Energy Audit and Survey Report

Holy Cross Church, Milton Keynes

"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
Matt Fulford	Marisa Maitland	11th March 2020	1.0

Contents

1. Executive Summary

An energy survey of Holy Cross Church, Milton Keynes 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.

Holy Cross Church, Milton Keynes is relative modern church built 30 years ago and located in a residential area of Milton Keynes. It is used extensively as a community centre including daily use with a preschool as well as providing a venue for Sunday worship and other church events. 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.

Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Payback	Permission needed	CO2 saving (tonnes of CO2e/year)
Contact suppliers to arrange for the meters to be changed to smart meters	None	None	Nil	N/A	None	N/A
Switch electricity (and gas) suppliers to ones which provide 100% renewable (or green gas) supplies	None	None	Nil	N/A	None	N/A
Change existing lighting for low energy lamps/fittings	7,760	£1,269	£4,448	3.50	List A / List B / Faculty	2.38
Install PIR motion sensors on selected lighting circuits	629	£103	£847	8.24	List A / List B / Faculty	0.19
Insulate exposed pipework and fittings in plantrooms	3,156	£120	£800	6.65	List A / List B / Faculty	0.58
Install Cavity Wall Insulation into external walls	4,292	£164	£2,500	15.29	List A / List B / Faculty	0.79

Replace thermostatic radiator valves (TRVs)	1,073	£41	£3,000	73.38	List A / List B / Faculty	0.20
Fit 270mm of insulation into the loft	5,365	£204	£2,000	9.78	List A / List B / Faculty	0.99
Change to elec POU Hot Water	8,521	£325	£3,000	9.24	List A / List B / Faculty	1.57
Replace all windows and doors with UPVC DG	8,047	£307	£40,000	130.46	List A / List B / Faculty	1.48
PV array on south and west 6kWp	4,800	£785	£8,000	10.19	List A / List B / Faculty	1.47

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

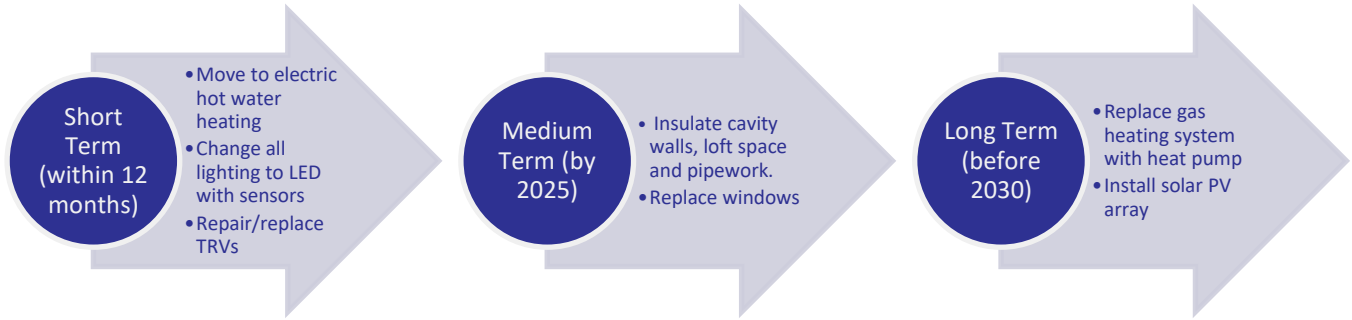
Based on current contracted prices of 16.36p/kWh and 3.81p/kWh for electricity and mains gas respectively.

If all measures were implemented this would save the church £3,300 per year.

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.

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 Holy Cross Church, Milton Keynes 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 Holy Cross Church, Milton Keynes, 2 Church Hill ,Two Mile Ash, Milton Keynes MK8 8EQ was completed on the 27th February 2020 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.

Holy Cross Church, Milton Keynes	
Gross Internal Floor Area	400 m^2
Listed Status	Unlisted
Typical Congregation Size	50

The church typically used for 51 hours per week for the following activities

Services	2 hours per week
Meetings and Church Groups	4 hours per week
Community Use	45 hours per week

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

4. Energy Procurement Review

Energy bills for gas and electricity have been supplied by Holy Cross Church, Milton Keynes and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	16.99.p/kWh	Above current market rates
Night Rate	15.57p/kWh	Above current market rates
Standing Charge	27p/day	N/A

The current gas rates are:

Single / Blended Rate	3.81p/kWh	Above current market rates
Standing Charge	27p/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 energy sourced energy 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.

5. Energy Usage Details

Holy Cross Church, Milton Keynes uses 8,535kWh/year of electricity, costing in the region of £1,400 per year, and 63,118kWh/year of gas, costing £2,400.

This data has been taken from the annual energy invoices provided by the suppliers of the site. Holy Cross Church, Milton Keynes has one main electricity meter, serial number D08W547394. There is one gas meter serving the site, serial number 476219S.

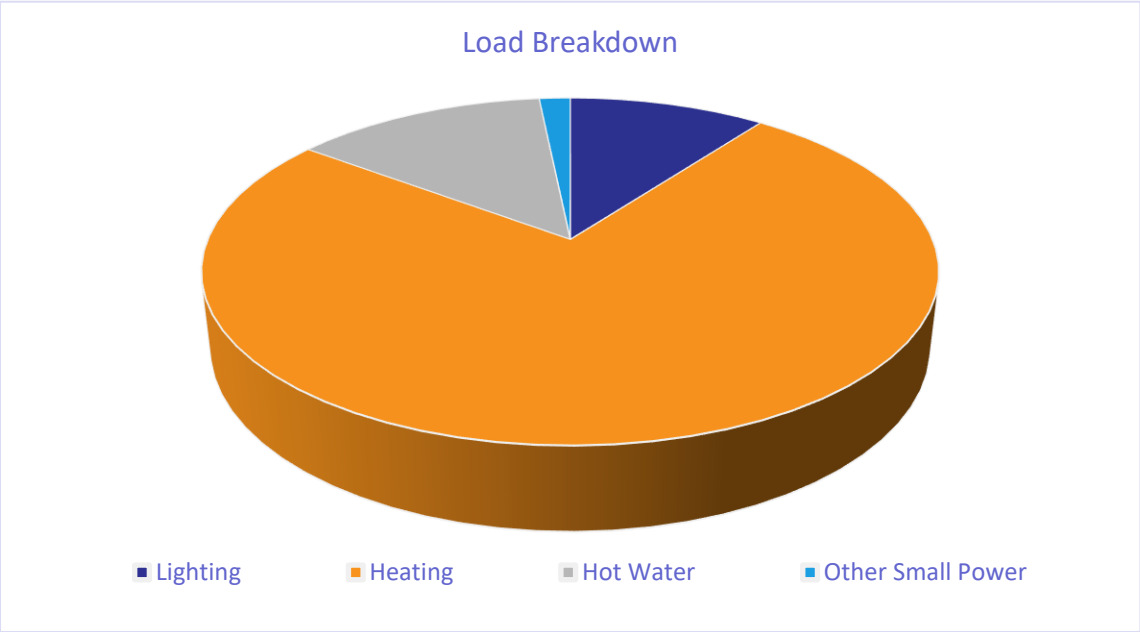
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	D08W547394	1 phase 80A	No AMR connected	External wall on entrance ramp
Gas – Church	476219S	Parkinson Cowan	No pulse or AMR	External wall on entrance ramp

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.

5.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	Predominantly inefficiency fluorescent lighting throughout the church	10%
Heating	Heating provided by gas boiler to radiators around the church/hall with TRVs	75%
Hot Water	Hot water heated from gas boiler into a hot water tank and used in WC basins and kitchen tap	13%
Other Small Power	Other plugged in appliances such as in the kitchen and office	2%



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 loads are lighting and hot water.

5.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use Holy Cross Church, Milton Keynes uses 7% more electricity and 5% more heating energy than would be expected for a church of this size. This is in part reflective of the large usage of this church but it would be expected that a modern church building would be far more efficient than the old medieval churches so this data does suggest that there is much that can be done to improve the efficiency of this building.

	Size (m^2 GIA)	Holy Cross Church, Milton Keynes use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
Holy Cross Church, Milton Keynes (elec)	400	21.34	20	10	7%
Holy Cross Church, Milton Keynes (heating fuel)	400	157.79	150	80	5.20%
TOTAL	400	179.13	170	90	5%

6. Energy Saving Recommendations

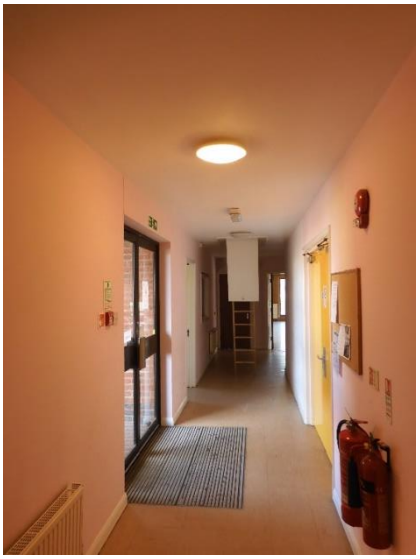
6.1 Lighting (fittings)

The lighting makes up a significant element of the overall energy load within the building and is by far the biggest user of electricity. All areas are lit by inefficient fluorescent fittings. It is recommended that all of the fittings within the building, scheduled in Appendix 1, are 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 the total capital cost (supplied and fitted) would be around £4,500. The annual cost saving would be £1,270 resulting in a payback of around 3.5 years.

The supply and installation can be carried out by any reputable electrical contractor and a free survey and quotation can be obtained from Batchelor Electrical, contact Stuart Patience on 01202 266212; 07793 256684; stuart@batchelor-electrical.co.uk.

6.2 Lighting (control for internal lights)



There are several lights which could currently remain on all the time the building is being used in areas such as corridors, toilet areas, kitchen and the like. 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. There are also spaces around the entrance area which benefit 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.

6.3 Insulation of Pipework and Fittings

The pipework within the plant room and loft space 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 ESOS Energy Ltd (contact Adrian Newton 0117 9309689, adrian@esos-energy.com).

6.4 Thermostatic Radiator Valves (TRVs)

There are TRV's on all the radiators within the building but it was noted that some of these were broken and therefore not working correctly. It is recommended that all the TRV's are reviewed and replacement heads and/or valves are fitted.

Replacement TRV heads are widely available i.e. www.screwfix.com/p/drayton-trv4-sensing-head/7109R. If a new valve is required this will involve a plumber undertaking some minor work.

6.5 Move to Electric Hot Water System

The hot water within the building is currently served by the gas boiler heating up an old hot water tank in the boiler room and that then feeds the taps in the building for hand washing and in the kitchen. The old immersion baptistry pool has not been used for over a decade.

As the hot water demand in the build is relative low, and in order to move the building to a position where it does not need to burn gas as a fossil fuel in the summer just for its hot water, it is recommended that the existing hot water system is removed and replaced with electric point of use hot water heaters. There would need to be two installed, one for the kitchen and one which can serve the WC's. A simple 5l unit such as https://www.ariston.com/uk/Electric_Water_Heaters/andrislux would work well in both locations and should be wired into a 24 hour/7 day timeclock such as a TimeGuard FST77. This should be set up with times to match the times that the building is occupied and this will prevent the standing losses from the unit wasting energy during periods when the building is not occupied.

6.6 Roof Insulation

Photo 1 - Note darker areas near wall indicate missing insulation

The loft void above the ceiling was inspected as part of this audit and found to have only 100mm of insulation present and not all of this was laid to fill in the gaps especially at the eaves or where subsequent work has taken place. 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.

The ceiling/roof of a building is the largest contributing area to heat loss from a building as heat rises. The insulation of such spaces can therefore have a dramatic impact on both the efficiency of the heating system and the temperature of the space below. Insulation measures such as this also need to be combined with control measures such as TRV's or room sensors to ensure that the space does not overheat because of the additional insulation.

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

6.7 Wall Insulation

The building 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 cavity walls did not require to be insulated and therefore it is likely that there is no insulation present but it could be added through injecting it 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. As with the loft insulation, 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 9309689, adrian@esos-energy.com).

6.8 Replacement Windows and Doors

The biggest loss of heat within this regularly used building is the windows and doors. They are the original poor quality timber single glazed windows and are a significant element to thermal discomfort within the building as well as requiring the heating system to work much harder to overcome the impact of them.

It is recommended that all the windows and doors within the building are replaced with uPVC or timber double glazed units. These should be specified to have espagnolette locking mechanisms which help secure the windows and doors tightly against the draught seal, prevent the unit from bending or warping and improves security. Any local double glazing specialist will be able to competently quote and carry out this work.

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	Yes – the south and west roof slopes could have PV installed
Battery Storage	Yes – in conjunction with the above
Wind	No – no suitable land away from buildings
Micro-Hydro	No – no water course
Solar Thermal	No – insufficient hot water need
Ground Source Heat Pump	Yes – potential for a system to be drilled in the car park area in future
Air Source Heat Pump	Yes – could potentially work as an air to air replacement for the gas system once building is fully insulated
Biomass	No – not enough heating load as well as air quality issues

This is a modern building which is in regular use. PV systems are viable where the majority of the electricity generated is used by the building when it is generated and this would be the case in this building given its large daytime usage. A small battery storage system could also be installed to extend the use of the generated power into the evenings. The roof is in good condition and easy to access and therefore this site would be very viable for a PV system which would be expected to pay back within 8 to 12 years.

This site would also be viable to the use of heat pumps to replace the gas heating system in the future to take the building off relying on fossil fuels. To make any heat pump installation viable the building will first need to be well insulated and airtight so the recommendations earlier in this report for the insulation of the loft, walls and replacement doors and windows must be completed first. It would then be viable to consider the use of an air to air source heat pump within the space or a ground source heat pump to feed the water in the existing heating system. In both cases the existing 80A electrical supply would need increasing. While this is a viable solution the focus for the church should be on implementing the fabric and energy saving solutions earlier in this report and consider the use of heat pumps as a final step in the process once this is complete and when the existing gas boiler reaches the end of its life.

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 .

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.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Kitchen	2	5ft Single LED	£113.47	£187.40	1.65
Ladies	3	2D LED 11W	£33.05	£163.65	4.95
Disabled	1	2D LED 11W	£11.02	£54.55	4.95
Gents	2	2D LED 11W	£22.04	£109.10	4.95
Corridor	5	2D LED 11W	£55.09	£272.75	4.95
Entrance	4	600 x 600 25W Panel	£119.02	£305.80	2.57
Entrance	7	Virgo 8W (110m dia)	£38.01	£302.19	7.95
Entrance	2	2D LED 11W	£22.04	£109.10	4.95
Vestry	2	2D LED 11W	£22.04	£109.10	4.95
Prayer Room	4	600 x 600 25W Panel	£119.02	£305.80	2.57
Main Hall	13	600 x 600 25W Panel	£386.83	£993.85	2.57
Main Hall	18	Virgo 8W (110m dia)	£97.75	£777.06	7.95
Altar	6	LED GLS	£157.72	£63.00	0.40
Store	1	5ft Single LED	£24.03	£93.70	3.90
Large store	2	5ft Single LED	£48.06	£187.40	3.90