



Energy Audit Report for St. Cuthbert's Church



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|--------------|--|
| Site Address | St. Cuthbert's Church, Darlington, DL1 5QG |
| Church Code | 613230 |
| Author | Tim Mawby Graduate Consultant |
| Date | 16 th December 2019 |
| Version | 1.0 |

1 Executive Summary

An energy survey of St. Cuthbert's Church, Darlington, DL1 5QG 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. This audit has been provided in conjunction with 2buy2, the Church of England's Parish Buying scheme provider.

This energy audit has been undertaken by a suitably qualified and experienced energy auditor. Benefits of implementing the opportunities identified in this Report include a reduction in energy costs in the first instance, but could also reduce other costs, increase staff awareness and engagement, and improve comfort and staff satisfaction in the workplace.

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 is used as the action plan for the church in implementing these recommendations over the coming years:

| Energy Saving Measure | Annual Energy Savings (kWh) | Annual Cost Savings (£) | Estimated Capital Cost | Payback Period (Years) | Annual Carbon Savings (Tonnes CO ₂ e) |
|--|-----------------------------|-------------------------|------------------------|------------------------|--|
| Church - replace 200W halogen uplights with 60W LED alternatives. | 3,494 | £496 | £2,400 | 4.8 | 1.1 |
| Chancel - replace 200W halogen uplights with 60W LED alternatives. | 582 | £83 | £400 | 4.8 | 0.2 |
| Vestry - replace 58W T8 fluorescent tubes with 22W LED alternatives. | 37 | £5 | £20 | 4.0 | <0.1 |
| Bell Tower - replace 58W T8 fluorescent tubes with 22W LED alternatives. | 75 | £11 | £40 | 3.6 | <0.1 |
| TOTALS | 4,188 | £594 | £2,860 | 4.8 | 1.3 |

The headline messages from the audit are:

- ▲ £2,860 investment in energy reduction measures would achieve an estimated annual saving of 4,188kWh (combined electric and gas).
- ▲ Based on current electricity and gas tariffs, this would result in an annual financial saving of £594.
- ▲ The simple payback period on this investment is 4.8 years.

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

2 Church Information

A site survey was undertaken by Tim Mawby on Monday 9th December 2019. The survey was non-invasive (visual only) and entailed a general walk throughout the church areas, including back of house spaces and plant rooms.

Photograph 1: St. Cuthbert's Church External View



| General Information | |
|----------------------------|--|
| Site Address | St. Cuthbert's Church, Darlington, DL1 5QG |
| Listed Status | Grade I listed Building |
| Building Age | Built in 1180 |
| Floor Area | 660m ² |
| Usage | Typically 10 hours per week |

3 Energy Procurement Review

Energy bills for gas and electricity have been supplied and have been reviewed against the current market rates for energy.

3.1 Electricity

| | |
|----------|-------------|
| Day Rate | 14.20 p/kWh |
|----------|-------------|

3.2 Gas

| | |
|------|------------|
| Rate | 3.25 p/kWh |
|------|------------|

The review has highlighted that there may be opportunities to gain environmental benefits 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 CofE Parish Buying scheme (<https://www.parishbuying.org.uk/categories/energy/energy-basket>). This scheme only offers renewably sourced energy and therefore it is an important part of the process of making Churches more sustainable.

4 Energy Usage Details

4.1 Cost & Consumption

| Energy Type | Annual kWh |
|-------------|------------|
| Gas | 163,220 |
| Electricity | 25,895 |

If not already in place, 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 in use.

4.2 Energy Benchmarking (Based on CofE Shrinking the Footprint – Energy)

| Energy Type | Size (Sqm) | Benchmark Energy Use (kWh/Sqm) | Actual Energy Use (kWh/Sqm) | Variance from Benchmark (%) |
|-------------|------------|--------------------------------|-----------------------------|-----------------------------|
| Gas | 660 | 105 | 247 | 135% |
| Electricity | 660 | 20 | 39 | 95% |

The Church is using more Gas than expected. The Church is using more Electricity than expected.

5 Building Performance and Opportunities

The building is well run with proactive onsite team in terms of energy conversation with some areas of improvement already being identified. The following sections will highlight where further improvements could potentially be made.

5.1 Building Envelope

From visual inspection, the building envelope appears to be in a reasonably good state of repair. However there is no wall or roof insulation.

5.2 Heating System – Boilers

Heating is provided to the Church via 4no. Keston/Ideal gas condensing boilers, installed in 2014. They are stored in the basement plant room and are operational for approximately 8 hours per week. A control panel is located in the main church, where it is programmed to suit the schedule for the upcoming week. This can also be manually overridden to provide additional heating. During the site visit, it was noted that the boilers' frost protection setting was set to 10°C, however it is not clear whether this was the upper or lower limit. It is recommended that further investigation is carried out to ensure the frost protection is set to activate at 5oC.

It is recommended that the client explores the possibility of installing an air to water heat pump heating system in order to move towards the goal of decarbonising energy consumption.

Photograph 2: Church Boilers



5.3 Heating System – Pipework and Distribution

The pipework for the heating systems in the basement plant room is well lagged. As such, no recommendations have been made in this area.

5.4 Heating System – Heat Emitters

Heating to the church is served via 12no. cast iron radiators. These radiators are supplied by heating pipes that are fixed to the walls and run in floor trenches covered with grilles. Additional radiators supply heat to the chancel (4no.) and vestry (3no.) spaces. Radiators are typically obstructed by furniture which limits the effectiveness of the heating. It is advised that items are removed from the immediate vicinity to allow for better heat convection in the space.

The church is currently in the process of fundraising in order to improve the church's infrastructure. The current plan highlights changes to the building's current heating system to a more efficient underfloor heating system. As such, no recommendations have currently been made in this area.

A range of portable plug-in heaters are also present throughout the building and are used to provide additional heating to the smaller rooms when required.

Photograph 3: Church Radiators



5.5 Hot Water System

There is no hot water system in the church.

5.6 Lighting

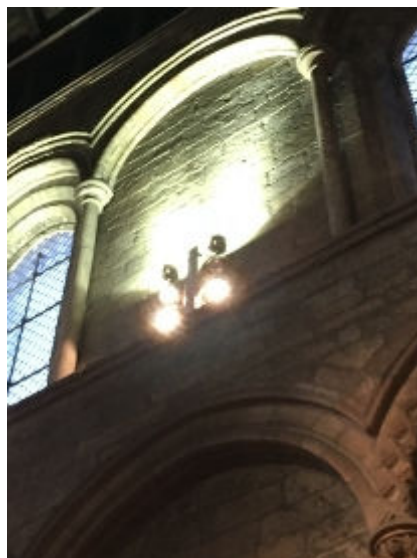
There is no lighting control system, motion detectors or daylight dimming controls. All light fittings are controlled via manual on/off switches, from a central panel in the office.

The range of light fittings throughout the church areas are detailed below:

Church

- ▲ 48no. 200W halogen uplights – recommended to be replaced with 60W LED alternatives.
- ▲ 96no. LED downlights

Photograph 4: Halogen Uplights and LED Downlights



Chancel

- ▲ 8no. 200W halogen uplights – recommended to be replaced with 60W LED alternatives.
- ▲ 32no. LED downlights

Vestry

- ▲ 2no. 58W T8 fluorescent tubes – recommended to be replaced with 22W LED alternatives.

Photograph 5: Fluorescent Tubes



Bell Tower

- ▲ 4no. 58W T8 fluorescent tubes – recommended to be replaced with 22W LED alternatives.

5.7 Renewables

There are currently no renewables on-site. A free desktop survey can be carried out by a specialist solar installer to identify the possibility of installing solar PV panels.

6 Potential Saving Opportunities

As part of the assessment, we carry out a close inspection of M&E plant and their associated controls, with the aim of identifying any issues that have significant impact on energy consumption and correct building operation. We have reviewed the building and associated HVAC and lighting operations and identified the following potential energy conservation opportunities (ECOs), which should be investigated:

| Category | Actions | Potential Annual Savings | | | Investment (£) | Simple payback (yrs.) |
|----------------------------------|--|--------------------------|-------------|---------------------|----------------|-----------------------|
| | | Elec/Gas (kWh) | Cost (£) | (tCO ₂) | | |
| Lighting | Church - replace 200W halogen uplights with 60W LED alternatives. | 3,494 | £496 | 1.1 | £2,400 | 4.8 |
| Lighting | Chancel - replace 200W halogen uplights with 60W LED alternatives. | 582 | £83 | 0.2 | £400 | 4.8 |
| Lighting | Vestry - replace 58W T8 fluorescent tubes with 22W LED alternatives. | 37 | £5 | <0.1 | £20 | 4.0 |
| Lighting | Bell Tower - replace 58W T8 fluorescent tubes with 22W LED alternatives. | 75 | £11 | <0.1 | £40 | 3.6 |
| TOTAL ELECTRICITY SAVINGS | | 4,188 | £594 | 1.3 | £2,860 | 4.8 |
| TOTAL GAS SAVINGS | | N/A | N/A | N/A | N/A | N/A |
| GRAND TOTAL | | 4,188 | £594 | 1.3 | £2,860 | 4.8 |

7 Assumptions

7.1 Assumptions

- ▲ The lighting costs excludes labour, installation and access which will require the confirmation of a specialist lighting contractor.
- ▲ Average cost of electricity at 14.20p/kWh.
- ▲ Average cost of gas at 3.25p/kWh.
- ▲ Electricity carbon emission rate of 0.31598 kgCO₂/kWh.
- ▲ Natural Gas carbon emission rate of 0.20776 kgCO₂/kWh.

7.2 Economic Life

CIBSE Guide M Appendix 12.A1 gives the economic life of plant common plant items. After this time the maintenance and repair make it economic to replace the asset. There will be energy savings inherent in the new equipment and the need to meet the minimum requirements of the Building Regulations. Some capital plant has long payback periods, when based on energy efficiency alone, but these should be part of an asset replacement programme with only the 'additional' cost of higher than minimum required energy standards being used to calculate ROI.

7.3 Implementation

Reviews of Energy Projects and Initiatives are designed to provide a high-level indication of options available clients and will not constitute a recommendation for implementation. Pricing and potential savings are indicative values and will not constitute an offer.

7.4 Cumulative Savings and Double Counting

It should be noted that further investigation may rule out some measures as impractical, either physically or financially. Some measures are mutually exclusive and provide diminishing returns if implemented together. For example, if the lighting load is reduced through more efficient lighting, there will be an increase in the heat demand on boilers, as the new lights generate less heat.

Each energy conservation measure is assessed independently at this stage so that they can be fairly compared. An assessment of any overlap will be undertaken once any projects are selected for implementation.

8 Funding Sources

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-Nov-2019.pdf>

9 Faculty Requirements

It must be noted that all works intended to be undertaken should be discussed with the DAC at the Diocese.

Minor works 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.

Major 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 as 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 Limitations

The recommendations contained in this Report represent ESOS Energy's professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Sustainability Consultant.

ESOS Energy obtained, reviewed and evaluated information in preparing this Report from the Client and others. ESOS Energy conclusions, opinions and recommendations has been determined using this information. ESOS Energy does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which ESOS Energy has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

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