# SOLAR

## FOR FAITH BUILDINGS

**Saving The Planet &**
**Saving You Money**

# Introduction

**All the world's major faiths acknowledge that climate change is a major threat to our planet and its people.**

Most are encouraging faith communities to do everything they can to reduce their own greenhouse gas emissions, and many have set ambitious targets for this. Our good news, presented in this booklet, is that installing solar panels on faith buildings can substantially reduce those emissions. The even better news is that installing solar panels offers financial benefits, through reducing electricity bills.

We hope that, through publishing this information, your faith community is encouraged to investigate the installation of solar panels on your faith building to protect our planet and as wise stewardship of your own assets. In doing so you will also be acting as a beacon of change for the wider communities you serve, encouraging and inspiring all to share your concerns and actions for our planet and its people.

**The Right Reverend John Arnold**

**Eleventh Bishop of Salford and Environment Lead for Catholic Bishops in England and Wales.**

# CONTENTS

01

# THE BIG PICTURE

# 01 The big picture

## 1.1 Caring for Creation

**There is now irrefutable evidence that human emissions of greenhouse gases are heating our planet and causing suffering to many of its most vulnerable inhabitants.**

As people of faith, we recognise our responsibility to care for this planet and its people by reducing our emissions. We are often worried by the costs of such innovation, but installing solar panels to power our places of worship can reduce emissions and pay for itself through savings on electricity bills. This report illustrates the emissions reductions that are possible through installing solar panels and how cost-effective this can be.

## 1.2 What have we done?

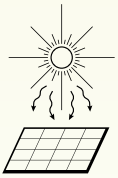
To do this we commissioned case studies of six faith communities across Greater Manchester and created computer models to find the optimum combination of solar panels and batteries across these sites. We then estimated the benefits of that optimum configuration in terms of reduced greenhouse gas emissions and lower electricity bills and compared this to an estimate of installation costs. Finally, we tested how the findings would have been affected if we made a range of assumptions about how electricity costs might change in the future.

The case studies were conducted by a team led by Red Co-operative Ltd for the Roman Catholic Diocese of Salford, working in partnership with the Faith Network for Manchester with funding from Electricity North West. Full data fare available at **this link**. This report has been written by Dr Richard Baker.

All costs detailed in this report are from the time of writing (Summer 2025) and are subject to change.

1.3

# What benefits did we find?



**Installing solar panels across the six sites was predicted to substantially reduce greenhouse gas emissions from electricity use.**

In the best case, solar panels reduced this to zero. Even in the worst case, the reduction was over half (56%).


Over the 25-year lifetime of the panels, these reductions were found to be approximately five times the emissions resulting from **manufacturing** the panels.

Average time to recoup cost

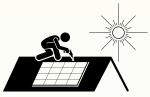
5 yrs 7 months

Across all the sites, the reduction in electricity bills each year represented just over 20% of the estimated installation cost. On average it would take less than 6 years for the money invested in the panels to be paid back through these reductions. After that, the savings continue to benefit the faith community for the rest of the life of the panels. When we looked at how our calculations might be affected by different assumptions, such as how electricity prices might change in the future, we still found that under the worst-case scenario, electricity bills would still be reduced each year by over 13% of the installation cost.

Batteries, by contrast, led to quite modest further reductions in emissions (4% to 13%), add substantially to the upfront cost, and have considerably longer payback times (only one was predicted to cover its installation cost within 10 years). In all the sites, investing in more panels to achieve the same reduction in emissions as a battery would have cost considerably less (21% to 43% of the cost of batteries).

1.4

## How many panels were needed?

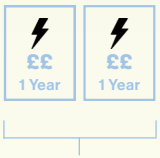


The more panels that are installed, the greater the reduction in overall greenhouse gas emissions. The financial returns, however, are optimised if the number of panels is matched to the site's electricity consumption.

Your energy use is measured in kilowatt-hours (kWh) and the size of the installation in kilowatts at peak generation (kWp). At most sites we looked at, the optimum size was around 1kWp for every 2,000 kWh of power consumed each

year, requiring arrays of between 6 and 10kWp. The biggest site, which consumed 60,000kWh each year, required 30 kWp of solar panels.[1]

Another way of looking at this is in terms of financial cost. At current prices, the optimum array cost approximately twice as much as the annual electricity bill. The installation costs thus ranged from £8,000 to £32,000.




Upfront cost of the optimum array

We chose the optimum sized array as that which minimised the payback time (the number of years required to recoup the initial investment through reduced fuel bills). Larger arrays still lead to further reductions in both emissions and electricity bills and are still effective investments with only slightly longer payback times. Arrays of twice the optimal size led to bills being reduced each year by at least 13% of the installation cost with a maximum payback time of 7½ years.

Within sensible limits, the more a faith community can afford to invest in solar panels the more it will benefit the environment and save on its electricity bills.

1 Note that this assumes optimum positioning of the panels. If this is not possible then a larger installation may be required. This is the sort of issue that needs discussing with your installer as you make detailed plans. See mcscertified.com/find-an-installer/ for an installer near you.

## 1.5 What does this mean for your faith community?

The case studies were not selected at random. We selected these places of worship because they are used during the daytime throughout the week (four or more days each week) for most of the year.

If your place of worship is similar, then it is highly likely that solar panels will substantially reduce your greenhouse gas emissions and bring you financial benefits. The sooner you can install panels, the sooner you and the planet will start to reap the benefits. Batteries on the other hand, under current market conditions, do not offer the same benefits.

If your building is used little during the day, either because most use is in the evenings or because it is only used on your holy day, then solar panels will still reduce greenhouse gas emissions, but will not bring the same financial returns. It may be that, in these circumstances, a battery could improve the cost effectiveness of the whole system, but you will need to take expert advice on what suits your buildings best.

## 1.6 How can we raise the money?

For the sites that were part of this study, spending money on solar panels was a solid investment for the future. Predictions show significant reductions in carbon emissions and a long-term financial benefit. Returns annualised over ten years generally exceed current interest rates on savings accounts or for borrowing, as of June 2025.

There are several ways of raising money for this investment. It may be possible to combine two or more of these.

1.6.1

### Direct Fundraising

The combination of environmental and financial returns should provide a strong platform for requesting direct donations or promoting a wider fundraising campaign. Donors will be contributing to an immediate reduction in greenhouse gas emissions and the long-term financial viability of their faith community.

1.6.2

### Grants

There are generally fewer grants now to fund solar installations than in the past, but it is still worth doing research to see if they are available.

1.6.3

### Existing Funds

Many faith communities already have some sort of cash reserves. It may well be that using these to invest in solar panels will give a better return than those funds are currently attracting. You will of course have to balance this use of such funds with other potential uses (including maintaining a reasonable reserve to protect against unanticipated future expenses).

1.6.4

### Borrowing

The returns on the investment may be sufficiently large for it to make sense to borrow to pay for installation with repayments being made from the money saved on electricity bills.

1.6.5

### Community Energy

For larger installations (above 50 kWp), it might be viable to raise funds through a community share offer, which would be best done in partnership with a local community energy scheme (you can find details at **communityenergyengland.org** or similar sites).

This will have the same environmental benefits as funding panels yourself, but the financial benefits will be shared with the community investors. This will reduce the financial benefits to the faith community but may have other advantages, such as opening up new possibilities for the faith community to interact with the wider community of which it is a part.

1.7

# Who makes the decisions and manages the risks?

Faith communities in the United Kingdom have a wide range of decision-making processes.

Some will be able to act independently, some will have decisions made for them by a regional or national organisation and many may need decisions to be approved at more than one level. You will need to make sure that any decisions, about fund-raising, planning and installation, follow the processes in place for your community.

As with all financial decisions there is a degree of risk in investing in solar panels. The computer models we used all made various assumptions including the cost of electricity over the time taken to recoup the investment. Although we tested these assumptions over a range of likely scenarios they remain assumptions. We think that there is a strong environmental and financial case for investment in solar panels in general. We are, however, unable to provide specific technical or financial advice to individual faith communities. It remains the responsibility of each faith community to ensure that they understand the risks as well as the potential benefits in coming to a decision.

Most solar panels are manufactured overseas, many of which have a poor record of employment rights and poor environmental policies. Most faith communities will want to shop around to ensure that the panels they are purchasing have appropriate guarantees of ethical manufacturing processes. It is our belief that this is still possible for the cost of the panels used in these calculations.

02

# CASE STUDIES

## 2.1 Bolton Road Methodist Church

Bolton Road Methodist Church in Bury is a lively congregation with an active community outreach programme. The purpose-built brick building was opened in 2002 with an octagonal worship area surrounded by a suite of flexible use rooms. As well as a range of church groups, the buildings are used for a community pantry and community night centre.

Our study estimates the church's current annual electricity bill could be reduced by 30% by an 8 kWp installation, which would reduce the emissions associated with their electricity use by 46%. This would cost about £10,000 but would be repaid from the savings in 5½ years. Doubling the size of the array would increase savings by a further 50%. It would be slightly less cost-effective but still repay the investment within 6 years.

## 2.2 Hidden Gem Roman Catholic Church

St Mary's Church in central Manchester truly is a hidden gem, being open for quiet prayer and services throughout the day and throughout the week. It is a heritage building accommodating artwork of national importance and attracts many visitors and tourists. Over recent years it has gone through several phases of building restoration and are now considering including solar panels in the next phase.

Our study suggests that an 8 kWp installation costing approximately £10,000 would reduce carbon emissions associated with electricity use by 57%. They would recover the initial cost within 5 years through reducing their current electricity bill by 45%, and savings would continue after that.

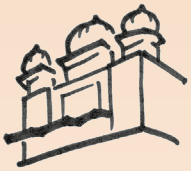
Using transparent panels over the glass covered space between the church and presbytery could also make that space more usable by providing partial shade which would reduce overheating during the summer.

## 2.3 Sacred Heart Roman Catholic Church

Sacred Heart is a large brick-built church with a presbytery (priest's house) and parish centre. There are a range of activities during the week, including community groups hiring the parish centre two weekday evenings and some weekends.

Our study found that a 10kWp array costing about £10,000 would reduce carbon emissions associated with electricity use by a half. This would generate savings of about £3,000 each year leading to the installation costs being paid back in less than 5 years.

## 2.4 Sri Guru Gobind Singh Gurdwara



This is a busy Sikh temple in Whalley Range, Manchester. Like all gurdwaras it has a langar, a free community kitchen that serves 2,000 meals each week. It spends nearly £20,000 on electricity each year with consistent use throughout the day, week and year. It has a large flat roof that would be ideal for solar panels.

Our study shows that a 30 kWp array would reduce greenhouse gas emissions by just over 4 tonnes, about half what it emits from current electricity use. Although an investment of just over £30,000 would be required, this would be paid back in six years, and after that the Gurdwara would continue to benefit from savings of over £6,000 on electricity bills each year. If the Gurdwara converted from cooking on gas to electricity, then the same array of panels would reduce the electricity bill by even more.

## 2.5 St Vincent de Paul Roman Catholic Church

The site of St Vincent de Paul's in Bolton includes a brick-built church, church hall and presbytery. The church is open for services on most days of the week. Our study suggests that a 10kWp array costing about £12,000 would reduce carbon emissions associated with electricity use by nearly 60% and reduce the annual electricity bill by over a third.

Like many churches, the altar is in the east and the main roof faces south – which is perfectly orientated to optimise the output of solar panels.

Electricity use shows more pronounced peaks than other churches at the time of the morning service and later in the evening. This is the one church where a battery would make significant further savings (a further 15%). The combination of the battery and a larger array could reduce emissions associated with electricity use to zero and still pay back the investment within 6 years.

2.6

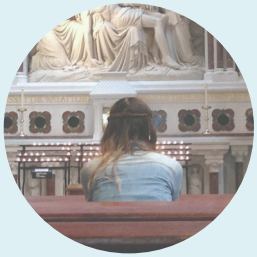
## Syke Methodist Church

Syke is a small but busy Methodist congregation on the edge of Rochdale. They had a major renovation in 2020 that transformed the traditional stone-built church into a modern multi-purpose building that they share with **Syke Community Base**. The building is well used throughout the week with peak electricity use through the middle of the day. Their electricity bills are just over £2,000 per year.

Our study suggests that a 6 kWp array would generate almost the same amount of electricity as they currently use each year. It would payback a cost of about £8,000 over 7 years through reducing electricity bills by 65%. These savings would continue for the lifetime of the system (at least 20 years).

03

# A BIT MORE DETAIL

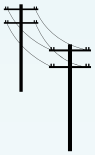


# 03 A bit more detail for those that want it

**This final section explains how and why we have reached some of our conclusions.**

It is primarily for the benefit of those who would like to look beyond the headline figures. There are a few more footnotes here to try and make things as clear as possible.

## 3.1 How is electricity from solar panels used?



Most faith buildings use different amounts of electricity at different times of the day, which varies throughout the week and year. This is called your electricity consumption profile.

If you are consuming less electricity than you are generating at any time, then that electricity is taken directly from the panels. Any electricity that you generate but do not need can be sold to your electricity supplier to be used somewhere else (unless you have a battery – see below). If you are consuming more electricity than you are generating, then you take all the electricity generated by the panels but will need to purchase more from your supplier to meet your additional requirement. These processes are automated and tracked by a smart meter, so the way you use your electricity does not have to change at all.

## 3.2 Reducing greenhouse gas emissions

From the point of view of reducing greenhouse gas emissions[2] it doesn't really matter where the electricity is used.

A kilowatt-hour of solar electricity used within your faith building has an almost identical effect to the same kilowatt-hour of electricity being exported to the grid. Either prevents the need to generate the same kilowatt-hour of electricity at a power station and thus prevents the emissions associated with this.

Put simply, the more solar panels you install, the more electricity you are going to generate and the more greenhouse gas emissions you will prevent. You will only be limited by the available space on your roof (see later) and what you are prepared to spend.

## 3.3 Reducing bills

As we've seen, it doesn't really matter where electricity is used from the perspective of reducing emissions, this does however, have a profound effect on how much your bills are reduced. The electricity you generate from your panels and use within your building reduces the amount you need to buy from your supplier. For every kilwatt-hour you generate you

2 We use the term "greenhouse gas" emissions here to mean the emissions of any gases that are contributing to global warning. "Carbon dioxide", "$CO_2$", or "carbon" emissions are similar terms but only account for the warming effect of carbon dioxide and will be lower. Different gases have different warming effects, so greenhouse gas emissions are measured in the number of tonnes of $CO_2$ that would have an equivalent effect (abbreviated to $tCO_2e$).

will save yourself the cost of purchasing that kilowatt-hour from your supplier (the import price).

If you generate more electricity, under the Government's Smart Export Guarantee (SEG), your supplier is obliged to buy this from you. There is no specified minimum for the price they must pay (the export price). Even if you shop around, you are unlikely to find a supplier who will buy exported electricity at anywhere near the price that they sell it for. In these case studies we've used an export price that is about a third of the current import price. Using electricity on site effectively results in three times the cost benefit to exporting it for use somewhere else.

If you install a small array of panels then your generation profile may always be less than your consumption profile and all your electricity will be used on site. This guarantees you saving the full import price of electricity and will lead to the highest savings per kilowatt-hour of generation.

If you install a bigger array, then you will generate more electricity, but at times you may find that your generation profile exceeds your consumption profile. When this happens, the electricity that can be used on site will save you the full import price, but the rest will be exported to the grid for the lower export price. On average you will therefore gain less per kWh of electricity generated. Despite this, the benefits of generating more electricity in total may outweigh this lower price per kWh. In all the case studies, the optimum sized array was one for which some electricity was exported (representing between 8% and 29% of the overall financial benefit).

If the array gets too big, you will end up selling a high proportion of the electricity you generate back to your

supplier at a low export price. This will increase on the time taken to repay your original investment.

How much income you generate will depend on how your generation profile, which increases with the array size, matches your consumption profile. If you understand both well, then you can make some intelligent guesses about how much income you might generate from an array of a particular size. For the case studies, we have used computer modelling to quantify this.

## 3.4 The potential of batteries

Batteries can affect these calculations in three ways.

### 3.4.1 Time shifting without import

If your solar panels generate more electricity than your building is using, then some of that electricity can be stored in the battery and used on-site at other times of the day when the panels are generating less electricity than the building needs. This has little effect on emissions reduction[3] but, by increasing the amount of electricity used on-site, will increase the cost savings.

3 Compared with exporting the same electricity to the grid.

3.4.2

### Time shifting with import

If your faith building is on a time of use (TOU) tariff with energy cheaper when supplied at night than it is during the day, then the battery can be charged up overnight at the cheaper rate for use during the day when it would have cost more. This can be combined with some storage of excess generation from the panels to increase cost-savings still further.

3.4.3

### Trading

There is a growing market for small scale battery storage to be used by electricity suppliers to help balance the demands of the grid between times of high and low renewable energy generation. Some income is available from allowing batteries to be used in this way.

The emissions released in the generation of a kilowatt-hour of electricity (the carbon intensity) vary throughout the day and are highest at times of peak demand (generally in the early evenings). If either form of time-shifting can reduce the electricity taken from the grid at these times, then this will also reduce emissions.

The case studies conclude that while there is potential to reduce emissions and costs through battery use these reductions are generally quite small and insufficient to justify either the financial cost of the battery or the environmental cost of its manufacture. In most cases the payback time is comparable to the expected life of the battery.

3.5

# How have we obtained our data?

The electricity generation profiles that we have used have come from similar installations in Greater Manchester. Areas south of Manchester are likely to receive more sunshine each year (and generate more electricity) and those to the north are likely to receive less (and generate less). There are now widely available and often free resources (e.g. **opensolar.com**) that allow you to predict the output of panels placed on your faith building based on the information contained in the 3d version of Google maps.

Where possible we have used electricity consumption profiles specific to the place of worship. Electricity bills detail the electricity consumed each month and, if smart meters are installed, suppliers are often able to provide half-hourly summaries of energy use. Where this is not available, we have used clamp meters to monitor the electricity entering a building over a period of several weeks and combined this with monthly data from bills to generate annual consumption profiles.

Electricity price information has been taken largely from the tariffs that currently apply at the different sites. None of the sites use export tariffs, so these have been estimated from similar installations elsewhere.

## 3.6 Thinking ahead

Our analysis makes assumptions about electricity consumption profiles, electricity generation profiles and the cost of electricity. It is thus worth reflecting on how these might change in future, particularly over the 6 years or so when the costs of the investment are being paid back. We have reasonable confidence that the environmental justification for an installation will be unaffected by likely changes in the model assumptions, but the cost implications could be affected quite markedly by changes in electricity prices.

The biggest savings come from reducing the amount of electricity that has to be purchased from the electricity company. If the price of that electricity goes up, then these savings will increase. One of the reasons solar panels give a much better return now than they did four years ago is that electricity prices are about twice what they were then.[4] Although prices are likely to fall in the long-term as the transition to cheaper renewable resources continues, they will be tied to gas prices for the next few years, and it is this that has led to the current high prices.

There is also income from selling excess electricity to the grid and how the price of this will vary into the future is uncertain. For most places of worship, receipts from exported electricity are a relatively small proportion of overall savings (about 10% in 4 of the 6 sites) and the overall finances won't be affected too much by changes to the export price. If export prices increase substantially, however, much larger installations will become financially viable.

4 The cost of panels is also reducing, though more slowly now than in the past.

Any savings and potential income need to be balanced against the cost of the installation. Over recent years, the cost of a solar installation of the size recommended for these places of worship has levelled out within the UK. The cost of batteries is continuing to fall which might make them more cost-effective in future.

## 3.7 Summary of results

| | Bolton Road | Hidden Gem | Sacred Heart | Gurdwara | St Vincents | Syke |
|---|---|---|---|---|---|---|
| Annual electricity demand (kWh) | 18,000 | 13,000 | 19,000 | 58,000 | 18,000 | 5,900 |
| Optimal array size (kWp) | 8 | 8 | 10 | 30 | 10 | 6 |
| Reduction in emissions | 46% | 57% | 51% | 54% | 58% | 101% |
| Annual savings (£) | 1,900 | 2,300 | 3,000 | 6,200 | 2,300 | 1,300 |
| % of savings coming from export | 23% | 10% | 8% | 9.8% | 11% | 29% |
| Payback time for panels (years) | 5.8 | 4.8 | 4.4 | 5.9 | 5.7 | 6.9 |
| Additional reduction using battery | 4.4% | 4.3% | 3.2% | 7.5% | 13.5% | 5.4% |
| Payback time for batteries (years) | 12 | 16 | 16 | 12 | 8 | 12 |

# MORE INFORMATION

**Solar for Greater Manchester Faiths | Faith Network 4 Manchester**: Faith Network for Manchester is an interfaith forum working together to foster cohesion, understanding and harmony across Manchester.

**Environmental Stewardship in Places of Worship – A Guide to Reducing our Carbon Footprint**: Led by the Diocese of Salford. It includes links to the following resources which have been produced by different faith groups and can be accessed through **linktr.ee/ClimateandWorship**.

**A Rocha Eco Church**: An award scheme for churches. The website includes specific guides to a range of relevant technologies.

**Church of England Checklist**: Easy tool to visualise actions advised through the Church of England Net-Zero route map.

**Church of England Environment Programme Webinars**: Addresses a wide range of environmental issues and practical advice for places of worship looking to make changes or create momentum within a congregation.

**Church of England Net-Zero Carbon Church**: Practical tips for all faith buildings particularly those that are listed and historic buildings.

**Climate Resilient Church**: Advice on Climate Resilience within a church building and community.

**Community Energy England**: Website offering advice and support for those wishing to use community share offers to raise finance for renewable energy projects.

**The Ecological Gurdwara**: Specific advice for Sikh groups.

**Eco Judaism**: A Jewish perspective on environmental responsibility with links to their Sustainability Action Plan programme.

**Green Temple Guide**: Hindu-specific guidance.

**Green Up! Toolkit**: For Mosques and Islamic Groups.

**The Guardians of Creation Project**: Guidance for Catholic Dioceses on decarbonisation strategy and carbon accounting, at the diocesan level.

**Historic England**: Guidance for heritage buildings on retrofit and zero carbon technologies.

**The Journey to 2030**: Support for parishes, schools and faith communities (with a focus on Catholic Social Teaching) to care for creation in all its forms.

**Methodist Net Zero Advice**: 4-step process for Methodist buildings, but accessible and easily adapted to all places of worship.

**Met Office: Causes of Climate Change**: An introduction to the facts about climate change.

**The Microgeneration Certification Scheme**: Provides detail on heat pumps and finding an approved installer.

**Muslim Council of Britain Eco-Friendly Mosques**: 6-step programme for Mosques to become Eco-Friendly, includes checklist, practical steps and case studies.

**Muslim Guide to Energy**: Bahu Trust guidance on energy use in Mosques (and other resources).

Use this QR code or go to **linktr.ee/ClimateandWorship**

Here you can access the full list of further reading above, as well as information on award schemes and more case studies.

## Credits

Solar for GM Faiths is a project led by the **Diocese of Salford** in partnership with the **Faith Network 4 Manchester**. It has been funded by a grant made by Electricity North West through their **Powering our Communities** scheme.

This report has been written by Dr Richard Baker based on six case studies commissioned from a team led by **Red Co-operative Ltd**, and overseen by Dr Emma Gardner, Head of Environment, Diocese of Salford.

DIOCESE OF SALFORD

faith Network 4 Manchester

electricity north west