



Energy Audit and Survey Report

St Bartholomew's Church, Ducklington



"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

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1. Executive Summary

An energy survey of St Bartholomew's Church, Ducklington 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 Bartholomew's Church, Ducklington is a Grade I listed parish church dating back to the 12th century with 14th century alterations. There is only electricity supplied to the site.

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.

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?
Change existing lighting for low energy lamps/fittings	833	£117	£1,563	13.33	List B	
Correct error on mixed up night and day readings and advise SSE of charitable status	N/A	£452.78	Nil	N/A	None	

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?
Fit draft proofing to historic doors	194	£27	£800	29.37	List B	
Upgrade (43nr) pew heaters on retained pews to central nave and choir stalls. Remove (10nr) overhead radiant heaters from nave and chancel.	2,215	£312	£7,000	22.46	List B	

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?
When pews removed from side aisle, relocate 4 overheads to wall south aisle and add Far IR wall panel heaters	N/A	N/A	N/A	N/A	Faculty	
Upgrade over door air heaters inside church and remove from porch to north door	N/A	N/A	N/A	N/A	List B	



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

Based on current market prices of 14.072/kWh for electricity.

If all measures were implemented this would save the church £438 per year.

2. Introduction

This report is provided to the PCC of St Bartholomew's Church, Ducklington 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.

St Bartholomew's Church, Ducklington is a Grade 1 listed parish church dating back to the 12th century with 14th century alterations.

An energy survey of the St Bartholomew's Church, Ducklington, Church Street, Ducklington, OX29 7UG was completed on the 2nd July 2019 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.

St Bartholomew's Church, Ducklington	
Gross Internal Floor Area	240 m ²
Listed Status	Grade I
Typical Congregation Size	50

The church typically used for 6 hours per week for the following activities

Services	3 hours per week
Meetings and Church Groups	2 hours per week
Community Use	1 hour per week

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



3. Energy Procurement Review

Energy bills for electricity have been supplied by St Bartholomew's Church, Ducklington and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	13.522p/kWh	In line with current market rates
Night Rate	11.514p/kWh	In line with current market rates
Standing Charge	£21.27p/quarter	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 and should continue with their current procurement practices. On renewal, we would therefore recommend that the church obtains a quotation for its 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.

Note: The readings submitted have mixed up the day and night reads and have provided the night consumption as the day consumption and vice versa. This should be corrected by contacting SSE (the current supplier) and explaining the situation. This would save the church £125/year by the correct rate being applied.

A review has also been carried out of the taxation and other levies which are being applied to the bills. These are:

VAT	20%	The PCC is 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.
FiT	100% charged	A FiT charge is being applied. It should be checked that this is being charged in accordance with the supply contract.



The above review has highlighted that VAT and CCL are being charged when the organisation is understood to be a charity and have VAT exemption status. As such the PCC of St Bartholomew's Church, Ducklington should send the supplier a VAT declaration confirming this and check all supplies on other sites. The VAT declaration form is available from <https://www.ssebusinessenergy.co.uk/wp-content/uploads/2017/03/fo-es-be-820-vat-declaration-form.pdf>



4. Energy Usage Details

St Bartholomew's Church, Ducklington uses 12,929 kWh/year of electricity, costing in the region of £1,680 per year.

This data has been taken from the annual energy invoices provided by the suppliers of the site. St Bartholomew's Church, Ducklington has one main electricity meter, serial number P96C35041.

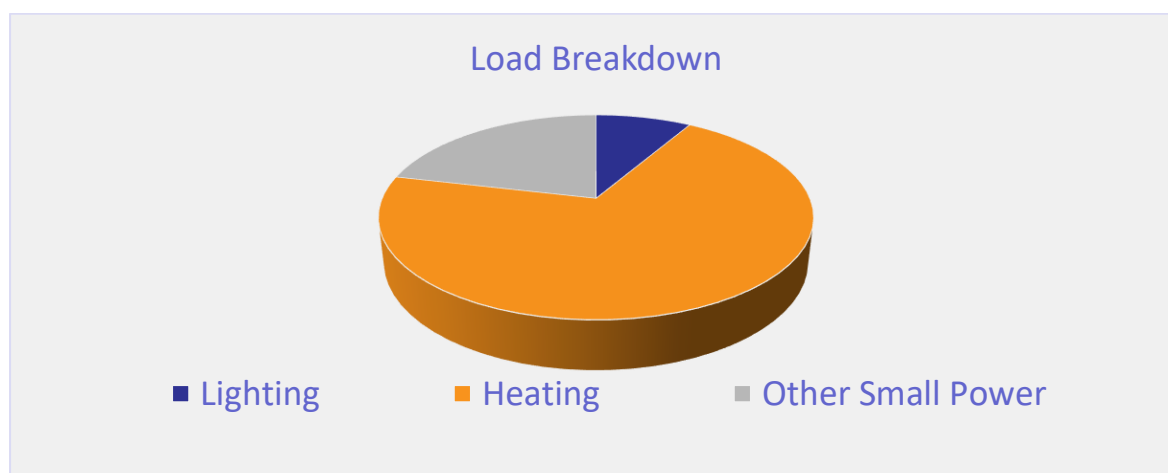
Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church	P96C35041	3 phase 100A	None	GF elec switch room

It is recommended that the church consider asking their suppliers to install a smart meter so that the usage can be monitored more closely and the patterns of usage reviewed against the times the building is used.

4.1 Energy Profiling

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

Service	Description	Estimated Proportion of Usage
Lighting	SON Flood lights to nave. Halogen spotlights and some LED elsewhere	8%
Heating	78 pew panel heaters @ average 150W, 20 overhead radiant heaters @ 2kW. Two over door heaters @ 2kW	70%
Other Small Power	Organ, kitchen appliances, sound equipment and the like	21%



As can be seen from this data, the heating makes up by far the largest proportion of the energy usage on site.



4.2 Energy Benchmarking

In comparison to national benchmarks for Church energy use St Bartholomew's Church, Ducklington uses 66% less energy than would be expected for a church of this size. This is largely due to the church being lightly used during the week and heated by an electrical heating system.

	Size (m ² GIA)	St Bartholomew's Church, Ducklington use kWh/m ²	Typical Church use kWh/m ²	Efficient Church Use kWh/m ²	Variance from Typical
St Bartholomew's Church, Ducklington (elec)	240	57.49	20	10	187%
St Bartholomew's Church, Ducklington (heating fuel)	240	0.00	150	80	N/A
TOTAL	240	57.49	170	90	-66%



5. Energy Saving Recommendations

5.1 Lighting (fittings)



The lighting within the church is mainly from either large SON flood lights or halogen spotlights. There are a few LED lights that have been installed into the nave.

It is recommended that all of the fittings, scheduled in Appendix 1, are changed for LED units. The nave floods can be replaced for LED flood lights but it is important that these are specified well and we would recommend using a flood light which has a colour of around 3500K and an antiglare (micro prismatic) diffuser on the front. If the church wished to consider a new lighting scheme then there are lots of other options available.

The spotlights to the WC, Vestry and Altars can all be changed to LED bulbs in the same fittings.

If all the lights were changed the total capital cost (supplied and fitted) would be £1,563. The annual cost saving would be £117 resulting in a payback of around 13.33 years.

The GU10 spotlights could be self-installed and therefore cost much less than the supply and fit cost above. In this case the £150 grant available through this process could be very usefully employed to fund the purchase of replacement LED lamps which the church installs themselves.



5.2 Under Pew Heaters

Given the church's usage profile we would suggest that the direct electrical heating strategy for the church provides an efficient use of energy. The current pew heaters are of such a low output and of an age where they are not likely to be effective at providing comfort. The high level infra-red heaters are mounted too high to be effective in warming the congregation and emit an unpleasant red glow.

As with most medieval churches, this church would have survived most of its life without any form of heating; the modern addition of heating is not needed to preserve the fabric but only to provide thermal comfort to occupants. The previous trend of 'conservation heating' for fabric issues is now largely considered to be unnecessary and is being avoided by the likes of National Trust and English Heritage.

We would recommend that the existing heaters are replaced for under-pew panel heaters which have a much greater heat output than the existing panels. This can be undertaken in the central area and choir stalls where the pews are to be retained after the reordering. The overhead units can then be removed to the main nave and chancel and a net saving will be achieved. For replacement, two most popular under-pew heaters within churches are BN Thermic PH30 heaters (<http://www.bnthermic.co.uk/products/convection-heaters/ph/>) or similar from <http://www.electrichheatingsolutions.co.uk/Content/PewHeating>. Cable runs to the pew heaters could run along the North and South walls (all cabling should be in armoured cable or FP200 Gold when above ground) to the both rows of pews quite easily.

The under-pew (see photo below) and panel heaters have been recently installed at St Andrews Church, Chedworth, Gloucestershire, GL54 4AJ. The church is open in daylight hours so can be viewed at any time.



5.3 Use of Electric Panels for Heating Side Aisle

The heating in the side aisle is currently served by the existing poor pew heaters and there are proposals for the pews in this area to be removed which would mean that the proposed under pew heating recommended above would not be possible. It is therefore recommended that the PCC consider installing electrical panel heaters on the perimeter walls in this area on a time delay switch and removing the overhead units as part of the reordering works. Four of the existing overhead wall heaters could also be relocated into this area to provide some top up heating if required.

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 accidentally after use.

5.4 Overdoor Air Heater



In order to achieve the sense of a 'warm welcome' into the church an over door air heater could be provided. This would also help to provide warmth to the rear of the church up to and include the font. Such an over door unit should be sized to cover the whole width of the door and it is suggested the BN Thermic 860 model would be quite suitable.

There is currently existing overdoor heaters to both doors and to the north porch but these are too small and narrow to be effective. By upgrading the two overdoor heaters inside the church the existing unit located in the north porch can be removed as this provide no useful heat inside the church at all.

The overdoor heater will have some fan noise associated with it especially when running at high speed. For quieter services the use of it can be limited to being on for 30mins of so prior to a service and as the congregation arrived and then switched off or to a low speed during the welcome/first hymn. It can then be switched on at the end of a service if required.



5.5 Draught Proofing External Doors

There are a number of external doors in the building. These have the original historic timber doors on them, but these do not close tightly against the stone surround and hence a large amount of cold air is coming into the church around the side and base of these doors.

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



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	No – all roofs are visible at some point
Battery Storage	No – No renewable energy to store
Wind	No – No suitable site
Micro-Hydro	No – Water course
Solar Thermal	No - No significant hot water need
Ground Source Heat Pump	No – Does not match heating needs of church
Air Source Heat Pump	No– Does not match heating needs and fabric of church
Biomass	No – issues with deliveries, storage and existing heating system



There are not considered to be any viable renewable energy possibilities at this church. While the potential for a small PV array on the south facing slope of the main nave roof (which is largely hidden from view by the roof of the south aisle) has been considered it was found that the roof covering are not ideal for this, the slope has some minor visibility from a specific spot in the church year and the usage profile of the electricity in the church does not well match the generation profile of any PV array. While the potential for a PV array in this location may become more viable in the future at this point it is not considered to be a worthy recommendation.



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>.

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 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.



Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
WC	2	GU10 LED	£4.48	£23.60	5.27
Vestry	5	GU10 LED	£11.20	£59.00	5.27
Nave	13	50W LED Flood	£70.77	£1,186.90	16.77
Nave	6	NO CHANGE			
Altars	9	GU10 LED	£20.15	£106.20	5.27
Porch and external	4	LED GLS	£10.64	£42.00	3.95

