ESOS-ENERGY
Energy efficient solutions

# Energy Efficiency and Zero Carbon Advice

## St Mary's Church Hall
## PCC of St Mary's Trentham

DIOCESE OF LICHFIELD

| Author | Reviewer | Date | Version |
|---|---|---|---|
| David Legge | Matt Fulford | 2nd November 2022 | 1.0 |

# Contents

# 1. Executive Summary

An energy survey of St Mary's Church Hall 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 Mary's Church Hall is a two storey, split level church hall built in 1983. The hall is of brick construction with unfilled cavity and flat felted roofs. The hall has uPVC double glazed windows and doors throughout. The church hall comprises of a main hall, youth club hall, kitchenette, office, lobby and WCs. There is only electricity supplied to the site from the church and the hall is heated by direct electric panel heaters.

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) |
|---|---|---|---|---|---|---|
| **Change existing lighting for low energy lamps/fittings** | 65 | £20 | £285 | 14.57 | Faculty | 0.02 |
| **Install PIR motion sensors on selected lighting circuits** | 10 | £3 | £48 | 15.54 | List B | 0.00 |
| **Install SavaWatt devices on fridges and freezers** | 140 | £42 | £50 | 1.19 | List A (None) | 0.04 |
| **Top up roof insulation from 100mm to 270mm** | 112 | £34 | £1,800 | 53.42 | List A (None) | 0.03 |
| **Inject cavity wall insulation into walls** | 281 | £84 | £9,000 | 106.84 | Faculty | 0.07 |
| **Fit timed fused spurs to hot water heaters** | 162 | £49 | £90 | 1.85 | List A (None) | 0.04 |

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

Based on the current market price of 30p/kWh for electricity.

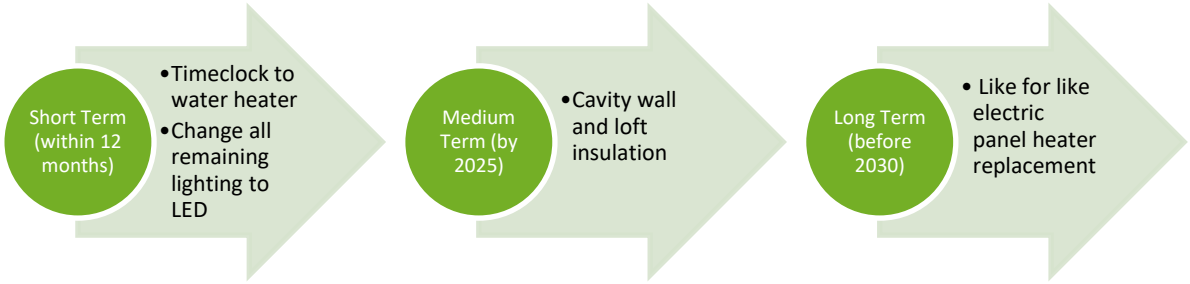
**If all measures were implemented this would save the church hall £231 per year and reduce its carbon footprint by 0.20 tonnes (11%)**.

## 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.

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's Church Hall 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's Church Hall, Park Drive, off Whitmore Road, Trentham, Stoke on Trent ST4 8AB was completed on the 9th June 2022 by 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 Mary's Church Hall** | |
|---|---|
| Gross Internal Floor Area | 180 $m^2$ |
| Listed Status | Unlisted |

The church typically used for 15 hours per week for the following activities

| **Type of Use** | **Hours Per Week (Typical)** | **Average Number of Attendees** |
|---|---|---|
| Meetings and Church Groups | 14 hours per week | Varies |
| Community Use | Ad hoc use only | Varies |

There is additional usage over and above these times for parties, occasional events and the like.

# 4. Energy Usage Details

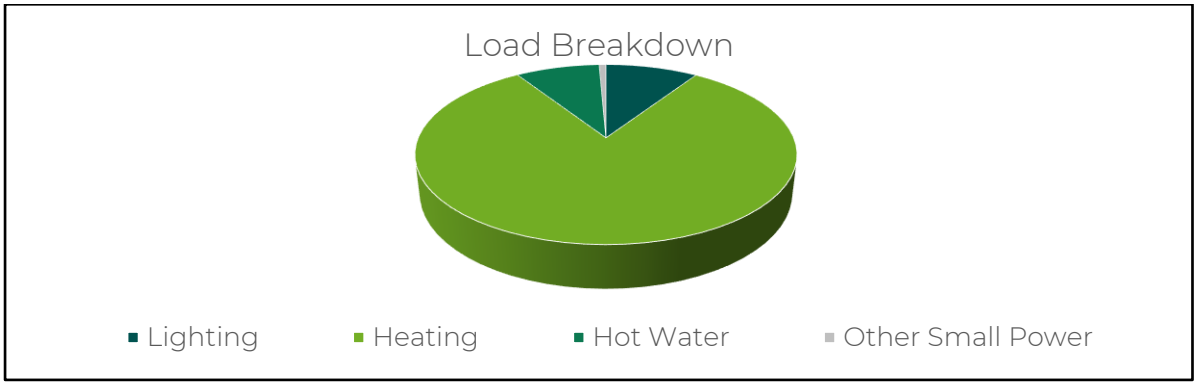
St Mary's Church Hall is estimated to use 6,891 kWh/year of electricity, costing in the region of £2,067per year. The total carbon emissions associated with this energy use are 1.74 $CO_2e$ tonnes/year.

This data has been estimated as a split from the annual energy invoices provided by the suppliers of the church.

## 4.1 Energy Profiling

The main energy consuming plant can be summarised as follows:

| Service | Description | Estimated Proportion of Usage |
|---|---|---|
| **Lighting** | Predominantly LED lighting but some 2D lamps in bulkhead fittings remain | 9% |
| **Heating** | Electric wall heaters throughout | 81% |
| **Hot Water** | Electric point of use water heaters | 8% |
| **Other Small Power** | Plug in loads and kitchen appliances | 1% |




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 hall energy use St Mary's Church Hall uses 69% less total energy than would be expected for a church hall of this size.

| | Size ($m^2$ GIA) | Annual Energy Usage (kWh) | Actual kWh/$m^2$ | Benchmark kWh/$m^2$ | Variance from Benchmark |
|---|---|---|---|---|---|
| **St Mary's Church Hall** (elec) | 180 | 6,891 | 38.28 | 20.00 | 91% |
| **St Mary's Church Hall** (gas) | 180 | 0 | 0.00 | 105.00 | -100% |
| **TOTAL** | 180 | 6,891 | 38.28 | 125.00 | -69% |

## 5. 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 church hall is currently heated by wall mounted direct electric heaters which appear to be in working order and well maintained. The use of electric heaters already offers a decarbonised heating solution. The sporadic use of the church hall does not warrant the consideration of a heat pump to provide heating as the current system is responsive and sufficient to provide adequate heating to individual spaces.

The various options for a decarbonised heating solution have been reviewed in the table below.

| Decarbonisation Heating Solution | Viable |
|---|---|
| **Air to Water Source Heat Pump** | No – does not suit use of building |
| **Air to Air Source Heat Pump** | No – does not suit use of building |
| **Water Source Heat Pump** | No – no water source locally |
| **Ground Source Heat Pump** | No – significant archaeology |
| **Electric Panel Heaters** | To be replaced with thermostatic and timeclock-controlled heaters at end of life |
| **Overhead Infra-Red Heaters** | No – least preferred heating source due to comfort |

# 6. 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.

## 6.1 New LED Lighting

The lighting makes up a relatively large overall energy proportion of the electricity used within the church. Most areas of the building have had efficient LED lights installed but there still remains a number of inefficient fluorescent fittings within the lobby.

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 on a simple "like for like" the total capital cost (supplied and fitted) would be £285. The annual cost saving would be £20 resulting in a payback of around 14.6 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. Guidance on lighting, produced by Historic England for churches, can be found at https://historicengland.org.uk/advice/caring-for-heritage/places-of-worship/making-changes-to-your-place-of-worship/advice-by-topic/lighting/

## 6.2 Lighting Controls (Internal)

There are several lights which currently remain on all the time in areas such as the lobby. 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.

## 6.3 Refrigeration Controls

Within the church hall there is a domestic refrigeration unit within the kitchen/servery area. 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 SavaWatt 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/. (Note the self-installed SavaPlug has been discontinued, butthe professionally installed Savacontrol option is available) The installation does not cause any significant disruption to operations and can be undertaken during normal operating times.

## 6.4 Timers on Fuse Spurs to Water Heaters

There are a number of electric point of use water heaters in the church hall to provide hot water for hand washing. This only needs to heat the water to the required temperature when the building is in occupation but at the moment this heater is directly wired in without any form of time control and therefore maintains it 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 TimeGuard 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.

## 6.5 Cavity Wall Insulation

The church hall 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 loft spaces can be arranged through ESOS Energy Ltd (contact Adrian Newton 0117 930 9689, adrian@esos-energy.com).

### 6.6 Insulation to Roof

The loft and ceiling was not inspected as part of this audit but was considered 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. If there is no accessible roof space, then insulation should be added when the roof is replaced/recovered to minimise heat loss.

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.

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 9309689, adrian@esos-energy.com).

## 7. 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** | No – tall trees giving heavy shade |
| **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** | No – insufficient electricity supply |
| **Ground Source Heat Pump** | No – archaeology in ground and radiator system |

Now that the Feed in Tariff scheme has come to an end the installation of solar PV panels in situations where there is not almost full usage of the electricity generated on site is not really viable.

Having reviewed the site it is not considered that there is good viability for any renewables and instead a good clear focus on reducing the energy demand of the building should continue with a targeted approach on reducing the heating energy.

There is potential for a small PV array on the roof of the South Aisle of the church which has been considered within the church report.

Wind turbines require highly exposed sites and should be located 250m way from buildings as such this site is not suitable for a wind turbine to be installed.

Hydro electricity is a highly efficient source of renewable energy but requires a body of flowing water with a differential height which is not present on this site.

Solar thermal installations are best suited to heat water for use in washing up, hand washing and bathing. There is minimal hot water demand at this church so such an installation would not be viable.

Heat Pumps are a low carbon method of creating heat, there use and suitability for this church have been review in the section earlier on in this report on Efficient and Low Carbon Heating Strategies.

Biomass is an alternative boiler and fuel to oil or gas. It requires wood chips or pellets to be delivered on site, stored and then fed into a large boiler for burning. While the fuel is not a fossil fuel there are emissions from the burning of wood and these can be detrimental to local air quality particularly in more built up areas for all these reasons it is not considered a viable recommendation for this site.

## 8. Funding Sources

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/

## 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. 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/

Climate Stewards encourages people to 'reduce what you can and offset the rest' as part of your journey to Net Zero carbon emissions. They provide training and resources to help you understand climate change and its impacts, and to calculate the carbon footprint from your activities including travel, energy, expenditure, and food. Their online carbon calculators for individuals and smaller organisations are free to use, and they provide bespoke carbon footprint audits for larger organisations.

Having reduced as much of your organisation's carbon footprint as you can, there will always be unavoidable emissions from your work and travel. Carbon offsetting allows you to compensate for the negative impact of your carbon emissions by funding projects which take an equivalent amount of $CO_2$ out of the atmosphere. These either involve locking up ('sequestrating') $CO_2$ as trees grow, or reducing emissions by using low-carbon technology such as fuel-efficient cookstoves or water filters.

Climate Stewards has a close relationship with all their project partners in Ghana, Uganda, Kenya, Tanzania, Nepal and Peru. They work closely with them to design, develop, implement and monitor projects which will not only mitigate carbon, but also bring tangible benefits to the local community - including improved health, savings in time and money previously spent on buying or collecting fuel, and improvements in local biodiversity. Each project is assessed using their Seal of Approval protocol which enables us to assess and monitor carbon mitigation and ensure robust, sustainable and transparent partnerships.

## Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

| Room/Location | Number of Fittings | Recommended Upgrade | Annual Saving (£) | Total Cost (£) | Payback |
|---|---|---|---|---|---|
| **Lobby** | 4 | 2D LED 11W | £20 | £235 | 12.01 |