



# Energy Opportunity Survey

St Barnabas, Alwoodly, LS17 7NA

**Green Journey**

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THE CHURCH  
OF ENGLAND

Diocese of Leeds

# Energy Opportunity Survey

Green Journey has been appointed by the Diocese of Leeds to carry out energy surveys and provide churches with the opportunity to join the Green Journey energy basket. The aim is to reduce the carbon footprint and energy costs of all churches within the Diocese of Leeds 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, while 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 the Church of England over £370,000 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, promoting a more environmentally conscious stewardship at local, regional and national levels.

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.



# Energy Opportunity Survey

## Site Summary



## Site Overview

Site Address		Site Contact	
Church Name	St Barnabas	Contact	
Town	Alwoodly	Telephone	
Postcode	LS17 7NA	Email	

Audit Information		Site Information	
Auditor	Mark Rudhall	Annual Operating Hours	180
Audit Date	03/04/2019	Square Meters	340
Audit Time	10:30am		

Report Information	
Report Author	James Carson
Date	08/04/2019

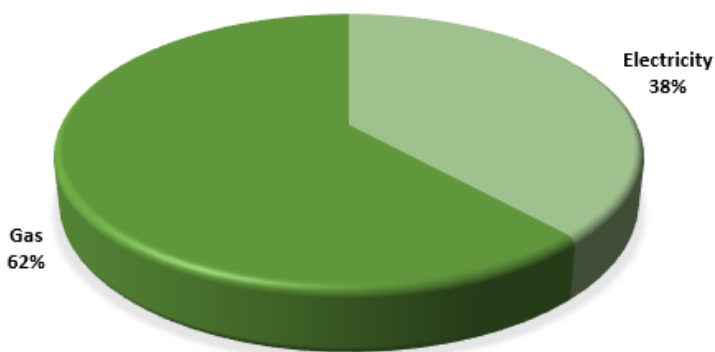
# Energy Opportunity Survey

## Energy Overview

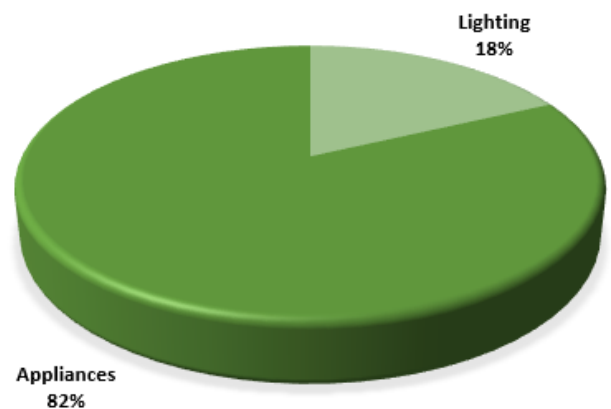
### Energy Breakdown

Electricity		Gas	
Period Covered	May 2018–April 2019	Period Covered	May 2018–April 2019
Electricity Usage (kWh)	1,602	Gas Usage (kWh)	2,590
Cost per Annum (£)	266.71	Cost per Annum (£)	103.20
Meter Quantity	1	Meter Quantity	1

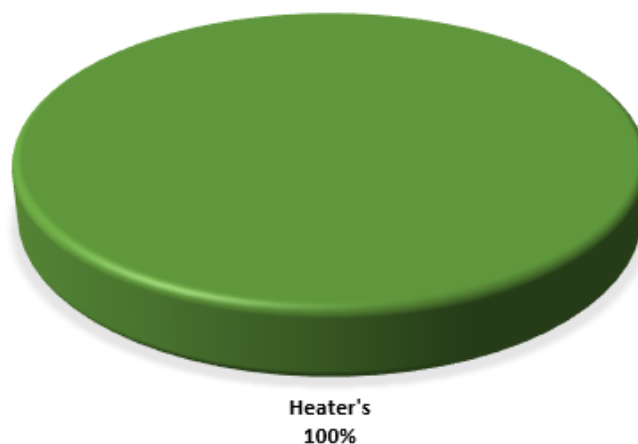
### Total Energy Breakdown



### 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.

# Energy Opportunity Survey

## Sustainability Overview

The following paragraphs contain information on the energy efficiency and sustainability of your church. This draws on observations made on, but is not limited to, building structure, lighting and space heating (such as boilers, electric heating). All recommendations provided within the report are intended to help your church streamline its energy consumption, reducing costs and ensuring the sustainability of your church is as near to what is deemed to be practically feasible. For example, churches that replace inefficient lighting with LED fixtures have observed on average, an 80% saving in lighting costs.

If you would like further advice on any of the recommendations made here, please get in touch and we will be happy to assist. We advise that you also speak with either the DAC Secretary or your Archdeacon to ascertain if a Faculty decision will be required, and if so to find out how your

## Main Heating

It is often challenging to find the correct temperature to heat your church. The following guidelines are provided based on our experience and if followed can help preserve the long-term structural integrity of your church.

Occupancy	Temperature (°C)	Comments
During a church Service	18-21°C	Most suitable temperature for the congregation during a service
Open Door (if the church remains open to the public throughout the day)	12°C	Comfort Temperature
Vacant/Overnight	8°C	Minimum temperature for reducing surface and interstitial condensation of the church building

However, it is acknowledged that financial restraints may not allow for a minimum background temperature of 8°C to be followed at all times.

# Energy Opportunity Survey

## Balance and Temperature

### Balancing Energy Consumption, Comfort and Conservation

Balancing the conflicting requirements of occupant comfort, protection of historic fabric and energy consumption can be challenging. Historic buildings are sensitive to changes in environmental conditions. This is particularly true in those that contain organic materials in their construction or contents such as furniture, pictures, timber panelling and leather components such as those found in church organs.

The most important environmental parameter in a historic building is relative humidity (RH), which should ideally be in the 40-65 per cent range. When RH is too low, cracks can form in organic materials and furniture joints tend to become loose. When RH is too high there is an increased risk of mould growth, dry rot and insect infestation.

Understanding the prevailing conditions in a building is key to providing effective control. Factors such as moisture entering the building due to poor maintenance of rainwater disposal will affect the internal environment.

### Temperature, Humidity and Comfort

If a volume of air is cooled, its relative humidity will rise up to the point of 100 per cent RH, which is known as its dew point, and further cooling will cause the water vapour to condense out. This is demonstrated when warm air touches a cold single glazed window in the winter months and condensation forms on the surface of the glass.

The external environment changes during the seasons, being generally cold in winter with lower RH and warm in summer with higher RH. When buildings are heated in winter to make them more comfortable for the occupants, the general RH in the space is reduced below the ideal humidity range for conservation and this presents an increased risk to organic contents and fabric.

One approach that is often used in historic buildings is 'conservation heating'. It has been found that heating the internal space of a building to a few degrees above the external ambient air temperature generally maintains the internal relative humidity within the ideal range.

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## Types of Heating

### Central Heating

Central heating is designed to provide even heat distribution within the whole building, at the same time supplying heat to the building envelope. It is used to reach the desired comfort level, or to provide background heating to the building in order to prevent very low temperatures and frost. The most common use is for large building volumes, and the most popular systems are radiators, warm-air heating, natural or forced-air convectors, electric or fuel stoves and underfloor heating.

Central heating requires a huge amount of energy, a part of which is wasted through thermal bridges, leakage and storage in the building envelope. Typically historic churches are not energy-efficient buildings and their scope for improvement can be limited. Being based on the dispersion of heat, central heating is not very effective in this type of building, where there are so many potential sources of heat loss.

### Local Heating

Local heating is designed to produce the best radiant temperature only in the occupied parts of the building, with some local increase in air temperature and a minimum of draughts. The rest of the church volume remains almost unaffected and preserves its historical climate, or departs from it only slightly. Local heating is most commonly used for small congregations and building volumes, for example small churches or specific parts of them which are in use. The most popular systems are radiant heating from infrared (IR) emitters located overhead, on side walls or at floor level; and pew heating using electric panels, tubular heaters, water pipes or radiators, or heated carpets.

This type of heating system disperses a small amount of heat in targeted areas, while the building envelope and historic furnishings or artworks are exposed to little or no change in temperature. Outside the moderately heated occupied area, the RH remains almost unaffected.

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## Types of Heating Continued

As we have seen, church heating usually comes in two forms. The most common type of system (**Central Heating**) uses cast iron radiators or large pipes, often located against the external walls but less frequently against internal partitions. Pipes (either elderly cast iron or modern 'finned' pipes which release heat more efficiently) are also commonly found beneath cast iron grilles which run down the aisles. These are usually fed by gas/oil boilers in a semi-underground chamber. Occasionally this is supplemented by the other widely used system (**Local Heating**), electric radiant heating coils fixed beneath the pews or on the walls. These are often used as a primary heat source in smaller churches.

Old churches are seldom insulated and often have large expanses of single glazing. Some heat radiates from the appliances but reaches only a small proportion of the floor area, while the rest circulates through convection currents, and most of the benefit is lost as it cools in the upper voids of the building. Much of the perceived warmth tends to come from the body heat of the people in the congregation, who are usually dressed in outdoor clothing.

Underfloor heating is usually considered in churches where there is an uninterrupted expanse of flooring and a desire to reduce energy consumption. With a low surface temperature of around 29°C, the primary advantage of an underfloor heating system in a church is that heat is provided evenly across a broad area, enabling an ambient temperature of around 18°C to be maintained up to two metres above the floor and emanating from directly beneath the congregation. This means that the visitors readily perceive warmth on entering the building and can shed their coats.

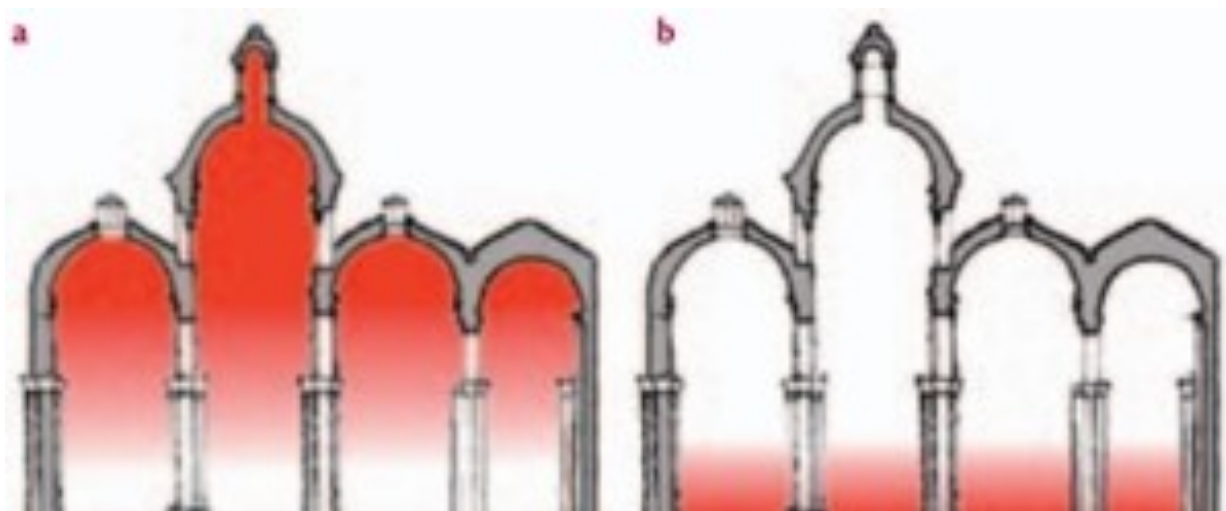


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## Types of Heating Continued

Considerable fuel savings can be achieved by installing a dual-fuel system where a ground source heat pump (GSHP) can run the underfloor heating, and gas, where available, can heat the radiators. GSHP is a viable source of energy even at sites with sensitive archaeology as it is now possible to extract heat from ground below the archaeological threshold by using radial boreholes, avoiding long trenches for pipes in the churchyard.

Underfloor heating can also work with solar thermal energy as a source, provided there is space for a large thermal store of warm water, but there are almost always difficulties (ethical and aesthetic rather than practical) associated with installing solar panels on the roof of a historic church. Insulation can also be installed under the floor at the same time as underfloor heating and, in a historic building, this may be the only place where it can be introduced.



The two heating strategies: (a) central heating aims to provide even heat distribution throughout the building while also supplying heat to the building envelope. Most of the heat is accumulated in the upper part of the building (b) local heating aims to produce the best radiant temperature within the occupied area of the church only, with some local increase in air temperature and minimum draughts. The rest of the building remains almost unaffected and preserves or remains close to its historical climate.

# Energy Opportunity Survey

## Heating Controls

The overall efficiency of a heating system is based on three factors: the efficiency of the boiler, the type of fuel used and the responsiveness of the controls. It is often the latter of these that gets overlooked. Appropriate controls will ensure that a heating system is only in use when actually needed; saving money, reducing carbon emissions and maintaining the correct comfort level.

There are many varieties of controls, but they all control the timing of the heating system and/or the demand temperature required. Traditionally, a heating system would be fitted with a programmer (a clock device with "on" and "off" periods) and a room thermostat (that monitors the air temperature in the church). There are now many automated devices that can offer these from a remote location, called "smart controls" such as Nest, Hive and Evohome.

In addition to the above, modern controls include thermostatic radiator valves (TRVs), programmable TRVs, zone control, boiler energy managers, weather compensators and load compensators.

In real terms, the three most cost effective controls in building's and church halls, depending on the heat demand and budget available are:- boiler energy managers, programmable room thermostats and TRVs.

However, a note of caution. The pipework of old heating systems may not be configured to take modern controls. We would be happy to carry out a detailed survey and advise further, but would also recommend consultation with your Diocesan Heating Advisor.

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## Energy Supply and Metering

Switching to a green supply would allow St Barnabas to significantly reduce its carbon footprint and enhance its sustainable image.

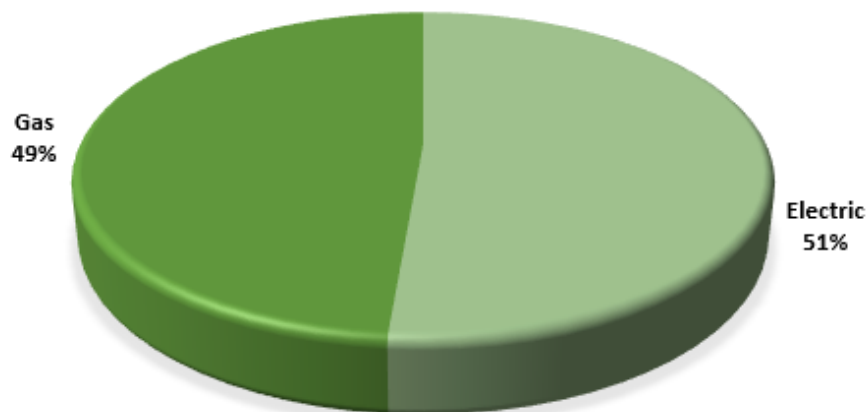
### Green Electricity & Carbon Neutral Gas

Currently St Barnabas purchase electricity from Utility Warehouse (1,602 kWh/annum) and gas from Utility Warehouse (2,590 kWh/annum).

Electricity Utility Warehouse g of CO <sub>2</sub> per kWh	Gas Utility Warehouse g of CO <sub>2</sub> per kWh
0.359	0.210

St Barnabas electricity supply accounts for 0.57 tonnes of CO<sub>2</sub> per annum, thus it is recommended that the church switches to a 100% green electricity supply.

St Barnabas gas supply accounts for 0.54 tonnes of CO<sub>2</sub> per annum, thus it is recommended that the church switches to a 100% carbon neutral gas supply.



### Automatic Meter Reading (AMR)

AMR-metering provides accurate, remotely read data on energy consumption. This allows for analysis of real time half- hourly data for both gas and electric, identifying areas for significant energy savings, such as out of hours consumption.

In addition, AMR metering enables a water consumption profile analysis to be undertaken, allowing for any leaks to be identified.

# Energy Opportunity Survey

## Main Heating (Gas)

The church has 7 heaters which account for 100% of the total gas consumption. Gas heating is in use during church services and events throughout winter.

We would advise that timer switches be installed on the heaters in order to reduce energy consumption by ensuring the heater is only operated when required.

We would advise that the scheduled usage of the heaters be examined to identify any potential reductions in gas consumption. For example, if the church has two events on per week and is otherwise unoccupied, it would be prudent to ensure that the gas heater usage accurately reflects this. By closely coordinating the church's schedule with gas heater usage it may be possible to optimise your heating system and subsequently reduce your consumption.

Please note, that if you wish to make any changes to your current heating system you should first consult your Diocese Heating Advisor.



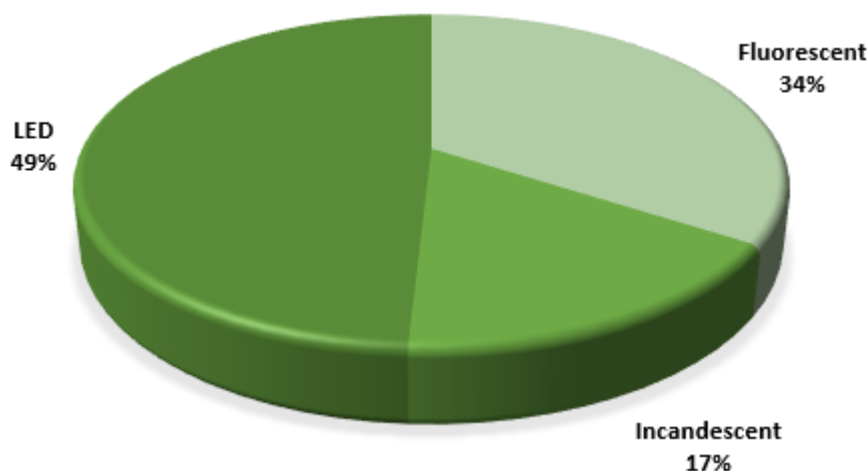
# Energy Opportunity Survey

## Lighting

In total, lighting contributes 18% of the site's total electricity consumption. Lighting fixtures within the church are predominantly LED lights.

We would advise replacing the existing light fixtures 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.

It is suggested that the Fluorescent bulbs be prioritised for replacement. Although fluorescent lighting is efficient compared to halogen/incandescent lighting, further efficiencies can be yielded by replacing it with an LED equivalent. As an illustration, 16W fluorescent bulb can typically be replaced by 4W LED equivalents. Thus, the same quality of light can be produced by an LED equivalent with a 75% reduction in energy consumption being observed.



## LED Lighting Savings

If you would be interested in receiving a bespoke quotation (incl. delivery & installation) for new LED lighting at the church, please call Green Journey on either of the below numbers;

0191 300 6161 or 0333 006 7177

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## Renewables Recommendation

### Solar Photovoltaic Electricity (Solar PV)

Due to the location and construction of the roof, there is scope for St Barnabas to consider the installation of solar PV panels. This would allow the generation of renewable power on site and provide a certain degree of independence from the national electricity grid. Should you wish to consider solar PV, we would arrange for a solar PV specialist to inspect the Nave roof and provide a quotation for the cost of installation and the likely payback; we would be able to assist with the preparation of the Statements of Significance and Need. However, it is likely that your insurers, particularly Ecclesiastical Insurance, would require to approve and inspect any such scheme prior to the commencement of work. Of course, any PV scheme would also require approval from your DAC and local Planning Authority.



Location	Project Cost (£)	Number of Panels	Annual Saving on Electricity (£)	Total Annual Savings (£)	Payback (Years)
Nave Roof	21,243.75	64	1,309	1,309	16.22

# Energy Opportunity Survey

## Renewables Recommendation

### Solar Photovoltaic Electricity Battery Storage

Coupling solar batteries with solar arrays is a relatively new practice. The advantage of doing so is three-fold. First, a solar battery stores the energy generated during sunlight hours and makes it readily available for use during non-production hours, such as at night or on cloudy days, essentially enabling your church to run on **100% renewable solar energy** around the clock, as long as electricity demand does not exceed the supply that the battery can provide.

Second, a solar battery storage system can **lower your energy costs significantly**. By charging the solar battery during off-peak hours and discharging it during peak hours, you can avoid paying a lot for electricity from your utility company. The savings from this can serve towards reducing your solar battery storage system costs.

Lastly, by adding a solar panel battery to your solar system, you can choose to be independent from the national grid at any time, thereby ensuring energy security for your church.

Usable Capacity (kWh)	Estimated Cost (Lithium-Ion Batteries)
3–4 kWh	From £3,500
4–7 kWh	From £4,300
7–9 kWh	From £5,200
9–13.5 kWh	From £ 5,950

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## Renewables Information

### Biomass

When the gas grid is unavailable, particularly in rural areas, wood fuelled systems, called biomass, are often a cost effective and environmentally friendly option.

Biomass is regarded as a low carbon form of heating as the carbon dioxide emitted when the wood is burned is assumed to be the same amount that was absorbed over the tree's life when it was growing. The process is regarded as sustainable if new trees continue to be planted in place of those used for fuel.

Biomass boilers often tend to be more expensive to install compared to their oil-fired equivalents; however, they may attract Renewable Heat Incentive (RHI) payments that could help offset the initial capital cost.

### Ground and Air Source Heat Pumps

Heat pumps absorb heat from the air or ground around a property and convert it to usable heat that can be used in radiator, or preferably, underfloor heating systems. Like biomass systems, heat pumps may be a viable option when there's no access to the mains gas grid, however, a reliable electricity supply is essential.

Heat pumps are eligible for attractive government subsidies to help offset the cost of installation. Cheaper Economy 7 electricity tariffs can be used to lower the cost of electricity to power the heat pump.

Heat pumps are more reliable than conventional boilers as heat pumps deliver heat at lower temperatures over much longer periods. They are energy efficient and generate 50% less CO<sub>2</sub> per kWh than conventional heating systems.

For every unit of electricity used in heat pumps, you get between 3-5 units of heat, making it an efficient way to heat a building.

Green Journey is able to provide specialist advice on the above technologies and RHI payments.



# Energy Opportunity Survey

## Appliances & Windows

### Appliances

In total, appliances contribute 82% of the site's total electricity consumption. Appliances within the church include water heater, monitor, sound system, printer, scanner/photocopier etc

We would advise ensuring that there is at least a 2 inch gap between the wall and your fridge/freezer. This will ensure that the device efficiently releases heat, meaning less energy will need to be used to keep the appliance interior cool.

Furthermore, we would advise that, where finances permit, the church seeks to purchase only equipment which has a high energy efficiency rating. Ratings typically go from "A" to "G" however some appliances, such as fridges and freezers, go up to A+++.

### Windows

The windows at the church feature single glazed fittings.

Double glazing reduces the rate of heat loss by up to 65% compared to its single glazed counterpart. Benefits of double glazing also include a reduction in condensation, noise pollution and improved security.

However, it may be possible to improve the areas around the windows. For instance, make sure that there are no gaps between the fixture and the wall as this could be a source of heat loss within the building.

We would advise where possible, that the church installs secondary single glazing. Secondary single glazing adds another single pane to the currently installed fixture. It is possible that secondary single glazing can reduce heating consumption by as much as 10% from current levels.

# Energy Opportunity Survey

## Summary of Costed and Non Costed Recommendations

Recommendation	Total Cost (£)	Annual Saving (£)	Payback (years)
Solar PV	21,243.75	1,309	16.22

Recommendation	Benefit
Maintain areas surrounding the windows	Ensure that there are no damaged areas around the windows that could be a source of additional heat loss.
Install secondary single glazing	This can yield heat loss savings of up to 10%.
Adopt an energy efficient procurement policy	Replace existing appliances with more energy efficient alternatives at the end of their working life.
Appoint an 'Energy Champion'	Appoint someone to ensure appliances and energy consumers are switched off when not needed.
Warm Air Curtains	To retain heat in the building by creating a barrier to the cold air.
LED Lighting	Light Emitting Diodes use less electricity and have a lower wattage rating whilst being brighter and lasting up to 50,000 hours.
Battery Storage	Store the energy your panels are producing to be more energy efficient and lower your energy costs.
Car Charging Points	To allow the electricity produced to be used to charge electric vehicles.

# Energy Opportunity Survey

## Green Journey Contacts

### Administration

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Diocese Environmental Officer

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## Appendices

### Appendix 1 – Church



### Appendix 2 – Exterior Wall





# Energy Opportunity Survey

## Appendices

### Appendix 3 – Windows



### Appendix 4 – Church Ceiling



# Energy Opportunity Survey

## Appendices

### Appendix 5 – Gas Heater



### Appendix 6 – Lighting





# Energy Opportunity Survey

## Appendices

### Appendix 7— Lighting



### Appendix 8 — Sound System



# Energy Opportunity Survey

## Appendices

### Appendix 9 – Water Heater



### Appendix 10– Heater





# Energy Opportunity Survey

## Water Overview

As of 1st April 2017, the water market in England became deregulated. This allows non-domestic entities to switch water suppliers. Green Journey is delighted to be able to provide water efficiency and procurement services to churches. It is important to note that your church's water consumption will be billed based on one of the two tariffs outlined below:

- **Non-metered Value** – In this case, your consumption is estimated based on an estimated water consumption, in addition to a Rateable Value (RV) attributed to your church. RV is a value given to all churches in the U.K based on the area and operation of the church.
- **Metered Value** – In this case, volumetric consumption data can be recorded and transmitted to your water supplier, this may also extend to surface water/sewerage charges, where a secondary water meter exists.

For more information on the above, please get in touch with Green Journey whom can help you secure the most competitive water rates. In the meantime, there are a number of ways your church can improve its water consumption, as detailed below.

**Rainwater Harvesting** - This involves rain water being collected in outside tanks, which can then be reused. This will reduce the volume of water the church uses, as they can harness rainwater for usage in urinals/toilets and other greywater facilities. As such, your church will require less water by volume, allowing it to improve its water efficiency.

**Tap Aerators** - Tap aerators can reduce water supply rates by as much as 60% per minute. Older taps, such as those installed within church's, supply water at an average rate of 15 l/m, compared to 6 l/m when having an aerator installed. This will reduce your annual water consumption, especially where your kitchen and toilet areas are in frequent use. Aerators can be installed on most taps; Green Journey can facilitate this should your church wish to go ahead with it.

# Energy Opportunity Survey

There are an array of funding mechanisms available to churches to make alterations to its building structure, undertake crucial maintenance work and to improve on current energy efficiency. Our in-house team can assist your church in applying for such funding, ensuring that you will have the best chance of being successful in your application.

## Listed Places of Worship (LPW) Grant Scheme

This scheme allows eligible churches to claim back VAT on qualifying services and products it purchases. It is only aimed at listed church buildings which provide public religious services at least six times each year. Qualifying services and products are detailed in depth in LPW guidance, however the key areas that qualify for this grant are identified as: electrical (including energy efficiency improvements) and structural works, aesthetics improvements, plumbing (including heating systems). Funding is accessible via two separate routes:

- Projects with a value of £500-£1000 (only one application can be submitted per year)
- Projects >£1000 (an unlimited number of applications can be submitted in this category)

## Heritage Lottery Funding

Available since September 2017, this supersedes the “Grants for Places of Worship” programme. 100% of funding can now be applied for via:

- “Our Heritage” scheme (up to £100k)
- “Heritage Grants” (up to £5million)