Energy Opportunity Survey for St Andrew's Church, Cheddar

Green Journey

Energy Opportunity Survey

Green Journey

Introduction

Green Journey has been authorised by the Diocese to carry out energy surveys and provide churches with the opportunity to join the Green Journey energy scheme. The aim is to reduce the carbon footprint and where possible energy costs of all churches within the Diocese and across the wider Church of England.

Green Journey's buying power allows us to offer renewable energy at a similar, or lower, price to standard energy. This allows all churches opting into Green Journey to practise responsible stewardship, whilst also making a saving. Green Journey can help you in your stewardship by reducing your electricity and gas bills, whilst also providing a report detailing your church's energy consumption and sustainability, advising on how both can be improved.

"To date, Green Journey has saved Churches in England over £420,000 in energy bills and VAT reclaims."

Reducing our energy consumption and cutting carbon dioxide emissions is of paramount importance for all, as together we must face the effects of climate change. The Church of England is a leading advocate of sustainability awareness and action, with all levels of the Anglican church committing to be carbon neutral by 2030.

Consumption figures presented in this report are calculated from billing figures and information collected during the energy survey. An estimation of your electricity consumption breakdown is also included, for example lighting could be projected to comprise 60%, kitchen appliances 30% etc. Due care has been given to ensure that these are as close to the observable figure as possible, however these should be considered as calculated approximations only.

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Site Summary

Site Address	
Church Name	St Andrew's Church
City/Town	Cheddar
Postcode	BS27 3RF

Site Contact	
Contact	Paul Tullett
Email	paultullett@aol.com

Audit Information	
Auditor	Glen Clement

Report Information	
Report Author	Glen Clement

Non-Costed Recommendations

Recommendation	Benefit
LED Lighting	Reduced lighting based consumption
Heating Appraisal	Reduced heating based consumption (main church)
Secondary Glazing	Reduced heat loss and therefore gas consumption
Green Procurement	Reduced energy consumption from purchased products i.e. white goods , IT equipment etc.
Energy Saving Strategy	Provides a formalised approach to energy management
Net Zero Strategy	Provides a formalised approach to achieving Net Zero

In addition to the above, there is also a renewables appraisal located on pages 6 to 8.

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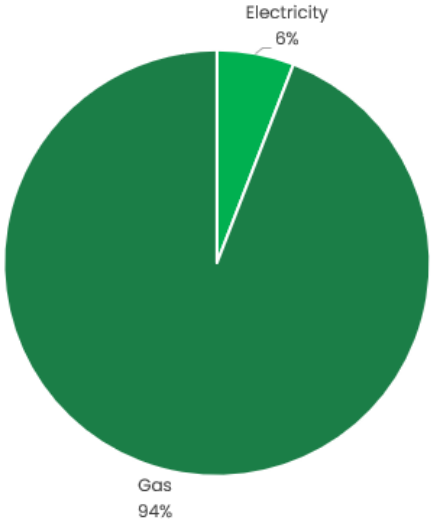
Energy Overview

Energy Breakdown

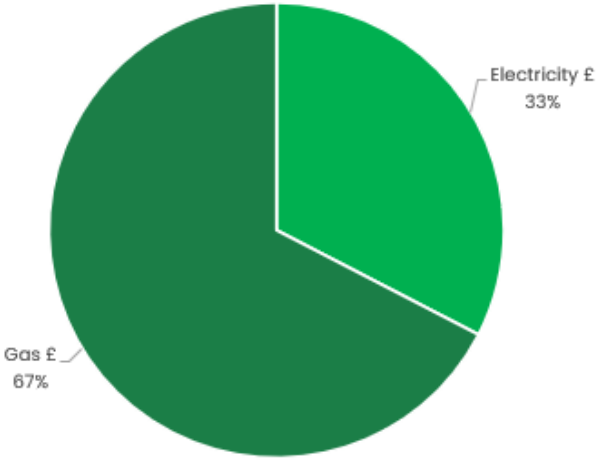
Electricity	
Electricity Usage (kWh)	1,682
Cost per Annum (£)	£630.49
Meter Quantity	1

Gas	
Gas Usage (kWh)	27,058
Cost per Annum (£)	£1,304.00
Meter Quantity	1

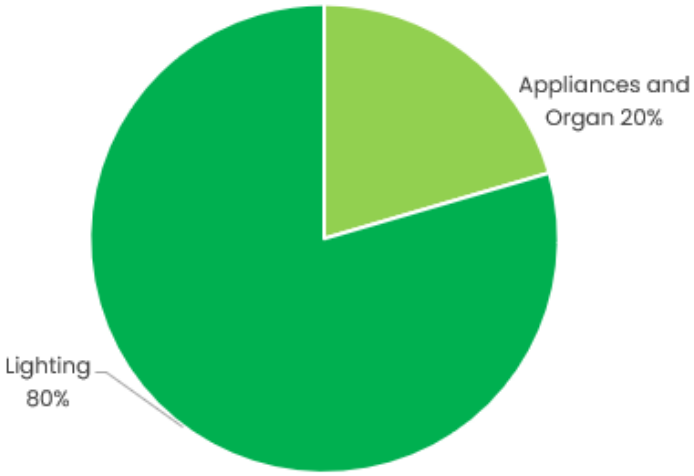
Total Energy Breakdown



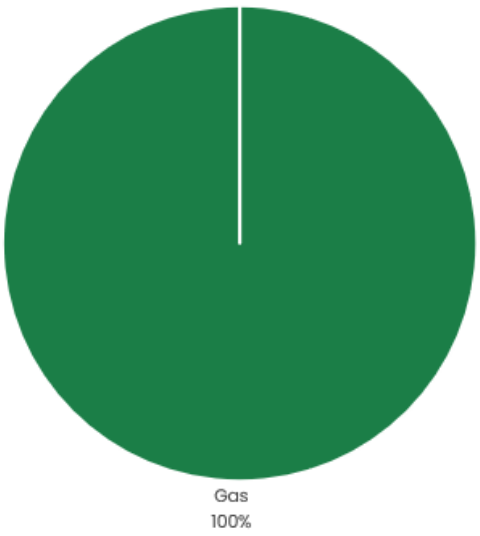
Cost Breakdown



Electricity Breakdown



Gas Breakdown



N.B. Breakdowns are based on observations made at the site and discussions with the church representative during the site visit.

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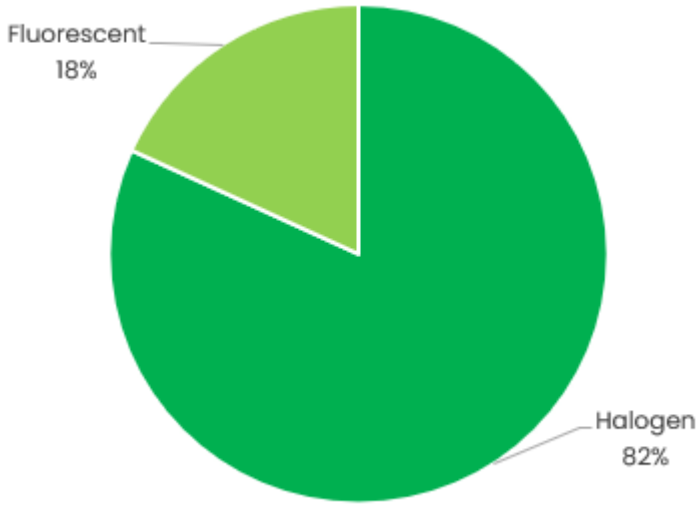
Description of Energy Consumers

Space Heating and DHW

Heat Source	Area Served (Heating)	Area Served (DHW)	Controls	Heat Delivery
Potterton Performer NXR 3	Main Church	NA	Timer, Thermostat	Cast Iron Radiators + Piping

Lighting

In total, lighting contributes 80% of the site's total electricity consumption. Lighting fixtures consist of halogen and fluorescent fittings.



Electrical Appliances and Organ

Organ and electrical appliances account for approximately 20% of electricity consumption and include but are not limited to:

Sound System	Organ

Air Source Heat Pump (Air to Water) V's Current Gas Heating

An Air Source Heat Pump (ASHP) works by transferring heat absorbed from the outside air to an indoor space, via wet central heating systems.

In order to operate optimally, either underfloor heating or low temperature radiators are needed to deliver and emit heat effectively. This will therefore mean an upgrade to the current infrastructure, as high temperature radiators and piped heating is present.

As observed below, air source heating can provide a reduction in consumption of 16,232 kWh, 18,036 kWh, 19,324 kWh and 20,291 kWh at SPF's (Seasonal Performance Factor) of 2.5, 3, 3.5 and 4 respectively, compared to the current method of gas heating.

Annual running costs are higher at all SPF's assessed.

Heating System Solution	SPF	Energy Saving (kWh)	Annual Running Costs (£)	Difference in Annual Running Costs (£) VS Current System +/- (£)
Air to Water Heat Pump	2.5	16,232	£4,020.65	+£2,716.64
	3	18,036	£3,350.54	£2,046.54
	3.5	19,324	£2,871.89	+£1,567.89
	4	20,291	£2,512.90	+£1,208.90

Conclusions

Incorporating air source heating would require changes to the heat distribution network.

Energy savings can be made, however annual running costs are higher at all SPF's assessed.

It should be noted that an ASHP may not meet the heat demand of the site, in this instance a hybrid system would be needed i.e. ASHP supplemented by direct electric heating.

It is advised that a heating engineer is consulted to provide an exacting system design, predicted energy savings and ROI's.

Ground Source Heat Pump

A ground source heat pump (GSHP) harvests solar heat absorbed by the ground. At present, there are two types of collectors; pipe loop horizontal or vertical.

In terms of available area, there isn't adequate space to consider a horizontal system, so this can be discounted, a vertical system would therefore be the only potential option.

In terms of installation, vertical systems require surface boring, something that can be difficult in urban settings. Another consideration is the geological make up of the area, as this can impact the process.

From a heat delivery perspective a GSHP works optimally when underfloor heating is implemented. This will add to the capital cost of the project, as a proportion of heat delivery is provided by high temperature radiators.

In addition to the above, a designated plant room is needed to store the associated heat exchanger, compressor and water cylinder, which again adds to the project CAPEX.

Speaking from an energy efficiency perspective, a significant energy reduction can be seen, however, this is likely to be outweighed by the infrastructural considerations highlighted above.

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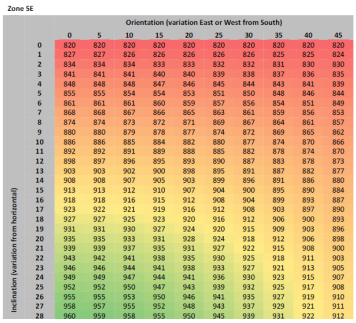
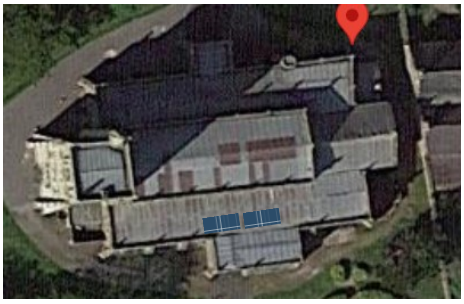
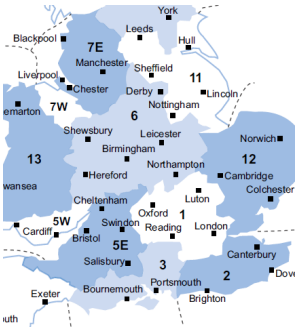
Renewables Appraisal

Renewables Appraisal - Solar PV

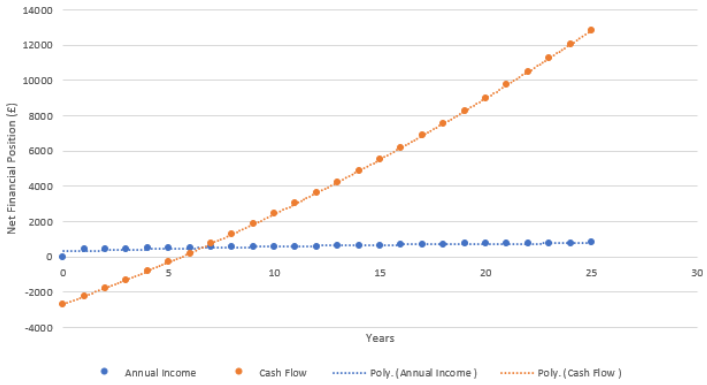
The below provides potential energy and fiscal savings associated with the installation of Solar PV at site.







Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Cash Flow	-£2,681.25	-£2,224.23	-£1,767.20	-£1,310.18	-£808.48	-£306.78	£194.92	£741.29	£1,287.66	£1,834.03	£2,425.08	£3,016.12	£3,607.17
Year	13	14	15	16	17	18	19	20	21	22	23	24	25
Cash Flow	£4,242.89	£4,878.61	£5,514.33	£6,194.72	£6,875.11	£7,555.50	£8,280.57	£9,005.64	£9,730.70	£10,500.45	£11,270.19	£12,039.93	£12,854.34



Location	Project Cost (£)	Number of Panels	Annual Generation (kWh)	1st Year Total Savings (£)	Payback (Years)	Net Income (25 Years)
South Roof	£2,681.25	6	1,496	£457	5.6	£12,854.34

The above is based on an assumed 10% increase in electricity unit rates per 3 year period (year 0–3715p/kWh). The above provides an estimate of potential generation capabilities and associated financials. A full quotation is required to gain exacting figures and may differ from the figures provided.

The estimated cost of Solar PV is £2,681.25 with an associated payback period of 5.6 years, and a full life net income of £12,854.34. There is adequate room for a larger PV array, however the sites energy use does not warrant this. There may be planning considerations given the ecclesiastical status of the building.

ECM 1 - Heating Appraisal

Church heating is provided by 1 x Potterton Commercial NXR 3 boiler. The current boiler requires a new flu, which will be discussed at faculty.

The below provides a comparative analysis of three potential options for future heating at the church.

- High Efficiency Boiler
- ASHP (Air Source Heat Pump)
- Radiant Heating

Heat Source	Description of Heat Source	Annual Consumption (kWh)	Annual Costs (£)	Assumptions	Other Consideration
Current Boiler	80% Seasonal efficiency	27,054	£1,304.00	Assumed reduction in efficiency to 80% due to age of boiler (Circa 2002)	NA
New High Efficiency Boiler	1 x Gas boiler (93% seasonal efficiency)	23,563	£1,134.48	NA	A new flu will be required
Radiant Heaters	6 x 3 kW radiant heaters located above pews	4,842	£1,799.00	This assumes 6 x radiant heaters, operating for 269 hours per year. Operating hours are reduced (compared to the current system) as heating lead times are lowered. (Please note this is an estimate of operating hours, and actual figures may vary)	NA
ASHP (Air Source Heat Pump)	ASHP with low temperature radiators	7,730	£2,871.89	SPF of 3.5 assumed	Changes to heat delivery network (see page 6)

At the current unit rates (gas 4.82 p/kwh, electricity 37.15 p/kwh), a high efficiency gas boiler is likely the most cost effective method of heating the church. When assessing all three options, energy reductions can been seen from an ASHP and direct radiant heating. However, due to the differential in unit rates (gas to electricity), annual running costs are still higher.

The above may change however, as gas prices are likely to rise in the next procurement cycle.

Please note, the above radiant heater analysis is based on 6 heaters in total. This is only an estimated quantity, and a lesser or greater number may be required. Please consult a heating engineer who can provide exacting system specifications.

ECM 2 - LED Lighting

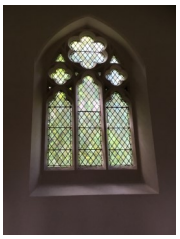
To reduce consumption, existing light fixtures can be replaced with light emitting diode (LED) equivalents. This could manifest as a proactive LED retrofit scheme or as a reactive scheme whereby current fixtures are only replaced at the end of their working life.

Current Type	LED Replacement	Quantity	Annual Energy Saving (kWh)	Annual Saving (£)	CAPEX (£)	Payback Period (Years)
Halogen Flood (300W)	100W Premium UFO High Bay	12	672	£249.67	£1,123.06	4.5
Total			672	£249.67	£1,123.06	4.5

Please note that the above costings are indicative only and are for the supply of LED lights. All costs are exclusive of VAT.

ECM 3 - Secondary Glazing

Secondary glazing could be implemented (see below example) to reduce heat loss via improved insulation. The retrofit should be sympathetic to the aesthetics of the building, as this is important in an ecclesiastical setting.



ECM 4 - Green Procurement

When referring to future purchasing decisions it is suggested that equipment which has a high energy efficiency rating is purchased. Ratings typically go from "A" to "G" however some appliances, such as fridges and freezers, go up to A+++.

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Energy Conservation Measures

ECM 5 - Staff Training & Energy Saving Strategy

The below outlines a potential energy saving strategy which is designed to implement the principles of energy management into the church's operations.

Stage of Methodology	Overview
Creating Baselines and KPI's	This will allow for current performance to be quantified and provide quantifiable and verifiable figures to compare improvements against.
Research	Gain an understand of current energy related practices.
Energy Action Plan	Produce strategy to improve energy performance.
Implementation	Implement changes outlined in action plan.
Responsibility	Assign Green Champion and Green Team.
Staff Training and Energy Awareness	Conduct staff training to inform staff of new strategy.
Review	Review of key performance indicators to quantify effectiveness of action plan.

Please see overleaf for a more detailed description of the above.

ECM 5 - Staff Training & Energy Saving Strategy Continued

Stage of Methodology	Components
Creating Baselines and KPI's	This will allow for current performance to be quantified and provide quantifiable and verifiable figures to compare improvements against. Realistic KPI's can also be produced i.e. reduce total annual electricity consumption by 5% against 2019 baseline.
Research	Conduct initial meeting with senior management to discuss current energy related areas i.e., heating of uncopied areas, excessive radiator settings, staff attitudes and education levels relating to energy management.
Energy Action-Plan	This should include specific projects and method to achieve, for example: **Project** - Regulate radiator outputs **Methodology** - Train Staff to set rads to an efficient level Action plans should relate to KPI's outlined above.
Implementation	Implement changes outlined in action plan i.e. modify BMS, install LED lighting.
Responsibility	To ensure action plans are implemented a Green Champion can be appointed as the person with overall responsibility for this. It is also advised that a 'Green Team' is also created. Green Team members can monitor if action plans are being carried out i.e. ensure unoccupied areas are not being lit, efficient radiator settings are being implemented etc. This method provides accountability and therefore increases the potential for action plans to succeed.
Staff Training and Energy Awareness	To aid the above staff training can be carried out to inform all staff members of the sites energy strategy. This can be done in a presentation format outlining the fundamentals of the scheme, describing green initiatives and introducing the Green Champion and team. Progress presentations/meetings can also be implemented to update staff on achievements or areas for improvement. Lastly, Green strategies can be communicated in future staff inductions to provide an understanding of the scheme from the outset.
Review	Conduct regular review meeting to:- track performance against KPI's, quantify effectiveness of action plans , highlight successes, identify areas for improvements and modify the strategy where necessary.

ECM 6 - Net Zero Strategy

If no plan is already in place, it is advised that a 'Net Zero' strategy is developed in order to aid your transition to net zero carbon emissions by 2030. This will allow the development of targets and specific action plans around different areas of focus.

As part of the net zero strategy it is recommended that a 'Green Champion' is appointed. The 'Green Champion' can monitor progress towards achieving net zero emissions and also take responsibility for implementing action plans i.e. ensuring unoccupied areas are not being lit etc.

Further ways in which you can work towards achieving your net zero goal can be found within the following Diocesan and Church of England webpages;

- Bath and Wells Diocese Environmental Pages - https://www.bathandwells.org.uk/faith/environment/sustainable-buildings
- Church of England's 'Practical Path to Net Zero' - https://www.churchofengland.org/resources/churchcare/net-zero-carbon-church/practical-path-net-zero-carbon-churches

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Green Journey Contacts

For more information on the areas discussed with this report or for assistance in the procurement and installation of any of the energy saving opportunities, please contact us via the following channels:

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