Energy Audit and Survey Report

St Mary's Church, Church Lane, Wendover

"There is a plan to reduce global carbon emissions to net zero by 2050. The plan will work. It involves all of us. We need to begin now, in our homes and workplaces and churches"

Revd Dr Stephen Croft, Bishop of Oxford

Version Control

Author	Reviewer	Date	Version
Paul Hamley	Matt Fulford	13th November 2019	1.2

Contents

1 Executive Summary

An energy survey of St Mary's Church, Church Lane, Wendover was undertaken by Inspired Efficiency Ltd to provide advice to the church on how it can be more energy efficient and provide a sustainable and comfortable environment to support its continued use.

St Mary's Church, Church Lane, Wendover is a large church dating from the 14th century, with restorations in 1839 and in 1869 by G.E. Street. It has been reordered in the last decade including an underfloor heating system replacing the previous Victorian installation of cast iron pipes in trenches. There is both gas and electricity supplied to the site.

The church has a number of ways in which is 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.

Short Term: Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Simple Payback (years)	Permission needed	To be actioned by who / when?
Obtain Group Buying quotation from Parish Buying – both utilities	Nil	5-20% of total utility expense of £6,500	Nil	N/A	None	Treasurer
Investigate optimisation of underfloor heating with temperature datalogger	TBC	TBC	£40	N/A	None	Warden or technical person

Medium Term: Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Simple Payback (years)	Permission needed	To be actioned by who / when?
Replacement of 50W light bulbs with 13W LEDs (assumes all currently halogen)	3	£500	£2,000	4	List A	Warden

Long Term: Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Simple Payback (years)	Permission needed	To be actioned by who / when?
Heat pump	70,000 [2/3 of required heat input]	Nil initially as gas is replaced by electricity. Gives protection against gas price rises.	£40,000	N/A	Faculty	PCC

Centre heating connected to heat pump	0	As above, but no annual centre boiler service charges	£5,000	N/A	Faculty	PCC
Solar panels powering heat pump	30,000	£4,100 If UFH is supplied solely by SPV	£60-70,000 For a 40kWpeak system	16	Faculty	PCC

Long term measures will significantly reduce energy use and reliance on the electricity grid but require significant investment.

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

Based on current contracted prices of 14.45p/kWh and 3.28p/kWh for electricity and mains gas respectively, inclusive of standing charges and VAT at 5%

If short and medium term measures were implemented this would save the church around £1,000 per year.

2 Introduction

This report is provided to the PCC of St Mary's Church, Church Lane, Wendover to provide them with 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's Church, Church Lane, Wendover, HP22 6BN was completed on the 17th October 2019 by Dr. Paul Hamley. Paul is an energy auditor with experience of advising churches and small businesses. He is part of the Diocesan Environment Officers Energy Group developing advice for the Church of England and authored the 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's Church, Church Lane, Wendover	
Gross Internal Floor Area	380 m^2
Listed Status	Grade II*, Conservation Area
Typical Congregation Size	75 x two morning services
Seating Capacity	320

The church typically used for 20 hours per week for the following activities:

Services	Average 4 hours per week
Meetings and Church Groups	9 hours per week Bell ringers, choir, drummers
Community Use	U3A 4 hour per week; 200 people Concert monthly = 1 hour/week
Occasional offices	12 weddings p.a. = 48h 24 funerals p.a. = 48h (2 hpw)

Church Centre (adjoining building – north east corner); this has an average use of 40 hours/week for the following activities:

Floor area	90m^2
Services	Tea and coffee Sunday mornings 2 hours/ week
Meetings and Church Groups	2 hours per week
Community Use	Art group 4 days/week AA group one evening/week 35 hours / week
Occasional offices	Tea & Coffee : average 1 hour/week

Figure 1. Showing flint construction

Figure 2. The nave has a recent underfloor heating system

3 Energy Procurement Review

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

The current electricity rates are:

Day Rate	15.630p/kWh	Above current market rates
Night Weekend Rate	13.200p/kWh	Above current market rates
Standing Charge	27.95 p/day	N/A
Availability Charge	p/kVA	N/A
Meter Charges	p/day	N/A

The current gas rates are:

Single / Blended Rate	3.146p/kWh	In line with current market rates
Standing Charge	30.00p/day	N/A
Availability Charge	p/kVA	N/A
Meter Charges	p/day	N/A

The above review has highlighted that there are opportunities to gain cost savings from improved procurement of the energy supplies at this site. We would therefore recommend that the church obtains a quotation for its gas and electricity supplies from the Diocese Supported parish buying scheme, http://www.parishbuying.org.uk/energy-basket. This scheme only offers 100% renewable electricity and 20% "green" gas from anaerobic digestion and therefore it is an important part of the process of making churches more sustainable.

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

VAT	5%	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.

4 Energy Usage Details

St Mary's Church, Church Lane, Wendover uses about 21,000 kWh/year of electricity, costing in the region of £3,000 per year, and 111,000kWh/year of gas, costing £3,650.

This data has been taken from the annual energy invoices provided by the suppliers of the site (see Appendix 2). St Mary's Church, Church Lane, Wendover has one main electricity meter, serial number 105EB01492. There was one gas meter seen, serial number M016 A14239 10A6.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	105EB01492	EDF Type MT300-D2A51-V12 Three phase		Tower stairwell
Gas – Church	M016 A14239 10A6	Itron MDA 16	AMR capable but not connected	External gas meter cupboard Next to boiler room

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

Figure 3. Gas meter is located in a cabinet against the NE building wall

4.1 Energy Profiling

The church and centre are both heated by separate boilers, it is assumed that the gas meter seen supplies both the church and the church centre boilers. The centre boiler timings are unknown.

Estimation of gas use: 28kW boiler run for 7 hours for 5 days per week +some use at weekend (40 hours) x 26 weeks - approximately 30,000kWh p.a. The church use is then 81,000kWh. (2018 total 111,317kWh).

The main energy use within the church can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting Church	Nave lighting (high level) >42 x 50W bulbs (2.1kW) + 16 x 50W floor installed uplights (0.8kW) Estd. 1100h use 3300kWh 96 bulbs stated; additional lighting in chancel and tower 1500kWh Lighting often on low setting during week est 2500kWh	13.5%
Lighting Centre First floor of centre not visited (in use) – heavily used	Likely to be a major contribution to electricity use with centre lights in use 5 days per week plus evening use. Perhaps 70 hours/week. Estd 3500h use Estimate 3kW load 10,500kWh	
Heating Church	Remeha 110 boiler driving underfloor heating Gas 81,000kWh Infrared heaters in tower (not in use)	84%
Heating Centre	28kW Vaillant boiler heating centre. Gas 30,000kWh	
Hot Water	Kitchen – served by domestic combination boiler (28kW) but assume kettles used for drinks	1.1%
Other Small Power Annual use estimates	Electronic organ 500W 500kWh Projector 500W bulb 500kWh Kitchen – microwave 900W 50kWh Fridge 500kWh Dishwasher 1.5kW 6 washes/ week 1000kWh Coffee maker 1kW 100kWh 2 kettles 2kW each 30 boils/week 300kWh Estimate 3000kWh	1.2%

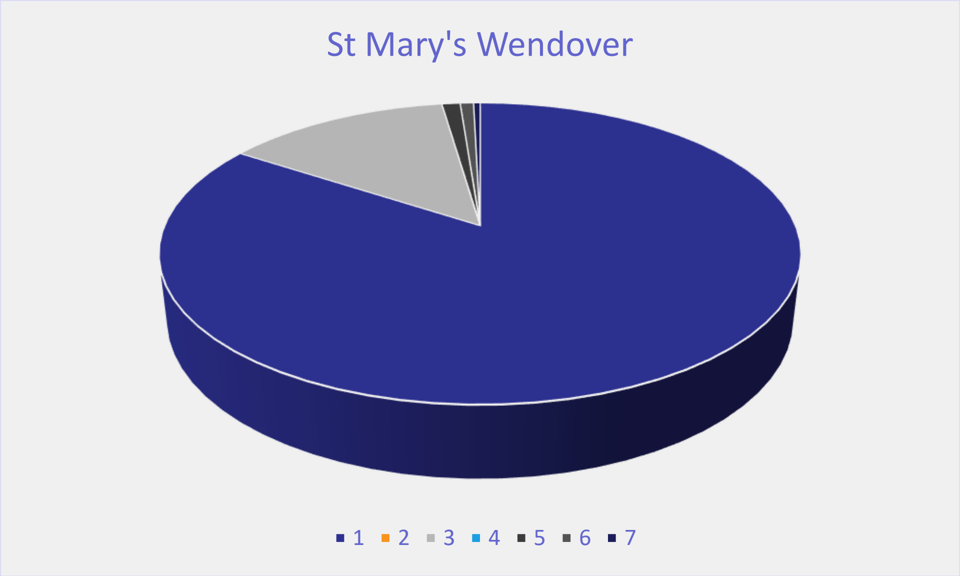

Figure 4. Energy breakdown

Key 1 Gas heating (84%), 2 Electric heating (zero), 3 Lighting (13.5%)

4 External lighting (0), 5 Hot water (1.1%), 6 Small power (0.8%), 7 Organ (0.4%)

As can been seen from this data, the heating makes up by far the largest proportion of the energy usage on site. The other significant load is lighting.

4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St Mary's Church, Church Lane, Wendover uses more electricity heating energy than average for a church of this size. These figures are not adjusted for occupancy and illustrate a church which is used intensively.

	Size (m^2 GIA)	St Mary's Church, Church Lane, Wendover use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Mary's Church, Church Lane, Wendover (elec)	380	55	20	10	275%
St Mary's Church, Church Lane, Wendover (heating fuel)	380	293	150	80	195%
TOTAL	380	348	170	90	204%

5 Energy Saving Recommendations

5.1 Lighting (fittings)

The lighting makes up an estimated 13% of the energy load within the building, and all areas of the church appear to be lit by non LED bulbs, offering an opportunity to reduce electricity use.

The high-level lights in the nave are mostly Osram 510 lumen Halospot 111 (halogen) of 50W each. These are stated to have a four year lifetime; requiring access at height every 3-4 years for replacement. 42 bulbs counted = 2.1kW.

Figure 5 Location of nave lighting at base of roof

It is recommended that all of the fittings, scheduled in Appendix 1, are changed for LED; and that Parish Buying in bulk for cost reduction is investigated, with bulbs purchased in advance and a contractor booked in advance to negotiate a cheaper rate. The nearby church of St Andrew's Hyde Heath (near Amersham) also uses 111 type spotlights (about 20 of them).

For the spot lights the Megaman range of LED spot (reflector) lights https://www.megamanuk.com/products/led-lamps/reflector/ provides some very suitable substitutes to the current lamps. The high-level track affixed lamps can be replaced by LED AR111s; most of the "professional" range have the correct track fittings. The range is dimmable, has different beam angles (spot to wide) and a power requirement of 11-13W each. This would reduce consumption from the nave lighting to 0.5kW. Any new LED fitting would have a much longer life and hence reduce the replacement frequency and access expenses. (LED lifetime estimates are 15-20 years).

Uplighters are recessed into the floor at the base of each column (2 bulbs – 16 in total). These might be GU10 fittings, probably 35 or 50W – LED replacements are available at 10-13W.

Figure 6 Recessed GU10 LED uplighter

There is a separate stage lighting system with 12 round 3 pin sockets. This has not been used since church refurbishment (about a decade ago). It is likely that the lamps are very high power. If they were ever to be used again, an EICR / PAT test is strongly recommended first.

LED replacement lights can be procured for similar cost to conventional halogen bulbs; the installation (access) cost will be the same. Savings will be accrued from longer lifetimes and less frequent access costs; possibly avoiding three replacement cycles within 20 years.

In this case the £150 grant available through this process could be very usefully employed towards the purchase of replacement LED lamps.

5.2 Lighting (control for internal lights)

The current control box offers ten different lighting regimes for different effects.

Dimmable LED replacements must be selected for compatibility.

Figure 7 Lighting control selection

5.3 Lighting (control for external lights)

There are no floodlights. Low power path lights are thought to have been changed to LED. These have a light sensor to come on after dark, and a timer to turn off late at night.

5.4 Other Electrical Saving Measure – Voltage Reduction

The voltage was measured as 249.8V. This is towards the upper end of the range (207-253V).

Many products destined for the European market are designed for 220V, operating at higher voltage can result in higher temperatures. Lighting, motors, fridges, transformers will benefit from lower energy consumption and longer lifetimes if run at lower voltages.

There will not be a saving from items such as kettles and heaters where heat is the only output – a kettle will take longer to boil at 220V than 250V as it will always require the same energy input.

An explanation of voltage reduction can be found here: https://www.explainthatstuff.com/voltage-optimisation.html

Speak to your electricity supplier about voltage reduction (at the transformer), 10% is possible.

5.6 Heating Overview

The church is open all day and the connected church centre is heavily used.

Underfloor heating was installed at reordering approximately a decade ago. This is able to keep the church at a suitable temperature. During the audit in October, upholstered seats were at 16.5°C, the ceiling at 16°C and the external walls at 16.4°C. Pews have been moved away for the external walls (this has created a corridor from the north porch to the internal entrance to the centre – kitchen and drinks area), so the congregation are not sitting next to cool surfaces.

There are no radiant heat panels installed, and these are not considered necessary.

It may be possible to optimise the underfloor heating to reduce gas consumption by 10-20%. This would require purchase of an inexpensive temperature datalogger and collection of data. A process of temperature measurement, weather forecast watching and feedback from the congregation would inform alterations to the thermostat setting. Setting a slightly lower temperature during the week (when visitors will arrive with coats during cooler weather) and raising it for Sundays is an option.

Figure 8 North Aisle

Figure 9 Nave

5.7 Boiler – Church

A Remeha 110 boiler is installed in a boiler room under the church centre (an integral part of the building which may have been a chapel or vestry at some point). This is a condensing boiler of 96% efficiency. Use with underfloor heating indicates a low return temperature, so the boiler should be operating in condensing mode.

The boiler is set to run to maintain a temperature of 17.5°C at the thermostat in the chancel. On the day of the audit, this delivered seat temperatures of 16.5°C, with the heated floor at 19 to 21°C. The boiler will be running intermittently to maintain this, operating more during the winter and at night.

Its sizing will be sufficient to heat the church from cold, so most of the time it is expected to be operating at under capacity.

5.8 Space Temperature Set Point

Currently 17.5°C. As discussed above, this could be reduced during the autumn and spring, during the week with suitable monitoring.

Comparing the gas used for a week with the controls set at present; and the gas used with the underfloor heating turned off at night would be instructive.

Figure 10 Chancel. The thermostat is on the wall to the left above the fire extinguishers

This is a G.E. Street tiled floor; similar to St Mary's Bloxham and St James the Less Pimlico.

Many churches run the background heating at a level of 14°C and then increase this to 18°C for services and other usages. Such a strategy should be considered, noting that the warm up time for underfloor heating will be long.

5.10 Endotherm Advanced Heating Fluid

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

This fluid is in addition to, and complementary to 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 consumption by over 10% and helps the building to heat up quicker.

5.11 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 valves, have been left uninsulated. These exposed areas of pipework contribute significantly to wasted 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 expose pipework and fittings are insulated with bespoke made 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 arranges through Anthesis Ltd (contact Margaret Davis, 0117 403 2689, Margaret.Davis@anthesisgroup.com) or ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com).


Figure 11 Boiler room pipework

5.13 Roof Insulation - Centre

The church centre is used heavily during the week and is heated for a considerable proportion of the year. Insulating the roof, up to maximum specified levels (270mm insulation) is recommended.

Insulation guidance is available at https://www.energysavingtrust.org.uk/home-insulation/roof-and-loft

5.14 Wall Insulation

The church centre could also benefit from internal wall insulation – this would of course reduce the size of the room by about 5cm on each wall.

5.15 Double glazing

The church centre would benefit from double glazing where not already fitted, as it is a heavily used space. Internal double-glazing panels could be made to slide or hinge open depending on the type of window reveal.

5.16 Quattro Seal

There are a number of external doors in the building. Those which are the original historic timber doors on them should be checked for air tightness during windy weather. Where these do not close tightly against the stone surround and a large amount of cold air is coming into the church around the side and base of these doors, draught proofing should be added.

It is recommended that draught proofing is fitted to all external doors. A product called QuattroSeal (see link below) is often used in heritage environments to provide appropriate draught proofing where a timber door closes against a timber frame.

http://www.theenergysavers.co.uk/application/files/1714/7197/4194/National_Trust_Case_Study.pdf

5.18 Church Centre – future heating options

A replacement plan for the current domestic combination boiler could be:

A] if a heat pump system was installed, this could be connected to the centre as well as the church. Radiators would need to be sized to give appropriate temperatures; 19-20°C rather than 16-17°C church. Connecting the two systems would require careful and correct decisions on sizing and control to be made by heating engineers.

B] Electric heating – underfloor heating with top up radiant panels wall mounted (probably above seat level so they are not hidden by furniture) – possibly disguised as works of art, or ceiling mounted. Radiant heating supplies heat much more quickly than convection.

C] Electric fan assisted convector heaters. These would be more expensive to run compared to gas (currently about 3.5 times per kWh, but 4.3 times with your current contracts), but would not attract the annual service and certification charge (~ £100) and have a lifetime double that of a boiler.

Over a 25 year period using your current prices: Two new domestic boilers plus 25 annual services = £1000 + £1000 + £2500 + [25 x 30.000kWh x 3.3p/kWh] = £29,250

Or Heaters: Five x £1000 + [25 x 30,000kWh x 14.45p/kWh] = £113,375

5.19 Far Infrared Panel Heaters

If option B is selected, there are a variety of radiant panels available, which include water filled, traditional glowing ceramic bars, near IR which glow pink, and far IR which do not emit light. Some can reach very high surface temperatures (and are suitable for high up ceiling installation – not close to occupant distances as at the church centre).

Water filled systems are not suitable for small buildings.

Suitable electric panel heaters would be far infrared panels such as https://www.warm4less.com/infrared-heaters/all/

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.

6 Future Opportunities

6.1 Heat Pumps

There are several types of heat pump system.

A ground source system requires either a long pipe, let into the ground in shallow trenches (but at least 50cm below ground level), or a borehole.

An air source system requires heat exchangers with fans. They are cheaper to install (no trenches or boreholes), but the running cost in the UK is higher than for a GSHP system because the average temperature of air is lower than that of the ground (10°C), so more electrical energy is needed to run the pumps to extract the same amount of heat. Siting the units is an issue as they look like large air conditioning units. They can be contained behind a wall or in a very well-ventilated outbuilding.

A water source system is like ground source, but with the coils in a lake or river. The lake nearby the church is technically close enough, but land ownership issues are unlikely to make this an option. The National Trust have installed a successful system on the Menai Strait, and a Midlands university has demonstrated that you do not need deep water for it to work – although using shallow water which can freeze is inadvisable.

6.2 Ground Source Heat Pumps

The church expressed the desire to consider a Ground Source Heat Pump as a future boiler replacement option.

The churchyard immediately north of the church may not contain burials. Careful investigation of parish records, and a ground penetrating radar survey would be needed to explore this.

Immediately south of the church is a gravel surfaced car park.

This has potential as a ground source heat site; possibly in addition to the grassed churchyard area.

Again, research into potential burials will be required. It would be necessary to ensure sufficient protection of the coils against disturbance or compaction by vehicles. One method might be to install a geogrid – mats with small square holes to allow drainage. This will prevent areas of gravel being worn away due to frequent parking in particular areas, turning or torrential rain. The grid is backfilled with gravel, so would appear a similar colour as before.
https://www.grassform.co.uk/buy/geogrids/

A type of heat pump system called Interseasonal Heat Transfer can allow a ground source system to store summer heat, collected under tarmac. Additionally, it is designed to allow the system to be used for cooling. However, it requires more plant than a conventional GSHP system and therefore probably would not fit in the existing boiler room. If there is not a requirement to cool the church then this would be too complex and expensive.


Figure 12 Churchyard


Figure 13 Car park

If underfloor heating is run constantly; 81,000kWh / 8736 hours per year is an average load of 9.3kW. With a heat pump giving a Coefficient of Performance [COP] of 3, this will require 27,000kWh of electricity to run. If the centre heating is also to be run from the heat pump, 37,000kWh of electricity will be required to generate 111,000kWh of heat.

6.3 Air Source Heat Pumps:

If a ground source system is not possible or too expensive, air source heat pumps can be considered. The "lift" from average air temperature to desired interior temperature is higher (as the average temperature of the air is lower than the soil), so ASHP are more expensive to run than GSHP.

Thus, although very suitable for use with low temperature underfloor heating, they may be more expensive to run to heat the centre than by using gas. As electricity is currently 3.5x more expensive than gas; an average COP of >3.5 would be required for ASHP to break even compared with gas – and the COP will be considerably less (around 2) on a cold night.

6.4 Solar Photovoltaic Power

The "greenest" *on site* scenario would seem to use solar electricity to drive a heat pump supplying underfloor heating. 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 – this would be the case if the power is used to drive a heat pump. However, the sun doesn't shine at night (!) so you will still need to buy electricity from the grid.

You could add a battery to help use the excess power, but it would have to be very large and expensive to store summer generation for the winter.

The case for generating your own solar power is much less as the Feed in Tariff has been withdrawn, although a replacement "Smart Export Guarantee" is promised.

111,000kWh heat requirement over 8736hours (1 year) averages at 12.6kW – although it will be a higher requirement in winter, perhaps 50-60kW. [Peak requirement in the winter; peak SPV production in the summer].

To supply this purely by solar PV (generating during perhaps 40% of annual hours) would require a large system capable of generating 60kW when it is running; a system supplying 80kWpeak which could generate 76,000kWh. This would require about 500m^2 of area. If you wanted to run the underfloor heating constantly and buy electricity from the grid overnight, then a 20kWpeak system would be sensible, powering the heating during the spring and autumn and helping in the winter.

The south aisle roof is approx. 27m long by 4m wide, giving 108m^2, there is enough area for a 15-20kWpeak system. The shallow roof angle may allow panels to be laid directly, but at the optimum angle (about 40 degrees), they would be very visible and being a grade II listed building permission is unlikely to be granted. Figures 13 & 14 indicate nearby trees, so generation would be impeded at low sun angles; this cannot be considered as an optimum site for PV. There is also potential for a small PV array on the roof of the tower but this would serve a small lighting load only.

Figure 14 The south facing roofs are visible, there is no parapet at the edge of the aisle roof, so the only location likely to obtain permission for solar PV panels is the tower roof.

Battery storage would help (but at extra expense). It 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 therefore investment into this may be worth delaying at this stage.

It is worth exploring whether there will be a strip of land parallel to HS2 which could be used for a community / church / council solar scheme. An example of a church-based community solar scheme is St John's Sunshine in Manchester. http://www.stjohnssunshine.org.uk/

7 Other Recommendations

7.1 Electric Vehicle Charging Points

The church has a car park to the south side which serves both the church and the frequently used church hall. 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 electric vehicle charging points, 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 church to be able to sell tokens or have a coin operated device that would at least cover the costs of the electricity use and could make a small income. As the hall is a place of work for the pre-school users it may be able to benefit from a grant to part cover the installation costs of a charger from https://www.gov.uk/government/publications/workplace-charging-scheme-guidance-for-applicants-installers-and-manufacturers

This would be a valid project to ask for community financial support – the church then providing an accessible charging point in the village ("come to church and fill up"!).

8 Funding Sources

This audit programme offers each participating church the chance to apply for a grant of up to £150 towards implementing some of the audit's recommendations. An application form is included with this report.

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 .

As the church centre is attached to the listed church, works would probably be eligible for the Listed Places of Worship VAT reduction Scheme. http://www.lpwscheme.org.uk/

Trust for Oxfordshire's Environment (TOE) does have some funds available (over and above the small implementation grants of £150 available through this scheme) to support energy efficiency improvements in community facilities. If your church is used by the wider community, visit www.trustforoxfordshire.org.uk or contact admin@trustforoxfordshire.org.uk to find out if your project is eligible for a grant of up to about £5,000.

9 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.

10 Other Observations

The churchyard has potential for various ecological initiatives such as wildflower areas nest boxes and "bug hotels". Information panels can help engage casual visitors and explain the link between theology and creation care.

This church has already installed underfloor heating and has a good engagement with the community. There is a vision for achieving further reductions in energy use, and for engaging with the ARocha EcoChurch scheme.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Nave high level lighting	96	Replace 50W AR111 bulbs with 11-13W LED AR111 bulbs	3kW 1000 hours church use (lights not on full) Est 1500kWh £180		Lifetime 3-4 times current halogen bulbs. Save two sets of replacement bulbs and operating savings
Nave column uplighters	16	Replace halogen bulbs with LED			
Church Centre		Replace with LED if necessary			

Appendix 2 Listing

Parish church. C14 restored 1839 and in 1869 by Street. Flint rubble with random blocks of stone, ashlar stone dressings - older work in church, restoration in limestone. Tiled roofs except for lead on nave aisles. Nave, aisles, chancel with C19 vestry on N., chapel on S.; embattled west tower with small "spike"; traceried belfry windows, small lancet with shafts to mid-stage of N. side; stair turret on S. side and heavy buttresses. Traceried windows, many restored. C19 south porch, containing C14 door- way with ball flower ornament. Oak north porch. Interior C14 tower arch, later C14 nave of 5 bays, tall columns with leaf carving on capitals. C19 fittings including circular marble pulpit probably by Street.