Energy Audit and Survey Report

Charing Church Barn, Charing

PCC of Parishes of Calehill with Westwell

Version Control

Author	Reviewer	Date	Version
Paul Hamley	Matt Fulford	26th January 2020	1.0

Contents

1. Executive Summary

An energy survey of Charing Church Barn, Charing 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 and is subsidised from Total Gas & Power, the Parish Buying schemes principal energy suppliers.

Charing Church Barn, Charing is a mediaeval timber framed building, moved and reconstructed in 1958. Electricity only is supplied to the site. The building 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	CO2 saving (tonnes of CO2e/year)	£/tonne of CO2
Replace lighting with LED lights in existing fittings	1200	£242	£200	1.52	List A	0.37	£542.53
Switch electricity (and gas) suppliers to ones which provide 100% renewable (or green gas) supplies	Nil	N/A	Nil	immediate	None	N/A	N/A
Replace stage lighting with LED lights	Annual use unknown	Unknown	£200 per light	-	List B	-	-
Arrange for a joiner to inspect timber windows and doors to replace any seals and ensure tight closing and report if existing glass could be changed for double glazed units within the existing frames	350	£38	£700	18.4	List A	0.11	£6,510.42

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

Based on contracted prices of 11.00p/kWh for electricity. **If all measures were implemented this would save the church £242 operating expenditure per year.**

2. Introduction

This report is provided to the PCC of Charing Church Barn, Charing 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 Charing Church Barn, Charing, TN27 0LPwas completed on the 26th November 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.

Charing Church Barn, Charing	
Gross Internal Floor Area	180 m^2
Listed Status	Unlisted
Typical Congregation Size	Not applicable

The hall is used by several groups, estimated at 12 hours per week. There are regular users including brownies and an NHS group holding six meetings annually, plus community events. This includes wedding receptions, cream teas, harvest suppers, birthday parties. A local dramatic society uses the hall occasionally, full stage lighting is provided plus changing rooms behind the stage.

Hall annual use = 624 hours

Heating hours: Hall = 364 hours.

3. Energy Procurement Review

Energy bills for electricity have been supplied by Charing Church Barn, Charing and have been reviewed against the current market rates for energy.

The current electricity rates are:

Single / Blended Rate	11.0000p/kWh	In line with current market rates
Standing Charge	£10.96/month	N/A
FiT charge	2.38% of consumption	N/A

The above review has highlighted that the current rates being paid are in line or below current market levels and the organisation can be confident it is receiving good rates.

However, it may be beneficial to obtain a quotation *together* with the church, as better rates may be available from having two supplies.

We would therefore recommend that the church obtains a quotation for the hall electricity supply 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.
FiT		A FiT charge is being applied. It should be checked that this is being charged in accordance with the supply contract.

The above review confirmed that the correct taxation and levy rates are being charged.

4. Energy Usage Details

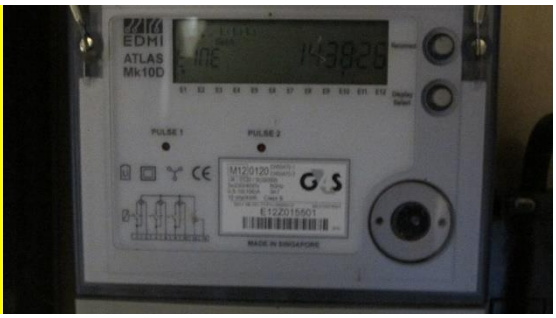
4.1 Annual Consumption

Charing Church Barn, Charing uses 6,300 kWh/year of electricity, costing in the region of £8,850per 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 – Hall	E12Z015501 (main consumption) E12Z057718	Both EDMI Atlas Mk7c	Yes	Inside hall entrance

All the meters are AMR connected and as such energy profile for the entire energy usage should be possible. Half hour meter data has been provided for the purpose of this report and this has been used to verify the data.



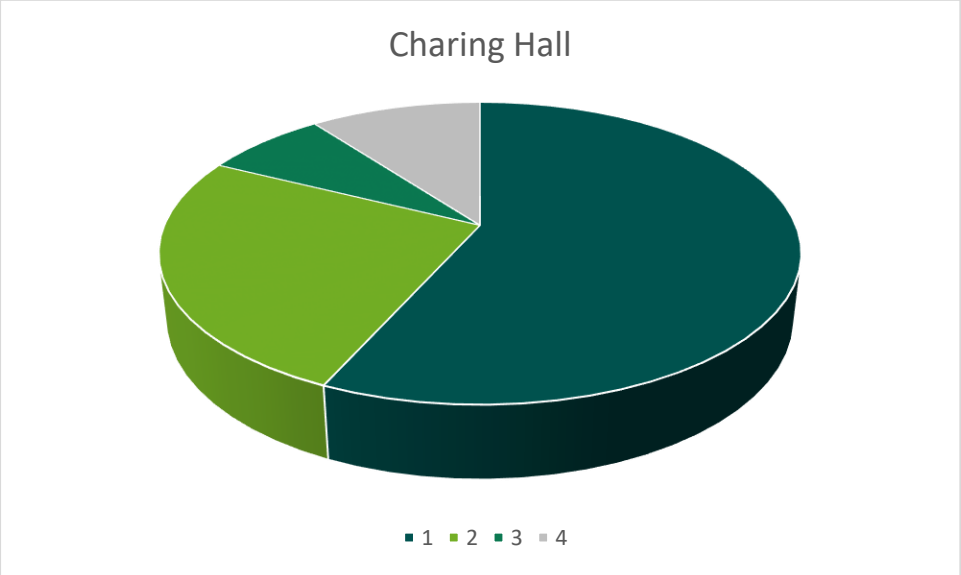
4.2 Energy Profiling

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

Service	Description	Power	Annual Use/ kWh	Estimated Proportion of Usage %
Lighting	3 chandeliers of 14 lights, switched in two banks of 6 or 8. Halogen lamps ~77W	3234W	1500	27%
Kitchen		100W	50	
Toilet		50W	few	
Changing Rooms		600W	24	
	Each 3 incandescent bulbs			

Stage Lighting		1kW	50-100	
Heating [Electric]	4 radiant bar heaters x 3kW each 300 hours in full	12kW	3600	57%
Hot Water	Kettle, 20 boils (3 mins) /week Zip Hydroboil Water heater, 1 hrs / week Speedflow water heater, 1 hrs / week	3kW 2kW 2kW	156 156 156	7%
Kitchen	Oven Indesit (1 hr/week) Ceramic hob (1 hr/week) Fridge Proline Microwave Proline Food warmer Heating trolley (Bartlett)	2kW 3kw 90W 1kW 1kW 1.5kW	104 156 200 26 10 78	9%
Other Small Power	Vacuum cleaner	1.5kW	78	-

Total Annual Consumption 2019: 6,300kWh



KEY 1 Heating 2 Lighting 3 Hot Water 4 Small Power

4.3 Energy Benchmarking

No benchmarking data is available for church halls.

The energy use per area is 20kW/m2 for heating and 15kW/m2 for lighting and other uses.

5. Energy Saving Recommendations (Electricity)

5.1 Lighting (fittings)

It is recommended that all of the fittings, scheduled in Appendix 1, are changed for LED.

If all the lights were changed, requiring around 50 small LED candle bulbs of 5W, plus kitchen and toilet lighting the total capital cost (supplied) would be around £200. The annual cost saving would be £132 resulting in a payback of around 2 years. All of the lights could be self-installed.

Changing to LED stage lighting would allow removal of the large and heavy lighting units, require significantly less power, with simplification of cabling.

6. Energy Saving Recommendation (Heating)

6.1 Heating System

The hall is currently uses electric radiant heaters. These are not 100% efficient at converting electricity to heat since they produce some light, but are efficient. Should they require replacement, radiant far infrared panels are recommended (these do not produce any visible radiation).

They are rectangular panels and come in three temperature ranges;

Low temperature for hospitals (42°C) and schools (55°C); these are designed for floor level installation close to people, Medium temperature, and high temperature (150°C) designed for high ceiling installation e.g. under warehouse roofs. Care must be exercised if these are to be installed from wooden beams as they can cause drying and embrittlement.

Basic models come in white, but some suppliers provide them in a range of colours which can include bespoke matching to stonework or brickwork colours, patterned finishes or displaying artwork, as supplied by the following company: https://www.suryaheating.co.uk/custom-image-heating-panels.html.

Suitable electric panel heaters would be far infrared panels such as https://www.warm4less.com/product/63/1200-watt-platinum-white- . These can be purchased widely and fitted by any competent electrician. It is recommended that they are fitted with a time delay switch such as https://www.danlers.co.uk/time-lag-switches/77-products/time-lag-switches/multi-selectable-time-lag-switch/159-tlsw-ms so they cannot be left on accidently after use.

7. Energy Saving Measures (Building Fabric)

7.1 Insulation

The building is understood to consist of a mediaeval timber frame, probably on a base of modern (1958) materials. The frame is probably infilled with materials of 1950's specification – there is a hole in the wall near stage left at one point.

It is worth considering future plans for refurbishment which could include replacement of the fill between the frames with insulating material (or perhaps adding an internal insulating skin from material such as Celotex or Kingspan. Also whether there is any opportunity for insulation under the floor.

Given the desire to retain the internal environment from the timber framing, people should be aware that the building should not cater for modern expectations of temperature in the winter!

7.2 Draught Proofing to Doors

Where external doors do not close tightly, it is recommended that draught proofing is fitted. 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.

Other simple measures such as using a small fridge magnet painted black over the large key hole or the use of 'sausage dog' type draught excluders at the base of little used doors can prove to be very effective. Doors should be reviewed in daylight and gaps where the light shines through sealed or filled in whatever the most appropriate way is for the specific door.

7.3 Windows

There is a large area of west facing window. With irregular use of the hall, it would not be cost effective to install double glazing however doing so is likely to improve the comfort levels within the hall considerablly. The windows should be maintained to be draught proof and reviewed to see if the glass panes could be swapped to doubled glazed units within the existing frames

If there are draughts caused by windows not shutting correctly, a joiner should ease the frames and replace any seals.

8. Saving Recommendations (Water)

8.1 Tap Flow Regulators

Consideration should be given to fitting tap flow regulators as taps can be inadvertently left running.

The flow rate of the taps can be easily regulated by fitting flow regulators within the taps. It is recommended that flow regulators such as those manufactured by neoperl (http://www.neoperl.net/en/) are fitted into all the viable hand wash basin taps to save on both water and heating of the hot water.

These regulators can be self-installed or 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	No – insufficient demand, visible roof
Battery Storage	No – no viable PV
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	No – no water based heating system
Air Source Heat Pump	No – no water based heating system
Biomass	No – not enough heating load as well as air quality issues

9.1 Solar PV potential

Given the historic nature and appearance of the barn and surrounding area, you would probably not wish to install solar photovoltaic panels!

The size of the west facing roof would allow about 80m^2 of panels to be installed (provided the building structure could support the additional weight and wind loading). As it is west facing this reduces the generation potential. 80m^2 will generate 12kW peak (south facing), overshading and orientation would reduce this to around 8kWpeak which would generate around 7,000kWh per annum. If most hall use takes place during evenings and weekends this weakens the financial case, unless a battery is added.

The government has advertised a "Smart Export Guarantee" to begin in 2020 which would pay for electricity generated and exported to the grid (the Feed in Tariff having ended). One of the issues for churches is that most lighting use is at periods when the electricity is not being generated, so any implementation of an SPV system must wait until the SEG terms are guaranteed to assist financial viability.

Average 2018 domestic installation costs are £1,750 per kWpeak installed, but as low as £1,200 per kWpeak for larger systems); a 12kWpeak system would cost £21,000. This does not include cost of any battery.

If the church and hall obtains its electricity through Parish Buying, it is guaranteed to receive 100% renewable electricity, from a solar or wind farm elsewhere, and thus make a contribution towards cutting CO_2 emissions.

10. 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

11. 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.

12. Report Circulation

In addition to the PCC, this report is also sent to:

1. Your DAC secretary and your DEO, because
    - They maybe be able to offer you help and support with implementing your audit
    - They want to look across all the audits in your diocese to learn what the most common recommendations are.
2. Catherine Ross, the officer in the Cathedral and Church Buildings team centrally who leads on the environment, who wants to learn from all the audits across the country. She will be identifying cost-effective actions churches like yours might be able to make.

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

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
HALL	42	42 x 5 to 7watt LED			
Changing rooms	3 x 2	LED bulbs of sufficient lumen output (10-15W)			
Kitchen		LED replacements			
Toilets		LED replacements			
TOTAL estimate	**Current 4kW**	**LED total <500W**	Load reduction 3.5kW by changing to LED, saving around 2200kWh or £242 annually	Est. £200 Self installed	1 year

There are a variety of LED floodlights on the market ranging from those around 10-25W retailing at £25 to powerful 12000 Lumen lamps (150W replacing 1200W non LED) at around £75, such as the V-Tac Slimline LED Floodlight 150w Daylight. There is no need to purchase outdoor IP65 rated moisture resistant models.

Note that LED lamps also offer savings from 3-4 times longer lifetimes in addition to lower operating costs.

Stage Lighting could be provided by the more powerful LED floodlights. There are also LED floodlights with diodes of different colours which allow a variety of colours to be projected.