HOUSE PLANNING HELP

Episode 206

What solar PV panels should I get for my roof? – with Robert Flynn from Solarbarn

The show notes: www.houseplanninghelp.com/206

Ben: Tell me about yourself and your company.

Robert: My name's Robert Flynn, my company is Solarbarn. I've been running Solarbarn since 2010.

2010 was an important date in the history of solar power in the UK because it was when the government introduced the feed-in tariff scheme which really kicked the whole industry into life. Prior to that, there was no solar power really being installed and prior to that, I had been an IT consultant for twenty-five years.

Ben: Do you like the feed-in tariff or is it a bit of a double-edged sword?

Robert: The thing about the feed-in tariff was that it succeeded in creating the industry. It was what was needed early on. It was very generous in its early years and what that made happen was the creation of a whole new industry. Installers like me set up installation companies, wholesalers came in and started selling equipment, and those installation companies and wholesale companies are here now. So, the industry has been established.

The feed-in tariff is now tailing off, but that's fine because the benefits from solar now are largely based on self-consumption, with the feed-in tariff just being a little bit of an added incentive. In due course it will go and solar, like all other renewable energies, will stack up on its own merits.

Ben: We've done podcasts before on solar PV, but what we haven't done is anything about the installation process and what you'll have to think about. That's what's been nice about Buckinghamshire Passivhaus, our hub case study, is that I've seen you on site and all the things that you've been doing. So, I'd like to run through some of those.

I suppose my first question will be an obvious one for anyone who comes to think about solar PV. How do you know how many panels you want?

Robert: The Buckinghamshire Passivhaus project has been a cracker. We love jobs like this. Super house, exotic design, large roofs which we always like for putting solar panels on to.

We had discussions with the clients about how big the system should be and in the end, they decided that on the basis of only having to install solar once, they may as well put a big system in. Because really, with solar PV, there isn't a case of a system being too big. It may well produce more electricity than you need at a particular point in time, but that electricity isn't wasted. It simply goes out into the distribution network and it gets used by other people in the district, your neighbours.

So, a big system might produce more than you need at a particular time during the summer, but it will produce more than a small system would in the winter, perhaps when you're more likely to need it.

Ben: What are the variables too? I imagine you can have panels that work better than others, more expensive ones. Would that be right, or are they all much of a muchness?

Robert: There are a wide range of solar panels. You can get very efficient ones. You've always been able to get solar panels which are more efficient than the pack, but the trade-off is they're more expensive.

Back in 2010 when I started the business, a typical solar panel was two-hundred watts and if you wanted a two-hundred-and-forty watt panel, you would pay a lot of money for it. Things have moved on. A standard solar panel now is three-hundred watts and you can get a three-hundred-and-sixty watt panel if you really want to pay more money.

If you've got a big roof, you don't need to buy super-efficient panels because you can just put more of them up. So, expensive solar panels that produce three-hundred-and-sixty watts are really only necessary if you've got a small roof and putting typical size panels on it doesn't give you the power you need.

Ben: What about orientation? Is it always south facing?

Robert: We often get asked about orientation. The thing about orientation is that you're stuck with it. You don't have a choice really. Your house points in the direction it points in.

The mathematics are as follows: a south facing array will produce more kilowatt hours in a year than an array pointing east or west or south-east or south-west.

It depends on the pitch as well. The shallower the pitch, the less of an issue orientation is because if you've got a really shallow pitched roof, twenty degrees, the panels are really pointing up in the air, rather than pointing at the horizon. Steep roofs, forty-five, fifty degrees, it makes a difference because they are pointing towards the horizon. So, a forty-five degree pitch, east-west, will produce probably twenty-five, twenty-six percent less than the same array on a south facing roof.

Having said that, an east facing array will produce a bit more in the morning, and a west facing array will produce a bit more in the afternoon than a south facing array. So, an east-west array, you'll get a flatter production profile during the day, whereas a south facing array, you'll get this big peak at midday and perhaps less in the morning and less in the afternoon. So, in terms of self-consumption, there are benefits sometimes in going east-west.

Ben: On this particular project, what did you need to sort out before the installation could get going?

Robert: Lots of conversations with the architect and clients. They ultimately decided they wanted a big array, twenty-four panels, two rows of twelve, which is large on a house.

It was quite tight up and down. We had four metres ridge to gutter on the main roof. The solar panels are sixteen-hundred millimetres. Two of those, three-point-two, three-point-three metres. So, if you put those in the middle, you're not left with a lot of tiles top and bottom, especially on an in-roof.

So, there were discussions perhaps about dropping the whole array down and just running it straight into the gutter, which would've left a decent number of rows of tiles at the top. But in the end, the clients decided they wanted it in the middle. So, in conjunction with the roofers, we put it in at just the right place to allow, I think, three rows of tiles at the top and three rows of tiles at the bottom.

Ben: And you do this early on, before the tilers turn up. You're putting in some form of base that they click in to?

Robert: Yes. This is an in-roof installation which is typical on new build. The attraction here is that the solar panels are part of the roof, rather than being built above the roof, which is what you typically see on a retrofit. It looks nicer, it looks tidier, it looks deliberate and you can

save some money on roof tiles because in this particular case, forty-odd square metres of solar panels means forty-odd square metres fewer roof tiles required.

The sequence of events: the roof is built, the roof is felted and battened, and at that stage we come in and we lay interlocking plastic flashing frames onto the battens. Ultimately, they will take the solar panels. Once they are installed on the battens, the roofers then come back and they tile around those flashing frames, putting in the necessary flashing to make it all watertight. They finish the roof and then once they've gone, we come back and we put the solar panels into the flashing frames.

The appeal of that process is that the solar panels aren't in the roof whilst the roofers are still tiling and working with angle grinders and hammers and so on and so forth. The solar panels are safe. We're pretty confident they're not going to get bashed by roofers.

Ben: That was pretty much the last thing they did. You held off, held off until the scaffolding was coming down. Is that ever an issue or are they very careful around PV?

Robert: What was unusual in this instance was that the scaffolding included a metal roof to keep the site dry during construction. It's nice for us because it means that we can work in the dry on a wet day. The fear was that the scaffolders would be removing the tin roof with scaffolding poles et cetera and might damage the tiles. So, we had to wait for the roof to be removed before we could then put the solar panels in.

Ben: Can you go out in any conditions and do these relevant stages?

Robert: No. We have to be safe. We take health and safety very seriously. So, if it's below freezing, we have a problem because scaffolding builds get frosty and slippery. So, we won't work if it's below freezing. If it's high wind, we don't want to be carrying solar panels up a roof because it's a bit like carrying up a sail. And we don't want to work in heavy rain because it is electronics. We are plugging these things together with electric plugs and sockets and what we don't want to happen is for water to get in the plugs and sockets.

So, we have to be aware of the weather and work around it.

Ben: That's a good question actually, on how waterproof they are. I'm assuming they're very waterproof because they stay up there and brave the elements and form your roof. There's no weak spot other than that initial plugging in?

Robert: No, the flashing frames are really well designed in interlocking. They work like Velux windows in that sense. And the electrical components, MC4 plugs and sockets on solar panels are completely watertight once they're plugged together. So, once it's all in, it is completely weatherproof.

You just don't want to be plugging it together whilst it's wet.

Ben: On the inside, what do we have? Because on the outside, we've put in the panels, we've plugged them in. It's pretty simple once you've got those flashing units there. But you have to come back again, don't you?

Robert: Yes. So, electrically, in this particular instance, the solution that we agreed with the clients uses power optimisers. So, for each solar panel, there is a power optimiser and the benefit there is that the solar panels work independently of each other. If one of them was to get shaded, for example, it wouldn't affect the output from any of the other panels, which on a traditionally wired system is an issue.

All of that DC power then comes out of the optimisers and goes into an inverter. That converts the high voltage DC coming out of the solar array into 230 volts AC which you can use in your house.

Ben: How do you make sure that it feeds in and it's all going to work okay? Is it just a simple hook-up? No doubt you have to inform the electricity company you are with?

Robert: On single phase systems, up to four kilowatts of solar can be installed under what we call G83 regulations, which means that we can go in and install the system, and we simply send a piece of paper off to the distribution network operator afterwards saying, 'just to let you know, we've installed a three kilowatt system on this house.'

Ben: Distribution operator being the electricity company or something different?

Robert: DNO – distribution network operators – are the companies that own the local electricity infrastructure in your area. For example, in the East of England where we operate, it's UK Power Networks. There's often discussion about excess solar electricity going back into the grid. Well, yes and no. It actually goes back into the distribution network, rather than the transmission grid.

For systems greater than four kilowatt single phase, you need to get approval in advance, as is the case with the Buckinghamshire Passivhaus project. It was a seven kilowatt system on single phase.

One can't just go and install that and tell the DNO afterwards. You have to seek their approval in advance.

Their worry is that big systems like that on very sunny days when there is little consumption demand, can be injecting a lot of power back into the distribution network, and they need to be comfortable that the network infrastructure is capable of taking that load. That was the case here.

Ben: What else do you do in that commissioning process?

Robert: First time around, we need a nice, bright, sunny day to make sure that there's enough power going into all of the panels and optimisers. We switch the inverter on and then it's a pairing process where the inverter talks to all its optimisers and they pair with each other. A bit like commissioning a local area network with a computer. Once that's happened, they all power up and away the system goes.

During the pairing process, each power optimiser is producing just one volt DC which is nice and safe, and in fact, if anything ever goes wrong with the system, it drops back to that. It's a really nice safety feature. But once the system's up and running and the inverter is ready to go and the optimisers are ready to go and there's plenty of sun hitting the array, it will run up to about four-hundred volts DC and away you go.

Ben: As a user, what do you have to do, if anything?

Robert: Nothing. Just enjoy the fact that you're using lots of electricity being produced from the sun. There aren't any moving parts with a solar PV system.

The inverters power electronics and they get hot when they're producing a lot of power and eventually they will go. Inverters will last at least five years, a lot of them are guaranteed to last between five and ten. Some of them now, as is the case on the Buckinghamshire project, that inverter is guaranteed for twelve years.

Ben: What's different about that?

Robert: The use of power optimisers means that the inverter itself has to do less work. Therefore, it is guaranteed to last longer.

Ben: Is there anything else we need to know about in this process, important parts of it, or have we covered it fairly well?

Robert: I think something else that's worth mentioning is that a lot of customers of PV systems now have an immersion heater diverter. Because in a lot of cases, PV systems will produce a lot of power when you don't need it. So, it'll meet your consumption demands plus there'll be some left over, and a really clever thing to do with that surplus power that's about to be exported is divert it to your immersion heater.

But only the surplus. So, even though you've got a three kilowatt immersion heater, if there's only a kilowatt of spare PV energy, it'll just divert that kilowatt into your immersion heater. The immersion heater still works, it just takes a bit longer to heat the water up. But what these people find is that they pretty much get free hot water between April and October, even with a modest sized PV array.

Ben: Is that working well in conjunction with going out to your power network?

Robert: The goal with solar is to use as much of that electricity as you can before exporting it.

Ben: Why?

Robert: Because it's more valuable to use it than it is to export it. The cost of electricity these days is about fourteen, fifteen pence per kilowatt hour. The notional export rate is five pence per kilowatt hour, which is what you get paid for selling the export. Having said that, on domestic, that figure is just estimated, not measured. But the point is that it's more valuable for you to use it. So, any way that you can use that electricity, store it and use it.

And that's of course where batteries come in. Because in domestic situations, you typically produce more electricity than you need during the day and then early in the morning and late in the evening when you come home from work and you start switching appliances on and it's dark, you're not producing any solar electricity because it's dark and you're therefore pulling electricity from the grid and paying for it. What would be really good is if you could use the surplus that you've produced during the day, rather than exporting it, you store it and therefore you can increase your self-consumption. Batteries do that very, very well.

In my opinion, the economics aren't quite right yet. They're just a little bit too expensive, they don't store quite enough and they don't quite last long enough. But if batteries get cheaper, last longer and store more, and as the price of electricity goes up, there will be a

tipping point where suddenly it makes sense to put batteries into solar PV installations.

Ben: Have we got any batteries on this particular project?

Robert: Not yet, but we've futureproofed it. We've put all the cables in ready for batteries, we know where the batteries are going to go, and importantly, we've put the technology in there which will measure how much of the power they use and how much of it they export. Because really, to work properly, you need to size the batteries to match the characteristics of the house. Not necessarily to match the size of the PV array, but to match the consumption characteristics of the house.

It's often very difficult to tell how much power a house will export during the course of a year. So, to do it properly, you put the PV array in, you put measuring equipment in, after a year you can go back and say, 'you produced seven-thousand kilowatt-hours or solar electricity last year. You actually used two-thousand of it, you exported five-thousand of it. If we go ahead with batteries, we need this sort of size of battery array.' Rather than just guessing and putting in something that's too small or too big.

Ben: We did a podcast recently with Robert Llewellyn and he was mentioning how the car could become your battery. Have you any experience of this and does it seem likely, a Tesla approach where you plug in and it works one way and flows the other way as well?

Robert: I think this is what's really exciting about the whole industry at the moment. Do I have any experience? No, I don't. But it sounds fantastic, doesn't it? Where you've got your battery car parked outside, you've charged up your car on solar all day, so there it is at six o'clock at night and it's full of solar electricity that you've produced for free during the day.

If you're then going to go out and drive somewhere that evening, that's fine. If you're not and you're going to stay at home, why not pull back that power that you've put into your car, put it into your house and then the following day you can charge the car up again.

Marvellous. I don't know whether the technology exists today to do that, but I'm sure there are very clever people looking at it right now and it will be a marvellous thing. I think this convergence of all these renewable technologies, electric cars – that's what makes this whole field so exciting.

Ben: As we get towards the end, I want to divert attention to my own project. Because it's been interesting. We haven't made any

allowance for solar PV at all, and a lot of that actually comes down to the aesthetics.

So, a few questions in here. What about ground arrays? How do they work? Are they just as viable?

Robert: Yes. A solar panel pointing to the sun produces as much electricity sitting on a frame in the ground as it does on a roof on a house. If you've got plenty of space, you might want to consider putting solar panels on the ground.

There are pros and cons. Firstly, you need planning consent to put them on the ground, unless you're only putting a handful in which isn't worth doing. But to put a meaningful sized array on the ground, you need to have planning consent and that can put some people off. You need to have a lot of space really. You need to provide some sort of security because you've got high voltage DC and you don't want kids and animals getting in there and chewing the cables. So, you might want to put a fence around them. And if you're very rural, there is the issue of theft. The thing about putting a solar array on a roof is that people can't nick it and you're unlikely to have your kids unplug the cables and get an electric shock.

In terms of cost, it's really only worth putting a ground-based array in if it's big. If you can put it on a roof, that will be the cheaper way of doing it. Even though you've got to pay for scaffolding to put it onto a house roof, if you can get it on a roof, that's fine. So, typically, for that reason, the ground-based arrays we put in for clients tend to be big. Thirty, sixty kilowatt systems, two-hundred panels which produce a lot of power. Typically for big country houses that have swimming pools and huge oil consumption and so on and so forth.

Ben: Do you have to consider how far away it is as well? Because when you're on the roof, you just go straight in.

Robert: Yes, there is an issue with cables. We did a thirty kilowatt ground-based array for a client a little while ago, a listed building. English Heritage were also involved because there was an important landmark within the vicinity. Although we had plenty of land, they wanted it in a different position than he did. It ended up being two-hundred metres from the house.

So, that is a two-hundred metre cable run which needs trenching. And the problem with the cables is that not only do they got longer, but as they get longer, they have to get fatter because you don't want voltage drop.

In the end, I think the cables alone on that job cost a thousand pounds, which is why it's really only worth considering ground mount for fairly substantial sized schemes, unless they're very close to the house.

Ben: We haven't talked too much about cost. How does this size up? And also, people always want to know about pay back. When is it going to pay back?

Robert: Pay back largely based on self-consumption in the early days, when the feed-in tariff was very generous, the bulk of the economic benefit was feed-in tariff payments and savings were the icing on the cake.

The feed-in tariff rates have come down now, so it's pretty much the other way around. The bulk of the benefit of putting in solar is self-consumption savings. So, producing lots of electricity, using it yourself and therefore not having to buy it from the grid.

What you need to bear in mind there, of course, is fuel price inflation. Electricity, fifteen pence a kilowatt hour now, might be thirty pence a kilowatt hour in a few years' time. So, as the cost of electricity goes up, the savings go up. So, you need to have a view on inflation.

The feed-in tariff scheme, whilst it continues, will provide a little bit of icing on the cake.

Generally, the people that were motivated purely on return on investment and how quickly they could get their money back are not those that install solar these days. The people that install solar these days are the people that want to do it because they know it's the right thing to do.

On domestic, most of the work we do now is new-build where the addition of a solar system is just considered a bit of an extra cost at the time of construction. Obviously, there are no scaffolding costs because the scaffolding is usually up, it's zero percent VAT because it's a new build, so all of those things make it cheaper. And in the global scheme of things, putting a four, six kilowatt system on a new build house really doesn't add much to the cost but provides a huge ongoing benefit thereafter.

Ben: On my own project, if I wanted to do a little bit of futureproofing and think I probably do want an array up there at some point, is there anything I can do in the setup now that will help me later?

Robert: Not really. On new builds, we're mostly doing in-roof. That's a decision that you need to make at the time because what we can't do is leave a big hole in the tiles to put solar panels into in five years' time. So, if you want to go in-roof, you need to make that decision and it needs to be done as part of the construction of the house.

If you do decide to come back later, it then becomes a standard retrofit installation, which is no different to retrofitting on a house that was built ten, twenty, thirty, forty years ago.

Potentially, I suppose running cables, if you think that there is a good chance you're going to go ahead. What we find in a lot of new build houses now is that they don't have lofts anymore. The lofts are now second-floor accommodation. So, whereas in an old house, we'd go up into the loft and we can bring the cables through the roofing felt, into the loft and then down the house, often in new builds there are no lofts because they're all plastered out. So, potentially a smart and inexpensive move there would be to run a cable in. So, a cable terminating on the roof and then terminating downstairs. That might only cost fifty quid and we can come back and plug the solar into it later.

Ben: Any final thoughts on this topic of solar PV, getting an installation on a new build?

Robert: My view is that putting solar PV into a new build should be a no brainer. It should just be the part of every house that's built in this country. And if you're not particularly keen about it, just stick a couple of panels on and that'll help a bit, adding virtually nothing to the cost of the build.

If you're serious and passionate about it, and a lot of people are now, put up a lot. Put up a dozen solar panels on the roof and that will produce three-, four-thousand kilowatt hours a year of electricity for twenty years. Why not do that?

Ben: Robert, thank you for all the information today. A really good chat. Thank you.

Robert: Thank you very much.