# Energy Audit and Survey Report

# St Andrew's Church, Hyde Heath

*"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 | 25th October 2019 | 1.1 |

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# 1 Executive Summary

An energy survey of St Andrew's Church, Hyde Heath 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 Andrew's Church, Hyde Heath comprises a 20th century solid walled brick building with a hipped tile roof. Electricity only is 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** | 0 | 10-30% of Costs [£140-£400] | 0 | Immediate | None | Treasurer<br><br>Deadline to inform current suppliers 23rd February |
| **Draught proofing doors and keyholes** | 5-10% (4-800) | £65-130 | £30 | 0.3 to 0.5 | None | Warden ASAP |
| **Secondary double glazing of hopper windows** | 5-10% (4-800) | £65-130 | £500 | 3.5 to 7 | Faculty | PCC |
| **Light bulb replacement** | 5% (380) | £63 | £400 | < 4 * | List A | Warden As required, but buy in bulk |

* Light bulb replacement savings are partly due to less frequent changes necessary with LED replacements

| 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? |
|---|---|---|---|---|---|---|
| **Install timers on electric heaters so they do not have to be left running overnight during winter** | 10-20% (800-1600) | £130-260 | Approx £140 per heater | | List A/B | PCC |

| 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? |
|---|---|---|---|---|---|---|
| **Air Source Heat Pump** | 4000 | £600 | Circa £20,000 | | Faculty | PCC |

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

Based on current contracted prices of 17.853p/kWh (weekday) and 16.170p/kWh (evening and weekend) for electricity.

**If all short term measures were implemented this would save the church £300+ per year**.

# 2 Introduction

This report is provided to the PCC of St Andrew's Church, Hyde Heath 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 Andrew's Church, Hyde Heath, 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 "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 Andrew's Church, Hyde Heath** | |
|---|---|
| Gross Internal Floor Area | 130 $m^2$ |
| Listed Status | Unlisted. Constructed 1910 |
| Typical Congregation Size | 12 |

The church typically used for 5 hours per week for the following activities:

| | |
|---|---|
| Services | 0915congregation 12-15<br>2 hours per week |
| Meetings and Church Groups | |
| Community Use | Adjacent church school has a key. Used for meetings and coffee mornings for parents, monthly.<br>= 1 h.p.w<br>Handbell ringers every 2 weeks<br>= 2 h.p.w |
| Occasional Offices | 1 per annum<br>Av. 0.1 hours per week |

**Figure 1** St Andrews's , dating from 1910, has a solid wall construction with tiled roof.

# 3 Energy Procurement Review

Energy bills data for electricity has been supplied by St Andrew's Church, Hyde Heath and has been reviewed against the current market rates for energy.

The current electricity rates are:

| | | |
|---|---|---|
| **Weekday Rate** | 17.853p/kWh | Above current market rates [12.99 to 13.77p/kWh] |
| **Weekend and Evening Rate** | 16.170p/kWh | Above current market rate |
| **Standing Charge** | 29.499p/day | Above current market rate |
| **Availability Charge** | p/kVA | N/A |
| **Meter Charges** | p/day | N/A |

The current electricity contract ends on 24th March 2020; notice must be given by 23rd February 2020.

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 electricity with 20% green gas 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 Andrew's Church, Hyde Heath uses approximately 8,500 kWh/year of electricity, costing in the region of £1,500 per year. Consumption and cost has risen, comparing data for 2017, 2018 and 2019. This data has been taken from the annual energy invoices provided, with 33 months of electricity data provided.

| | | |
|---|---|---|
| **2017** | £1,201.92 | 7,236 kWh |
| **2018** | £1,479.84 | 8,909 kWh |
| **2019** | £815.18 to 7 Oct<br>£1,400 scaled to 12 months | 4,907 kWh (9 months)<br>8,400 kWh (yearly estimate) |

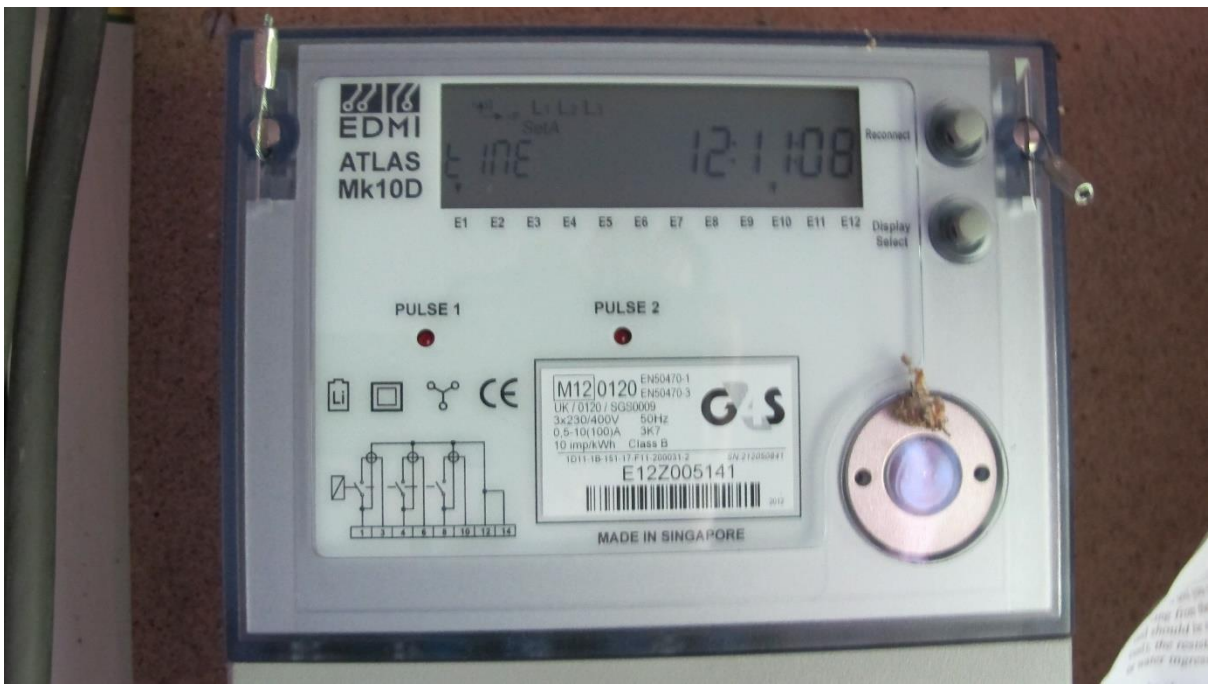
Note that the charge dated 10/01/2017 has not been included, and the three monthly charge dated 09/01/2018 has been included in the figures for 2017 (and vice versa for 08/01/2019) since this mostly relates to the October to December period.

St Andrew's Church, Hyde Heath has one electricity meter, serial number E12Z005141.

| Utility | Meter Serial | Type | Pulsed output | Location |
|---|---|---|---|---|
| **Electricity – Church** | E12Z005141 | EDMI Atlas Mk10D | Two pulses | Corridor |

The meters are not AMR.

**Figure 2** Electricity meter



## 4.1 Energy Profiling

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

| Service | Description | Estimated Proportion of Usage |
|---|---|---|
| **Lighting - Church** | 18 spotlights, GE Halogen AR111, 50W Total 900W<br><br>7 uplights, Osram Halogen 77W, E27 fitting<br>(short lifetime stated ~ 1 year) Total 540W<br>= 375 kWh | 8% |
| **Lighting – Kitchen & Toilets** | Corridor 4 x GU10 halogen Total 200W<br>Kitchen 4 x GU10 halogen Total 200W<br>Toilets 3 x GU10 halogen Total 200W<br>= 150kWh | 3% |
| **Heating – Church** | Electric convector heaters 5 x 0.75kW<br>Overnight use in winter, 30 Sundays for 18 hrs<br>= 2000kWh<br>+ 15 Sundays for 3 hrs = 45 hours = 34 kWh<br><br>School use, 8 uses annually x 9 hours =270kWh | 88% |
| **Kitchen & toilets** | Electric convector heaters 3 x 0.75kW<br>Continual winter use to prevent freezing (1/3 power)<br>3 months ~2200 hours @0.25kW = 1640kWh<br>+ 20 Sundays for 3 hrs = 60 hours = 135kWh<br><br>School use, 8 uses x 9hrs =72hours = 162 kWh | |
| **Hot Water** | Immersion heater in cupboard 3kW<br>20 mins use per week, annual use =12 kWh<br>Kettles 2 + 3 kW<br>3 boils per week, annual use = 12 kWh<br>Food warmer (once a year) 1 kW = 3 kWh<br>Kitchen total estimate = 27 kWh | 0.56% |
| **Other Small Power** | Electronic Organ 500W x 60h = 30kWh | 0.6% |

This sums to 4823 kWh or about 50% of billed useage. This suggests that the heating has also been run at extra times than estimated above.

**It is suggested that timer controllers are added to the convector heaters – this would mean they could be set to come on in the early hours of the morning, rather than 7pm the previous evening.** Experimentation will be needed to discover the optimum start time – it will be weather dependent.

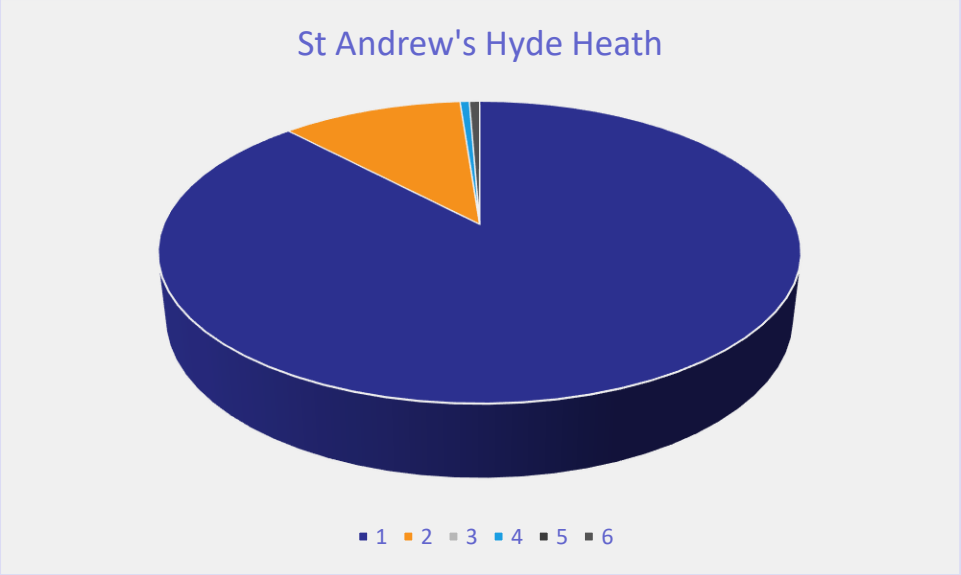



**Figure 3** **Load breakdown**

**Key** 1 Electric heating [88%] 2 Lighting 3 Lighting (external – zero)

4 Hot water 5 Small power (zero) 6 Organ

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 Andrew's Church, Hyde Heath uses 38% of the average electricity use which would be expected for a church of this size. This is due to the low occupancy hours.

| | Size ($m^2$ GIA) | St Andrew's Church, Hyde Heath use kWh/$m^2$ | Typical Church use kWh/$m^2$ | Efficient Church Use kWh/$m^2$ | Variance from Typical |
|---|---|---|---|---|---|
| **St Andrew's Church, Hyde Heath (elec, non heating)** | 130 | 7.75 | 20 | 10 | 77% |
| **St Andrew's Church, Hyde Heath (heating electricity)** | 130 | 56.8 | 150 | 80 | 38% |
| **TOTAL** | 130 | 64.6 | 170 | 90 | 38% |

# 5 Energy Saving Recommendations

## 5.1 Heating Overview

Heating of the church and adjoining office is provided by Dimplex electric convector heaters, five in the church, one in each of the corridor, kitchen and toilet.

Currently they are switched on at 7pm on Saturday evenings in winter to warm the building in time for the 09:15 Sunday service. This gives 18 hours if they are run until 11am. This may be wasting several hours of heat – it may be that starting at midnight or 4am would be sufficient. Installing timer controllers would allow the heating hours to be optimised.

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. Such units can be purchased at any electrical wholesaler and fitted by your existing electrician or any NICEIC registered electrical contractor.

## 5.2 Draught Exclusion – Hopper windows

Hopper windows at high level are likely to cause draughts. Installing secondary double glazing would control this.

**Figure 4** High level hopper windows may be a source of draughts and cold air entering.

## 5.3 Draught Exclusion, Doors: Quattro Seal

There are three external doors into the building. These should be checked in windy conditions to ascertain if cold air is coming into the church around the side and base of these doors. Open keyholes should be blocked and covered (blue tack and a small piece of card, or a coin can be used).

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

## 5.4 Roof Insulation

There is some insulation above the ceiling. This should be checked to see if it complies with the recommendation of 270mm. Reducing heat loss over an 18 hour heating period will have a positive effect (although not as much as for a building heated daily).

## 5.5 Underfloor insulation

The floorboards rest on joists which have no insulation underneath and are stated to be supported directly by the earth underneath (i.e. with no supporting brick pillars and airspace).

Future refurbishment should consider installing underfloor insulation.

## 5.6 Lighting (fittings)

The lights in the church appear to be a mix of 18 x 50W AR111 units at roof beam level, and 7 x 77W Osram E27 uplights. They should be replaced with LED lamps. As well as lower energy consumption (about 20W each), LED lamps have a much longer lifetime; 15-20 years compared to 1-3 for halogen lamps, so there will be extra savings on bulb costs and the frequency of access expenses.

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 (111mm diameter?); 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.

St Mary’s, Wendover also use AR111s, so group purchase discounts may be possible.

# 6 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** | No |
| **Wind** | No |
| **Micro-Hydro** | No |
| **Solar Thermal** | No |
| **Ground Source Heat Pump** | No |
| **Air Source Heat Pump** | Yes |
| **Biomass** | No |

There is potential for a small PV array on the roof. 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 churches 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) 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 expected to fall substantial over the next 2 to 3 years therefore investment into this may be worth delaying at this stage.

An air source heat pump system would be a potential replacement for the current heaters. Currently, direct electric heating is used where 1kW of electricity delivers 1kW of heat.

Heat pumps upgrade low grade heat in the environment using refrigeration technology. They typically result in 2.5 to 3 times the amount of heat provided for the electricity used (Coefficient of Performance, COP). So 1kW of electricity will deliver 2.5 to 3 times that amount of heat.

It is therefore a future option for heating the building and reducing operating costs.

The unit could be located at the rear of the building.

# 7 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 office is attached to the listed church, any future 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.

# 8 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 |
|---|---|---|---|---|---|
| **Church** | 18<br>50W AR111 | 13W LED AR111 | 175kWh<br>£30<br>+ 4x lifetime<br>[save 2x £360] | @£20ea<br>£360 | 4 years |
| **Church** | 7<br>77W halogen E27 | 20W LED | 100kWh<br>£17<br>+ 4x lifetime | @£3 ea<br>£21 | 1 year |
| **Kitchen & corridor** | 11<br>50W GU10s | 13W GU10 LEDs | 106kWh<br>£17<br>+ 8x lifetime | @£1.50 ea, non dimmable | 1 year |

The saving from changing the large AR111 bulbs to LED is mainly realised by their longer lifetime and avoiding two or three purchases of similar sized halogen bulbs.