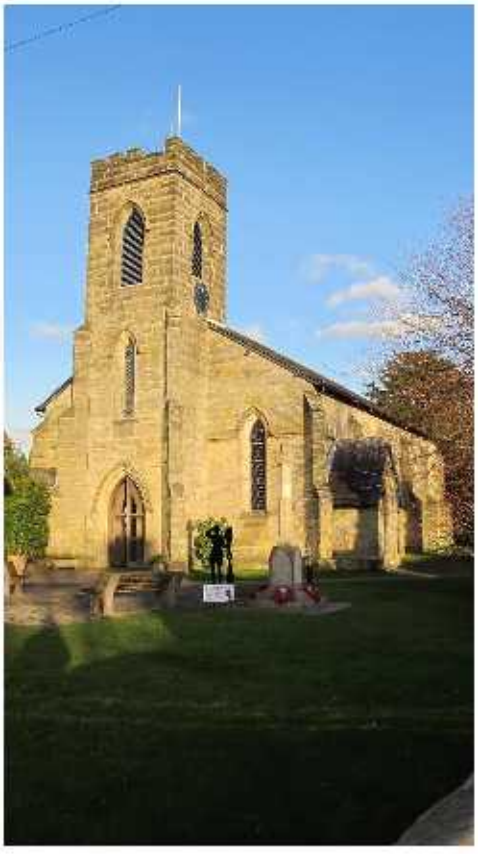
ESOS-ENERGY
Energy efficient solutions

Energy Audit and Survey Report

Trinity Church, The Street, Sissinghurst



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1. Executive Summary

An energy survey of Trinity Church, The Street, Sissinghurst 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.

Trinity Church, The Street, Sissinghurst is a Victorian church built in 1838 formed of one widen roof span with a small extension behind the altar and a narrow west tower which forms the entrance to the building. The vestry was expanded in 1992 and linked to the adjacent hall. Only electricity is supplied to the site.

The church 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.

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
Purchase a Temperature and Relative Humidity datalogger	N/A	N/A	£50	N/A	None	N/A	N/A
Remove storage heaters (replacement if necessary with conventional convectors)	11000kWh (if not replaced)	£1600	Nil (£2,000 if replaced)	Immediate	List A / B	3.38	N/A
Draught proofing of hopper windows	175	£20	£10	0.5	None	0.05	£186.01
Change kitchen spotlights to LED (if they are not already)	150	£22	£30	1.38	None	0.05	£651.04
Draught proofing of doors	150	£22	£20	0.92	None	0.05	£434.03

Contact suppliers to arrange for the meters to be changed to smart meters	None	None	Nil	N/A	None	N/A	N/A
Switch electricity (and gas) suppliers to ones which provide 100% renewable (or green gas) supplies	None	None	Nil	N/A	None	N/A	N/A
Investigate Solar photovoltaic panels on hall roof	Generate 6400kWh	£928	£14,000	15.09	Faculty + planning permission	1.97	£7,120.77

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

Based on current contracted prices of 14.50p/kWh for electricity.

If all measures were implemented this would save the church in the region of £1000-1600 per year.

2. Introduction

This report is provided to the PCC of Trinity Church, The Street, Sissinghurst 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 Trinity Church, The Street, Sissinghurst, was completed on the 9th December 2019 by 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.

Trinity Church, The Street, Sissinghurst	606243
Gross Internal Floor Area	220 m^2 + Hall of 80m^2
Listed Status	Grade II
Typical Congregation Size	40

The church typically used for 2.5 hours per week and the hall for 15 hours per week for the following activities

Services	1.5 hours per week
Occasional offices (8 per year)	1 hour per week
Community Use (church)	School, 3 x per year
Community Use (Hall)	12-14 hour per week
Meetings & Church Groups (Hall)	1 hours per week

This gives an annual usage of 140 hours for the church and 780 hours for the hall.

The church is open during daylight hours; 0800-1530.

Heating hours – hall 7/12 x 780 = 450

Church – 140 hours underpew (7/12 x 140h plus preheating) + 1000+ due to night storage heaters.

3. Energy Procurement Review

Energy bills for electricity have been supplied by Trinity Church, The Street, Sissinghurst and have been reviewed against the current market rates for energy.

The current electricity rates are:

Day Rate	14.50p/kWh	In line with current market rates
Night Rate	9.74p/kWh	In line with current market rates
Standing Charge	25p/day	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. We recommend that when the current contract comes to an end the church obtains a quotation for electricity supply from the CofE parish buying scheme, https://www.parishbuying.org.uk/index.php/categories/energy/energy-basket. This scheme only offers 100% renewable energy sourced electricity 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.

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

4. Energy Usage Details

Trinity Church, The Street, Sissinghurst uses 20,861 kWh/year of electricity, costing in the region of £2,500 per year.

This data has been taken from data provided by the treasurer.

Trinity Church, The Street, Sissinghurst has one main electricity meter.

Utility	Meter Serial	Type	Pulsed output	Location
Electricity – Church and Hall	K8801209	3 phase E43B3B-RH	no	Cupboard, south wall of vestry

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 used.

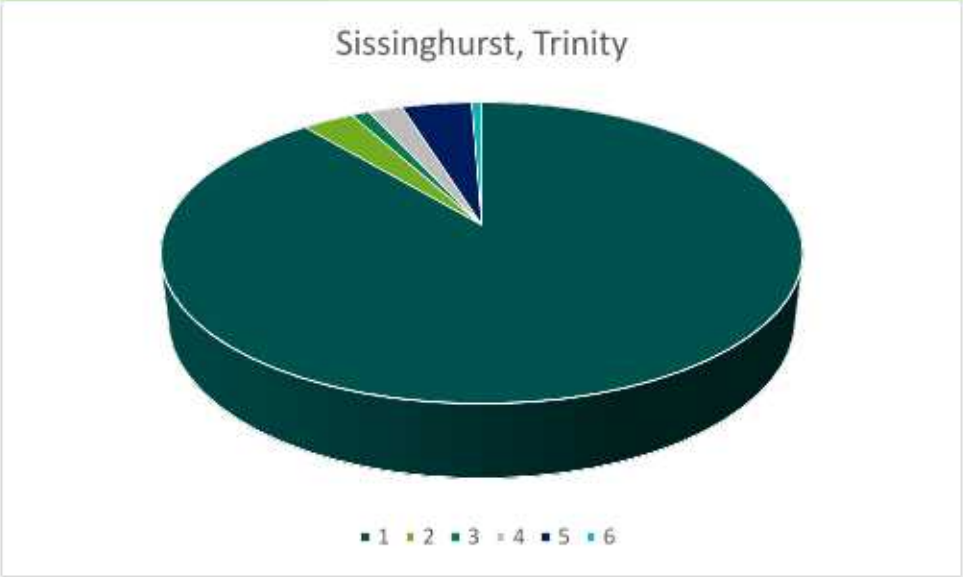
Meter K8801209 in vestry.

Electricity bill reference is L8903039 which is a different number to the meter shown above – this should be clarified with your supplier.

4.1 Energy Profiling

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

Service	Description	Power	Annual Use/ kWh	Estimated Proportion of Usage
Lighting	See Lighting survey Church (140 hours use) Hall (780 hours use) Floodlights (2000 hours use)	 1.18kW 0.62kW 0.112kW	 165 485 225	4.2%
Heating Church	Church underpew heaters 24 central pews x est 600W 25 aisle pews x est 400W With preheating and no summer use, assume 140 hours use Church storage heaters 3x 3kW If on for 7 months (Oct- April) at night rate times 2230-0030 and 0230-0730, this is 1470 hours = 13230kWh (too high for the total). Vestry 2 wall mounted electric convectors Rarely used, est 10h	 14.4kW 10kW 9kW 5kW	 3416 11000 50	69.3%
Heating Hall	3 Dimplex wall mounted convector heaters 450 hours use (7/12 x 780hours)	9kW	4100	19.7%
Hot Water	Kettles, 2 x 2,5kW 20 boils of 3 minutes/ week x 52 weeks used Urn – Macro (100 hours use)	2.5kW 3kW	130 300	2.1%
Other Small Power	Microwave Oven Panasonic NN S 02715 Fridge Food warmer Cooker est 2 hours/week Hob Extractor Fan	800W 200W 500W 3kW 3kW 500W	5 200 25 300 300 50	4.2%
Organ	Organ, pipe est 4h/ week Clavinova est 1h/week	500W 500W	100 26	0.6%
Totals	Heating Church			14466
	Heating Hall		4100	
	Other		2295	
	Total		20861kWh	



KEY 1 Heating 2 Lighting internal 3 Lighting external

4 Hot water 5 Small power 6 Organ

As can be seen from this data, the heating makes up by far the largest proportion of the energy usage on site. The other significant loads are lighting (mostly CFL) and cooking in the hall.

The power of the under pew heaters has been estimated – in fact, they might be more powerful and hence consume proportionally more power. However, the impact of the three corner located storage heaters appears to be considerable and still will be even if it is overestimated.

4.2 Energy Benchmarking

In comparison to national benchmarks[1] for Church energy use, Trinity Church, The Street, Sissinghurst uses 38% less electricity and 66% less heating energy than would be expected for a church of this size. Note the area of 300m2 is the sum of church and hall. Heating use is low since under pew heating does not involve preheating the entire church for several hours.

	Size (m^2 GIA)	Trinity Church, The Street, Sissinghurst use kWh/m^2	Typical Church use kWh/m^2	Efficient Church Use kWh/m^2	Variance from Typical
Trinity Church, The Street, Sissinghurst (elec)	300	7.66	20	10	-38%
Trinity Church, The Street, Sissinghurst (heating fuel)	220	65.7	150	80	-43%
Church hall	80	51			
TOTAL	300	69.5	170	90	-40%

[1] CofE Shrinking the Footprint – Energy Audit 2013

5. Energy Saving Recommendations (Electricity)

5.1 Lighting (fittings)

The lighting makes up a relatively small overall energy load within the building. The lighting table in appendix 1 lists all fittings. Most are CFL bulbs – replacing these with LED will approximately half the (small) lighting consumption – it will mean changing bulbs every 15-20 years rather than every ~5 years. All of the bulbs are at relatively low level so may be changeable by the church.

Parish Buying is a source of bulk buying discounts.

The downlights in the tower lobby are GU10 halogen spotlights which have a fairly short lifetime. Installation of LED lights here, and in the kitchen is recommended .

6. Energy Saving Recommendation (Heating)

6.1 Heating System and Strategy

The church currently uses a mixture of under pew heaters and night storage heaters to heat the church. This is reported to work well and provides adequate thermal comfort into the church.

However, the treasurer drew attention to the night rate electricity cost being higher than the day – storage heaters are the reason. It was unclear when they are being charged, but around 5 hours per night from October to April with 3 x 3kW heaters will account for 11000kWh.

Tube heaters main control – there are individual switches at each heater, visible to the left.

The underpew heaters are a ideal for of efficient heating. If they require replacement or upgrade in the future, 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.electricheatingsolutions.co.uk/Content/PewHeating. Existing cable runs and switching could be reused.

6.2 Reduce / Discontinue Background (storage) Heating

Many churches would have survived most of its life without any form of heating. The modern additional 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. The only times when background heating may be required is if there are historic wall paintings or to for the preservation of large artefacts such as tapestries. The organ (and other sensitive areas such as historic papers stored in the vestry) may require some local background heating specific to that area. In general, sensitive paper records should be removed for storage in the county archive and organs can be installed with a local background tube heater such as https://www.dimplex.co.uk/product/ecot-4ft-tubular-heater-thermostat within the organ casing in order to provide the heat where it is required. The fabric is often subject to the greatest damage by humidity (which is naturally higher when the air is warmer as warmer air has greater capacity for holding more moisture), as a result of large temperature swings (from central heating systems turning on and off) and from the excessive drying out/baking of timbers where high temperature heating units have been fixed to them (such as overhead heaters fixed to timber wall plates)

Providing constant background heating to the church building as a whole is excessive and wasteful of energy. At the very least we would recommend that this background level of heating provided by the storage heaters is avoided all together.

6.3 Storage Heaters

It was stated that the reason for using storage heaters overnight was to deal with dampness in the corners of the building. There were no visible signs of damp on any wall or window during the visit.

Storage heaters work by charging overnight (when costs are cheaper) and storing heat by heating bricks. This heat slowly leaks out; when heat is demanded a fan blows air over the bricks.

This does not give a large flow of heat. If (often during the evenings in domestic settings) more heat is required, the heating element is put on, along with the fan – at expensive rates, heating both the room, and the bricks again – it is then very expensive. Heating the church by storage heater will never deliver much warmth during Sunday service times, and they are a very expensive way of "topping up" the underpew heating for the coldest times of the year and Christmas services. It is recommended that they are removed, and the roof cause of any damp issues (clearing rainwater goods, reinstating French drains around the perimeter, repairing pointing etc.) are addressed.

6.4 Dehumidification

Heating will not remove any cause of dampness or humidity.

What heating does is to increase the amount of moisture which can be dissolved in the air – this can have the effect of sucking moisture out of wall surfaces in damp areas. But it has to go somewhere – unless the building is well ventilated when it is warm (when doors and windows are usually closed to keep the heat in), then it will condense on the coldest surface when the air cools (often a window).

Heating has not removed moisture or reduced humidity; it has just moved it elsewhere.

The church should ensure its gutters and roof, drains and soakaways are adequately maintained to prevent moisture from entering the building.

It is recommended that the church purchase a temperature and humidity monitor such as the Easylog-USB-2 (around £50). This will allow you to monitor the relative humidity levels, which should be between 45% and 70% (below 40 can lead to cracking of wood as it dries out, above 75 allows growth of moulds and insect infestations).
https://www.lascarelectronics.com/software/easylog-software/easylog-usb/

6.5 Use of Electric Convector heaters for Heating Specific Areas only

If there is still a need to install heating additional to under pew heaters, then conventional convector heaters, or radiant infrared panel heaters could be installed. These would then be used only when needed when people are present.

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 can not be left on accidently after use.

7. Energy Saving Measures (Building Fabric)

7.1 Draught Proofing to Doors

There are a number of external doors in the building. These wooden framed doors do not close tightly against the wood surround and hence an amount of cold air is coming into the church around the side and base of these doors.

Where a timber door closes against a timber frame 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 keyhole 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.

7.2 Hopper Windows

The church has four hopper windows, which may be a source of draughts. Small gaps where the windows are not airtight can be filled with black plasticine. This is recommended by Historic England as it is non-permanent and does not cause damage.

8. Other Recommendations

8.1 Health and Safety

It was noted that one of the three parapet stones on the tower overlooking the main entrance had been dislodged and fallen back onto the tower roof. This was discussed; it should be inspected professionally by the Inspecting Architect or suitably qualified person and any loose stonework made safe.

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	Possible on hall roof
Battery Storage	Future
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 – electric heating
Air Source Heat Pump	No – electric heating
Biomass	No – electric heating

The church roof is unsuitable for the installation of PV: the tower roof is too small, but the hall roof has potential, especially as the hall is often used during the day. A small system would be viable if the church uses sufficient electricity during the day. However, moving to a 100% renewable electricity tariff will contribute to lowering the church's carbon footprint without any expenditure on technology.

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 PV system may be best considered when the SEG terms are guaranteed to assist financial viability – but this is less of an issue with a hall used regularly during the day.

The south facing hall roof offers an area of around 50m^2. This could generate 0.15kWpeak/m^2 giving an 8kWpeak system. A 1kWpeak system can generate 800kWh annually, giving a total annual generation of 6400kWh. This is more than the halls annual electricity use (~5400kWh) so it would cover daytime lighting and cooking.

Battery Storage is not strictly a renewable energy solution, but battery storage does however provide a means of storing energy generated from solar PV on site to be able to be used at peak times or later into the day when the PV is no longer generating. It therefore extends the usefulness of the existing PV system particularly in this sort of church. This is a new but fast-growing technology with prices expected to fall substantial over the next 2 to 3 years.

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.

Appendix 1 – Schedule of Lighting to be Replaced or Upgraded

Room/Location	Number of Fittings	Recommended Upgrade	Annual Saving (£)	Total Cost (£)	Payback
Church					
8 chandeliers x 5 ~20W CFL	40 Total 800W				
Chancel					
Fluorescent tubes ~ 25W	4 Total 100W				
Tower lobby **GU10 spotlights (50W?)**	4 Total 200W		160W 140 hours 22kWh £3.25	£20	6 years
Vestry **CFL bulbs**	4 Total 80W				
Floodlights **CFL, 42W** **SON, 70W (Newlec, sodium)**	 1 1 Total 112W	None			
Hall **CFL, large ~25W**	 8 Total 200W				
Kitchen **Recessed spotlights (possibly halogen 70W)**	 6 Total 420W	To LED if they are halogen bulbs	360W 780 hours 281kWh £41	£30	1 year
Toilets and corridor **CFLs ~15W**	 3 Total 50W				

Most of the current lighting appears to be CFL bulbs. Changing to LED will reduce energy consumption by around 50%, but the saving will be in longevity rather than in operating cost given the low use hours of the church; LED bulbs having a lifetime of 3-4x that of CFL. If any halogen bulbs are identified; which may include the tower lobby spotlights and kitchen lighting, these should be changed for LED equivalents.

Floodlights are on from dusk to 2330, and also or about an hour in the morning. Looking at the local times of sunset throughout the year, this approximates to 2000 hours use.

Kitchen lighting