INSPIRED EFFICIENCY

ENERGY • CARBON • SUSTAINABILITY

Energy Efficiency and Zero Carbon Advice

St Mary the Virgin, Kirtlington

PCC of St Mary's

DIOCESE OF OXFORD

Author	Reviewer	Date	Version
Marisa Maitland	Matt Fulford	13th April 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, provide a sustainable and comfortable environment to support its continued use, and move towards net zero.

St Mary the Virgin dates back to the Norman times, and has undergone a number of major refurbishments during its lifetime. The church was more recently re-ordered in 2009 and it is current heated from a gas fired underfloor heating system and it is lit exclusively with LED lamps. There is both gas and electricity supplied to the site. The church should be congratulated for having completed many energy efficiency measures and for the sensible control of the underfloor heating in an energy efficient manner.

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 and the route to net zero carbon are 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)
Consider registering for Eco Church	The EcoChurch programme, which is recommended by the Church of England, helps congregations care for the environment in all aspects of church life. The programme is free; in the Oxford Diocese, you can, however, make a donation towards its costs.					
Install a Solar PV array to roof of building (assumed 100% of energy generated used in building)	2,820	£408	£4,317	10.59	Faculty	0.71
Refurbish timber doors to seal up gaps in boards and at base	803	£32	£450	13.91	List A (None)	0.15
Add black plasticine to seal opening hoppers in windows	803	£32	£500	15.45	List A (None)	0.15

Refurbish outer porch doors with glazing to create a better draught lobby arrangement and greet people in porch not inside the church	803	£32	£4,000	123.63	Faculty	0.15
Switch electricity (and gas) suppliers to ones which provide 100% renewable (or green gas) supplies	None	None	Nil	N/A	None	Offset 8.25 tonnes

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

Based on current contracted prices of 17.39/kWh and 4.03p/kWh for electricity and mains gas respectively.

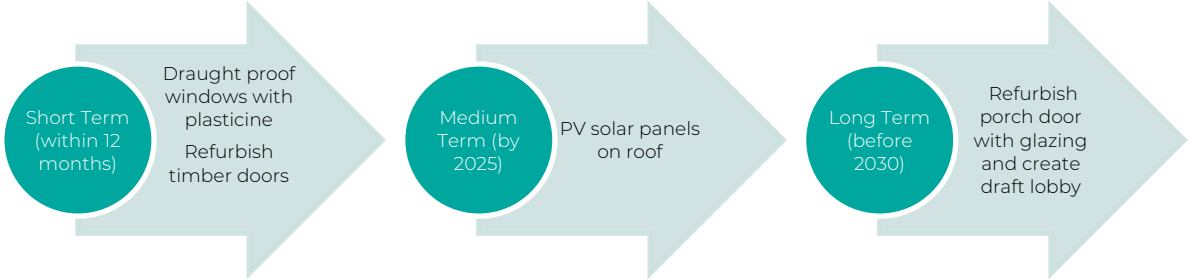
If all measures were implemented this would save the church £587 per year and reduce its carbon footprint by 1.16 tonnes (14%).

2. The Route to Net Zero Carbon

Our Government has committed to move towards Net Zero Carbon – the point at which we have reduced emissions as much as we can and then balanced any residual emissions through removal of carbon from the atmosphere. They have done this as part of a worldwide agreement which aims to limit global warming to well under 2 degrees Celsius, with an aim of keeping it below 1.5 degrees Celsius. This will help protect all of us from the impacts of climate change.

In February 2020, the Church of England's General Synod set its own Net Zero Carbon target. The first stage of this target covers energy used by churches, cathedrals, schools, vicarages, other church buildings, as well as emissions caused by reimbursed transport. The target date is 2030. The Diocese of Oxford has a diocesan commitment to reach a more broadly scoped Net Zero target by 2035 or as soon thereafter as possible.

This church has a clear route to become net zero by 2030 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, Church Lane Kirtlington OX5 3HU was completed on the 13th April 2021 by Matt Fulford. Matt is a highly experienced energy auditor with over 15 years' experience in sustainability and energy matters in the built environment. He is a chartered surveyor with RICS and a CIBSE Low Carbon Energy Assessor. He is a Member of the DAC in the Diocese of Gloucester and advises hundreds of churches on energy matters.

St Mary the Virgin	
Church Code	627049
Gross Internal Floor Area	429 m^2
Listed Status	Grade II

The church typically used for 7 hours per week for the following activities

Type of Use	Hours Per Week (Typical)
Services	3 hours per week
Meetings and Church Groups	4 hours per week
Community Use	0 hours per week
Occasional Services (weddings, funerals, etc averaged out over a year)	0 hours per week

4. Energy Procurement Review

Energy bills for gas 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:

Single / Blended Rate	17.39p/kWh	In line with current market rates
Standing Charge	31.22p/day	N/A

The current gas rates are:

Single / Blended Rate	4.03p/kWh	In line with current market rates

The electricity is supplied by British Gas, and is not purchased on a renewable tariff .
Going onto a renewable tariff is an important part of the process of taking churches towards net zero. The church is therefore encouraged to consider the Parish Buying Scheme, which uses the power of group purchasing to offer economies of scale in the procurement of energy. Its 'Green Energy Basket' tariff delivers 100% renewable electricity and 20% green gas. We would recommend that the church obtain a quotation for its gas and electricity supplies from the scheme: http://www.parishbuying.org.uk/energy-basket.
Alternatively, there are other suppliers that offer 100% renewable electricity, and in some cases 'green' or 'carbon neutral' gas.

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 3,349 kWh/year of electricity, costing in the region of £582 per year, and 40,132 kWh/year of gas, costing £1,617. The total carbon emissions associated with this energy use are XXXXX CO_2e tonnes/year.

This data has been taken from the annual energy invoices provided by the suppliers of the site. St Mary the Virgin has one main electricity meter, serial number E14Z017291. There is one gas meter serving the site, serial number E025K0402418D6.

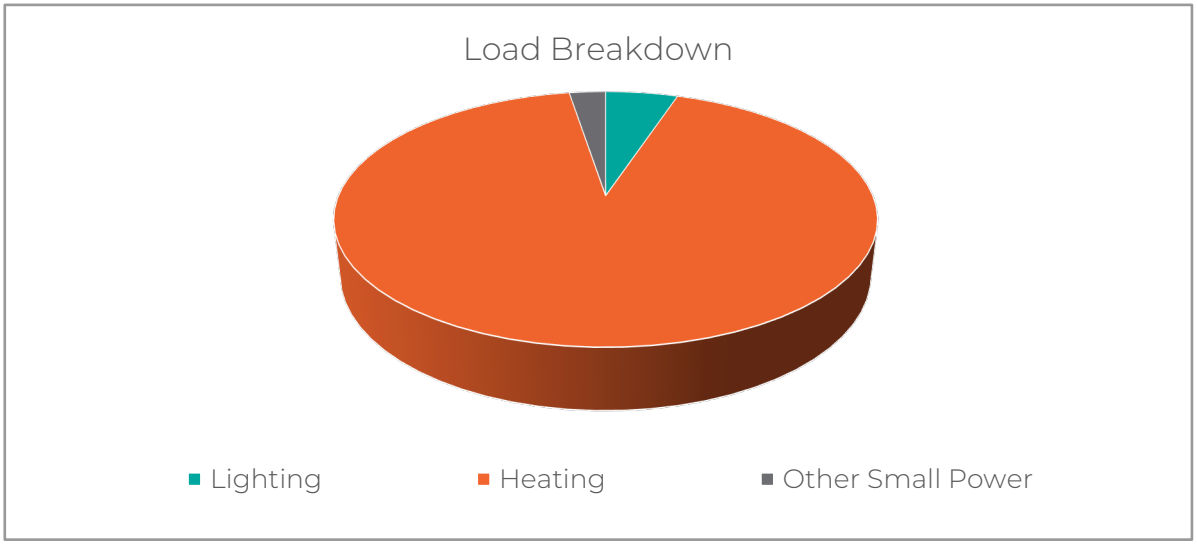
Utility	Meter Serial	Type	Pulsed output	Location
Electricity	E14Z017291	EDMI	Yes	High level corner
Gas	E025K0402418D6	MDK25	Yes	Enclosure by church gate

All the meters are AMR connected and as such energy profile for the entire energy usage should be possible. Half hour meter data has been not bee provided and the church should ask its suppliers if this is available for 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 use within the church can be summarised as follows:

Service	Description	Estimated Proportion of Usage
Lighting	All LED	5%
Heating	Gas fired underfloor heating system, well managed with 12 degree or lower background	92%
Other Small Power	Organ, pumps, and other small power	3%



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 61% less electricity and 38% less heating energy than would be expected for a church of this size.

	Size (m^2 GIA)	St Mary the Virgin use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
St Mary the Virgin (elec)	429	3,349	7.81	20.00	-61%
St Mary the Virgin (heating fuel)	429	40,132	93.55	150.00	-38%
TOTAL	429	43,480	101.35	170.00	-40%

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. In addition to these the church may also like to consider actions which help to improve thermal comfort for the congregation such as pew runners or cushions to insulate people from having to sit on colder pew surfaces and the used of breathable carpet matting to help insulate the congregation's feet from cold stone or timber floors.

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 church has an underfloor heating system heated from an efficiency gas boiler installed in 2017 and controlled very sensibly with a low background temp of below 12 degrees (required due to its wall paintings) and raised for services only.

The existing boiler should be expected to last unit around 2035 to 2040. At this time consideration should be given to replacing the gas boiler with an air source heat pump but until this time the church should continue to operate its modern system in the commendable efficient way it currently adopts.

7. Energy Saving Recommendations

There are a number of other measures that can be taken to reduce the amount of energy used within the church.

7.1 Draught Proof Window Hoppers

The window hoppers in the church tend to be a source of unwanted draughts in a church. Hopper windows should be kept maintained and repaired if rust has begun to bend the framework. Where there are small gaps, these can be filled with black plasticene which can be easily removed for summer opening and causes no damage.

7.2 Draught Proof External Doors

There are a number of external doors in the church. The historic timber doors do not close tightly against the stone surround and one door also has a sizable gap within the door where the timber has started to split. A result of which is a large amount of cold air is coming into the church around the side and base of these doors.

It is recommended that the draughtproofing around the door is improved and draught strips are added, as well as sealing up the gaps in the door. This could be achieved in a number of ways:

For timber doors that close onto a stone surround more traditional solutions such as brush draught strips rebated 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. Keeping the door maintained in a good condition is also important.

Simple measures such as having a 'sausage dog' style draught excluder laid along the base of a door (it needs to be sufficiently heavy to stay in place) where the kneelers have currently been used, using plasticine of the right colour to fill gaps where daylight can be seen, and putting painted fridge magnets over large keyholes can all be simple DIY measures which are effective.

7.3 Refurbish outer porch doors

To further reduce the heat loss during the heating season the outer porch could be glazed / enclosed to create a draught lobby into the church. We recommend that the doors are refurbished and glazing is added to them to enable this to be a draught lobby and the congregation can be greeted in the porch instead of inside the church allowing them to then quickly enter the church and the door to be closed behind them.

8. 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 – small array possible
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 – to be considered when boiler reaches end of life (approx. 15-20 years)
Ground Source Heat Pump	No – archaeology in ground and radiator system

There is potential for a small PV array on the roof of the tower or on the roof of the South roof behind the parapet. 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 (maximum of around 4 to 6) would be worth considering if at all.

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 starting to fall substantial and expected to continue to do so over the next 2 to 3 years.

9. 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 on this Parish Resources page: https://www.parishresources.org.uk/resources-for-treasurers/funding/

10. 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.

11. Offsetting

As you take action to reduce your emissions, you may also wish to offset those that you cannot yet reduce. If you would like to engage in offsetting, it is important to use a reputable scheme. The Church of England recommends Climate Stewards, which has a simple calculator that can help you to work out how much you would need to offset. https://www.climatestewards.org/

1 The Coaches, Fields Road, Chedworth, GL54 4NQ

01285 721134

07971 787363

INSPIRED EFFICIENCY

ENERGY • CARBON • SUSTAINABILITY