should be possible.

5.1 Energy Profiling

The main energy consuming plant can be summarised as follows:

Service	Description	Estimated Annual Consumption kWh	Estimated Proportion of Usage
Heating (oil)	Oil fired space heating, 50 (?) kW boiler	83,700	94.7%
Heating (electric)	Vestry – 2kW wall mounted electric heater, very occasional use.	100	0.1%
Hot Water	Kettle (s); estimated 20 weekly boils Ariston 2kW point of use water heater in toilet; minimal use	250 50	0.3%
Lighting	LED lighting to aisles, (60 x 5W) supplemented by theatre lights in nave as required (4kW) Other LED / CFL	LED 250 Theatre 2800 100	0.3% 3.2% 0.1%
Other Small Power	Organ, 1kW (very occasional use) Sound / PA system, 4kW Fridge, 150W Microwave, 1kW	50 600 450 50	1.3%



KEY: 1 Oil heating 2 Electric heating 3 Hot water 4 Lighting (Internal)

5 Lighting External (currently zero) 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.

5.2 Energy Benchmarking

In comparison to national benchmarks for church energy use St Mary the Virgin uses 50% electricity and 13% more heating energy than would be expected for a church of this size.

	Size (m² GIA)	Annual Energy Usage (kWh)	Actual kWh/m²	Benchmark kWh/m²	Variance from Benchmark
St Mary the Virgin (elec)	500	4,700	9.4	19	-50%
St Mary the Virgin (oil)	500	83,700	167.4	148 for gas	+13%
TOTAL	500	88,400	176.8	167	+5.8%

6. Church Reordering Plans

St Mary the Virgin, Stebbing is a Grade I listed church, constructed from 1324 onwards. It is a medium sized church (500m^2 GIA) serving a village of c. 1500 inhabitants, with 50% of the congregation drawn from a wider area. Some new housing (for ~200 inhabitants) is under construction. The church consists of nave, north and south aisles, chancel, two rooms to the NE (vestry – used as store areas) and a west tower. There is a detailed listing (HE ref 1112777).

The structure is mostly of flint, with brick parapets. The nave has a flat, leaded roof behind parapets which has potential for solar panels, as does the south aisle roof. The chancel roof is tiled with an internal ceiling, which has been insulated above.

The tower ground floor is fitted as a kitchenette and there is a single toilet. Above is a regularly used ringing chamber.

A Victorian underfloor heating system was fitted with pipework in brick vaulted ducts – there is one ventilation grille visible. 20th century radiators have been added around the perimeter and at the rear of the pews. The pipework has suffered repeated leaks since 2010 with loss of large amounts of water at each incident, requiring sections of the herringbone pattern brick flooring to be lifted. Leaching away of the sand infill has occurred, some of the brick vaulting may have deformed and the flooring is very uneven in levels which may lead to trip hazards in places.

To the south of the church water drains into a stone channel immediately next to the walls. This is not effective in channelling water away from the structure with water pooling during periods of heavy or sustained rainfall; the land immediately to the south is raised by about 1 metre above the channel and contains burials.

For these reasons, water has been penetrating the foundations of the building and its flooring and it has been placed on the Heritage at Risk Register.

Water can pool in the brick lined gully.

The PCC have developed a detailed Re-Ordering plan with the DAC (250 pages) and a Faculty paperwork is shortly to be submitted for approval. Advice has been obtained from the Church Buildings Council and a heating engineer has produced costed options for various heating systems.

As the flooring has to be lifted anyway, with deep excavations to remove redundant pipework and damaged brick vaulting, it is proposed to install underfloor heating. This will be installed in limecrete, which is porous, which will allow the floor to breathe; their being considerable moisture below.

It is believed that the church is built without proper foundations, so any major change in soil water content which could lead to shrinkage must be avoided.

CBC have mandated peripheral radiators around the aisle walls in addition to underfloor (a similar system is installed at St Mary the Virgin, Willesborough, Ashford).

As pews are to be removed, the alternative to underfloor heating would be either blown air space heating (expensive to run and loses heat very rapidly) or radiant infra red panels.

The aisles could be easily heated by the latter method, but the nave is wide (7.5m) and high (11m) with a beam pattern which does not permit installation of rectangular near IR panels.

The DAC has refused permission for overhead chandelier mounted (visible radiation) Infra red heating bars. These could be suspended from the arch centres in a similar position to the present lighting chandeliers (and so hold lights and heaters), but the width of the nave would mean that little heat would reach the centre.

Current (pre pandemic) use of the building is medium; it is recommended that detailed plans for underfloor heating with radiators address these areas

1) Sufficient heating at floor level for toddler groups / young children's activities
   This could utilise the existing area in the NW of the N aisle. A higher density of underfloor heating to ensure a warmer floor, and perhaps installation of some

rectangular far infra red panels on walls and ceiling here would create a zone which could be rapidly warmed for short meetings.
It is noted that reliance on space heating from wall mounted radiators will not give a rapid thermal response – you would need a long heat up time for the whole building. With IR panels, a zone could be heated rapidly whilst the majority of the building remains cooler.

Electric Far IR panel heater in a church (below book shelves)

2) A "warm zone" for elderly congregation members. This might again involve an area with a higher density of underfloor heating.

Ensuring that a new heating system can deliver a warm area to allow midweek small meetings (perhaps at short notice) without having to heat the whole space to 18°C or above is recommended.

The flooring issue must be tackled first.

It is proposed to power the underfloor system using the present oil boiler, converted to gas, which is expected to have a 10-20 year life. This will require connection to the nearby gas grid. A new pump will be required.

Ideal Falcon GTS boiler

In the medium term, the church plans construction of an extension to the north of the north aisle, connected by unblocking an existing bricked up archway. Completion by 2030 is possible.

This will enable a larger kitchen and multiple toilets which will allow the building to be brought into greater use more easily. The extension is proposed to have a basement. This would allow installation of a Ground Source Heat Pump [GSHP], possibly with boreholes radiating from here. Subsurface coils are not possible next to the church due to burials. The church owns a 4 acre field located around 100m from the building, so subsurface coils could be installed there, but trenching costs including under a minor road may prove prohibitive.

A cost of £6,000 has been quoted for connection to the gas mains: running a trench of about 4 times the length to access the church field would be at greater cost.   Both have to traverse ground with archaeology.

There is no current location to hide an Air Source Heat Pump (ASHP). Whilst it could be incorporated into the design of an extension, the efficiency is lower (may be half), and the demand for heat is greatest at cold temperatures when ASHPs are least efficient.

Burials occupy most of the surrounding churchyard.

The current boiler room (behind black doors) may be too small to support a GSHP installation. The existing toilet is located behind the window. This structure could be removed after construction of the north side extension – alternatively the whole area could be used for heating plant.

Installation of solar panels on the suitable roof areas (up to 200m2) would enhance the viability of a heat pump. Battery storage is desired.

A question is whether the costs of trenching and installation of a gas supply pipe would be better invested in a future heat pump. This would require (say) 10 years continued reliance on oil. The comparison with a switch to gas on carbon dioxide emissions are presented in Table 1.

7. 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 critical to review and set out a plan to make the church building more efficient and less carbon intensive and one way to achieve this is to consider a transition to electrical heating where this also represents a more efficient and comfortable solution for churches.

The church proposes to install underfloor heating, initially powered by the existing boiler, with the potential for future transition to a heat pump. The system will include some wall mounted radiators.

Additional far infra red panel heaters are recommended to create a small zone which can be heated rapidly. This type of heater could also be used to bring the vestry rooms into use when desired.

An area which could benefit from "instantaneous" electric heating

7.1 Install Electric Panel Heaters

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

7.2 Heating System Additives

In order to improve the efficiency of the new 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.

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 LED Lighting for Nave

The lighting makes up a relatively large overall energy proportion of the electricity used within the church due to the high power rating of the theatre lighting currently installed to light the nave.

It is understood that a new lighting scheme will be needed to appropriately re-light the nave.

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/

Installation of LED lighting with a total power below 500W would reduce electricity consumption by around 2,600kWh.

The aisle lighting is inconveniently located for the nave, currently lit by theatre lighting utilising 800 and 1000 watt lights.

8.2 Lighting Controls (Internal)

If the church is to be open for visitors during the week, then it is recommended that lighting controls are fitted. This should include areas such as the kitchen and toilet. 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. The body of the church benefits from a good amount of natural daylight coming in through the windows where artificial lighting is not required for much of the year during the day.

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 External Lighting Controls

It is recommended that motion sensors are also fitted to the new LED lighting which connects with church via the graveyard path to the field (location of car park).

8.4 Draught Proof External Doors

There are a number of external doors in the church. 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 in to the church around the side and base of these doors. There are some apparently unused small doors which would benefit from being fully draught proofed

It is noted that the church plans to fix the inner leaves of the historic porch doors open and install draught proof glass doors within a bespoke frame.

It is recommend that the draughtproofing around other doors (tower west door, tower stairs door) are improved and draught strips are added. This could be achieved in a number of ways.

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

For timber doors that close onto a stone surround more traditional solutions such brush draught strips 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.

Main porch doors, proposed for provision of draught proof glass doors

North side

South side of chancel

9. Saving Recommendations (Water)

9.1 Tap Flow Regulators

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. Other Recommendations

10.1 Electric Vehicle Charging Points

The church owns a field which is nearby to the boundary of the churchyard, part of which is to function as a car park.

In order to make a visible statement on the churches mission of stewardship and to facilitate more sustainable transport choices by those both visiting the church and using the hall, the church may wish to consider installing an electric vehicle charging point, probably on the side of the church hall to allow visitors to charge their electric car.

Installing a unit such as a Rolec Securi-Charge http://www.rolecserv.com/ev-charging/news/view/Robust-EV-Charging-With-Rolecs-SecuriCharge-EV-Wall-Unit-Coin-Token-PAYG would allow the organisation control over who is allowed to use the unit with a key operated system. Or given the type of use of the building and control over the usage of the car park as a whole a simple 32 amp type 2 wall pod type charger may be most suitable and these are widely available through many suppliers such as http://www.rolecserv.com/ev-charging/product/EV-Charging-Points-For-The-Home.

11. Renewable Energy Potential

The potential for the generation of renewable energy on site has been reviewed and the viability noted.

Renewable Energy Type	Viable
Solar PV	Yes
Battery Storage	Yes
Wind	No – conservation area
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Biomass	No – not enough heating load
Air Source Heat Pump	Unlikely, low use hours, unit location
Ground Source Heat Pump	Possible with new build – borehole on site or use distant field

11.1 Solar Photovoltaic Panels

There is potential for a PV array on the roof of the Nave and on the roof of the South Aisle. 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 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 (maximum of around 4) would be worth considering at present.

However, future installation of a heat pump, requiring electricity (in the order of 20-30,000kWh annually) would benefit economically from onsite generation, so these projects should be considered as a package.

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.

1:60 scale model (1851) showing flat roof sections.

The almost flat nave roof is partially shaded by the tower to the west and offers an area of around 20m length x 7.5m width, surrounded by a brick parapet wall. The south aisle offers an additional area of 20m x 4m giving a total of 230m^2, which needs to be reduced around the edges.

This could generate 0.15kWpeak/m^2 x 200m^2 giving a 30kWpeak system.

Panel orientation is likely to be flatter than the optimum angle to avoid visibility.

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

= 200m^2 x 0.15kWp/m^2 x 1000kWh/kWp x 0.93 x 0.9

= 25,110kWh

This is much larger than the church's current annual electricity use (4,700kWh) which could be reduced further with installation of LED lighting in the nave, to perhaps 2,000kWh. Current heating use is 83,700kWh per year. Supplying an equivalent amount of heat using a heat pump operating at a COP of 3 requires around 28,000kWh of electricity. An annual requirement would therefore be over 30,000kWh (assume use will rise with greater building use); solar PV could provide around 80% of requirements.

A heat pump system has the advantage of adding heat fairly constantly; the less electricity which needs to be bought from the grid for winter evening use, the better. Negotiating a good sale price for electricity will be beneficial.

Using costs for larger installations of £1,200 per kW peak; (average 2018 domestic installation costs were £1,667 per kW peak); a 30kWpeak system would cost £36,000.   This does not include cost of any battery.

11.2 Cost Summary

Utility		Amount, kWh
Electricity	Present reported	4,700
Oil	Present reported	83,700
Underfloor heating	Same heat input	84,000
Underfloor heating	Increase, more hours of use plus extension	100,000
Heat pump electricity	COP 2.8 (air, optimistic), 100,000 load	35,714
Heat pump electricity	COP 3.5 (ground), 84,000 load	24,000
The above two lines give	*high and low estimates*	
Electricity (not heat) use	Estimate with full LED lighting	2,000
Electricity (not heat) use	As above, plus extension, more hours of use	3,000
Total electricity	High estimate	39,000
	Low estimate	26,000
Solar PV generation	*Whole nave and south aisle system*	25,000
Grid Electricity need	High estimate	14,000
Grid Electricity cost	*At current day rate 13.9417p/kWh*	£1,952
Grid Electricity need	Low estimate	1,000
Grid Electricity cost	*At current day rate 13.9417p/kWh*	£139

11.3 Comments on Whole Life Costings [WLC] estimation spreadsheet.

The spreadsheet provided by the church is useful in showing the relatively greater costs of heat pump installation but followed by lower running costs.   It does not add the extra costs of solar panels, or the large offsetting of grid electricity that this could potentially provide – but there will still be reliance on grid electricity.   Efficiency measures such as draughtproofing can significantly reduce the energy requirement and thus reliance on grid electricity.

From reviewing the report there were are also a few items to note below:

1] The annual kWh requirement stated is too low (41,176kWh for oil).

The Church's Energy Footprint Tool entry states 83,700kWh heat from oil.   Four deliveries (12 September / 2 October / 3 January / 24 February) sum to 7,500 litres, which is 80,400kWh at 10.72kWh per litre of oil.   The annual heat requirement should be at least 80,000kWh – perhaps more if the building is brought into greater use.   With installation of underfloor heating, the weekly heating hours would be expected to remain high (currently 100, with background heating.   This is about 14 hours per day, but will not involve maximum boiler output power).

2] Average boiler output power requirement

Maximum estimation: 83,700kWh / 100hours per week x 30 weeks = 27.9kW

Minimum estimation: 80,000kWh / 100 hours per week x 40 weeks = 20.1kW

24kW is likely.

The WLC estimate for a UFH system is 32kW (UFH) plus 15kW (perimeter radiators) = 47kW.

If this represents average or continuous load, rather than peak load, the boiler will be required to run at double its current average output. The church should check that it is capable of doing so.

It appears to be around 50kW output, based on size, but its lifespan may be reduced if operating at maximum output.

3] Operating costs per year

The WLC estimates are lower than estimated in this report, e.g. year 1 of oil (red Option 1) is costed at £1,647. 2019-20 oil costs sum to £3,736.

As the total (present oil) consumption has been underestimated, the amounts of heat required from a heat pump, and hence electricity required are underestimated.

The Coefficient of Performance [COP] is the ratio of heat delivered (from the air, or ground reservoir of heat) to the amount of electricity used to pump it. A COP of 2.8 is a good (optimistic average) value for an ASHP; a GSHP may deliver 3.5; ideally 4.

Whilst a more efficient system may keep heat requirement to 80,000kWh, increased hours of use plus future extension may increase this to 100,000kWh. There are limited opportunities for energy saving from door draught proofing, with a maximum potential of 10%.

12. Funding Sources

There are a variety of charitable grants for churches undertaking works and a comprehensive list of available grants is available at https://www.parishresources.org.uk/wp-content/uploads/Charitable-Grants-for-Churches-Jan-2019.pdf . Other resources can be accessed through the wider site:

https://www.parishresources.org.uk/resources-for-treasurers/funding/

13. Faculty Requirements

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

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

Under the new faculty rules;

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

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

All other works will be subject to a full faculty.

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