

St ANDREWS PARISH CHURCH,

KEIGHLEY

CHURCH AND CHURCH HALL EXTENSION

AND REFURBISHMENT

MECHANICAL & ELECTRICAL SERVICES PROPOSALS REVIEW DOCUMENT



DESIGN ENGINEERS/CONTRACTORS

HEATING ▪ VENTILATION ▪ AIR CONDITIONING ▪ ELECTRICAL

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Heating Principles

Churches, being historic and architecturally sensitive buildings, present unique challenges when selecting a functional and efficient heating system.

Factors that need to be considered are:

1. Large Volume of Space

Churches often have very high ceilings and expansive open spaces. Heat rises, so warming the entire space becomes inefficient. Warm air provided at low level quickly dissipates upward, making it hard to maintain a comfortable temperature at the occupied heights.

2. Historic Construction Materials

Many churches are built with stone, brick, or other thermal heavy materials, which:

- a. Absorb a lot of heat before warming up.
- b. Radiate cold if not heated for long periods.

3. Poor Insulation

Historic churches often lack modern insulation in walls, floors, & roofs. Large stained glass windows also often consist of single pane glass that loses heat quickly.

4. Intermittent Use

Churches are typically used only a few days a week e.g., weekends and holidays. Heating the space constantly would be wasteful and expensive but heating only when in use means starting from very cold conditions each time.

Heating Emitter Selection

When selecting a suitable heating system for larger buildings, several factors must be considered to ensure efficiency, comfort, and cost-effectiveness, as below.

1. Building Size and Layout

- Building footprint area: Larger buildings need systems with higher capacity.
- Internal ceiling heights: Higher internal spaces require more energy to heat.
- Zoning requirements: Separated areas may benefit from heating controls to operate at each zone at different times and temperatures.

2. Energy Efficiency
 - Heat loss analysis: Carry out calculations to avoid under, or over, sizing heating systems.
 - BMS controls: Systems with advanced control systems and zoning can reduce energy use.
3. Fuel Type and Availability
 - Natural gas: Common and economical in many areas, but not available everywhere.
 - Electricity: Clean and widely available, but potentially more expensive to operate depending on system design.
 - Oil, propane, biomass: Viable where mains gas / electricity supplies are limited or costly.
 - Renewables: PV solar, wind or geothermal may be viable long term solutions to providing electrical energy.
4. Installation and Maintenance Costs
 - Initial cost: Equipment, materials and labour for installation differ across the systems.
 - Access to infrastructure: Using existing ducts, vents, or pipe systems can reduce costs, if they are of a good serviceable condition.
 - Ongoing maintenance: Some systems require additional and more regular maintenance than others.
5. Control and Automation
 - Intelligent BMS systems: Improve energy efficiency with programmable systems and learning protocols.
 - Occupancy schedules: Programmable systems can prevent heating the building during empty periods and can pre-heat spaces ready for occupancy.

Suitable Heating Systems Available

Selecting the most suitable heating system for a specific building is an important stage in the building construction or refurbishment and various factors need to be considered for each applicable system.

Below are the various options available for the large space heating system suitable to the Church.

LTHW Underfloor Heating

Underfloor heating (UFH) is a form of central heating that uses either electric heating cables or LTHW water filled pipes installed beneath the floor surface to warm a room.

Advantages of Low Temperature Hot Water (LTHW) underfloor heating systems are:

- Provides gentle, uniform warmth, which is ideal for large open spaces.
- Reduces cold spots or draughts common with radiators or convector based systems.

- Heating pipework is hidden below the floor finish or easily boxed in, so it doesn't interfere with historic walls, stained glass, or decorative elements.
- Avoids visual impact and clutter from radiators or fan coil units and associated pipework.
- Silent operation.
- Works well with low temperature heat sources like heat pumps or modern condensing boilers.
- More energy efficient over time compared to higher temperature systems.
- Reduces energy consumption by only heating the occupied zone i.e. 2m above floor level.
- Radiant floor heat feels comfortable even in large, tall spaces.
- Helps maintain a more consistent temperature throughout the space during services.
- Can easily be zone controlled to heat only specific areas, saving energy.
- Low maintenance and cleaning costs due to majority of equipment concealed in boxing and below flooring.

Disadvantages to LTHW underfloor heating systems are:

- Requires major alterations to flooring and structure – lifting the existing floor finish, excavation, insulation and replaying the new flooring.
- Risk of damaging listed or historically significant flooring or substructures without proper planning.
- Potentially slow heat up time and not ideal when installed along with old style boiler controls which would not offer background lower temperature control.
- Ideally needs to form part of a full services replacement to give the best operating conditions and is rarely compatible when installing to an existing LTHW heating system.

LTHW Radiators & Fan Convectors

Radiators and fan convectors are both heat emitters that form part of LTHW systems. Radiators primarily rely on natural convection to circulate warm air, while fan convectors use a fan to force air over a heating element.

Advantages of LTHW radiators and fan convector systems are:

- Traditional and well understood - tactile and easily recognised as a heat source.
- Radiator only systems are silent in operation, ideal for quiet spaces.
- Effective heat from radiators, usually due to high operating temperatures spaces feel warm even if the air temperature is lower.
- High heat output from fan convectors on relation to units physical dimensions.

Disadvantages to LTHW radiator and fan convector systems are:

- Not energy efficient as air based system need to heat the entire building internal space to maintain an even space temperature.
- Uses a high amount of energy if the hall is only used occasionally and needs quick warming.
- Uneven heat distribution as heat can concentrate near units and dissipate less effectively across large spaces.

- Fan convectors can produce noticeable operational noise and are not ideal during quiet services if incorrectly sized / positioned.
- Bulky radiators and convectors take up wall space and are less flexible for room layouts.
- Each radiator and fan convector needs connecting to the pipework, resulting in large pipes being on show or boxed in to the building.
- Fans convectors stir up dust which problematic for allergy sufferers, cleaning and spreading of germs or infections.
- More mechanical parts mean more potential for failure

LTHW Pipe Coils & Radiant Heating

LTHW pipe coils and radiant heaters in effect operate similar to radiators and provide heat to the applicable areas. Pipe coils are traditionally mounted below seating or around the perimeter of a room, whereas radiant panels are suspended at high level and heat the area directly below.

Pipe coil heaters would not be suitable for the proposed work to the Church as the bench seating is being removed to provide open flexible seating area throughout the Nave. This type of heater could be a consideration to the Chancel or Upper floor area if fixed bench type seating is planned.

Radiant panel heaters would not be recommended in this instance as the very high roof would cause problems with suspending the panels with industrial bracketry and fixings and would detract from the appearance and aesthetic of the church area.

High Heat Retention (HHR) Storage Heaters

High Heat Retention (HHR) storage heaters are high energy efficient electric heaters that use advanced manufacturing techniques and high-density bricks to store heat. These are best used with an electricity provider that offers off-peak energy such as the Economy 7 tariff.

Advantages and disadvantages of HHR storage heaters can be:

- High energy efficiency when compared to standard electric heater.
- Advanced controls with modern units offering programmable timers and Wi-Fi control
- Expensive to install due to the relatively high purchase costs compared to standard electric panel heaters.
- High electricity demand even when coupled with PV panels as incoming mains electricity needs to be sized to operate the heaters with no solar assistance.

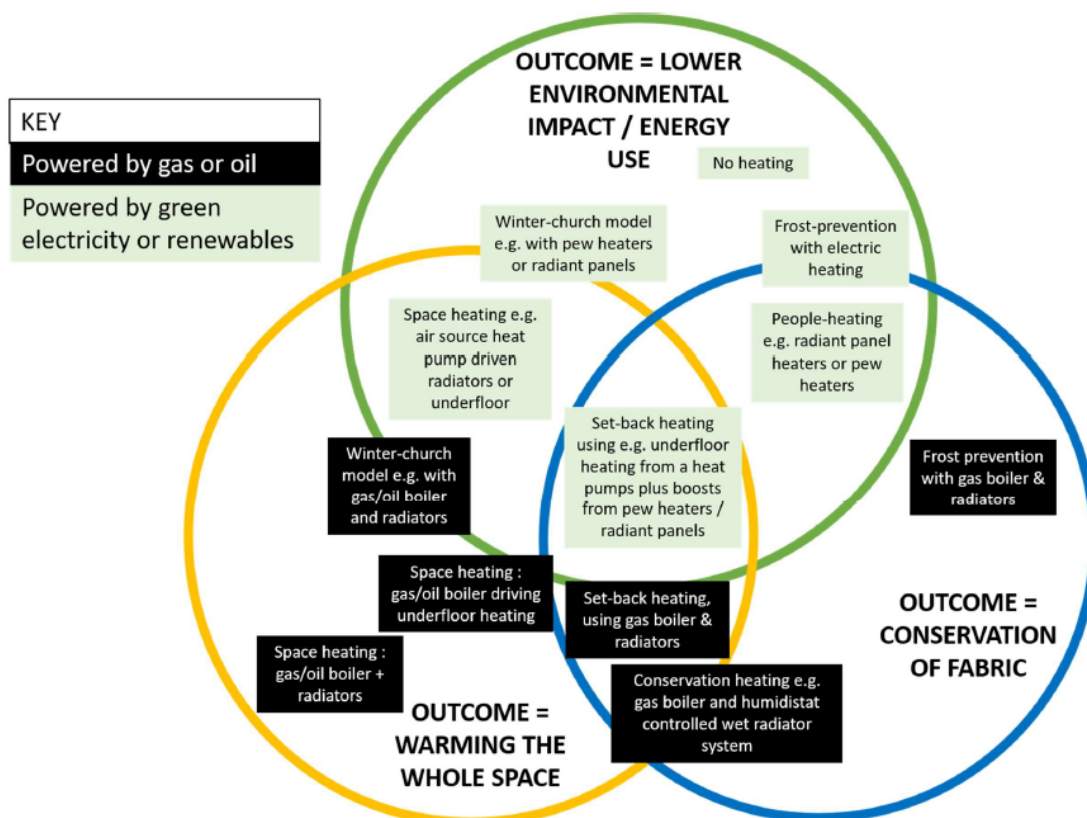
Summary

The installation of LTHW underfloor heating to the church will provide the most effective, energy efficient and quiet system which is visually discreet and can be integrated to the new plant and controls. This can be coupled with pew heaters where possible and LTHW fan convectors where appropriate to provide local heating to specific areas and assist with a quick warm up of the church area.

Incorporating the UFH installation to the large scale builderswork proposed for the church will work around the installation and allow the upgrades and alterations required for the install.

The UFH system can be easily included in the new heating plant and equipment and integrated to the new BMS controls to provide an energy efficient system, which will be easy to operate.

This is in line with the below Venn diagram highlighting options for heating Church buildings, amended to omit the pew heating / radiant panels which would not be suitable for this project.



Source: Church Buildings Council (Jan 2020) - Review of heating guidance: Establishing principles

The design of the UFH system can be carried out to avoid the Ledger Stones within the Church without causing problems with its operation. Underfloor heating system pipework routes are often tailored to suit areas in buildings to avoid obstacles, and as the Ledger Stones are a small percentage of the floor area, adequate heat will still be provided.

High Heat Retention (HHR) storage heaters could be used in place of the recommended fan convectors or radiators to provide additional heating to the Church rooms and Hall. Considerations to the suitability of the heaters needs to be given to the following.

Heritage appearance: some HHR units have a modern appearance and may not fit in with the traditional look of church buildings. The heaters would only be recommended to areas which have a modern appearance, such as the Meeting rooms, Hall or Office areas, if they are needed to bolster the UFH output or in lieu of LTHW radiators.

Electrical loading: the additional electrical loading of the heaters needs including in the incoming mains power sizing, which may increase the overall building electrical load. The additional loading for the HHR units may not necessarily reduce the loading requirements of the gas boiler equipment or air source heat pump equipment and implications of this would need considering at final design stage.

Integration with PV systems: Pairing HHR storage heaters with Solar PV is a highly efficient way to maximize free, self-generated renewable energy providing the system is installed with a smart energy diverter. This redirects excess power to the units instead of exporting it back to the grid, and should be a consideration in the final design proposals.

Operational requirements: it is proposed to install a sophisticated building energy management system to the building which considers occupancy times, and monitors internal and external temperatures. Not all HHR units can be integrated to such systems and may actually work against the new BMS system giving false temperature reading to areas also heated from the UFH system.

Long term implications: HHR units benefit the from low energy use if paired with the right energy tariff and can offer good energy savings if used with the correct Solar PV system. We would recommend the use HHR units is considered in the final designs, taking into consideration to the previous points above.

Heat Generating Equipment Selection

Gas Boiler Plant Only

A gas boiler is a heating appliance that uses natural gas to heat water, which is then circulated through a central heating system to provide warmth to a building and hot water for domestic use.

Advantages

- Efficient provider of heating. Modern condensing gas boilers can achieve efficiencies of over 90%, meaning less energy is wasted.
- Lower operating costs as natural gas is typically cheaper than electricity or oil in many areas.
- Reliable and quick heating provides consistent heat and hot water on demand, unlike some electric systems that may require time to heat up.
- Mature and proven technology with a long established infrastructure and technician familiarity ensure widespread support and easier maintenance.

Disadvantages

- Environmental impact as boilers burn fossil fuels, releasing carbon dioxide.
- Gas supply dependency requires a connection to the gas grid, which may not be available in rural or remote areas.
- Potential risk of gas leaks or carbon monoxide poisoning if the system is not properly maintained.
- Increasing regulations and government initiatives are pushing for a phase out of gas boilers in favour of heat pumps and renewable energy options.
- Natural gas is a non-renewable resource, subject to price fluctuations and long-term availability concerns.

Air Source Heat Pump

An air source heat pump (ASHP) is a low-carbon heating system that extracts heat from the outside air and uses it to heat a building's interior and domestic hot water. Essentially, it works like a refrigerator in reverse, transferring heat rather than generating it. Even when the outside temperature is low, there's still enough heat in the air for the heat pump to work effectively.

Advantages

- High energy efficient and low running costs.
- Produces 2 – 4 times more heat energy than the electrical energy consumed (CoP of 2 – 4).
- Especially efficient in mild to moderate climates.
- Reduced carbon emissions and more environmentally friendly than fossil fuel systems.
- Can be powered by renewable electricity for even lower carbon impact.
- Low maintenance due to fewer moving parts than combustion systems.
- Safe operation as no combustion, so no risk of carbon monoxide or gas leaks.

Disadvantages

- High upfront and installation costs compared to simple gas boiler plant equipment.
- Reduced efficiency in cold climates.
- Outdoor unit noise and lower grade units can be noisy during operation.
- Reduced heating operating temperatures limit options for hot water generation. Needs combining with regular electric water heaters or immersion heaters to provide hot domestic water.

Hybrid Gas Boiler & Air Source Heat Pump

A hybrid boiler plant and air source heat pump (ASHP) system combine a traditional gas boiler with modern air source heat pump equipment. This allows the system to switch between the two heating sources, maximizing efficiency and reducing reliance on fossil fuels. The heat pump, which extracts heat from the outside air, is used for most of the heating throughout the year, while the gas boiler acts as a backup, particularly during colder periods or when peak heat demand is needed.

Advantages:

- Highly energy efficient as the system uses the heat pump when conditions are favourable, reducing gas consumption.
- Reliable system as the gas boiler provides backup heating on very cold days.
- Much lower carbon emissions compared to using gas boiler plant alone.
- Smart operation: Many systems use smart controls to optimise performance and running costs.
- Can produce hot water from the boiler plant, which is provided at a higher temperature than standard ASHP plant can generate.
- Reduces the required plant size of costly ASHP equipment by providing back up and additional duty from the more cost effective gas boiler plant.

Considerations:

- Installation cost can be higher than a single system and intelligent BMS equipment is required for smooth efficient operation.
- Plant space is required for both units and ancillary equipment.

Summary

The installation of a hybrid gas boiler and air source heat pump is recommended for this particular project.

The system will provide high energy efficient equipment in the form of the ASHP, which will operate the heating system for large parts of the year, and will combine with the gas boiler plant to take advantage of the local mains gas network and high efficiency condensing boiler to provide hot water during the coldest days and also provide hot water to the building.

Building Heat Requirements

In order to maintain a comfortable temperature within the building, heat energy is required to offset the heat loss through the building fabric and air infiltration.

This can be shown as the table below.

Area Description	Heat Required: Rad / FCU (kW)	Heat Required: UFH & Add FCU Support (kW)	Heat Required: Combined (kW)	Recommended Heat Source
<u>Ground Floor</u>				
Narthex inc Entrance	28.80	15.60	15.60	UFH & FCU
Store	0.80	0.74	0.80	Radiator
Multi-Use	1.70	1.05	1.05	UFH
Cleaners	0.06	0.04	0	N/R
WC 1	0.14	0.09	0.14	Radiator
WC 2	0.11	0.07	0.11	Radiator
Acc WC	0.27	0.18	0.27	Radiator
Nave	118.80	57.60	57.60	UFH & FCU
Vestry	0.59	0.40	0.59	Radiator
Inst Store	0.59	0.40	0.59	Radiator
Chancel / Alter	36.00	6.00	36.00	Rad / FCU
Meeting Room	2.04	1.26	1.26	UFH
Toilet / Changing Place / Store	4.67	2.88	4.67	Radiator
Glazed Link	17.28	15.36	15.36	UFH & FCU
Hall	6.51	4.02	4.02	UFH
Kitchen	3.99	2.46	0	N/R
General Office	2.33	1.44	2.33	Radiator
Private Office	1.56	0.96	1.56	Radiator
Store, Utility	1.80	1.20	1.80	Radiator
<u>First Floor</u>				
Tower Balcony	1.94	1.08	1.94	Rad / FCU
Store	0.29	0.19	0.29	Radiator
Meeting Room	0.76	0.47	0.76	Radiator
Multi-use Space	4.54	2.52	4.54	Rad / FCU
Seating + Box Pews x2	7.20	3.00	7.20	Rad / FCU
Total Heat (kW)				
	243	119	158	

Estimated figures, subject to full and final design.

This shows the total estimated heat required for the different types of heating systems. To heat the building using a more traditional combination of LTHW radiators and fan convectors, 243 kW of heat is required.

The use of underfloor heating throughout would drastically reduce the heat load, but this is not recommended as certain areas with higher ceilings would need additional heat input to support the UFH.

We therefore recommend a combination of underfloor heating and radiators / fan coil units, as shown, which brings the total heating energy required to 158 kW.

Insulation

A breathable mineral wool insulation to the raised Chancel floor, and insulation within Floor Type 14 (the entrance area over the basement), with final viability to be confirmed once excavation works expose the vaulted ceiling and available depth, will be added to the final building design proposals.

The changes to the insulation should reduce the final overall heat loss from the building but as it covers a relatively small area of the building envelope, this will unlikely affect the final energy-performance assessment.

Existing Services

The existing heating is from a gas fired boiler serving an LTHW system via a combination of steel panel & cast column radiators and fan convectors, through steel pipework sited in floor voids and below ground.

On initial inspection, we noted the following regarding the heating installation.

- Single high capacity heating boiler, not offering any system resilience on event of equipment failure. Boiler manufacture date of 1990, giving inefficient non-condensing operation.
- No solenoid valve to the incoming gas mains service, therefore not providing any automatic shut off of the gas supply in the event of an emergency, activation of fire alarm, or detection of dangerous gases in the plantroom.
- Heating circulation is from a twin head fixed speed circulator. (*Legislation now states that all new heating pumps should be inverter driven which use much less energy than fixed speed pumps*).
- Pipework not insulated throughout therefore energy is wasted in the voids and below floor.
- Basic on / off controls, without any optimisation or compensation.

It has been recorded by the Church that the annual gas consumption over the previous 12 months was approx. 250,000 kWh. This can be attributed to the low energy performance of the boiler and emitters in the high hall, high energy wastage from the uninsulated pipework, and inefficient control system.

Estimated Energy Consumption

Energy consumption is calculated in the below tables.

These are based on the 3x options for main energy source

- Gas boiler plant
- Air source heat pump
- Hybrid gas / ASHP system

Anticipated yearly running costs have been included based on an average energy unit cost and is subject to the Church tariff agreement with their nominated suppliers.

This is highly dependent on the building occupancy and use, and is to be used as a comparison between the different systems only. Costs do not include any standing charges.

Gas Only Heating & Hot Water																	
	kW		Hrs		Days		Wks		WF		Energy Efficiency Factor			Energy Rate £ / kWhr	Estimated Annual Cost	Notes	
Gas Heating Load:	158	x	8	x	7	x	18	x	0.65	x	1.106	=	114,494.9	kWh	£ 0.07	£ 8,014.64	Gas heating: 2 wks Oct, 4 wks Nov, Dec, Jan & Feb
Gas Hot Water Load:	18	x	2	x	7	x	52	x	0.65	x	1.106	=	9,420.47	kWh	£ 0.07	£ 659.43	2x 300 litre cylinders per day
Total Energy Consumption:													123,915	kWh	Est Cost:	£ 8,674.07	

Air Source Heat Pump Only

	kW		Hrs		Days		Wks		WF		CoP Factor			Energy Rate £ / kWhr	Estimated Annual Cost	Notes
ASHP Heating Load:	158	x	8	x	7	x	18	x	0.65	x	0.3	=	31,056.5 kWh	£ 0.26	£ 8,074.68	CoP of 3
ASHP Hot Water Load:	14	x	2	x	7	x	52	x	0.65	x	0.3	=	1,987.4 kWh	£ 0.26	£ 516.73	Hot water required ASHP to 50C storage
Electric Hot Water Load:	4	x	2	x	7	x	52	x	0.65	x	1	=	1,892.8 kWh	£ 0.26	£ 492.13	Hot water required immersion heater to 60C storage
Total Energy Consumption:													34,937 kWh	Est Cost:	£ 9,083.55	

Combined Gas / Air Source Heat Pump

	kW		Hrs		Days		Wks		WF		CoP Factor				Energy Rate £ / kWhr	Estimated Annual Cost	Notes
ASHP Heating Load:	158	x	8	x	7	x	14	x	0.65	x	0.3	=	24,155.0	kWh	£ 0.26	£ 6,280.31	CoP of 3 - ASHP heating 14 wks
Gas Heating Load:	158	x	8	x	7	x	4	x	0.65	x	1.106	=	25,443.3	kWh	£ 0.07	£ 1,781.03	Gas boiler heating assistance 4 wks
ASHP Hot Water Load:	14	x	2	x	7	x	52	x	0.65	x	0.3	=	1,987.4	kWh	£ 0.26	£ 516.73	Hot water required ASHP to 50C storage
Gas Hot Water Load:	4	x	2	x	7	x	52	x	0.65	x	1.106	=	2,093.4	kWh	£ 0.07	£ 146.54	Gas boiler hot water assistance to 60C storage
Total Energy Consumption:													51,586	kWh	Est Cost:	£ 8,724.62	

Electrical Services

Preliminaries

The existing electrical installation within the existing buildings, although compliant at the time of installation, the installations do not fully meet the requirements of BS7671:2018 7671 IET Wiring Regulations.

It is therefore recommended that the whole of the electrical installation be replaced as part of the works.

Strip Out & Enabling Works

The existing electrical services throughout the buildings will be removed as part of the of the phased works.

Where services are removed and isolated, any work required to maintain areas in the building not being stripped out will be made.

Mains Low Voltage (LV) Distribution (LV is what is commonly known as mains voltage)

Incoming Electrical Service

Considerations

The existing supply authority incoming electrical mains and meter position is located on the half landing of the north stairs leading to the basement. At this position there are several switch fuses and consumer units which feed the consumer units and distribution boards located throughout the building.

Option1

As the existing electrical equipment at this location is below floor level it could remain in position. However, with access being limited it would not comply with BS 7671 IET Wiring Regulations. The location would not give adequacy of working space/accessibility to switchgear and consumer units/distribution boards.

Option 2

An application could be made to Northern Power Grid to relocate the existing supply or install the new supply into the basement. This would also afford limited accessibility and not comply with BS 7671 IET Wiring Regulations.

Option 3

An application could be made to Northern Power Grid for the new supply to be in the storeroom behind the welcome desk. The meter and switchgear arrangement would require circa 75% of the wall to the right of the door and circa 1.5M depth in a cupboard with full height and width opening doors.

Option 4

An application could be made to Northern Power Grid for the new supply to be in the external store/plant room in the new community building. This would require the community building being carried out as phase 1.

Summary

Options 1 & 2 do not meet current British Standards and as such should not be considered.

Dependant on the phasing both options 3 & 4 from a purely electrical regulations perspective are acceptable.

Option 3 would require a sub main being installed to a position to the southeast of the building with sufficient length left on the cable coiled to feed the community building.

Most major loads for the building will be fed from the community building i.e. external lighting, electric vehicle chargers, mechanical plant and kitchen, which will result in a large sub main cable being required.

There is at present a sub mains cable feeding the existing building, which would need to be temporarily connected to the new distribution network in the church to maintain the electrical supply.

Option 4 would be a cleaner simpler solution as the new supply would be installed into the new building, leaving the existing supply to feed the church until such time as work started in the church.

Sub Mains Distribution

Option 3

At the incoming mains position in the store behind the welcome desk a Molded Case Circuit Breaker (MCCB) panel board would be installed with sub mains distribution boards to feed the first floor, ground floor west area, the nave/chancel/alter the east meeting rooms and WC's and community building. A panel board is a large distribution board (fuse board but with MCCBs instead of fuses). An MCCB is a circuit breaker (like a fuse), which can take a larger load than a Miniature Circuit Breaker (MCB).

The supply to the community building would be terminated in the external store/plant room in an MCCB panel board to feed the external lighting, electric vehicle chargers, mechanical plant, kitchen and general areas lighting and power.

To comply with Part L2 energy efficiency standards, split metered lighting and power distribution boards should be installed to allow the monitoring of electrical energy consumption.

Option 4

At the incoming mains position in the external store/plant room an MCCB panel board to feed the external lighting, electric vehicle chargers, mechanical plant, kitchen, general areas lighting and power in the community building and the church.

The supply to the church would terminate in an MCCB panel board in the utility room to feed the general lighting and power in the first-floor west area, ground floor west area, the nave/chancel/alter, the east meeting rooms and WC's.

To comply with Part L2 energy efficiency standards, split metered lighting and power distribution boards should be installed to allow the monitoring of electrical energy consumption.

Conclusion

Option 3 would take up a considerable area of the store behind the welcome desk and without forming a separate room appears to be the only suitable area for the incoming electrical supply and meters.

The sub mains required from the furthest point of the buildings required to feed the largest loads in option 3, would be substantial and costly compared to having the incoming mains local to these loads in option 4.

Option 4 would be from an electrical perspective the preferred option.

Internal Lighting & Emergency Lighting

The existing lighting although functional would not meet the requirements of Part L2 energy efficiency standards and does not give flexibility in setting different scenes for the proposed multi use of the building.

The link space, Hall, entrance lobby and narthex area need to give bright welcoming illumination, with flexibility to offering a more subdued level of illumination.

The balcony/nave/chancel/alter will at times need various levels of illumination in different areas.

The above flexibility can be achieved with the use of lighting control system and dimmable light fittings, positioned such that a uniform level of illumination can be achieved for general services when required.

Additional specialist light fitting should be considered to illuminate architectural features as identified by the architect.

Office areas and meeting rooms to be standard LED panel lights installed in 600x600 suspended ceilings.

Toilet areas, circulation spaces and storerooms to have functional bulkheads or down lights.

All light fitting should be high efficiency LED.

Emergency lighting and signage to be designed to meet the requirements of BS5266-1.

External Lighting

The external lighting will include column mounted lights to the car park, bollards to walkways, wall mounted lights to the ramp.

Consideration will also be given to ground mounted up lights to light wash the existing church walls and soffit lights to light the building entrances.

Control of the external lighting (excluding safety/security lights) shall be automatically switched off between 23:00 and 07:00 by time-based controls. Programmable time-switches or astronomical timers

shall be integrated into the lighting control system, with an override only for maintenance/test purposes.

Luminaires must conform to ILP Guidance (e.g. GN01) for obtrusive light (commonly known as dark sky) with minimal upward or outward spill. All external lighting shall use full-cutoff fittings and be mounted/aimed to eliminate glare into the sky and adjacent properties.

Only the minimum required lighting for safety (permanent security lights) may remain on after 23:00; all other site lighting must be curbed.

Small Power

Socket outlets to the perimeter walls for general purpose and cleaning.

Office areas and meeting rooms to be complete with socket outlets for computer, printers etc.

Consideration will also be given to power for monitor/projector in meeting rooms.

AV Desk, organ, projector/s, screen/s sound equipment etc to have power as required.

Kitchen

Electrical supplies to be designed to accommodate the requirements of the specialist kitchen designer.

Fire Alarm

The fire alarm system to be designed in accordance with BS5839: Part 1: 2025 to provide a level of cover which meets L1.

The system shall be controlled by an addressable fire alarm panel.

Automatic detection shall be provided by fixed heat, rate of rise heat, optical smoke, multipurpose devices, aspirating systems, optical beam and duct probe sensors as appropriate to a particular area.

Electronic sounders, LED beacons and visual audio devices (VAD) shall be provided throughout the building providing a common sound output.

The system will activate secondary systems in the event of an alarm via means of remote devices and interfaces to the following, but not limited to, those listed:

- Plant to shut down. [Via isolation switch]
- Release Hold Open devices to close doors.

- Audio / Audio Visual systems
- Access Control System

Intruder Alarm

The intruder alarm installed by installers who are subject to inspection by the National Security Inspectorate (NSI), and who hold their Gold or 'Silver accreditation, or by the Security Systems & Alarms Inspection Board (SSAIB).

The system shall be designed to conform to PD 6662:2010 (which is the UK implementation of the European Standard EN 50131), BS 8243:2010, and Code of Practice. The system may be capable of generating Sequentially Confirmed Alarms, for the purposes of obtaining key holder or Police response should it be required.

The security alarm shall be provided with Dual com autodial facility; on activation the alarm shall automatically dial the remote to either a security manned control room or user confirmed by the client.

Disabled WC Alarm

Disabled Alarm shall include the following equipment.

- Overdoor audible/visual indicator
- Pull cord.
- Reset / reassurance unit.
- Power supply unit located in the ceiling void or at high level.

Testing & Commissioning

The whole of the electrical installations will be tested and commissioned in line with current Building Regulations, BSRIA & CIBSE guidelines and as set out in BS 7671:2018.

Health & Safety File (O&M's)

As Installed Drawings and Operating and Maintenance manuals shall be submitted prior to handover.

Photovoltaics

As part of the original mechanical & electrical services proposals review document a specialist photovoltaics company carried out a site survey to ascertain what is achievable utilizing the available roof space.

The conclusion was that in their opinion the age and type of the church roof make it unsuitable for the installation as disturbing the tiles could lead to breakages and therefore leaks into the building.

Consideration was also given to installing an “integrated solar roof system” incorporating a tray into which the panels are installed. This would require a large section of the roof tiles removing by a roofing contractor and the integrated solar roof system installing before flashing around the system is installed.

The makeup of the existing roof is unknown, and it is unlikely that a breathable roof felt has been installed prior to the roof tiles. As such integrating the “integrated solar roof system” is not considered practicable.

Four options were proposed for the installation of panels onto the new community building.

1. Install panels to both the north and south sides to the community building roof.
2. Install panels only to the south side of the community building roof.
3. Install panels only to the north side of the community building roof.
4. Install panels to the north side of the of the community building roof and mount an array of panels in the graveyard.

Each of the above options were considered in detail leading to option 2 and option 3 not being considered viable, with option 1 and option 4 remaining under consideration.

Subsequently, on the recommendation of The Diocesan Advisory Committee for the Care of Churches (DAC), a specialist with more expertise in the installation of photovoltaic panels on church and other listed buildings with stone slate roofs has been sought.

After careful consideration, Purelec Energy Ltd have been selected and below are their proposals for each option and summary document.



Solar PV Proposal Report

St Andrews Parish Church, Keighley

BD21 5HT

Church and New Church Hall Extension & Refurbishment

Prepared for: Richard Walsh – RJW Design Studio

Prepared by: Ross Weaver – Director

Date: 27th March 2026

Reference: PE1395

Purelec Energy Ltd

Unit 2, 14a Wakefield Road, Grange Moor, Wakefield, West Yorkshire, WF4 4DS

Tel: 01924 840 198 | MCS No: NAP 26506 | HIES No: PEL/A/0488

www.purelecenergy.co.uk

1. Introduction

Purelec Energy Ltd is pleased to present this comprehensive Solar Photovoltaic (PV) proposal report for St Andrews Parish Church, Keighley, as part of the wider church and new community hall extension and refurbishment project.

This report has been written to provide a detailed assessment of the solar PV options available across the various roof areas of the church and new community hall. It includes a review of the previous proposals prepared by Watsons Building Services Ltd, a comparison with the three proposal options prepared by Purelec Energy, and a thorough discussion of installation methodology, particularly in relation to the Yorkshire stone roof of the main church building.

Throughout this report I will refer to Watsons and their report. We are aware that a third party provided all solar related advice. We use this reference for ease of comparison.

Through discussion with Dominic Speed of Watsons Building Services Ltd, we have established that the minimum solar yield requirement for this project is **18,906 kWh per year**, as identified in the BRUKL compliance documentation (Option 2) for Building Regulations Part L Volume 2 2021.

All three of our proposals meet or exceed this minimum yield requirement, offering the church a range of options from using the existing church roof areas to a comprehensive solution covering all available roof space.

2. About Purelec Energy

Purelec Energy Ltd is based in Wakefield, West Yorkshire, and has been operating in the renewable energy sector since 2014. We specialise in the design, installation, and maintenance of Solar Photovoltaic and battery storage systems for both domestic and commercial clients, offering a complete turnkey service from initial design through to installation and ongoing support.

2.1 Accreditations and Standards

Purelec Energy holds the following key accreditations:

- Micro Generation Certification Scheme (MCS) – Membership No: NAP 26506, held continuously since 2014
- Home Insulation & Energy Systems Quality Assured Contractors Scheme (HIES) – Membership No: PEL/A/0488
- NICEIC qualified engineers install, test, and commission each system.
- QBE Insures us – Policy number – 10014147RE.

These accreditations ensure that every installation is completed to the highest industry standards, providing consumer protection and guaranteeing competent, trustworthy advice on all technologies and services we offer. Copies of our accreditations and insurance policies can be presented upon request.

2.2 Relevant Experience and Expertise

Over the past twelve years, Purelec Energy has developed extensive experience across a wide range of installation environments, including large-scale ground-mounted solar arrays, industrial rooftop systems, multi-million-pound mill conversions, school installations, and a broad range of domestic systems.

Crucially for this project, Purelec Energy has specific and demonstrable expertise in installing solar PV systems on Yorkshire stone roofs and within church environments. **Our completed project at New Mill Church** provides direct evidence of our capability to work on stone slate-roofed buildings of a similar nature, with the installation completed to an exceptional standard whilst maintaining the watertight integrity of the roof.

We pride ourselves on our ability to work sympathetically within church environments, understanding the heritage significance of these buildings and the care required to preserve their character whilst delivering modern renewable energy solutions.

2.3 Case Study: New Mill Church

The following photograph demonstrates our completed solar PV installation at New Mill Church, highlighting our expertise with stone slate roof installations and our ability to deliver a high-quality, aesthetically sympathetic result.



Aerial view of the completed New Mill Church installation, demonstrating the clean, professional finish achieved on a stone slate roof.

The images below show the hook and rail installation methodology used on stone roofs, including the lead flashing detail that ensures a fully watertight seal around each roof hook.



Stone roof hook installation detail



Lead flashing around hook for watertight seal



Hook and rail system on stone roof



Lead dressed hook and rail installation

3. Review of Previous Proposals – Watsons Building Services

In June 2025, Watsons Building Services Ltd produced their Services Proposals Review Document (Rev A), which included an assessment of photovoltaic options for the St Andrews Church project conducted by an independent PV company. This section provides a summary of the third parties findings and the limitations of their approach.

3.1 Watsons PV Options Summary

Watsons report proposed four options, all of which were limited to the new community hall roof and a potential ground-mounted array in the graveyard:

Option	Description	Panels	Yield (kWh/yr)	Budget Cost
1	Both sides of community hall roof	80 x 440W	12,500	£27,000+VAT
2	South side of community hall only	40 x 440W	5,200	£15,000+VAT
3	North side of community hall only	40 x 440W	7,300	£15,000+VAT
4	North side of hall + ground array in graveyard	~110	30,200	£47,000+VAT

Of these four options, Options 2 and 3 were deemed not viable as they did not meet the generation requirements of the Moorside Consulting Engineers Part L Volume 2 2021 report. Options 1 and 4 remained under consideration as they met the Building Regulations compliance requirements.

3.2 Key Limitation: Exclusion of the Church Roof

Critically, the Watsons report **excluded the main church roof entirely**, stating that “the age and type of the church roof make it unsuitable for the installation as disturbing the tiles could lead to breakages and therefore leaks into the building.”

The report also dismissed the option of an integrated system, noting that the makeup of the existing roof was unknown and that it was unlikely that a breathable roof felt had been installed.

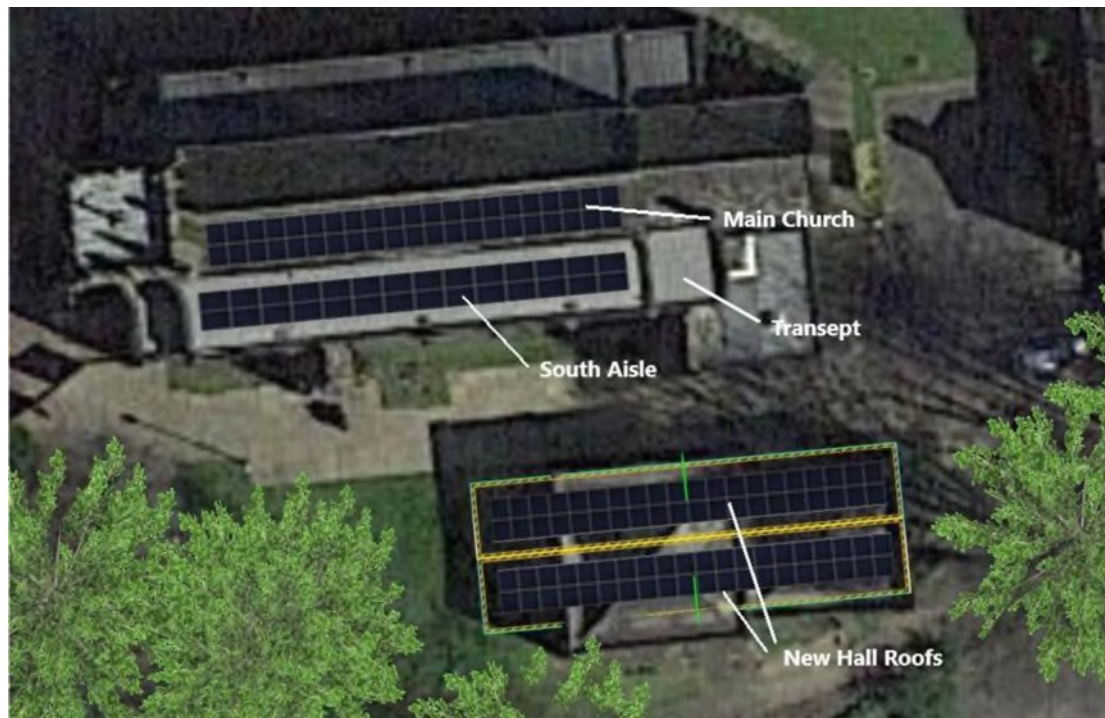
Purelec Energy respectfully disagrees with part of this assessment. **We believe the south side of the main church roof and the south aisle roof are both viable locations for a solar PV installation**, provided the work is carried out by installers with the appropriate expertise and methodology for working on Yorkshire stone roofs. Our proposals demonstrate how these roofs areas can be used effectively.

Once given a formal instruction, Purelec would conduct a closer inspection of the Yorkshire stone roof and its integrity.

We agree that an in-roof system is likely to be cost prohibitive as we feel the whole roof would need stripping to accommodate the required panels and to facilitate a fully compliant fire-resistant installation.

4. Roof Area Assessment

Purelec Energy has assessed the following roof areas of St Andrews Church for their suitability for a solar PV installation. This section discusses the characteristics, advantages, and challenges of each roof area.



Roof layout showing the various roof areas of St Andrews Church.

4.1 Main Church Roof – South Side (Yorkshire Stone)

Roof Type: Yorkshire stone slate

Fixing Method: Hook and rail system with lead flashing

Orientation: Approximately 174°–175° (south-facing)

Pitch: 45°

Pros:

- Excellent south-facing orientation providing optimal solar generation.
- Steep 45° pitch is ideal for year-round energy production, particularly during winter months when the sun is lower in the sky.
- Large, uninterrupted roof area allowing for a significant number of panels.
- Elevated position above surrounding buildings and trees reduces shading impact.
- Panels on the main church roof are less visually prominent when viewed from ground level due to the height and pitch of the roof.

Cons:

- Yorkshire stone requires specialist installation knowledge and care to avoid damage to the existing slates.

- Access is more challenging, requiring substantial scaffolding.
- Heritage sensitivity requires careful, sympathetic installation approach.
- The north side of the main church roof has been excluded due to its unfavourable orientation for solar generation.

Assessment: This is a highly suitable roof area for solar PV. Purelec Energy has the proven expertise to install on Yorkshire stone roofs, as demonstrated at New Mill Church and its large slate roof (using a similar method to that used on Yorkshire stone). With proper methodology and experienced installers, there is no reason the installation cannot be completed to an exceptional standard whilst maintaining the watertight integrity of the roof.

4.2 South Aisle Roof (Leaded/Standing Seam)

Roof Type: Leaded roof / standing seam

Fixing Method: Standing seam clamp system

Orientation: South-facing

Pitch: Low pitch 13°

Pros:

- Standing seam clamp system requires no penetration of the roof covering, preserving its watertight integrity.
- South-facing orientation provides good solar exposure.
- Lower height makes access and installation relatively straightforward.
- Non-invasive fixing method is ideal for heritage buildings.

Cons:

- Low pitch (13°) reduces optimal generation slightly compared to steeper roof areas.
- May experience some shading from the main church roof or trees, particularly in winter months.
- The aisle roof is more visually accessible from ground level, which may raise aesthetic considerations.

Assessment: A viable and practical location for solar PV. The standing seam clamp system is a proven, non-invasive fixing method that is well-suited to this type of roof. The lower pitch is partially offset by the favourable south-facing orientation.

4.3 Transept Roof (Leaded/Standing Seam)

Roof Type: Leaded roof / standing seam

Fixing Method: Standing seam clamp system

Assessment: This roof area has been excluded from our proposals. After careful consideration, the transept roof was deemed less suitable due to its orientation, limited area, and the potential for shading from adjacent roof structures. Including this area would add complexity to the installation without a proportionate increase in generation.

4.4 New Community Hall Roof (Slate)

Roof Type: Slate

Fixing Method: GSE in-roof frames

Orientation: Dual aspect – north (355°) and south (175°)

Pitch: 40°

Pros:

- New build roof in excellent condition with modern construction standards.
- New build roofs are ideal for in-roof frames – aesthetic finish and offset against cost of roofing slates are key benefits.
- Both north and south facing elevations are available, maximising total generation potential.
- Installation on a new build is generally more straightforward and cost-

effective. **Cons:**

- Significant shading impact from the main church building and surrounding trees, particularly on the north-facing slope.
- The Watsons report noted shading reduces generation capacity by approximately 48%, which is consistent with our modelling showing higher shading losses on this roof area.
- North-facing panels inherently produce less energy per panel than south-facing equivalents.

Assessment: The new hall roof is a suitable location for solar PV, and installing on both sides maximises total yield. However, the significant shading impact means the per-panel output is lower than on the church roof areas. This roof area benefits from being a new build with modern roofing materials, making it the most straightforward from an installation perspective.

5. Installation Methodology

The following section details Purelec Energy's proven methodology for installing solar PV on the various roof types present at St Andrews Church.

5.1 Yorkshire Stone Roof – Hook and Rail Method

Purelec Energy has developed a robust and proven method for installing solar PV on Yorkshire stone roofs. This method ensures the structural integrity of the roof is maintained and a fully watertight finish is achieved. The process is as follows:

1. We mark out the area for the solar panels on the roof surface, confirming the layout against the design drawings.
2. Identify the locations where each roof hook will be installed, based on structural calculations and wind load requirements.
3. Cut a square hole at each identified location to allow each roof hook to be securely fixed to the rafters beneath the stone slates.
4. Pack up the hooks where necessary to lift the hook above the top course of the Yorkshire stone slates, ensuring a level and secure mounting point and avoiding unwanted rubbing or contact.
5. Once all hooks are installed, dress lead around each hook to create a fully watertight seal and preventing any water ingress.
6. Fix the mounting rails to the roof hooks and tighten in place, ensuring the rails are level and aligned across the entire installation area.
7. Fix the solar panels in place on the rail system and complete a final adjustment to the hooks and rails to ensure a level array.

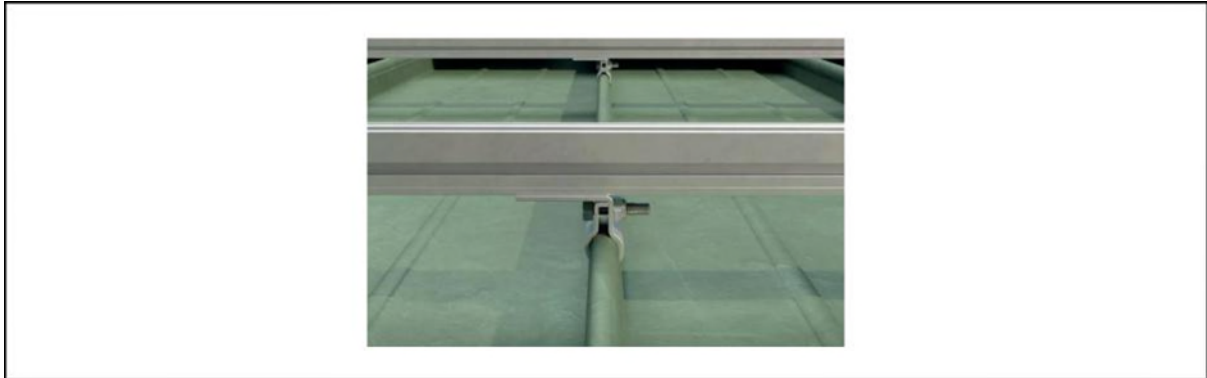


Installation stages on a Yorkshire stone roof.

If installed with care and attention by experienced installers, there is no reason the installation will not stand the test of time and remain fully watertight. The lead flashing technique used around each hook is a time-proven roofing method that, when executed correctly, provides a permanent and dependable weatherproof seal.

5.2 Standing Seam / Lead Roof – Clamp System

For the south aisle roof, which features a leaded/standing seam profile, Purelec Energy will use a standing seam clamp system. This method involves clamping directly onto the raised seams of the roof covering without any penetration of the roof material. This is an industry-standard, non-invasive fixing method that is particularly well-suited to heritage buildings where preserving the integrity of the roof covering is paramount.



Standing seam mounting bracket and rail.

5.3 Slate Roof – GSE in roof frames

For the new community hall roof, which features a modern slate finish, a low profile GSE in roof system will be employed. This has become a common method of solar PV installation in the UK for new build construction. Once the roof has been felted and lathed, the GSE frames are laid out and fixed into position. Appropriate flashings are installed around the full perimeter to help direct surface water run off. This method is well-proven, widely used, and provides a clean, aesthetic finish, which also helps towards the offset of roof slate costs.



Main installation stages using GSE in roof frames.

5.4 Proposed Site Inspection

Should the proposal prove attractive, Purelec Energy would arrange for one of our experienced roofers to visit the site and complete a closer inspection of the Yorkshire stone roof. This will allow us to verify the assumptions made regarding the quality and condition of the stone slates and confirm that the proposed installation methodology is fully appropriate. This inspection would be carried as a standard part of our pre-installation process for projects of this nature.

6. Purelec Energy – Proposal Options

Purelec Energy has prepared three proposal options for St Andrews Church, each utilising different combinations of roof areas. All three options have been designed using MCS compliant modelling software and use market leading all black JA Solar 465W panels with SolarEdge inverter technology.

SolarEdge technology is specifically designed to help comply with stringent fire safety regulations and insurer requirements, particularly for commercial solar installations. Its systems include built-in safety features like rapid shutdown and module-level monitoring to mitigate fire risks.

Key Fire Safety Features and Compliance include:

SafeDCTM Technology: Automatically reduces high-voltage DC to safe, touch-safe levels (typically 1V per module) when the inverter or grid shuts down. This ensures safety during installation, maintenance, and firefighting.

Arc-Fault Detection (AFCI): SolarEdge inverters feature built-in arc-fault detection, which identifies electrical arcing and shuts down the system before it can cause a fire, complying with standards such as UL 1699B.

Rapid Shutdown Compliance: SolarEdge inverters in Europe and Asia comply with NEC 2017 rapid shutdown requirements, reducing voltage within 30 seconds.

Firefighter Gateway: This feature provides a central point for emergency services to instantly shut down the solar PV system, ensuring no dangerous high-voltage DC lines run across the roof.

Sense Connect: A technology that detects abnormal heat buildup in connectors to prevent fire hazards before they occur.

6.1 Proposal Comparison Summary

	Option 1: All Roofs	Option 2: New Hall Only	Option 3: Stone & Seam
System Size	69.75 kWp	37.2 kWp	32.55 kWp
Number of Panels	150 x 465W	80 x 465W	70 x 465W
Annual Generation	46,361 kWh	19,868 kWh	26,504 kWh
Shading Losses	17.2%	23.1%	10.3%
Consumption Offset	260%	112%	149%
Self-Sufficiency	50.4%	43.5%	44.6%
System Price (ex VAT)	£88,732.98	£41,348.14	£51,823.41
Annual Savings (Year 1)	£5,251	£4,025	£4,544
Lifetime Savings (25 yr)	£241,555	£179,577	£199,228
Return on Investment	172%	334%	284%
Meets Min. Yield (18,906 kWh)	Yes ✓	Yes ✓	Yes ✓
Inverter	SE-66600-FUSE-FULL	SE30K-RW00IBNJ4	SE30K-RW00IBNJ4

All panel products carry a 25-year product warranty and a 30-year performance warranty. The SolarEdge inverter carries a 12-year product warranty.

All mounting systems carry a 10-year warranty.

6.2 Option 1: All Roofs – 69.75 kWp

This is the comprehensive option, using all suitable roof areas across both the main church and new community hall. It includes **150 x JA Solar 465W panels** arranged in four groups:

- Group 1: 40 panels on the new hall roof (south-facing, Azimuth 175°, Slope 40°)
- Group 2: 40 panels on the new hall roof (north-facing, Azimuth 355°, Slope 40°)
- Group 3: 42 panels on the main church roof (south-facing, Azimuth 174°, Slope 45°)
- Group 4: 28 panels on the south aisle roof (south-facing, Azimuth 174°, Slope 13°)

This option delivers the highest total generation at 46,361 kWh per year, producing 260% of the church's estimated annual consumption of 17,800 kWh. The surplus generation would be exported to the grid under the Smart Export Guarantee at £0.12/kWh. The combined shading loss across all groups is 17.2%. To reduce export to grid, battery storage could be used.

Price: £88,732.98 ex VAT | **Lifetime savings: £241,555**

6.3 Option 2: New Hall Roof Only – 37.2 kWp

This option focuses solely on the new community hall, utilising both north and south elevations. It includes **80 x JA Solar 465W panels** in two groups:

- Group 1: 40 panels (south-facing, Azimuth 175°, Slope 40°)
- Group 2: 40 panels (north-facing, Azimuth 355°, Slope 40°)

This option generates 19,868 kWh per year, producing 112% of estimated annual consumption. It has the highest shading losses at 23.1% due to the proximity of the main church building and surrounding trees.

This option only marginally exceeds the minimum yield requirement of 18,906 kWh, meaning that any degradation in panel performance or changes to shading conditions could result in the yield dropping below the regulatory threshold. It is the most cost-effective option.

Price: £41,348.14 ex VAT | **Lifetime savings: £179,557**

6.4 Option 3: Stone & Standing Seam Roofs – 32.55 kWp

This option uses only the main church roof and south aisle, excluding the new hall entirely. It includes **70 x JA Solar 465W panels** in two groups:

- Group 1: 42 panels on the main church roof (south-facing, Azimuth 174°, Slope 45°)
- Group 2: 28 panels on the south aisle roof (south-facing, Azimuth 174°, Slope 13°)

This option generates 26,504 kWh per year, comfortably exceeding the minimum yield requirement by approximately 40%. Crucially, this option has the lowest shading losses of all three proposals at just 10.3%, meaning each panel performs closer to its optimal output. The all-south-facing orientation provides the best per-panel generation efficiency.

Price: £51,823.41 ex VAT | **Lifetime savings: £199,228**

7. Comparison with Watsons Building Services Options

The table below provides a direct comparison between the most relevant Watsons options (Options 1 and 4, being the only two that met the Part L compliance requirement) and the three Purelec Energy proposals.

	Watsons Opt 1	Watsons Opt 4	Purelec Opt 1	Purelec Opt 2	Purelec Opt 3
Roof Areas	New hall (both sides)	New hall north + ground	All Roofs	New hall (both sides)	Main Church Stone & Seam
Yield (kWh/yr)	12,500	30,200	46,361	19,868	26,504
Budget Cost	£27,000+VAT	£47,000+VAT	£88,733+VAT	£41,348+VAT	£51,823 + VAT
Meets 18,906 kWh?	No X	Yes ✓	Yes ✓	Yes ✓ (marginal)	Yes ✓
Church roof used?	No	No	Yes	No	Yes

Key observations from this comparison:

- Watsons Option 1, whilst being the lowest cost, generates only 12,500 kWh per year, which falls significantly short of the 18,906 kWh minimum yield requirement established through the BRUKL compliance documentation.
- Watsons Option 4, which meets the yield requirement at 30,200 kWh, requires a ground-mounted array in the graveyard. This introduces significant additional complexity including planning permission requirements, archaeological considerations for excavation in the graveyard, trenching for approximately 120 metres of cable, and potential objections to the aesthetics of panels in the graveyard setting.
- Purelec Option 2 (New Hall Only) meets the minimum yield requirement at 19,868 kWh, although only marginally, using the same roof area as the previous PV company within the Watsons report Option 1 but with higher wattage 465W panels and SolarEdge optimiser technology.
- Purelec Option 3 (Stone & Standing Seam) comfortably exceeds the minimum yield at 26,504 kWh by unlocking the church roof areas that were excluded by the previous PV company, without requiring any ground-mounted arrays or graveyard excavation.

8. Why Purelec Energy is the Right Fit for This Project

8.1 Specialist Yorkshire Stone Expertise

The single most significant differentiator in this project is the ability to install solar PV on the Yorkshire stone roof of the main church building. Purelec Energy has direct, demonstrable experience of completing this type of installation to a high standard, as evidenced by our work at New Mill Church. This expertise opens up roof areas that were previously deemed unsuitable, significantly increasing the solar generation potential of the site without requiring ground-mounted alternatives.

8.2 Church Environment Experience

Working within a church environment requires more than technical competence. It demands a sympathetic understanding of the building's heritage significance, respect for the worshipping community, and the ability to carry out works with minimal disruption. Purelec Energy's experience at New Mill Church demonstrates that we can complete the physical installation to a high standard whilst working sensitively within the church environment.

8.3 Quality and Accreditation

As an MCS and HIES accredited installer with NICEIC qualified engineers, Purelec Energy provides the assurance that the installation will be completed to the highest industry standards. Our twelve years of continuous accreditation, combined with comprehensive insurance cover, provides the church with the confidence that they are engaging a reputable, competent, and dependable partner.

8.4 Technology and Products

All three proposals specify JA Solar 465W panels, which are a tier-one solar panel brand with excellent performance characteristics and industry-leading warranties (25-year product, 30-year performance). The SolarEdge inverter platform with power optimisers provides panel-level monitoring and optimisation, ensuring each panel operates at its maximum potential regardless of shading conditions on adjacent panels.

8.5 Environmental Impact

Depending on the option selected, the solar installation at St Andrews Church would offset between 112% and 260% of the building's annual electricity consumption, reducing CO₂ emissions by between 5 and 12 tonnes per year. Over the 25-year system lifetime, this is equivalent to planting between 933 and 2,223 trees. This aligns with the wider sustainability objectives of the church refurbishment project and the requirements of Building Regulations Part L.

9. Summary and Recommendation

Purelec Energy has presented three viable options for solar PV at St Andrews Parish Church, Keighley. All three options meet the minimum yield requirement of 18,906 kWh per year as established by the BRUKL Part L compliance documentation.

Each option has its own merits:

- Option 1 (All Roofs, 69.75 kWp) delivers the maximum generation and environmental benefit, making best use of all available roof space. It is the largest investment but delivers the highest lifetime savings.
- Option 2 (New Hall Only, 37.2 kWp) is the most cost-effective option with the shortest payback period, but only marginally meets the minimum yield requirement and is subject to significant shading losses.
- Option 3 (Stone & Standing Seam, 32.55 kWp) represents a compelling middle ground, comfortably exceeding the minimum yield with the lowest shading losses of all three options, and unlocking generation from the church roof without requiring ground-mounted arrays.

The key advantage that Purelec Energy brings to this project is the ability to use the south-facing Yorkshire stone roof of the main church building – a roof area that was excluded by the previous third-party solar installer. Our proven methodology and demonstrated experience at New Mill Church give St Andrews confidence that this installation can be conducted safely, sympathetically and to a standard that will stand the test of time.

We welcome the opportunity to discuss these proposals further and, subject to approval, would arrange a detailed site inspection by one of our experienced roofers to confirm the suitability of the stone roof prior to commencing works.

Prepared by: Jason Metcalf

07512 310829

jason.metcalf@purelecenergy.co.uk**For: Richard Walsh**

None, [Commercial] St Andrews

Church, Keighley, BD21 5HT

richard.walsh@rjwdesignstudio.co.uk, (44)07966

Quote #: 9873243 Quote

Date: 15th May 2026 Valid

until: 22nd May 2026



Solar Energy System Proposal

Dear Richard Walsh,

Thank you for the opportunity to present your Solar Energy System Proposal.

Best Regards,

Jason Metcalf

Project Manager

Purelec Energy Ltd - Established 2014

Unit 2, 14a Wakefield Road,

Grange Moor, Wakefield,

West Yorkshire, WF4 4DS

**Purelec Energy Ltd**

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Company Number: 09343993

MCS Membership No: NAP 26506

HIES Membership No: PEL/A/0488

**TESLA**
POWERWALLScan QR code on
your phone to access
the online proposal.

Our History

Purelec Energy are based in rural Wakefield, West Yorkshire, and specialise in the design, installation, and maintenance of Solar Photo Voltaic and battery storage systems. We cater for both the domestic and commercial sectors offering a turnkey service from design through to installation and ongoing support.

We became involved in the renewable industry at an early stage, seeing the potential for growth within this new market area. The renewable industry allows us to utilise our electrical experience, which has been developed over the last thirty years in business.

In 2014, we gained our Micro Generation Certification (MCS) and membership with the Home Insulation & Energy Systems Quality Assured Contractors Scheme (HIES). We have proudly retained annual membership to date and with both accreditations designed to maintain high standards and provide consumer protection, all of our customers can be sure each installation will be completed to the highest of standards.

By successfully achieving both accreditations and maintaining annual compliance, we are deemed a competent and trustworthy company advising end users about each of the technologies and service that we offer. It also allows you the peace of mind that you will be working alongside a company that has the skill set to deliver every time.

For the last nine years we have been successfully providing our expertise and services to our broad range of customers. We have worked on projects, which include large scale ground mounted solar arrays and industrial roof top systems, multi million pound mill conversions and school re wires and a wide range of domestic systems providing properties with bespoke solar and battery systems from household names such as GivEnergy.

Over the years we have been able to develop an extensive knowledge about the renewable industry and the UK market, allowing us to choose the most reliable products that will deliver on your investment.

We have grown organically, by offering the highest levels of customer service coupled with our carefully selected choice of products.

As we grow as a business it is important that all who work within the company share the same passion for what we do. It is also a priority that all employees have the necessary qualifications and training, which we provide on an ongoing basis.

Our Ethos

At the heart of our company is a passion to deliver the highest level of service to all of our clients. We always go that extra mile to make sure the process of installing your system or completing your project is as simple and stress free, for you, as possible.

With every project we take on, you can be sure to receive an exceptional service, and a feeling of security that you have picked the right people for the job.

Whenever you deal with a member of the Purelec Energy Team, you will be provided with friendly and honest advice. A lot of what we do is face to face communication with our clients, so these attributes are especially important. We always listen to the client and carefully take on board their requirements, making sure we deliver on a brief.

Whilst we know this can sound cliché, we honestly believe that we do offer all of our customers, just that little bit more than others.

We believe in honesty across the board, from our competitive pricing, to our professional advice, and we are confident this will show when you do business with us.

From time to time, things do go wrong, that's life. It is the way that you deal with the problem that sets you apart from the rest and we always make sure we rectify problems in a timely manner, with a "customer is always right's approach.

Over the years we have built a number of strong working relationships with our clients and associates, working with many of our clients for well over a decade.

Recommended System Option

69.75 kWp

System Size

£242,764

Lifetime Electricity Bill
Savings

£5,283

Estimated Annual
Electricity Bill Savings

£88,737

Total System Price
excluding VAT



Your Solution

Solar Panels

JA Solar

69.750 kW Total Module Power

150 x 465 Watt Panels (1AM54D-41-465-LR-TS-AB-MC4)

Inverter

SolarEdge Technologies Ltd.

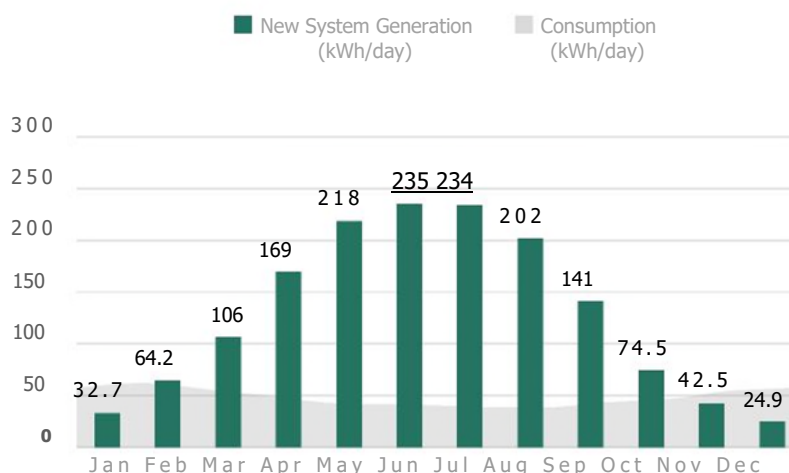
66.6 kW Total Inverter Rating

1 x SE-66600-FUSE-FULL

Warranties: 25 Year Panel Product Warranty, 30 Year Panel Performance Warranty, 12 Year Inverter Product Warranty

System Performance

264%



19%	81%
Self Consumption	Export to grid

System Performance Assumptions: System Total losses: 10.6%, Inverter losses: 2.0%, Optimizer losses: 1.2%, Shading losses: 16.0%, Performance Adjustment: 0%, Output Calculator: System Advisor Model 2020.02.29.r2. Panel Orientations: 40 panels with Azimuth 355 and Slope 40, 40 panels with Azimuth 175 and Slope 40, 42 panels with Azimuth 174 and Slope 45, 28 panels with Azimuth 174 and Slope 13.

Important Note: The energy performance and benefits of EESS is impossible to predict with certainty due to the numerous functions a system can be programmed to perform. This estimate is based upon the System Advisor Model (SAM) procedure and is given as guidance only. It should not be considered as a guarantee of performance

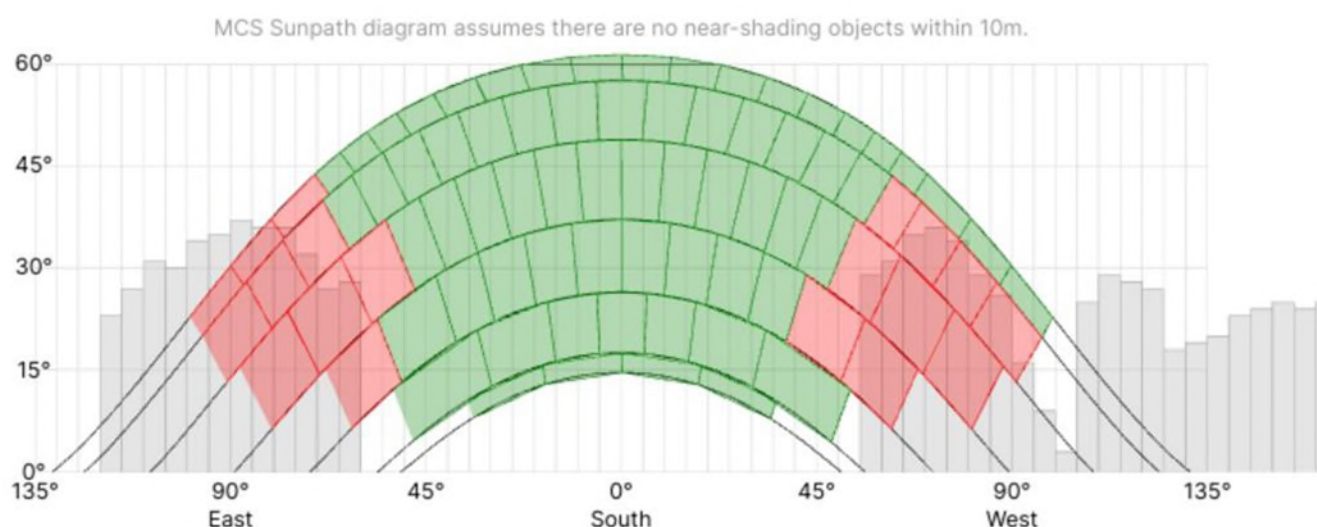
The MCS output (MIS 3002) and self-consumption (MGD 003) calculation methodology was not used in calculating the numbers in the table below. An alternative calculator System Advisor Model 2020.02.29.r2 was used.

A. Installation data		
Installed capacity of PV system - kWp (stc)	69.750	kWp
Orientation of the PV system - degrees from South	Group 1: 40 panels with Orientation: 175 ° Group 2: 40 panels with Orientation: 5 ° Group 3: 42 panels with Orientation: 5 ° Group 4: 28 panels with Orientation: 5 °	°
Inclination of system - degrees from horizontal	Group 1: 40 panels with Tilt: 40° Group 2: 40 panels with Tilt: 40° Group 3: 42 panels with Tilt: 45° Group 4: 28 panels with Tilt: 13°	°
Postcode region	11	
B. Performance calculations		

kWh/kWp (Kk)	803.7	kWh/kWp
Shade Factor (SF)	0.840	
Estimated annual output (kWp x Kk x SF)	47,072	kWh
C. Estimated PV self-consumption - PV Only		
Assumed occupancy archetype	In Half Day	
Assumed annual electricity consumption, kWh	17,800	kWh
Assumed annual electricity generation from solar PV system, kWh	47,072	kWh
Expected solar PV self-consumption (PV Only)	8,990	kWh
Grid electricity independence / Self-sufficiency (PV Only)	50.5	%

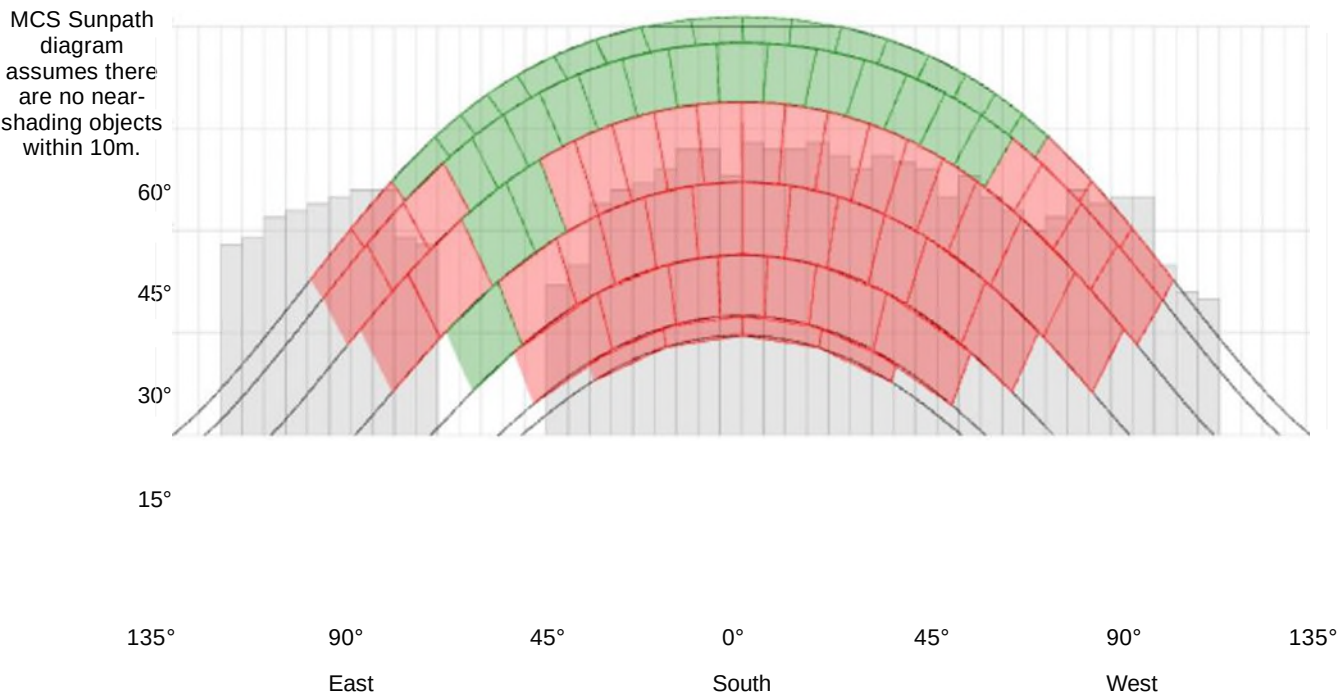
Sunpath Diagram

Disclaimer: The shade mask mapped onto the sunpath diagram is based off the field of view from a point in the center of the array. This means that the shade mask shown will only capture the shading experienced at the array center point, and will not reflect the shading casted onto other locations on the array.



Sunpath Diagram

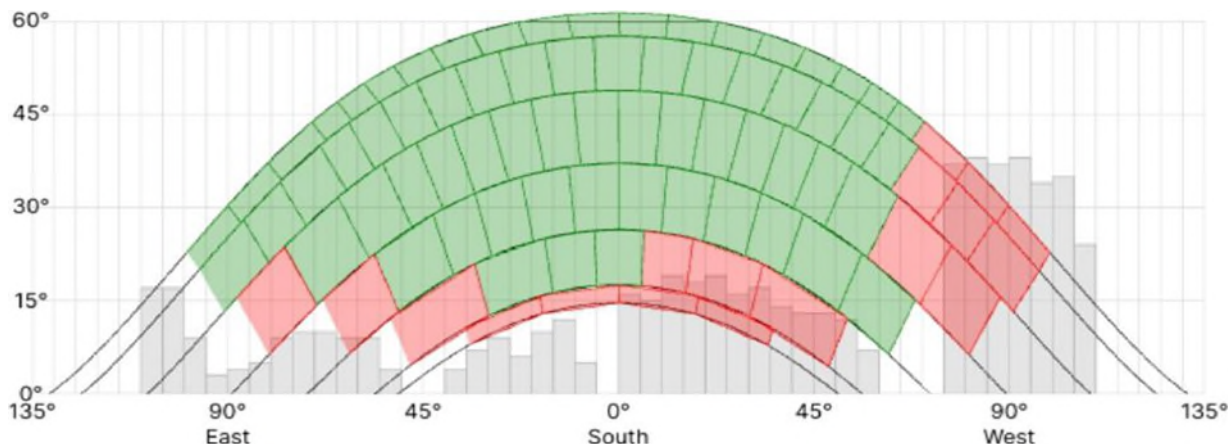
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Sunpath Diagram

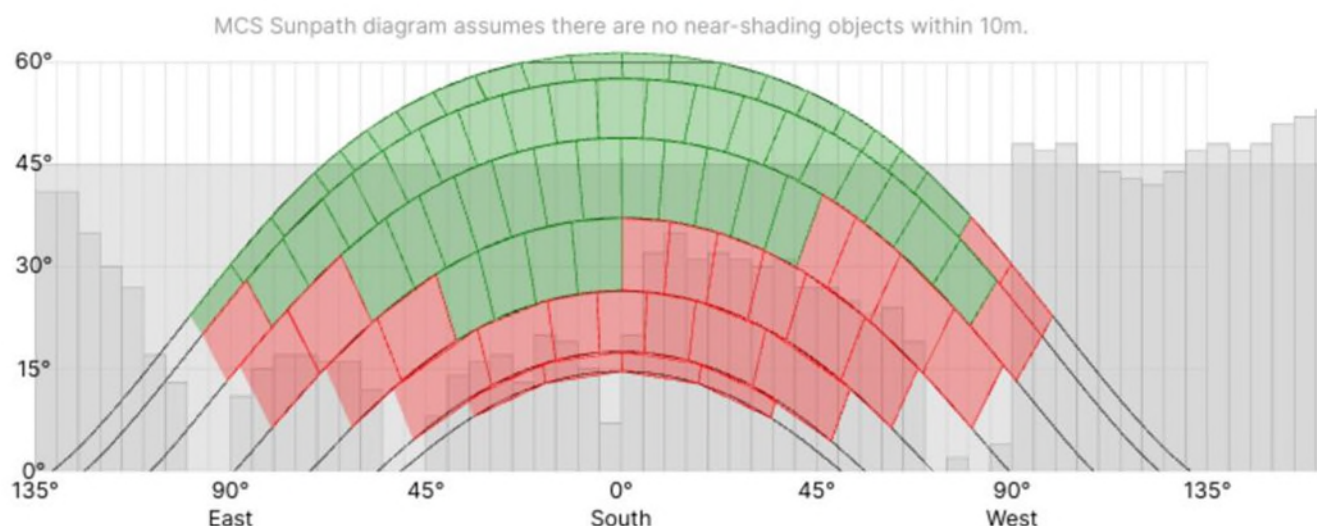
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MCS Sunpath diagram assumes there are no near shading objects within 10m



Sunpath Diagram

Disclaimer: The shade mask mapped onto the sunpath diagram is based off the field of view from a point in the center of the array. This means that the shade mask shown will only capture the shading experienced at the array center point, and will not reflect the shading casted onto other locations on the array.



Environmental Benefits

Solar has no emissions. It just silently generates pure, clean energy.



Each Year

264%

Consumption Offset

12tons

of CO₂ reduced per year

Over System Lifetime

356,326km

Car distance avoided

2,291

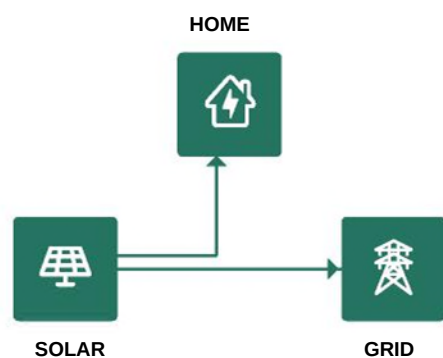
Trees planted

255

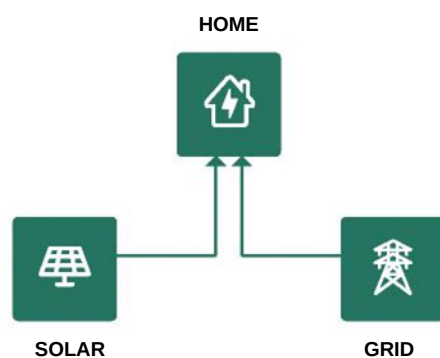
Long haul flights

How your system works

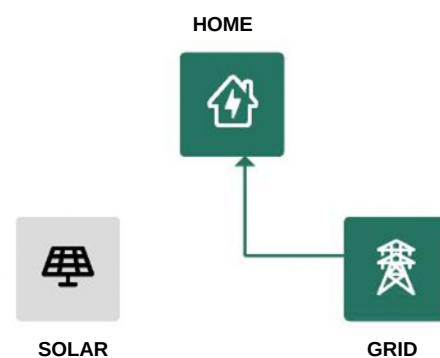
Generating Excess Solar



Partially Offset Usage



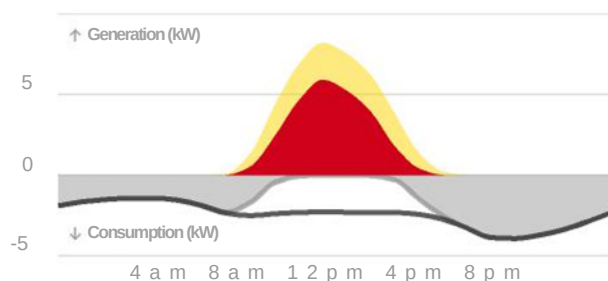
Night



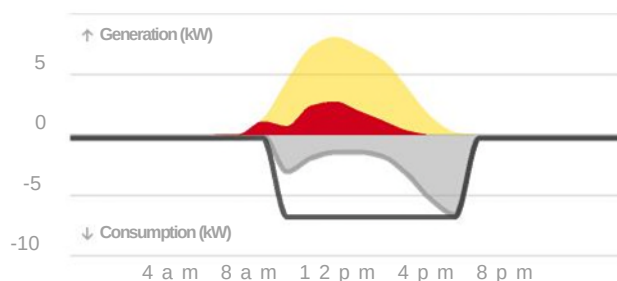
Daily Energy Flows

CONSUMPTION (kWh)
 GENERATION (kWh)
 NET CONSUMPTION (kWh)
 EXPORT TO GRID (kWh)

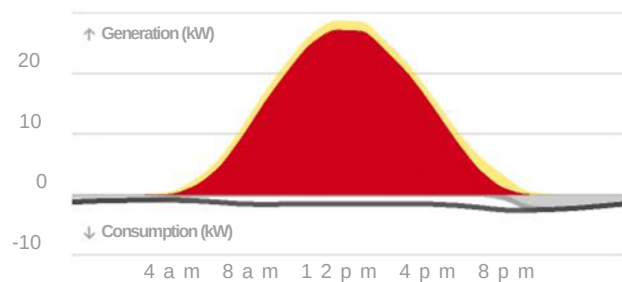
Winter Weekday



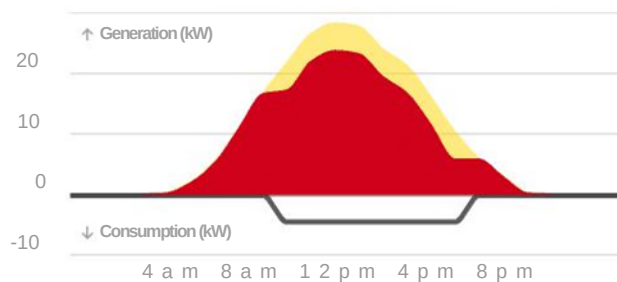
Winter Weekend



Summer Weekday

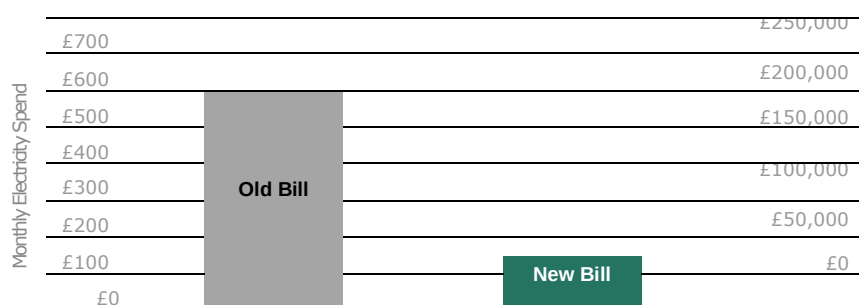


Summer Weekend

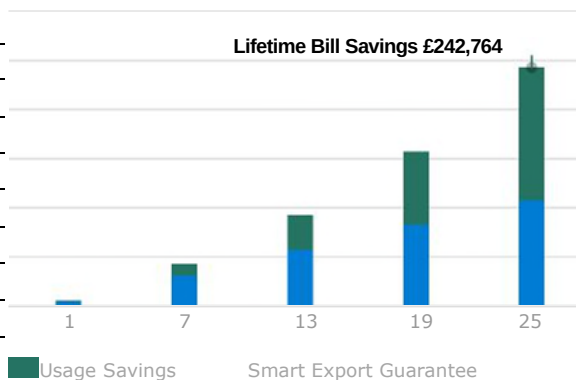


Electricity Bill Savings

First Year Monthly Bill Savings



Cumulative Bill Savings



Month	Solar Generation (kWh)	Net Grid Consumption before new system (kWh)	Electricity Imported after new system (kWh)	Electricity Exported after new system (kWh)	Export Credit (£)	Utility Bill before new system (£)	Utility Bill after new system (£)	Estimated Savings (£)
Jan	1,013	1,778	1,241	476	57	696	435	261
Feb	1,798	1,736	972	1,035	124	678	264	414
Mar	3,295	1,725	793	2,363	284	676	38	638
Apr	5,082	1,468	535	4,149	498	577	3	574
May	6,759	1,307	417	5,869	704	517	3	514
Jun	7,043	1,242	347	6,148	738	492	3	488
Jul	7,244	1,202	347	6,389	767	477	3	474
Aug	6,255	1,178	416	5,493	659	468	3	465
Sep	4,230	1,295	506	3,440	413	512	3	509
Oct	2,308	1,445	800	1,664	200	570	125	445
Nov	1,274	1,649	1,101	725	87	646	351	295
Dec	771	1,776	1,337	332	40	695	489	207

Your projected energy cost is calculated by considering a 5.49% increase in energy cost each year, due to trends in the raising cost of energy. This estimate is based on your selected preferences, current energy costs and the position and orientation of your roof to calculate the efficiency of the system. Projections are based on estimated usage of 17800 kWh per year, assuming Variable

Tariff Electricity Tariff.

Your electricity tariff rates may change as a result of installing the system. You should contact your electricity retailer for further information.

Proposed Tariff Details - British Gas Variable Tariff	
Energy Charges	
Unit Rate All Day\Mon-Sun	£0.38 / kWh
Smart Export Guarantee	

Smart Export Guarantee <i>All Days Mon-Sun</i>		£0.12 / kWh
Fixed Charges		
Standing Charge		£0.66 / d

Net Financial Impact Commercial 25% Deposit

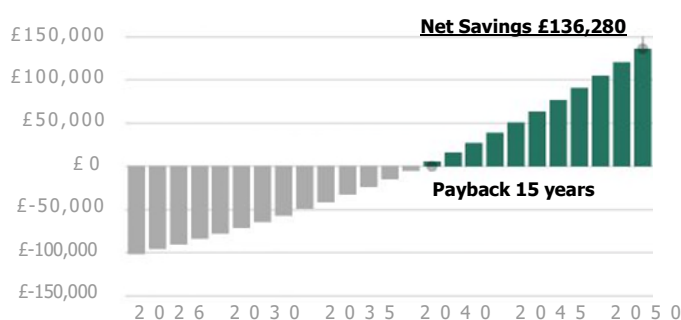
$$£242,764 - £106,484 = £136,280$$

Utility Bill Savings

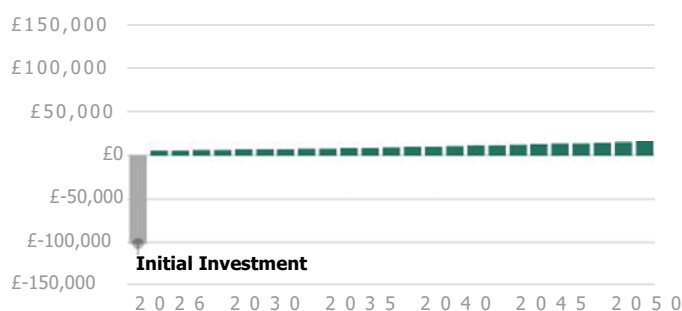
Net System Cost

Estimated Net Savings

Cumulative Savings From Going Solar



Annual Savings From Going Solar



£15,405

Net Present Value

21 Years 9 Months

Discounted Payback
Period

128%

Total Return on
Investment

6.1%

Rate of Return on
Investment

Year	Electricity Consumption (kWh)	Solar Generation (kWh)	Utility Bill (before new system) (£)	Utility Bill (after new system) (£)	Annual Savings (from new system) (£)	System Costs (Net of Dealer Incentives) (£)	Customer Incentives (Upfront) (£)	Net Savings (£)	Cumulative Impacts (£)
2026	17,800	47,072	7,005	1,722	5,283	106,484	0	(101200)	(101200)
2027	17,800	46,883	7,389	1,865	5,525	0	0	5524	(95676)
2028	17,800	46,695	7,795	2,015	5,780	0	0	5779	(89896)
2029	17,800	46,507	8,223	2,174	6,049	0	0	6048	(83847)
2030	17,800	46,318	8,675	2,342	6,333	0	0	6333	(77514)
2031	17,800	46,130	9,151	2,518	6,633	0	0	6632	(70881)
2032	17,800	45,942	9,653	2,704	6,949	0	0	6949	(63932)
2033	17,800	45,754	10,183	2,900	7,283	0	0	7283	(56649)
2034	17,800	45,565	10,742	3,106	7,636	0	0	7635	(49013)
2035	17,800	45,377	11,332	3,324	8,008	0	0	8007	(41005)
2036	17,800	45,189	11,954	3,554	8,400	0	0	8399	(32605)
2037	17,800	45,000	12,610	3,796	8,814	0	0	8813	(23791)
2038	17,800	44,812	13,303	4,064	9,239	0	0	9238	(14553)
2039	17,800	44,624	14,033	4,358	9,675	0	0	9675	(4877)

Year	Electricity Consumption (kWh)	Solar Generation (kWh)	Utility Bill (before new system) (£)	Utility Bill (after new system) (£)	Annual Savings (from new system) (£)	System Costs (Net of Dealer Incentives) (£)	Customer Incentives (Upfront) (£)	Net Savings (£)	Cumulative Impacts (£)
2040	17,800	44,436	14,803	4,673	10,130	0	0	10129	5252
2041	17,800	44,247	15,616	5,029	10,587	0	0	10587	15839
2042	17,800	44,059	16,473	5,403	11,070	0	0	11070	26909
2043	17,800	43,871	17,378	5,798	11,580	0	0	11579	38489
2044	17,800	43,682	18,332	6,215	12,117	0	0	12117	50606
2045	17,800	43,494	19,338	6,654	12,684	0	0	12684	63290
2046	17,800	43,306	20,400	7,117	13,283	0	0	13282	76573
2047	17,800	43,118	21,520	7,605	13,914	0	0	13914	90487
2048	17,800	42,929	22,701	8,120	14,581	0	0	14580	105068
2049	17,800	42,741	23,948	8,684	15,264	0	0	15263	120332
2050	17,800	42,553	25,262	9,314	15,948	0	0	15947	136280

Estimates do not include replacement costs of equipment not covered by a warranty. Components may need replacement after their warranty period. Financial discount rate assumed: 5.0%

Quotation

Payment Option: Commercial 25% Deposit

150 x JA Solar 465 Watt Panels (JAM54D-41-465-LR-TS-AB-MC4) 1 x SE-66600-FUSE-FULL (SolarEdge Technologies Ltd.) 1 x EM-ECA2-BL 8 x IMO-SI16-PEI 64R-2 1 x KG160 T204-GBA290 ST 75 x S1000-1GMXMBT	
Total System Price	£106,483.83 Including £17,747.30 VAT
Purchase Price	£106,483.83 Including £17,747.30 VAT
	
No Deposit	£0.00

Price excludes Retailer Smart Meter should you want us to install your Smart Meter it will be an additional cost.
This proposal is valid until 22nd May 2026.

Payment Milestones

Payment 1 (25%) Due when contract has been signed	£26,620.96
Payment 2 (65%) Due prior to equipment arriving on site	£69,214.49
Payment 3 (10%)	£10,648.38

Quote Acceptance

I have read & accept the terms and conditions.

Signature

Name

Date

Prepared by: Jason Metcalf

07512 310829

jason.metcalf@purelecenergy.co.uk**For: Richard Walsh**

None, [Commercial] St Andrews

Church, Keighley, BD21 5HT

richard.walsh@rjwdesignstudio.co.uk, (44)07966

Quote #: 9873243 Quote

Date: 20th May 2026 Valid

until: 22nd May 2026



Solar Energy System Proposal

Dear Richard Walsh,

Thank you for the opportunity to present your Solar Energy System Proposal.

Best Regards,

Jason Metcalf

Project Manager

Purelec Energy Ltd - Established 2014

Unit 2, 14a Wakefield Road,

Grange Moor, Wakefield,

West Yorkshire, WF4 4DS

**Purelec Energy Ltd**

Unit 2, 14a Wakefield Road, Grange

Moor

Wakefield West Yorkshire WF4 4DS



Phone: 01924 610829

Email: info@purelecenergy.co.ukWeb: www.purelecenergy.co.uk

Company Number: 09343993

MCS Membership No: NAP 26506

HIES Membership No: PEL/A/0488

**TESLA**
POWERWALLScan QR code on
your phone to access
the online proposal.

Our History

Purelec Energy are based in rural Wakefield, West Yorkshire, and specialise in the design, installation, and maintenance of Solar Photo Voltaic and battery storage systems. We cater for both the domestic and commercial sectors offering a turnkey service from design through to installation and ongoing support.

We became involved in the renewable industry at an early stage, seeing the potential for growth within this new market area. The renewable industry allows us to utilise our electrical experience, which has been developed over the last thirty years in business.

In 2014, we gained our Micro Generation Certification (MCS) and membership with the Home Insulation & Energy Systems Quality Assured Contractors Scheme (HIES). We have proudly retained annual membership to date and with both accreditations designed to maintain high standards and provide consumer protection, all of our customers can be sure each installation will be completed to the highest of standards.

By successfully achieving both accreditations and maintaining annual compliance, we are deemed a competent and trustworthy company advising end users about each of the technologies and service that we offer. It also allows you the peace of mind that you will be working alongside a company that has the skill set to deliver every time.

For the last nine years we have been successfully providing our expertise and services to our broad range of customers. We have worked on projects, which include large scale ground mounted solar arrays and industrial roof top systems, multi million pound mill conversions and school re wires and a wide range of domestic systems providing properties with bespoke solar and battery systems from household names such as GivEnergy.

Over the years we have been able to develop an extensive knowledge about the renewable industry and the UK market, allowing us to choose the most reliable products that will deliver on your investment.

We have grown organically, by offering the highest levels of customer service coupled with our carefully selected choice of products.

As we grow as a business it is important that all who work within the company share the same passion for what we do. It is also a priority that all employees have the necessary qualifications and training, which we provide on an ongoing basis.

Our Ethos

At the heart of our company is a passion to deliver the highest level of service to all of our clients. We always go that extra mile to make sure the process of installing your system or completing your project is as simple and stress free, for you, as possible.

With every project we take on, you can be sure to receive an exceptional service, and a feeling of security that you have picked the right people for the job.

Whenever you deal with a member of the Purelec Energy Team, you will be provided with friendly and honest advice. A lot of what we do is face to face communication with our clients, so these attributes are especially important. We always listen to the client and carefully take on board their requirements, making sure we deliver on a brief.

Whilst we know this can sound cliché, we honestly believe that we do offer all of our customers, just that little bit more than others.

We believe in honesty across the board, from our competitive pricing, to our professional advice, and we are confident this will show when you do business with us.

From time to time, things do go wrong, that's life. It is the way that you deal with the problem that sets you apart from the rest and we always make sure we rectify problems in a timely manner, with a "customer is always right's approach.

Over the years we have built a number of strong working relationships with our clients and associates, working with many of our clients for well over a decade.

Recommended System Option

37.2 kWp

System Size

£181,007

Lifetime Electricity Bill
Savings

£4,057

Estimated Annual
Electricity Bill Savings

£41,348

Total System Price
excluding VAT



Your Solution

Solar Panels

JA Solar

37.200 kW Total Module Power

80 x 465 Watt Panels (JAM54D-41-465-LR-TS-AB-MC4)

Inverter

SolarEdge Technologies Ltd.

29.99 kW Total Inverter Rating

1 x SE30K-RW00IBNJ4

Enclosed DC Switch IP66 2 pole 1 string 16A 800V

None

8 x IMO-SI16-PEL64R-2

Emlite 1-ph Bi-Directional generation meter 100A (1000 pulse/kWh) incl. Cover

None

1 x EM-ECA2-BI

Power Optimizer

SolarEdge Commercial Power Optimiser with 1.3m Input
40 x S1000-1GMXMBT

K&N Three Phase AC Switch Disconnect 160A

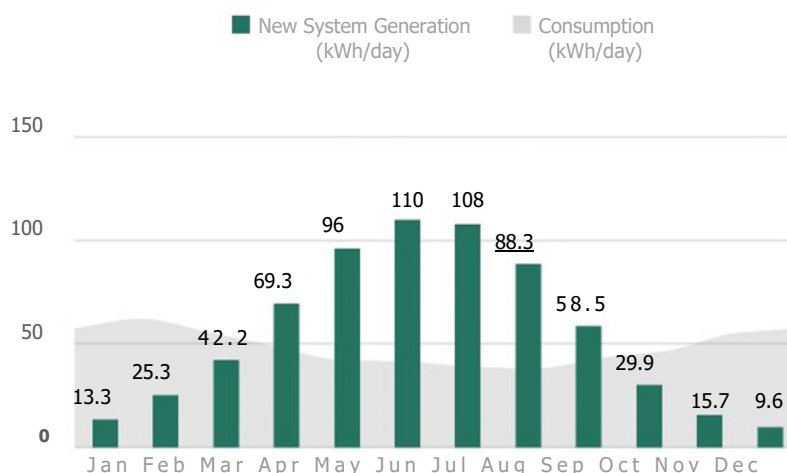
None

1 x KG160 T204-GBA290 ST

Warranties: 25 Year Panel Product Warranty, 30 Year Panel Performance Warranty, 12 Year Inverter Product Warranty

System Performance

114%



38%

Self Consumption

62%

Export to grid

System Performance Assumptions: System Total losses: 13.4%, Inverter losses: 2.0%, Optimizer losses: 1.2%, Shading losses: 21.7%, Performance Adjustment: 0%, Output Calculator: System Advisor Model 2020.02.29.r2. Panel Orientations: 40 panels with Azimuth 355 and Slope 40, 40 panels with Azimuth 175 and Slope 40.

Important Note: The energy performance and benefits of EESS is impossible to predict with certainty due to the numerous functions a system can be programmed to perform. This estimate is based upon the System Advisor Model (SAM) procedure and is given as guidance only. It should not be considered as a guarantee of performance

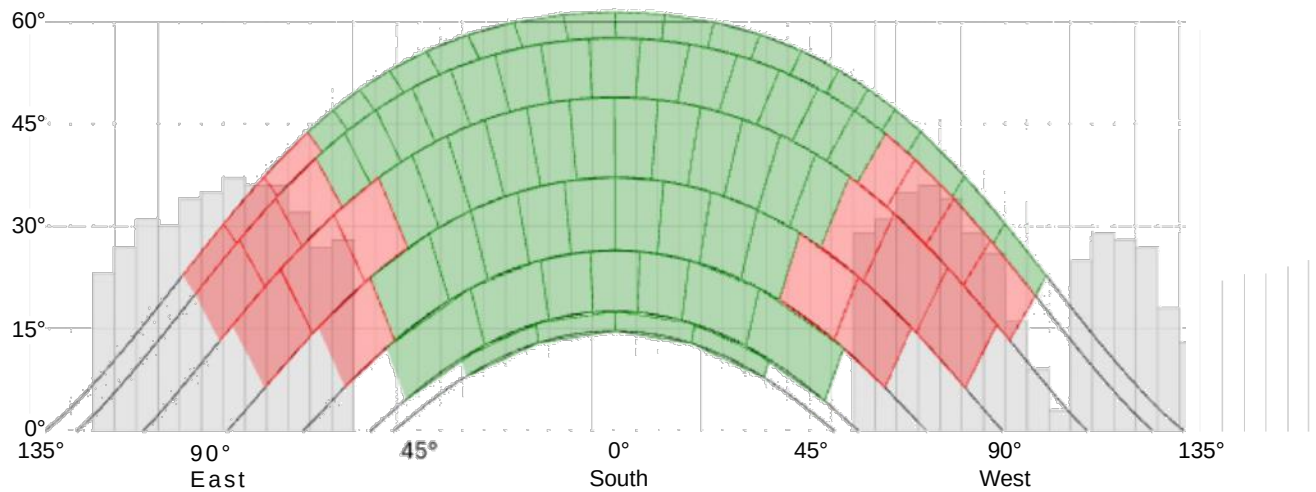
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Inclination of system - degrees from horizontal	Group 1: 40 panels with Tilt: 40° Group 2: 40 panels with Tilt: 40°	°
Postcode region	11	
B. Performance calculations		
kWh/kWp (Kk)	697.5	kWh/kWp

Shade Factor (SF)	0.783	
Estimated annual output (kWp x Kk x SF)	20,304	kWh
C. Estimated PV self-consumption - PV Only		
Assumed occupancy archetype	In Half Day	
Assumed annual electricity consumption, kWh	17,800	kWh
Assumed annual electricity generation from solar PV system, kWh	20,304	kWh
Expected solar PV self-consumption (PV Only)	7,757	kWh
Grid electricity independence / Self-sufficiency (PV Only)	43.6	%

Sunpath Diagram

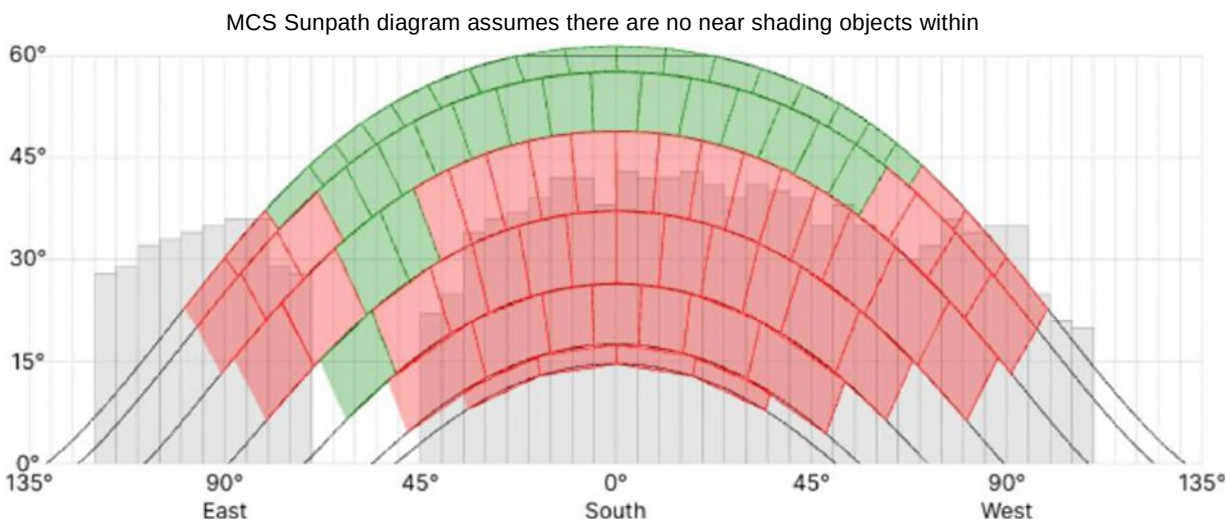
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Environmental Benefits

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Each Year

114¹⁰
5_{ton}

Over System Lifetime

153,695^{km}

Car distance avoided

988

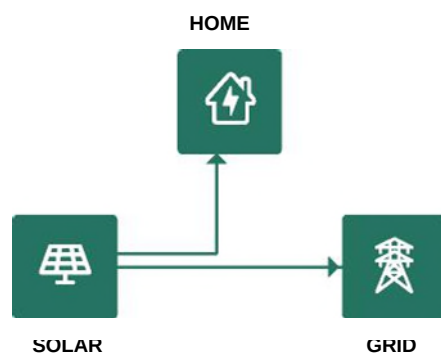
Trees planted

110

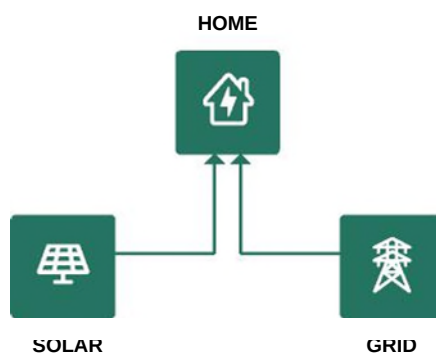
Long haul flights

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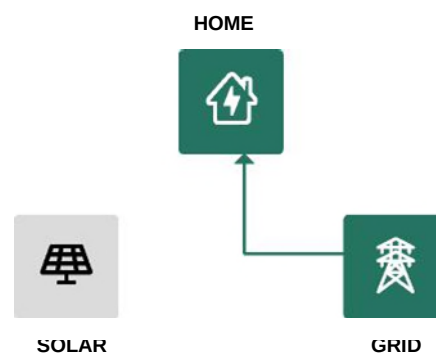
Generating Excess Solar



Partially Offset Usage



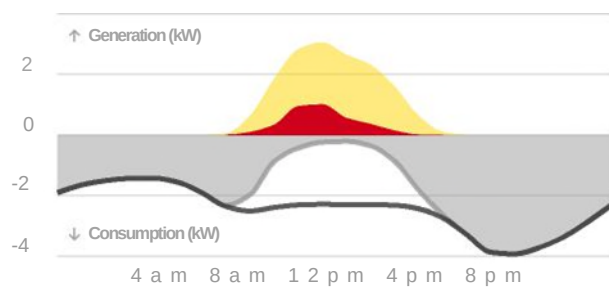
Night



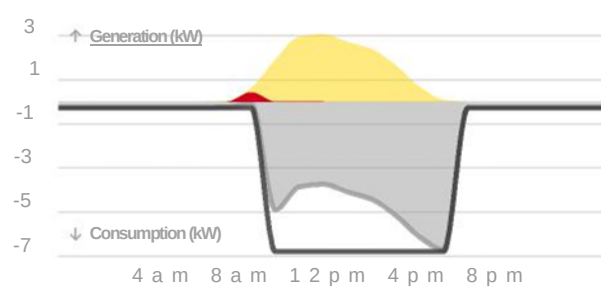
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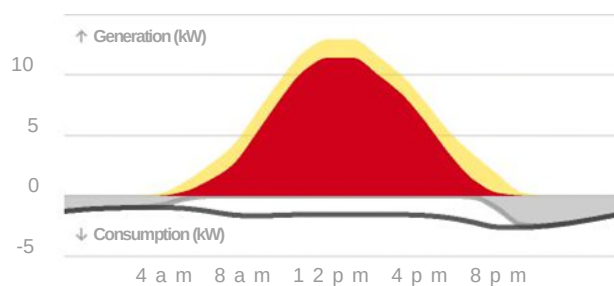
Winter Weekday



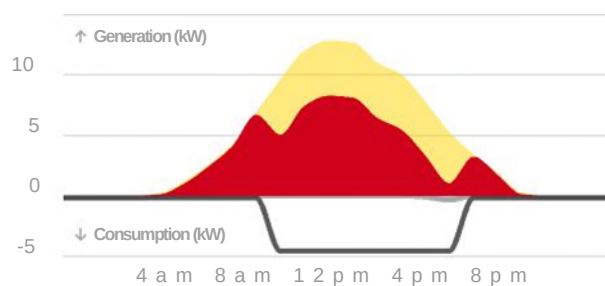
Winter Weekend



Summer Weekday



Summer Weekend



Electricity Bill Savings

First Year Monthly Bill Savings



Cumulative Bill Savings



Month	Solar Generation (kWh)	Net Grid Consumption before new system (kWh)	Electricity Imported after new system (kWh)	Electricity Exported after new system (kWh)	Export Credit (£)	Utility Bill before new system (£)	Utility Bill after new system (£)	Estimated Savings (£)
Jan	414	1,778	1,421	57	7	696	554	142
Feb	707	1,736	1,177	148	18	678	448	230
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May	2,976	1,307	448	2,117	254	517	3	514
Jun	3,291	1,242	381	2,431	292	492	3	488
Jul	3,340	1,202	368	2,505	301	477	3	474
Aug	2,739	1,178	441	2,002	240	468	3	465
Sep	1,754	1,295	584	1,042	125	512	117	396
Oct	928	1,445	916	399	48	570	321	249
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Smart Export Guarantee	

Smart Export Guarantee <i>All Days Mon-Sun</i>		£0.12 / kWh
Fixed Charges		
Standing Charge		£0.66 / day

Net Financial Impact Commercial 25% Deposit

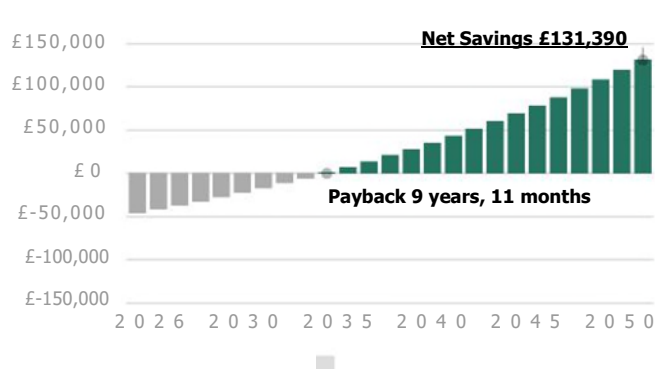
$$£181,007 - £49,618 = £131,390$$

Utility Bill Savings

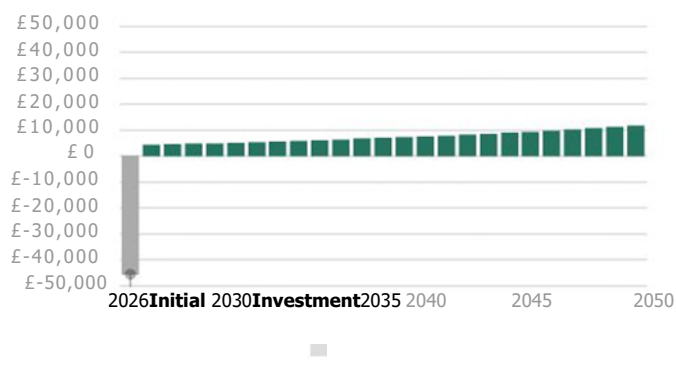
Net System Cost

Estimated Net Savings

Cumulative Savings From Going Solar



Annual Savings From Going Solar



£41,952

Net Present Value

13 Years 1
Month
Discounted
Payback Period

265%

Total Return on
Investment

10.8%

Rate of Return on
Investment

Year	Electricity Consumption (kWh)	Solar Generation (kWh)	Utility Bill (before new system) (£)	Utility Bill (after new system) (£)	Annual Savings (from new system) (£)	System Costs (Net of Dealer Incentives) (£)	Customer Incentives (Upfront) (£)	Net Savings (£)	Cumulative Impacts (£)
2026	17,800	20,304	7,005	2,948	4,057	49,618	0	(45561)	(45561)
2027	17,800	20,222	7,389	3,138	4,251	0	0	4251	(41309)
2028	17,800	20,141	7,795	3,339	4,456	0	0	4456	(36853)
2029	17,800	20,060	8,223	3,550	4,673	0	0	4672	(32180)
2030	17,800	19,979	8,675	3,773	4,901	0	0	4901	(27279)
2031	17,800	19,898	9,151	4,018	5,133	0	0	5132	(22146)
2032	17,800	19,816	9,653	4,296	5,357	0	0	5357	(16789)
2033	17,800	19,735	10,183	4,590	5,593	0	0	5593	(11196)
2034	17,800	19,654	10,742	4,900	5,842	0	0	5842	(5354)
2035	17,800	19,573	11,332	5,227	6,105	0	0	6104	750
2036	17,800	19,491	11,954	5,576	6,378	0	0	6378	7128
2037	17,800	19,410	12,610	5,960	6,650	0	0	6649	13778
2038	17,800	19,329	13,303	6,380	6,922	0	0	6922	20701
2039	17,800	19,248	14,033	6,823	7,210	0	0	7209	27911

Year	Electricity Consumption (kWh)	Solar Generation (kWh)	Utility Bill (before new system) (£)	Utility Bill (after new system) (£)	Annual Savings (from new system) (£)	System Costs (Net of Dealer Incentives) (£)	Customer Incentives (Upfront) (£)	Net Savings (£)	Cumulative Impacts (£)
2040	17,800	19,167	14,803	7,290	7,513	0	0	7513	35424
2041	17,800	19,085	15,616	7,783	7,833	0	0	7833	43257
2042	17,800	19,004	16,473	8,303	8,171	0	0	8170	51428
2043	17,800	18,923	17,378	8,851	8,527	0	0	8526	59955
2044	17,800	18,842	18,332	9,429	8,902	0	0	8902	68857
2045	17,800	18,761	19,338	10,040	9,299	0	0	9298	78156
2046	17,800	18,679	20,400	10,684	9,716	0	0	9716	87872
2047	17,800	18,598	21,520	11,363	10,157	0	0	10156	98029
2048	17,800	18,517	22,701	12,080	10,621	0	0	10621	108651
2049	17,800	18,436	23,948	12,836	11,111	0	0	11111	119762
2050	17,800	18,354	25,262	13,635	11,627	0	0	11627	131389

Estimates do not include replacement costs of equipment not covered by a warranty. Components may need replacement after their warranty period. Financial discount rate assumed: 5.0%

Quotation

Payment Option: Commercial 25% Deposit

80 x JA Solar 465 Watt Panels (JAM54D-41-465-LR-TS-AB-MC4) 1 x SE30K-RW00IBNJ4 (SolarEdge Technologies Ltd.) 1 x EM-ECA2-BT 8 x IMQ-ST16-DEI64P-2 1 x KG160 T704 GBA290 ST 40 x S1000-1GMYMBT	
Total System Price	£49,617.77 Including £8,269.63 VAT
Purchase Price	£49,617.77 Including £8,269.63 VAT
	
No Deposit	£0.00

Price excludes Retailer Smart Meter should you want us to install your Smart Meter it will be an additional cost. This proposal is valid until 22nd May 2026.

Payment Milestones

Payment 1(25%) Due when contract has been signed	£12,404.44
Payment 2 (65%) Due prior to equipment arriving on site	£32,251.55
Payment 3 (10%)	£4,961.78

Quote Acceptance

I have read & accept the terms and conditions.

Signature

Name

Date

Prepared by: Jason Metcalf

07512 310829

jason.metcalf@purelecenergy.co.uk**For: Richard Walsh**

None, [Commercial] St Andrews

Church, Keighley, BD21 5HT

richard.walsh@rjwdesignstudio.co.uk, (44)07966

Quote #: 9873243 Quote

Date: 20th May 2026 Valid

until: 22nd May 2026



Solar Energy System Proposal

Dear Richard Walsh,

Thank you for the opportunity to present your Solar Energy System Proposal.

Best Regards,

Jason Metcalf

Project Manager

Purelec Energy Ltd - Established 2014

Unit 2, 14a Wakefield Road,

Grange Moor, Wakefield,

West Yorkshire, WF4 4DS

**Purelec Energy Ltd**

Unit 2, 14a Wakefield Road, Grange

Moor

Wakefield West Yorkshire WF4 4DS



Phone: 01924 610000

Email: info@purelecenergy.co.ukWeb: www.purelecenergy.co.uk

Company Number: 09343993

MCS Membership No: NAP 26506

HIES Membership No: PEL/A/0488

**TESLA**
POWERWALLScan QR code on
your phone to access
the online proposal.

Our History

Purelec Energy are based in rural Wakefield, West Yorkshire, and specialise in the design, installation, and maintenance of Solar Photo Voltaic and battery storage systems. We cater for both the domestic and commercial sectors offering a turnkey service from design through to installation and ongoing support.

We became involved in the renewable industry at an early stage, seeing the potential for growth within this new market area. The renewable industry allows us to utilise our electrical experience, which has been developed over the last thirty years in business.

In 2014, we gained our Micro Generation Certification (MCS) and membership with the Home Insulation & Energy Systems Quality Assured Contractors Scheme (HIES). We have proudly retained annual membership to date and with both accreditations designed to maintain high standards and provide consumer protection, all of our customers can be sure each installation will be completed to the highest of standards.

By successfully achieving both accreditations and maintaining annual compliance, we are deemed a competent and trustworthy company advising end users about each of the technologies and service that we offer. It also allows you the peace of mind that you will be working alongside a company that has the skill set to deliver every time.

For the last nine years we have been successfully providing our expertise and services to our broad range of customers. We have worked on projects, which include large scale ground mounted solar arrays and industrial roof top systems, multi million pound mill conversions and school re wires and a wide range of domestic systems providing properties with bespoke solar and battery systems from household names such as GivEnergy.

Over the years we have been able to develop an extensive knowledge about the renewable industry and the UK market, allowing us to choose the most reliable products that will deliver on your investment.

We have grown organically, by offering the highest levels of customer service coupled with our carefully selected choice of products.

As we grow as a business it is important that all who work within the company share the same passion for what we do. It is also a priority that all employees have the necessary qualifications and training, which we provide on an ongoing basis.

Our Ethos

At the heart of our company is a passion to deliver the highest level of service to all of our clients. We always go that extra mile to make sure the process of installing your system or completing your project is as simple and stress free, for you, as possible.

With every project we take on, you can be sure to receive an exceptional service, and a feeling of security that you have picked the right people for the job.

Whenever you deal with a member of the Purelec Energy Team, you will be provided with friendly and honest advice. A lot of what we do is face to face communication with our clients, so these attributes are especially important. We always listen to the client and carefully take on board their requirements, making sure we deliver on a brief.

Whilst we know this can sound cliché, we honestly believe that we do offer all of our customers, just that little bit more than others.

We believe in honesty across the board, from our competitive pricing, to our professional advice, and we are confident this will show when you do business with us.

From time to time, things do go wrong, that's life. It is the way that you deal with the problem that sets you apart from the rest and we always make sure we rectify problems in a timely manner, with a "customer is always right's approach.

Over the years we have built a number of strong working relationships with our clients and associates, working with many of our clients for well over a decade.

Recommended System Option

32.55 kWp

System Size

£200,414

Lifetime Electricity Bill
Savings

£4,572

Estimated Annual
Electricity Bill Savings

£51,822

Total System Price
excluding VAT



Your Solution

Solar Panels

JA Solar

32.550 kW Total Module Power

70 x 465 Watt Panels (JAM54D-41-465-LR-TS-AB-MC4)

Inverter

SolarEdge Technologies Ltd.

29.99 kW Total Inverter Rating

1 x SE30K-RW00IBNJ4

Enclosed DC Switch IP66 2 pole 1 string 16A 800V

None

8 x IMO-SI16-PEL64R-2

Emlite 1-ph Bi-Directional generation meter 100A (1000 pulse/kWh) incl. Cover

None

1 x EM-ECA2-BI

Power Optimizer

SolarEdge Commercial Power Optimiser with 1.3m Input
35 x S1000-1GMXMBT

K&N Three Phase AC Switch Disconnect 160A

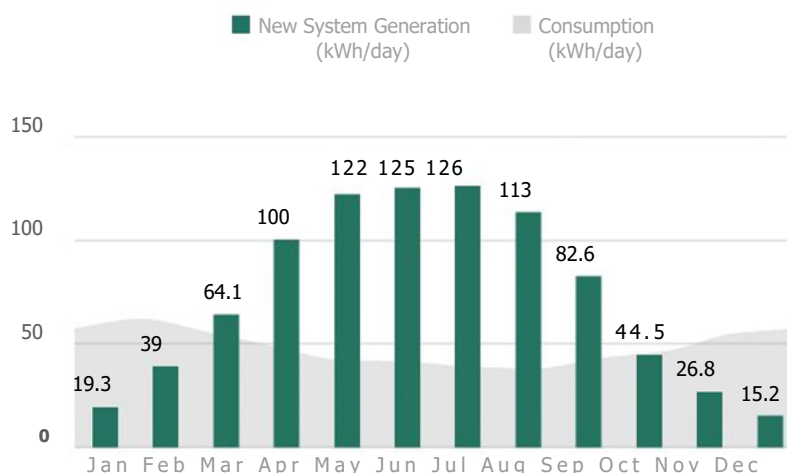
None

1 x KG160 T204-GBA290 ST

Warranties: 25 Year Panel Product Warranty, 30 Year Panel Performance Warranty, 12 Year Inverter Product Warranty

System Performance

150%



30%	70%
Self Consumption	Export to grid

System Performance Assumptions: System Total losses: 9.6%, Inverter losses: 2.0%, Optimizer losses: 1.2%, Shading losses: 9.4%, Performance Adjustment: 0%, Output Calculator: System Advisor Model 2020.02.29.r2. Panel Orientations: 42 panels with Azimuth 174 and Slope 45, 28 panels with Azimuth 174 and Slope 13.

Important Note: The energy performance and benefits of EESS is impossible to predict with certainty due to the numerous functions a system can be programmed to perform. This estimate is based upon the System Advisor Model (SAM) procedure and is given as guidance only. It should not be considered as a guarantee of performance

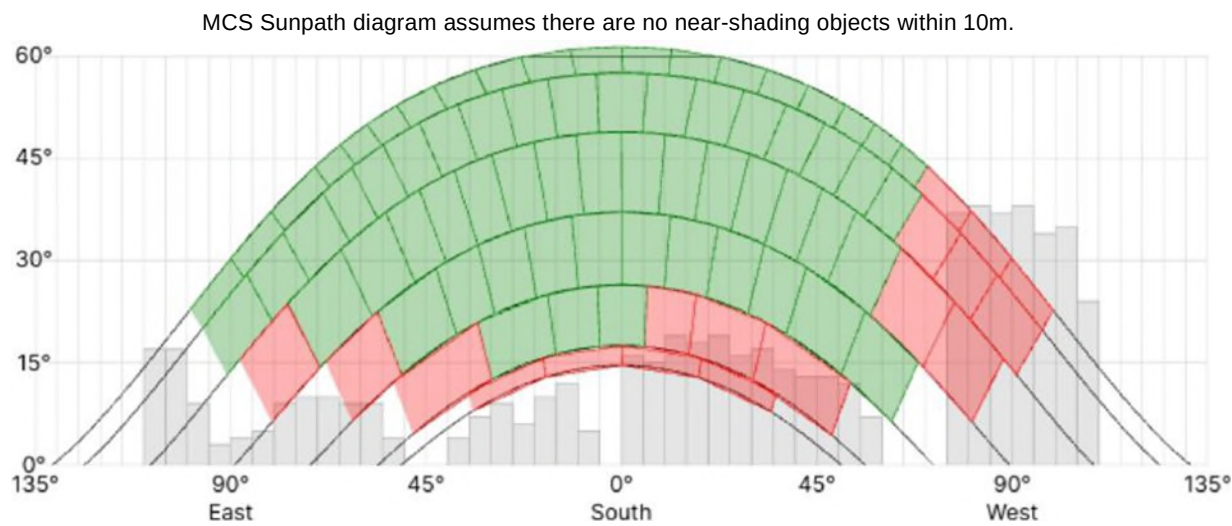
The MCS output (MIS 3002) and self-consumption (MGD 003) calculation methodology was not used in calculating the numbers in the table below. An alternative calculator System Advisor Model 2020.02.29.r2 was used.

A. Installation data		
Installed capacity of PV system - kWp (stc)	32.550	kWp
Orientation of the PV system - degrees from South	Group 1: 42 panels with Orientation: 5 ° Group 2: 28 panels with Orientation: 5 °	°
Inclination of system - degrees from horizontal	Group 1: 42 panels with Tilt: 45° Group 2: 28 panels with Tilt: 13°	°
Postcode region	11	
B. Performance calculations		
kWh/kWp (Kk)	908.4	kWh/kWp

Shade Factor (SF)	0.906	
Estimated annual output (kWp x Kk x SF)	26,779	kWh
C. Estimated PV self-consumption - PV Only		
Assumed occupancy archetype	In Half Day	
Assumed annual electricity consumption, kWh	17,800	kWh
Assumed annual electricity generation from solar PV system, kWh	26,779	kWh
Expected solar PV self-consumption (PV Only)	7,965	kWh
Grid electricity independence / Self-sufficiency (PV Only)	44.8	%

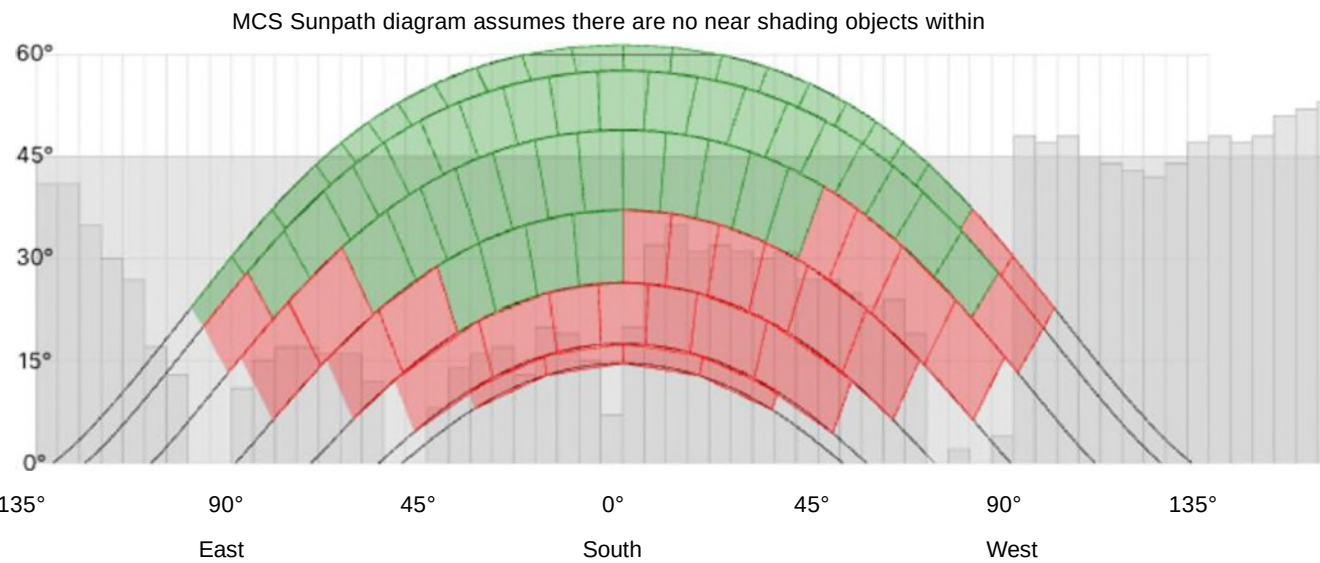
Sunpath Diagram

Disclaimer: The shade mask mapped onto the sunpath diagram is based off the field of view from a point in the center of the array. This means that the shade mask shown will only capture the shading experienced at the array center point, and will not reflect the shading casted onto other locations on the array.



Sunpath Diagram

Disclaimer: The shade mask mapped onto the sunpath diagram is based off the field of view from a point in the center of the array. This means that the shade mask shown will only capture the shading experienced at the array center point, and will not reflect the shading casted onto other locations on the array.



Environmental Benefits

Solar has no emissions. It just silently generates pure, clean energy.



Each Year

150%
7_{ton}

Over System Lifetime

202,711^{km}

Car distance avoided

1,303

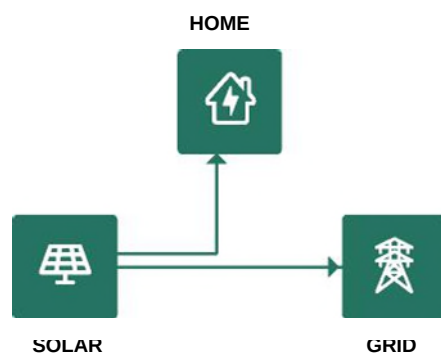
Trees planted

145

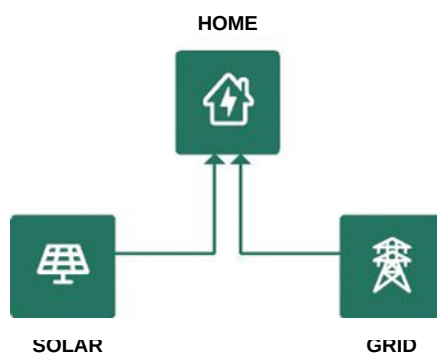
Long haul flights

How your system works

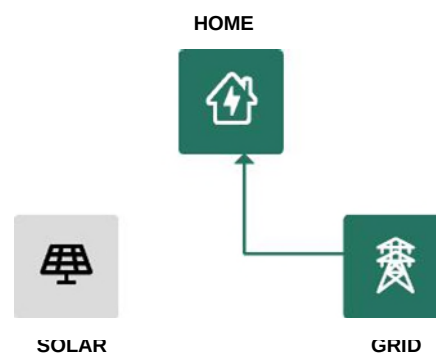
Generating Excess Solar



Partially Offset Usage



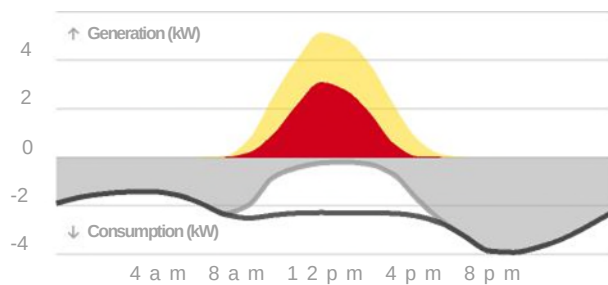
Night



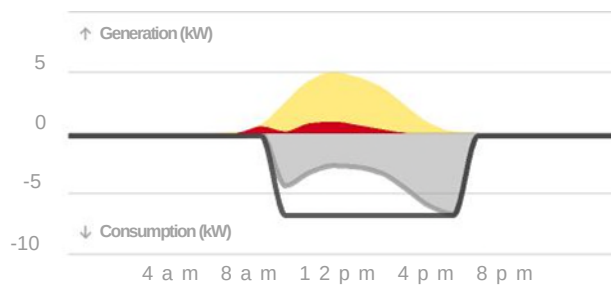
Daily Energy Flows

CONSUMPTION (kWh)
 GENERATION (kWh)
NET CONSUMPTION (kWh)
EXPORT TO GRID

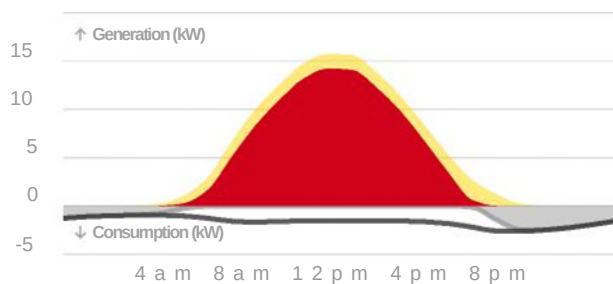
Winter Weekday



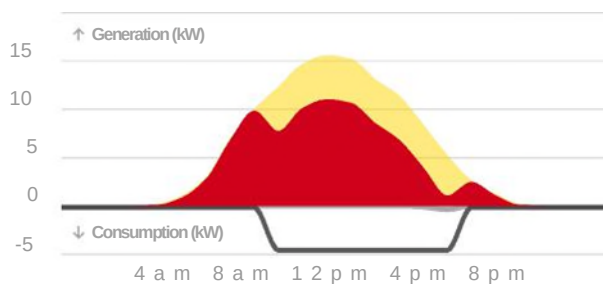
Winter Weekend



Summer Weekday

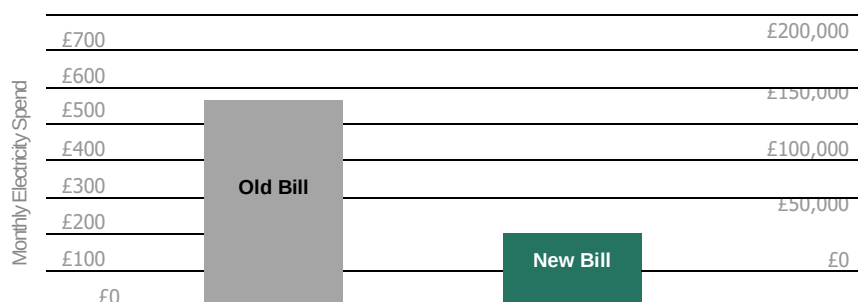


Summer Weekend

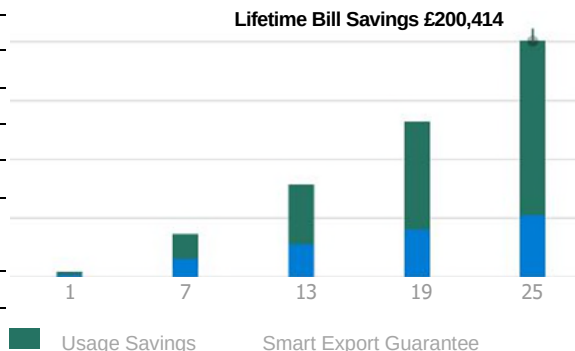


Electricity Bill Savings

First Year Monthly Bill Savings



Cumulative Bill Savings



Month	Solar Generation (kWh)	Net Grid Consumption before new system (kWh)	Electricity Imported after new system (kWh)	Electricity Exported after new system (kWh)	Export Credit (£)	Utility Bill before new system (£)	Utility Bill after new system (£)	Estimated Savings (£)
Jan	600	1,778	1,387	208	25	696	522	174
Feb	1,092	1,736	1,104	460	55	678	383	295
Mar	1,988	1,725	910	1,174	141	676	225	450
Apr	3,004	1,468	594	2,130	256	577	3	574
May	3,785	1,307	461	2,938	353	517	3	514
Jun	3,753	1,242	396	2,908	349	492	3	488
Jul	3,907	1,202	381	3,085	370	477	3	474
Aug	3,518	1,178	446	2,786	334	468	3	465
Sep	2,477	1,295	579	1,761	211	512	29	483
Oct	1,381	1,445	893	829	100	570	260	309
Nov	803	1,649	1,229	383	46	646	441	206
Dec	472	1,776	1,454	150	18	695	555	140

Your projected energy cost is calculated by considering a 5.49% increase in energy cost each year, due to trends in the raising cost of energy. This estimate is based on your selected preferences, current energy costs and the position and orientation of your roof to calculate the efficiency of the system. Projections are based on estimated usage of 17800 kWh per year, assuming Variable

Tariff Electricity Tariff.

Your electricity tariff rates may change as a result of installing the system. You should contact your electricity retailer for further information.

Proposed Tariff Details - British Gas Variable Tariff	
Energy Charges	
Unit Rate <i>All Days Mon-Sun</i>	£0.38 / kWh
Smart Export Guarantee	

Smart Export Guarantee <i>All Days Mon-Sun</i>		£0.12 / kWh
Fixed Charges		
Standing Charge		£0.66 / day

Net Financial Impact Commercial 25% Deposit

£200,414 - £62,186

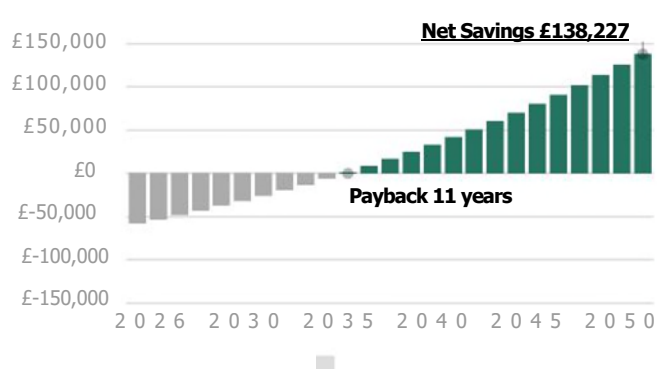
£138,227

Utility Bill Savings

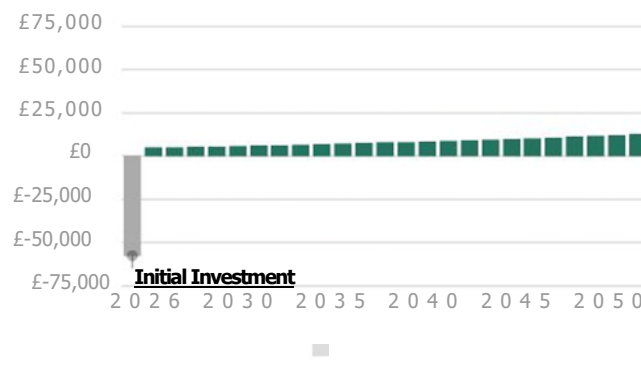
Net System Cost

Estimated Net Savings

Cumulative Savings From Going Solar



Annual Savings From Going Solar



£39,512

Net Present Value

14 Years 9 Months

Discounted Payback
Period

222%

Total Return on
Investment

9.6%

Rate of Return on
Investment

Year	Electricity Consumption (kWh)	Solar Generation (kWh)	Utility Bill (before new system) (£)	Utility Bill (after new system) (£)	Annual Savings (from new system) (£)	System Costs (Net of Dealer Incentives) (£)	Customer Incentives (Upfront) (£)	Net Savings (£)	Cumulative Impacts (£)
2026	17,800	26,779	7,005	2,433	4,572	62,186	0	(57613)	(57613)
2027	17,800	26,672	7,389	2,605	4,784	0	0	4784	(52829)
2028	17,800	26,564	7,795	2,802	4,993	0	0	4993	(47836)
2029	17,800	26,457	8,223	3,009	5,214	0	0	5214	(42622)
2030	17,800	26,350	8,675	3,227	5,448	0	0	5447	(37174)
2031	17,800	26,243	9,151	3,457	5,694	0	0	5693	(31480)
2032	17,800	26,136	9,653	3,700	5,953	0	0	5953	(25527)
2033	17,800	26,029	10,183	3,956	6,227	0	0	6227	(19300)
2034	17,800	25,922	10,742	4,226	6,516	0	0	6516	(12783)
2035	17,800	25,815	11,332	4,510	6,822	0	0	6821	(5962)
2036	17,800	25,707	11,954	4,816	7,138	0	0	7138	1176
2037	17,800	25,600	12,610	5,170	7,440	0	0	7440	8616
2038	17,800	25,493	13,303	5,546	7,756	0	0	7756	16372
2039	17,800	25,386	14,033	5,959	8,074	0	0	8074	24446

Year	Electricity Consumption (kWh)	Solar Generation (kWh)	Utility Bill (before new system) (£)	Utility Bill (after new system) (£)	Annual Savings (from new system) (£)	System Costs (Net of Dealer Incentives) (£)	Customer Incentives (Upfront) (£)	Net Savings (£)	Cumulative Impacts (£)
2040	17,800	25,279	14,803	6,403	8,400	0	0	8400	32847
2041	17,800	25,172	15,616	6,888	8,728	0	0	8728	41575
2042	17,800	25,065	16,473	7,399	9,074	0	0	9074	50649
2043	17,800	24,958	17,378	7,939	9,439	0	0	9439	60088
2044	17,800	24,851	18,332	8,507	9,824	0	0	9824	69912
2045	17,800	24,743	19,338	9,107	10,231	0	0	10231	80143
2046	17,800	24,636	20,400	9,740	10,660	0	0	10660	90804
2047	17,800	24,529	21,520	10,407	11,113	0	0	11112	101916
2048	17,800	24,422	22,701	11,111	11,590	0	0	11590	113507
2049	17,800	24,315	23,948	11,853	12,094	0	0	12094	125601
2050	17,800	24,208	25,262	12,637	12,626	0	0	12625	138227

Estimates do not include replacement costs of equipment not covered by a warranty. Components may need replacement after their warranty period. Financial discount rate assumed: 5.0%

Quotation

Payment Option: Commercial 25% Deposit

70 x JA Solar 465 Watt Panels (JAM54D-41-465-LR-TS-AB-MC4) 1 x SE30K-RW001BNJ4 (SolarEdge Technologies Ltd.) 1 x FM-ECA2-BL 8 x IMO-SI16-PEI 64R-2 1 x KG160 T204-GBA290 ST 35 x S1000-1GMXMBT	
Total System Price	£62,186.26 Including £10,364.38 VAT
Purchase Price	£62,186.26 Including £10,364.38 VAT
	
No Deposit	£0.00

Price excludes Retailer Smart Meter should you want us to install your Smart Meter it will be an additional cost.
This proposal is valid until 22nd May 2026.

Payment Milestones

Payment 1 (25%) Due when contract has been signed	£15,546.56
Payment 2 (65%) Due prior to equipment arriving on site	£40,421.07
Payment 3 (10%)	£6,218.63

Quote Acceptance

I have read & accept the terms and conditions.

Signature

Name

Date

Watsons report text continues

Battery Storage

Battery storage would maximise self-consumption of the generated electricity. These batteries can also be charged at lower rates, using overnight tariffs subject to agreeing an overnight tariff with the electricity supplier.

At present the costs for beneficial battery storage is prohibitively expensive. However, as the technology is advancing rapidly, consideration has been made for allowing space within the plant room for a future battery storage system. As technologies advance costs will reduce.

Wind Turbine

Small wind turbines are available for the domestic markets; however, these are not suitable for grid connections and should only be used for powering off grid equipment.

A typical 5KW standalone tower wind turbine installation cost is £28,000.00 + VAT plus an additional £8,000.00 + VAT for the installation. This would generate circa 14,000 KWh per year.

In addition to the costs above, due to trees around the location of the church hall, the turbine would need to be installed at the lower part of the grave yard adding the circa £17,000.00 + VAT for trenching, lockable kiosk and cabling.

This option would also be subject to planning, archaeological consideration in excavating the lower area of the grave yard and trenching along the wall line and objections to the aesthetics of the array in the grave yard. It is not considered viable.

Other Steps Taken To Reduce The Church's Carbon Footprint

Designing the electrical services for the building in a sustainable manner have been at the forefront along every step taken.

Lighting costs can be reduced by up to 90% by the introduction of LED energy efficient light fittings to replace less efficient tungsten, halogen and fluorescent lighting.

There has been consideration to allow where possible the ability to use natural daylight. Using dimming controls to light fitting in areas with window giving natural daylight, helps toward achieving additional energy savings.

Motion sensors installed to control lights in toilet areas, circulation areas and store rooms, will ensure that lights are only on when the areas are in occupation.

The use of metering linked to a Building Management Control System, will allow the areas where energy is being used to be identified. This involves installing individual electricity meters (sub-meters) in addition to the main electricity meter to track energy consumption for specific areas and specific large loads such as mechanical plant. This allows for a more detailed understanding of energy usage patterns and can help identify areas for potential energy savings.

Automatic operation, low-energy motors and innovative airflow design ensures fast dry speeds while using little electricity. Energy-efficient hand dryers cost a negligible amount to run compared to those which rely on heat evaporation.

Document Sign Off

Issued on 4 June 2026

A handwritten signature in black ink, appearing to be 'P. Cowling', written over a horizontal line.

Signed

Paul Cowling

Senior Mechanical Design & Project Engineer

For and on behalf of Watsons Building Services Ltd

A handwritten signature in blue ink, appearing to be 'D. Speed', written over a horizontal line.

Signed

Dominic Speed

Electrical Manager