A guide by St Mary Magdalene's Church, Woodstock

Steps to Solar on a Listed Church Roof

Introduction

I have been asked by other churches about our journey to obtain permission to put solar panels on the church roof. Here is my view of the steps you need to take. Your church will be different so there may be other things you need to do and perhaps some you don't, but I hope this helps navigate the route. If I have missed anything do let me know. I have tried to put this is a rough order, but some aspects will be an iterative process.

Background

St Mary Magdalene, Woodstock, a Grade II* listed building, needed to replace the lead roof. It had received a faculty for replacing the roof with a tern coated stainless steel (TCSS) roof and was fundraising. At the end of 2023 I was offered a free survey of the church by an electrical and facilities company I knew and respected. Previously I had thought that trying to do solar and a new roof was a step too far. However, the scaffolding will be up to work on the roof, so it seemed sensible to see if it was possible. The PCC decided it was worth investigating and we had some money that was assigned to this. We are among the first listed churches in the Oxford Diocese to apply and so we and the DAC had a steep learning curve.

The steps in rough order:

1. Electricity consumption and supply
    a. Understand your electricity consumption for a year split by month in kWh, this you can get from your bills
    b. Understand if you are on a renewable tariff (the diocese wants this)
    c. Understand your typical electricity consumption through a typical day
    d. Get a smart meter if you don't already have one. While you don't actually need one for solar panels it is unusual not to have one. So just ask for one from your electricity supplier. It's free. If possible, ask for half hour reporting.
        i. The information from a smart meter will give an interesting insight into your consumption and may show unexpected usage which may mean you can investigate and reduce your consumption
    e. Understand if you have single phase or three phase supply
    f. Get a Diocesan Energy Audit if you don't already have one
    g. Pattern of use per week (only needed for DAC but may help you to understand usage) example in Appendix.
2. Research the latest documents from Heritage England (currently it is called Energy Efficiency and Historic Buildings Solar Electric (Photovoltaics), the Church Building Council (CBC)'s guidance note Solar Panels and Faculty Guidance and local planning outcomes on other notable buildings in your area.
3. Work through the Pathway to Net Zero checklist if not already done so

4. Consider where to put the solar panels
    a. This might seem an obvious requirement as you have a church with a south facing roof or a “flat” roof. However, do you have any other property that could have panels put on them first? Which roofs of the church should you use? Should you put some on the tower? Is it worth putting on the north roofs? (Probably not.)
    b. Consider any shading (other buildings, parapets, trees), now or in the foreseeable future i.e. do you have trees that will eventually grow to shadow the panels for part of the day?
    c. You will need to document this thought process for the DAC application
    d. Use this when you ask a supplier to quote
    e. The DAC will insist you provide access for maintenance. Talking to many people with long-term solar panels, it is only the panels with low angles (less than say 10 degrees) that need occasional cleaning of bird droppings. However, the DAC say you will need to allow maintenance people to get access and probably mandate an annual maintenance regime.
    f. Don’t choose an area that you know the roof will need repair shortly
    g. Find out the angle of the roof(s) and, if possible, the actual size of the roofs. Your architect, if they have drawings, should be able to tell you this easily.
5. Batteries or not
    a. You probably need to get the quote with and without before deciding
    b. You will need space for the battery(s)
    c. I have been told that some insurers don’t like solar batteries so you may want to check
    d. If you have batteries you may wish to put in a smoke detector (or you can put in a heat detector which may be more appropriate for detecting a battery fire).
    e. You may want to future proof the installation and choose an inverter that can work with a battery even if not deciding on having batteries to start with.
6. Solar panel suppler& installer
    a. Find a good quality supplier who is prepared to work with you. You will need more information from them than just a typical domestic installation.
    b. They will need to be MCS certified as the DAC will insist on this and is a sensible requirement from the DAC
    c. Ask them for a quote and a payback period
    d. In your information to them you will need to provide:
        i. Electricity consumption
        ii. Price you are paying
        iii. They should tell you what you can get for selling power to the grid. Be aware that you may see high figures for The Feed in Tariff. This was a tariff that the government used to promote early adopters of solar (mainly domestic) and is no longer available. Look online to see what you might get. Be aware that churches are classified as a business customer, so you need to check that out. Octopus is a good indicator of a typically good figure 15p per unit/kWh (early 20024 price).
        iv. Explain you want bird netting between the panels and the roof
        v. Explain you need the cabling to the standard the DAC will require. See Appendix.

vi. Discuss cable routing. Explain that any fixings should be in the mortar. Our plan was to run the cabling alongside the inside of the parapet, under eaves and alongside lightening conductors where possible.
vii. Agree where inverters and battery(s)are to be located
viii. Provide the angle of the roofs and size if you have it (note many suppliers will do the initial quote relying on google maps to decide how many panels they can fit on the roof but it's not that accurate and doesn't allow for maintenance access).

7. Quote evaluation
    a. Check the electricity buy price and sell price they use is accurate and/or realistic
    b. Ask what price growth of the price of electricity they have used (this will often not be clear on the proposal)
    c. A good quality supplier will show a payback and cashflow over many years. Really cautious companies will put in the replacement cost of new inverters and batteries at the end of the guarantee of them although I have only heard of one installation that a component has failed and needed replacing.
    d. Typical price 2024 could be around £500 to £550 per panel including the inverters but excluding batteries
    e. Look to see the guarantee of the panels and equipment. Check that they are from a good, reputable manufacturer. Panels now should have a 25 - 30 years' guarantee. Note the panels will deteriorate in performance over the years and this should be detailed on any specification sheet. Due to the height of most church roofs replacing cheap components is costly due to access requirements.
    f. Note how many panels they are quoting
8. Decide on your preferred fixing method. Most solar panels are mounted on an aluminium frame and the frame is fixed to the roof. We were very focussed on a system that did not put any holes through the roof. No matter what any installer says a hole in the roof is a future point for a leak, particularly as the framework is likely to expand with exposure to sunlight and contract at night.
    a. A tiled roof is easy as they install brackets up under the tiles and fix into the roof structure, (some will suggest putting a hole through the tiles which I don't recommend) then fix that bracket to the frame.
    b. On a flat roof with a low angle, a ballast system may be appropriate. You may want the frame to be an A frame to increase the angle of the panels if this means it is not too visible. A ballast system is one where concrete blocks weigh down the frame holding the panels, i.e. the frame is resting on the roof, normally with some form of pads. The higher the angle of the roof, the more likely you will need to anchor the frame to the top of the roof to stop the frame sliding down the roof over time. At certain steeper angles a ballast system is not acceptable. 8% is acceptable but I don't know the cut off angle.
    c. On a lead roof with horseshoe or rope rolled joints you can clamp onto the joint. But getting the right clamps that are MCS certified may be difficult and the clamps may actually dig into the lead and damage it. I don't think there is a known ideal solution here.
    d. I am not aware of a solution for a half round lead rolled joint.
    e. On a terne-coated stainless steel (TCSS) roof with raised seams, clamps can be used on the raised seam. We went this way and while the majority of the replacement

roof is going to be half round rolled joints. Because the joints under the solar panels would not be seen we were allowed raised seam joints. This mean that if we take the panels off, we make the roof look like a rolled seam roof. The panels have a 30-year guarantee, are likely to last longer than that and are also likely to be replaced by new panels at the end of their life anyway.

9. Excess energy generation. You may be producing more energy than you use and you need to consider if you can use that energy for other things. You could heat water to either be used for hot water or for using in your heating system. Note that excess energy may be produced only in the summer months when you don't need heating.
10. This may be the time you talk to the DAC, say what you are working on and asking if there is anything particular you need to consider and discussing your thoughts.
11. Note you may apply for planning approval and DAC approval at the same time, or you may go for DAC approval first. If the DAC make changes to your plans and you have applied for planning permission you would then need to vary the planning permission. We did it in parallel due to timing of when we wanted to replace the roof.
12. **This is the point you start to incur costs**
13. Planning permission enquiry

    It is worth while putting in a pre-planning enquiry with the local authority. If your church is a listed building you will need planning permission. If your church is not a listed building the enquiry should clarify whether you do need planning permission. Asking for advice will indicate if there are areas the planning authority are likely to be concerned about. This will pre warn you about their general view and any specifics you may need to answer in your application. Worthwhile asking if you need a bat roosting survey and asking about timescales. (The Bat Conservation Trust has information for places of worship.)

    We had push back from the Conservation Architect from this enquiry. This enabled me to refute the issue raised. I then approached the chairman and another member of the council planning committee to gauge their view. They only gave me their "personal" view, but it was a worthwhile discussion, although in the end our application didn't need to go to the planning committee.

    We also had push back about our proposed fixing method, which was worded in such a way that said we couldn't do what we had proposed. I wrote back and explained that we could and the whole problem went away.
14. Get a structural engineer to calculate the loading on the roof of the panels to prove the roof is strong enough to support them. If using a ballasted system don't forget to include the weight of the ballast. Note: the engineer should check both the weight and should consider the lifting force (aka wind loading) of the panels, as the wind can get underneath them and try and lift them off.
15. Check with the local Distribution Network Operator (DNO) that you are able to export the amount of energy that you think you want to export. The DNO is not necessarily the people who provide your electricity bill but the people you complain to if you have a power cut (find your DNO). It may be that you have to limit your production in the summer and restrict or clip the output. Three-phase supply can take more power back into the grid than single phase. You can switch to a three-phase supply, but it can be expensive, and the supply company is very difficult to pin down their cost. Your preferred solar supplier can do this for you, or you can do it yourself, it doesn't need your architect to do this. (A guide to gaining a quote for a three phase upgrade.)

16. Get a bat survey (actually called a Preliminary Roost Assessment) if required by the local authority or the DAC. There are two levels of these. The first level can be done at any time. Cost in 2023 c£600. If that shows some signs of bats where you want to put the panels then you will need the second level of survey. This second level can only be undertaken between May and September (so plan ahead). Despite no bats in the roofs we were intending to put solar panels on, the planning authority insisted on a bat mitigation strategy, but I would wait until they ask you for one before getting one written (or using others you see on the planning portal as a base).
17. Architects' drawings. Get them drawn up. You may find that the solar provider did not measure accurately and that they were over ambitious in how many panels they could put on the roof.
18. Take photos to show the visibility of the roof from any public areas where the roof is visible. Get an image of what the roof will look like with solar panels on using photoshop or an artist's impression etc. You will need this for the DAC and it's helpful for planning.
19. Create a summary of Harm vs Benefit. This is a concept I found difficult, in conservation terms putting solar panels on a building will "harm" the building. Example in Appendix.
20. Apply for DAC approval you will need:
    a. An Energy Audit
    b. The Net Zero Checklist
    c. Costings and payback (i.e. quote from supplier)
    d. Architectural drawings and plans showing the panels
    e. Rationale document which should include:
        i. Actual energy consumption and how much you will generate and how much you will sell
        ii. If you have considered other uses for the generated electricity
        iii. Harm versus good for the building
        iv. Visibility of the installation (photographs)
        v. Artist's impression or computer-generated image (CGI) as to how it will look
        vi. All things raised in the Church Buildings Council (CBC) guidance
        vii. Comment that the PCC have approved this
        viii. Feedback from local authority planning enquiry
        ix. Detail of cable runs
        x. Lifespan of the equipment
        xi. Confirmation you have asked the insurer if they are OK with solar panels and or battery(s)
        xii. Details of other carbon saving work you have undertaken or plan to in the future.
    f. Statement of significance. This should detail the architectural importance of the building.
    g. Specification sheets for the equipment
    h. Possibly a bat survey.
21. Applying for planning you will need at least:
    a. Architectural drawings and plans showing the panels
    b. I used a similar rationale document to the DAC application but when the DAC asked for more information the rationale document grew but I didn't send the new version to the Planner
    c. Statement of significance

d. Bat Survey (possibly) and you may need a bat mitigation strategy even if you don't have bats and as part of that you will need a bat box installed
e. Ecology questionnaire which the planners insist is signed by someone with an ecology qualification
f. We volunteered a biodiversity gain (because we were asked to when we got permission for the roof replacement) although in fact in this instance I don't think we needed to (bird boxes, beehive etc).

I hope that this is of help to you and good luck

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Appendix

Cable runs

Fixings and cable runs/routes should be designed to minimise their visual impact and their impact on the fabric of the building. It's important to respect the character of the building. Any fixings should be non-ferrous fixings into mortar joints to reduce the impact on the historic fabric wherever possible and relevant.

The Council's preference is that all cabling should, as a minimum, be specified as low smoke and fume (LSF), however consideration should always be given to the use of a cable which offers greater fire resistance such as FP Gold 200 or cables manufactured in accordance with BS7629-1; or alternatively Mineral Insulated Copper Cables (MICC) where the setting is sensitive. Their longevity, durability and enhanced resistance to fire could offer additional benefits. Any fixings should be non-ferrous fixings into mortar joints to reduce the impact on the historic fabric wherever possible and relevant.

Usage

Example of how we provided the information:

St Mary Magdalene usage indication							
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Standard week							
	8am service			10am service			
	11am service						
						2-5 Office	
			2-5 Office	6.30 Junior Choir	2-5 Office	6.30 AA Meeting	
				7.30 Senior Choir	7.30 bell rining		
Frequent meetings							
	Note the number of meetings per year are detailed at the end of the description						
		8pm Woodstock society 10			11- 3 Probus 12	3pm berevement café 10	10am coffee morning 12
		8pm events 2	10 am singing group 12	7.30 events 2		7pm events 15	7pm Events 15
					1 - 8pm Woodstock Music society 3	5 - 10pm Woodstock Music society 3	5 - 10pm Woodstock Music society 3
			Funerals 12			all day Festive fair 2	all day Festive fair 2
				PCC meeting 5	PCC meeting 5		Weddings 12
	Various meeting in vestry unknown qty	Various meeting in vestry unknown	Various meeting in vestry unknown	Various meeting in vestry unknown	Various meeting in vestry unknown	Various meeting in vestry unknown	Various meeting in vestry unknown
				Compline 5	Compline 6		

Harm Vs Benefit example

Harm

1. The solar panels on the nave roof will be slightly visible from part way down the churchyard, and on a verge on the narrow Rectory Lane, however these are not the main viewpoint to see the church. Please note that the solar panels on the aisles have had a comment from the WODC that they will probably not be seen although exact drawings had not been supplied. Pre-planning response from WODC provided.
2. Some vertical cable runs may be seen, although most will be adjacent to existing cable runs of lightening conductors or supply power cable
3. The roof joins under the solar panels which will be covered by the panels will be standing seams and not rolled joints, however we have devised an arrangement to go over the standing seams should we ever remove the solar panels to ensure the reversibility of the system
4. Slightly more work will be required in the unlikely event that the new roof needs repair.

Benefit

1. Saving xx tons of CO_2 annually, the equivalent of xxx trees
2. Generating xxxx kWh per annum and reducing our dependency on fossil fuels
3. Reducing the electricity consumption of the church by xxxx kWh per annum which is equivalent to over £xxxx a year making the church more sustainable financially
4. Allowing us to help towards net zero. Solar panels are one of the few options open to us to help the CofE target of Net Zero
5. Locally there is much discussion about the massive Botley solar panel proposal. There is a slogan going around that solar should be on roofs not on fields. At two open meetings held in the church, one meeting was “for” and one was “against” Botley solar farm, in both meetings everyone agreed that solar panels on roofs were a good idea
6. Excess energy sold back to the grid
7. Provides a better financial position to be able to care for the grade II* for the public benefit.