ESOS-ENERGY
Energy efficient solutions

Energy Efficiency and Zero Carbon Advice

St Mary's Neighbourhood Centre, Islington
PCC of St Mary's Church

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1. Executive Summary

An energy survey of St Mary's Neighbourhood Centre, Islington was undertaken by ESOS Energy 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 Neighbourhood Centre, Islington was constructed in 1974. It offers meeting rooms, a gym , sports hall. There is a separate flat located on the first floor at the south end of the building. There is both gas and electricity supplied to the site.

The building has a number of ways in which it can become more energy efficient. Our key recommendations have been summarised in the table below and are described in more detail later in this report. It is recommended that this table is used as the action plan for the church in implementing these recommendations over the coming years.

Energy saving recommendation	Estimated Annual Energy Saving (kWh)	Estimated Annual Cost Saving (£)	Estimated capital cost (£)	Payback (years)	Permission needed	CO2 saving (tonnes of CO2e/year)
Replace fluorescent lighting with LED lighting	75% of 5kW load, 4700h use 18,000	£2,286	£7,000	3	List B	3.8
Replace boilers with two heat pump systems	72,000 gas 29,000 electricity required	Dependent on future electricity rates	£30,000	Unknown	Faculty	6.8
Install solar photovoltaic panels on south aisle roof	15,000	£1,905	£19,500	10	Faculty	3.1

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

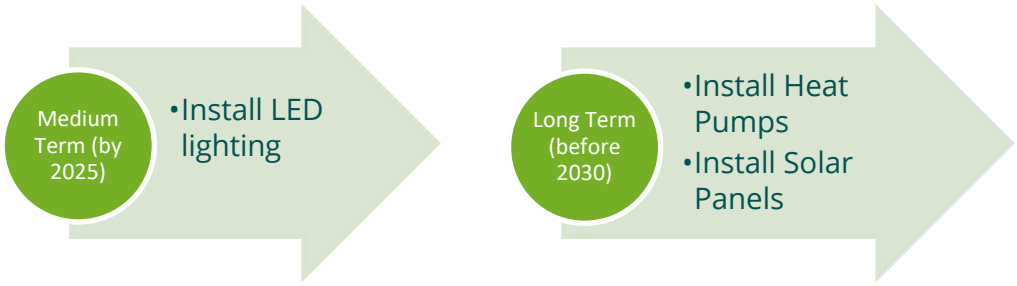
Based on contracted prices of 12.70p/kWh and 11.769p/kWh (was 3.31p/kWh) for electricity and mains gas respectively.

If all measures were implemented this would save around £4,000 per year in operating costs.

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 building has a clear route to become net zero by 2035 by undertaking the following steps:



3. Introduction

This report is provided to the PCC of St Mary's Neighbourhood Centre, Islington to give them advice and guidance as to how the church centre can be improved to be more energy efficient. In doing so the church will also become more cost effective to run with improvements in 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 Neighbourhood Centre, Islington, N1, 2TX was completed on the 3rd November 2022 by Dr. Paul Hamley. Paul is an energy auditor with experience of advising churches and small businesses. He is part of the Church Energy Advisors Network developing advice for the Church of England and authored the "Assessing Energy Use in Churches" report for Historic England. He is a CIBSE affiliate member and a Chartered Scientist, with experience of the faculty process gained from chairing the building committee of a Grade I listed church and has been an assessor for EcoCongregation.

The church was represented by Kate Tolson, Premises Manager.

St Mary's Neighbourhood Centre, Islington	HALL
Church Code	632250
Gross Internal Floor Area	650m^2
Volume	3,400m^3
Heat requirement	68kW
Listed Status	Unlisted

The building is typically used for 91 hours per week (13 hours daily) for the following activities:

Type of Use	Hours Per Week (Typical)
Bookable rooms	30
Sports hall and gym	40
Nursery	40 +

4. Energy Procurement Review

Energy bills for gas and electricity have been supplied by St Mary's Neighbourhood Centre, Islington and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single Rate	12.70p/kWh
Standing Charge	35p/day

Supplier: Haven/Drax

The current gas rates are:

Single / Blended Rate	11.769p/kWh
Standing Charge	25p/day

Supplier: Natural Gas

We would recommend that the church looks into 100% renewable tariffs and obtains quotations for its gas and electricity supplies from group purchasing schemes such as the Big Church Switch scheme, Charity Buying Group and the diocese supported Parish Buying scheme, http://www.parishbuying.org.uk/energy-basket.

These scheme offers 100% renewable electricity and a proportion of renewable gas and therefore are 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	20% on gas bills	The organisation is understood to be a charity and therefore should be benefiting from only be charged a 5% VAT rate. A VAT declaration should be sent to the supplier to adjust this.
CCL	100% charged	As the organisation is being charged the wrong VAT rate they are also being charged CCL which should not be applied as they are a charitable organisation. Sending the supplier a VAT declaration will remove this charge.

Whenever monthly electricity consumption exceeds 1,000kWh, or gas consumption exceeds 4,397kWh (52,000kWh per annum), 20% VAT is charged unless the customer has submitted a VAT declaration form. This should always be done when changing supplier.

The church is a charity and therefore can claim VAT exemption status.

Excess VAT paid can be reclaimed for the past three years.

VAT declarations are available from the suppliers website and can usually be found by typing the suppliers name followed by "VAT Declaration Certificate" into most website search engines.

5. Energy Usage Details

5.1 Annual Consumption

St Mary's Neighbourhood Centre, Islington uses 32,000 kWh/year of electricity, costing in the region of £4,500 per year, and 72,000 kWh/year of gas in 2021, costing £2,600. The total carbon emissions associated with this energy use are 19.7 CO_2e tonnes/year.

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

Utility	Meter Serial	Type	Pulsed output	Location
Electricity	21E 1011002	EDMI ES-30B	Yes	Boiler room, staff room corridor
Gas	M025 A01654 06 A6		Yes	

All the meters are AMR connected and as such an annual energy use profile for the site could be obtained from the supplier.

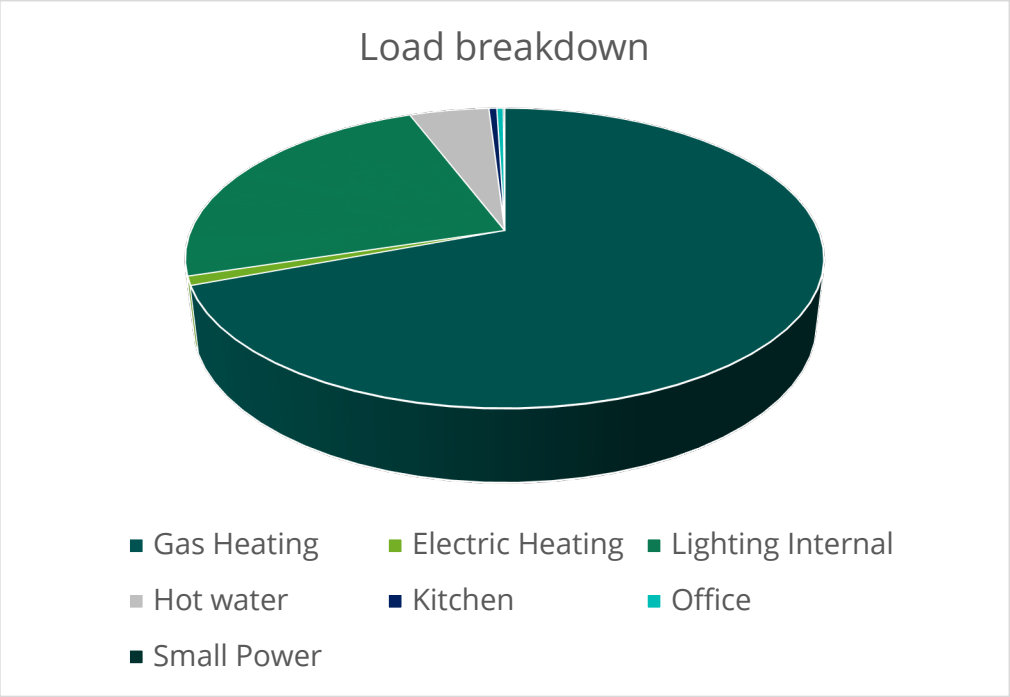
5.2 Energy Profiling

The main energy consuming plant can be summarised as follows:

	Equipment	Power kW	Annual Consumption kWh	Portion
Heating [Gas]	Meeting rooms & Nursery area Potterton Prima Gym, staff room area Ideal Logic Heat 30 Sports hall Gas fired Space heater	 30 30 Unknown 40 ?	 Total 72,000	 69%
Heating [Electric]	Boiler circulation pumps Space Heater fan	0.4 0.6	 Total 1,000	 1%
Lighting [Internal]	44 x fluorescent F70W 10 x F40W 88 x fluorescent F18W in square diffuser panels Various LEDs 4,700 hours use	3080W 400W 1584W 200W	 TOTAL 25,000	 24%
Hot Water	Fixed water heater, nursery area (normally gas heated in winter) Commercial Dishwasher Washing Machine (nursery use)	3 5 3	 1,000 2,000 2,000 TOTAL 5,000	 4.8%
Kitchen	Microwave Fridge	1 0.1	200 300 TOTAL 500	 0.5%
Office	Workstation	0.2	400	0.4%
Small Power	Vacuum cleaner	1.5	100	0.1%

Sum of estimates: 32,000kWh

Annual site electricity consumption, 2021: 32,517kWh



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.

6. Efficient / Low Carbon Heating Strategy

6.1 Reducing Environmental Impact

The energy used for heating a building makes up around 80% to 90% of the overall energy consumption. Heating also often uses gas or oil as its primary fuel, these are fossil fuels with high carbon emissions and little opportunity to decarbonise in the future. Electricity currently has carbon emissions of around the same level as mains gas but the carbon emissions associated with electricity are reducing rapidly as the UK builds more renewable energy and decommissions its remaining coal fired power stations. Mains gas does have some potential to reduce its carbon content through the use of bio gas and hydrogen but these are less developed solutions and will be unable to deliver 'zero carbon mains gas'.

It is therefore important to review and plan to increase building efficiency and become less carbon intensive. One way to achieve this is to consider a transition to electrical heating where this also represents a more efficient solution.

6.2 Site Heat Demand

The Centre for Sustainable Energy model[2] can be used to estimate heat load for the building.

Heat Load (kW) = Volume V (m^3) x Insulation Factor

Insulation Factors

Condition	Factor kW/m^3
Poorly insulated with open or broken windows, draughty doors (add 5%)	0.034
Poorly insulated (assume no interventions)	0.033
Some insulating features	Estimate value
Well insulated	0.022
Insulated to 2010 regulations	0.013

Area	Volume m^3	Insulation Factor kW/m^3	Heat Required (Space heating) kW	Boiler provision
Meeting rooms, nursery area	1,600	0.02	32	Potterton Prima 30kW
Sports Hall, gym, staff room	1,800	0.02	36	Ideal Logic Heat 30 30kW output

2 www.cse.org.uk/local-energy/download/estimating-the-heat-demand-of-a-hypothetical-community-building-79

Sports Hall office area boiler.

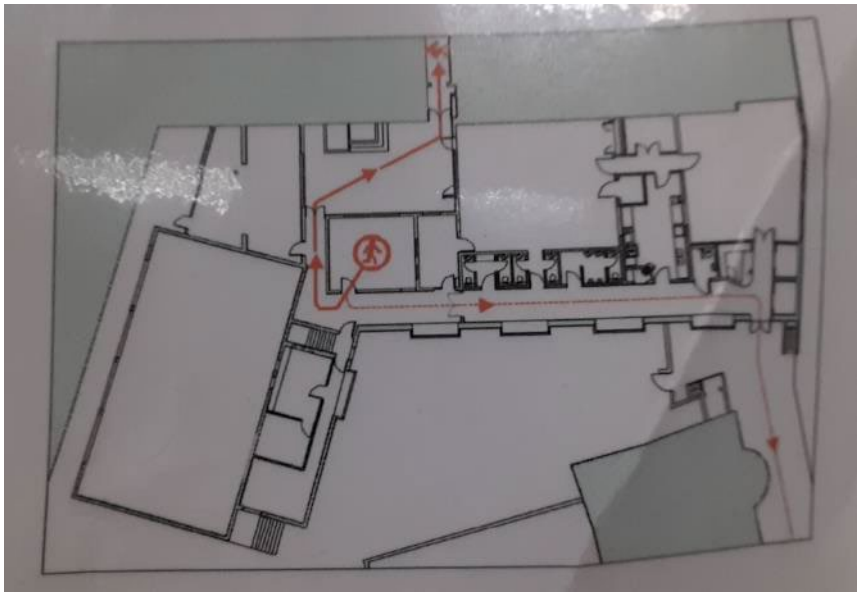
Sports hall gas space heater.

7. Energy Saving Opportunities

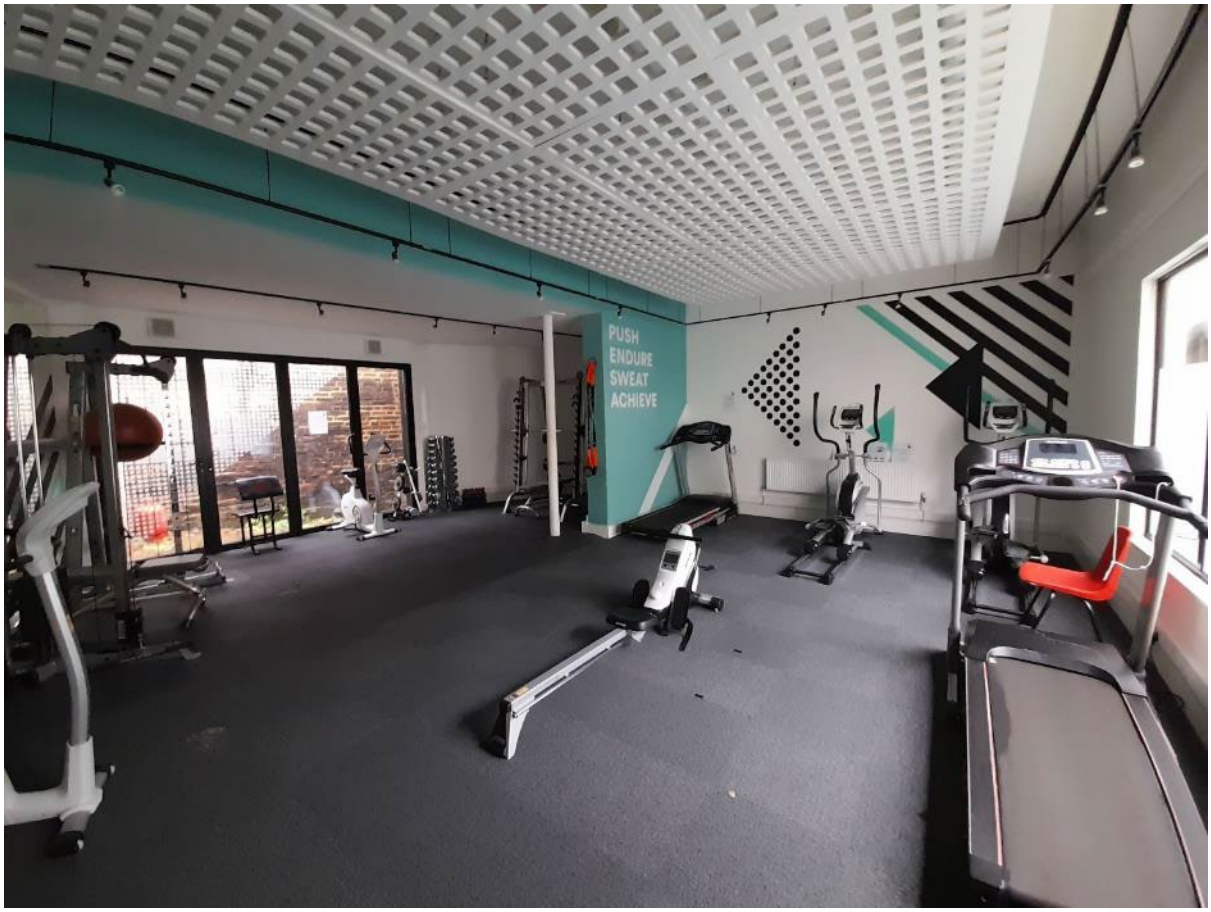
The Neighbourhood Centre building was constructed in 1974. It has concrete cavity walls and is double glazed. The roof was refurbished in 2017 with current levels of insulation added and new double glazed windows fitted.

Part of the building is let to a nursery. The Garden Room, Lounge and Kitchen are hireable. The end of the building furthest from the church, which has a separate boiler, contains a sports hall, gym and staff room.

Opportunities for energy saving arise from switching from gas fired boilers to heat pumps, and completion of LED lighting.



The angled room, bottom left of the plan is the sports hall, with the (asymmetric) gym above and staff room to the right. The room with the red symbol and that top right are bookable, the nursery occupies the central large room.



7.1 Installation of Heat Pumps

Heat Pumps are a low carbon method of creating heat.

As the hours if use of a building increase, so do heating costs.

Electrically operated heat pumps can provide between 2.5 times and 5 times the amount of heat in kW which they consume in electricity (This is termed the Coefficient of Performance, CoP). When replacing gas boilers directly, sometimes larger radiators are required, or fan assisted radiators, or running the system for longer periods to achieve the same temperature (but at less power input).

With electricity prices now only three times more per kWh than gas (it was about four times), heat pumps are becoming steadily more cost effective. Refrigeration technology is mature and reliable; the units appear to offer lower maintenance costs compared to gas boilers.

Heat pumps generally deliver water at around 55^{o}C (although there are higher temperature ones on the market which require more energy to run); thus are compatible with a building which is regularly used and can be supplied with constant heat at a medium level. Air source (to water) systems deliver between 2.5 and 3 times the amount of heat in kWh that they consume.

The Neighbourhood Centre is in regular use throughout the week. This pattern of use is compatible with an air to water heat pump supplying warm water to the pressed steel radiator network. It is recommended that quotations are sought from installers and a plan to replace the two boilers developed. Having two separate systems allows zoned control of the different parts of the building to be maintained, where there are different use patterns and temperature

requirements – for instance sports halls may only need to be heated to 16ºC. However, they also require a much greater rate of air change per hour than other uses of room, which then increases the heat required.

Potential installers should be asked to provide an option to retain the existing boilers (or a replacement) to cope with the occasional days when the temperature drops below 5ºC. This will minimise both the heat pump plant size required, and prevent very high electricity costs during very cold weather. It will, however, mean that there will still be annual gas maintenance costs.

External heat pump units could be located on the flat roof, or possibly by the sports hall end of the building. It is not recommended to locate them in the garden area facing the church or immediately adjacent to the first floor flat, due to noise.

Three external units similar to the above, or one large unit would be needed to supply 30kW of heat.

Ground Source Heat Pumps supplying water at around 50ºC are more efficient than their Air Source equivalent (since the average ground temperature is higher than the average air temperature), but would require a borehole. The compact nature of the site and difficult access for machinery may make this option impracticable. However, it is worth approaching suppliers for cost estimates due to the approximately 40% lower running cost compared to air source units.

Where a site has a daily requirement for heat (and thus high daily expenditure), the lower operating costs of a ground source pump outweigh the higher capital costs.

Some of the extra electricity required to run heat pumps can be obtained from solar PV panels. Some types of heat pump can provide cooling – solar powered cooling in summer is very efficient. With separate supply and meters to the church it would not be possible to use the solar power generated on the church roof, but an array could be fitted to the Neighbourhood Centre roof.

7.2 LED Lighting

Much of the lighting consists of either panels containing four fluorescent tubes forming part of a suspended ceiling, or individual fluorescent tubes. The gym and staff kitchen have been equipped with LED lighting. It is recommended that all the Fluorescent lighting is changed for LED and contractors are approached for quotations. 70W fluorescent units may be replaced by LED strip lighting of around 20W. There are approximately 44 x 70W units (40 in the sports hall) and approximately 88 x 18W tubes in square luminaires. The total fluorescent lighting load is 5kW. This could be reduced to between 1 and 2kW by LED lighting depending on the level of illumination required.

8. Saving Recommendations (Water)

8.1 Tap Flow Regulators

The building is in regular and heavy use including by young children. It is recommended that flow regulating taps are fitted. One supplier is Neoperl. Taps can be replaced by any good facilities staff.

9. Renewable Energy Potential

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

Renewable Energy Type	Viable
Solar PV	Yes
Battery Storage	Future potential
Wind	No – no suitable land away from buildings
Micro-Hydro	No – no water course
Solar Thermal	Yes but using solar panels and immersion heaters is more flexible
Biomass	No –urban air quality issues
Air Source Heat Pump	Yes
Ground Source Heat Pump	Possible if borehole is feasible
Air to Air Source Heat Pump	Other solutions are preferrable

9.1 Solar Photovoltaic Panels

The sports hall roof offers an area of around 100m^2 and the other roof sections an equivalent amount. There is shading at the south end of the roof from large trees, so using the northern, sports hall roof would give greater efficiency.

Panels generate around 0.15kWpeak/m^2. A 1kWpeak system can generate up to 1000kWh annually. The following formula calculates annual generation.

Annual Generation (kWh) = Area x 0.15kWp/m^2 x 1000kWh/kWp x Orientation Factor x Overshading Factor.

Roof Section	Useable area / m^2	System Size / kW peak	Orientation factor	Shading factor	Annual Generation, kWh
Sports Hall	100	15	Optimum 180 degrees / 35° angle 1.0	1	15,000

This is the maximum likely figure, which may be reduced by factors such as the weight of panels (due to roof strength) and access space between panels. The ability of the roof structures to support the extra loads should be discussed with the inspecting architect for the building.

It is recommended that the church does not plan to install solar panels until decisions are made regarding heat pumps. After heat pumps are installed; then once their electricity consumption is understood, solar PV systems can be sized appropriately. Without heat pump installation, the solar PV system should be sized to supply the regular loads of lighting (reduced in future after full LED installation) plus office equipment.

The hall system should be specified for future addition of a battery, when battery costs reduce, as this would extend the system usefulness into the evening.

Battery Storage is not strictly a renewable energy solution but provides 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. This is a new but fast-growing technology.

Using 2019 installation costs for simple access roofs (£1,300 per kWpeak); a 15 kWpeak system would cost £19,500.

10. Funding Sources

There are a variety of charitable grants for churches undertaking works and a comprehensive list of available grants is available at www.parishresources.org.uk/resources-for-treasurers/funding/

This includes a 77 page guide to funders and their criteria:

https://www.parishresources.org.uk/wp-content/uploads/Charitable-Grants-for-Churches-Jan-2020.pdf .