



## **Photovoltaic Systems – Some points to consider**

Many people have been asking The Greening Campaign ‘what is this PV FIT thing?’ We knew something about it but knew we needed to know more ! So we have carried out some research, read some books and spoken to lots of people – this is what we found out.

**The PV (Photovoltaic) FIT (Feed-in tariff) is a government initiative that can have financial benefits to householders and organisations that own property – this is why understanding it is important.**

Photovoltaic (PV) is a form of solar renewable energy and there has been lots of debate about how much CO<sub>2</sub> it saves or whether the PV panels are recyclable – these are what I consider to be the ‘bigger picture’ and we are not going to debate this here. What we are going to do is look at a step by step very basic outline of things we think you should consider before going down the route of PV installation, some of the options you can explore, and what questions you should ask.

### **Life before PV**

For the purpose of this information sheet, we are going to assume that you have carried out some preliminary research and action:

- You have insulated your property – insulation will give the best return on investment and give you best CO<sub>2</sub> savings
- Looked at the range of different options for renewable energy and decided PV is the best option for you
- Looked at your available roof space and decided to install PV instead of solar thermal (water heating) or have space for both
- Are aware that solar thermal will have a government incentive available next year to support installation called the Renewable Heat Incentive – this may affect your decision to go with PV

Look at your situation as a unique opportunity. Look at your assets and decide what is to your best advantage.

**There are lots of renewable energy options and some are complex and some are really simple. If you do not know which is the best option for your home please get advice.**

**This document will focus on PV and feed-in tariffs.**



An example of a 2kW array of PV

The system for an average house in the UK is 2.2 kW

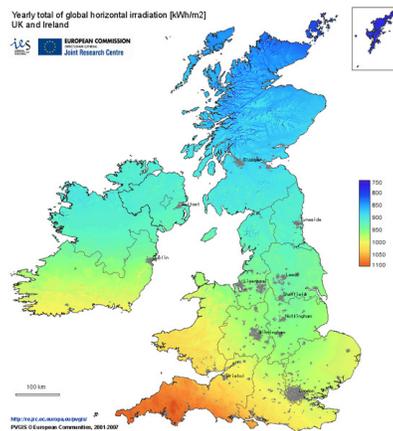
# What affects the output of a PV system?

There are lots of variables that affect how much energy you can produce from a PV system. When I started looking at this I thought it would be just like having my own mini national grid on my roof feeding me power in a steady stream and the amount of power depended on the size of system. WRONG!

It seems that there could not possibly be more variables to energy generation than with PV. Your installer will be able to advise on this but it is a good base to understand some of the factors that affect your energy output (if you need more detail please go to the books referred to at the end of this document).

Examples of some of the variables to power output:

- Where on the planet you are compared to the equator
- What sun band you are in – it varies quite considerably, even a few miles can make a difference and the amount of sunshine you get is very important (see map below)
- How full of 'stuff' is the air, eg near dirty industry may not be so good
- How much cloud or rain there is (cloud reduces output at a reduced rate equivalent to the reduction in the amount of sunshine emitting)
- Shading across the panel – a tree, a chimney from next door (this may vary at different times of the year due to the variations in the arc of the sun)
- The angle of the panel to the sun or roof pitch (usually best at approx 35 degrees)
- How close to South the panel is facing
- You need the National Grid to be working which means this is not going to power your home in a power cut (not even a bit of it)



## United Kingdom solar radiation map.

Taken from [www.mappery.com](http://www.mappery.com)

The bands do not fall where we would expect and if you see this full size you will see that the colour is also not completely regular

Even if all the above were not in the optimum situation, you could still produce energy, but it could be just minute amounts. This could mean that the amount of energy you would make would not even get the money back that you spent on the system and so it would, in some cases, not be worth installing. This is why you need to get someone to advise you on whether your home is suitable.

All these variables affect the amount of energy you produce and affect the amount of money you get back from your investment.

**Remember – you cannot store this electricity, and you must therefore use it as you create it, and/or sell it to the National Grid**

## Some preliminary investigations

*Check what planning restrictions* apply to your area. Most fittings do not require planning consent, but if you live in a listed building, or in a National Park there could be a need to apply for permission. Recently the planning system has changed and Planning Policy Statement 22 (PPS22) requires councils to take a positive view towards renewable energy and use it to help hit government targets renewable energy for 2020.

*Building regulations* will also need to be met.

You will also need to get the connection approval of the Distribution Network Operator who operates your section of the National Grid. However your installer should do this for you.

## The Feed-in Tariff

### What is a Feed-in Tariff?

At the moment there is a government initiative known as FITs (Feed-in-tariffs). They are only relevant to renewable energy that creates electricity and there are different Tariffs for different types of electricity generating renewable energy. They pay you money for each unit of energy that you generate but the tariffs differ with different types of equipment and different situations.

If you sign up before 31<sup>st</sup> March 2012, these payments are fixed by the government for 25 years for solar and 20 years for the rest. The tariffs are index-linked.

For example – payment per unit of electricity generated:

PV on new build	36.1p
PV on existing buildings	41.3
PV free standing	29.3
Hydro	19.9
Wind	34.5

These are the highest FIT options, but variations occur because it depends on the size of the system and sometimes where it is placed.

However it is very easy to see that the biggest payout comes from putting PV on existing roofs and this is what most people are considering at the moment.

There is no requirement to have fitted other energy efficient measures to the property to qualify.

Systems installed before April 2010 have a different set of tariffs and criteria attached to them.

### How does it work?

We are focusing on PV but the feed-in tariff applies to all forms of renewable electricity generation – PV, wind, hydro, etc, but it only applies to small scale generation (less than 5MW).

If you add a PV system on your roof, the government will pay you 41.3p for every unit of electricity you generate, even if you use that electricity yourself. If you join the scheme in the next couple of years (up to 31<sup>st</sup> March 2012) you will get this rate and it will stay the same (regardless of the price

of normal electricity) for the next 25 years. This means that installing PV can be financially beneficial.

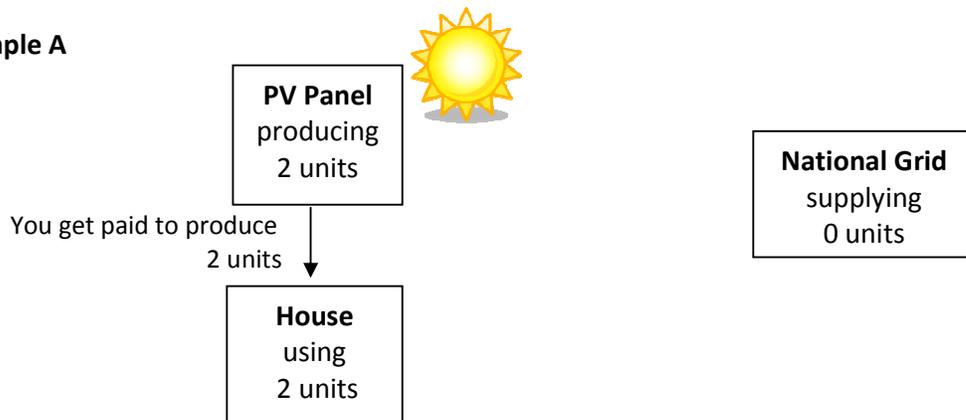
If you export some of the electricity (send it to the National Grid) because you don't use it yourself, you will get an extra 3p per unit (on top of the 41.3p).

The amount of electricity you generate is unlikely to be very high, probably less than 2kW at best, so careful planning is needed to make the most of it, for example only running your washing machine when the sun is shining. However, if you work on a computer from home, you will probably never have to pay for electricity for it during daylight hours ever again.

### What does this mean?

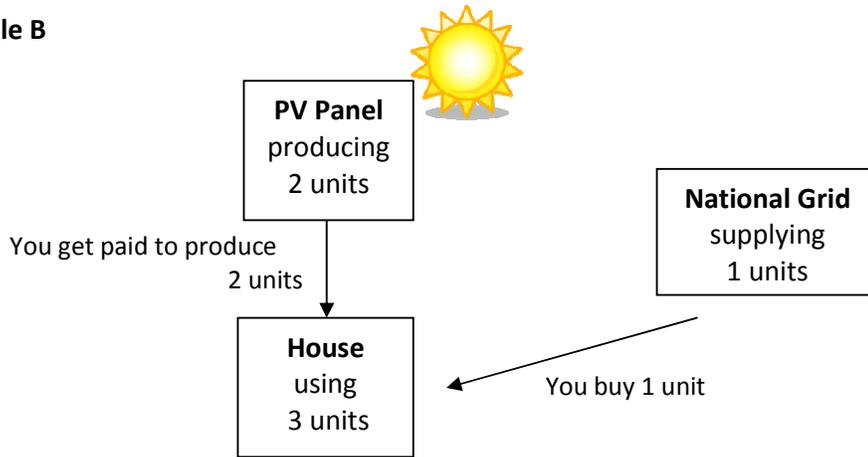
*In these diagrams the arrow indicates the flow of electricity*

#### Example A



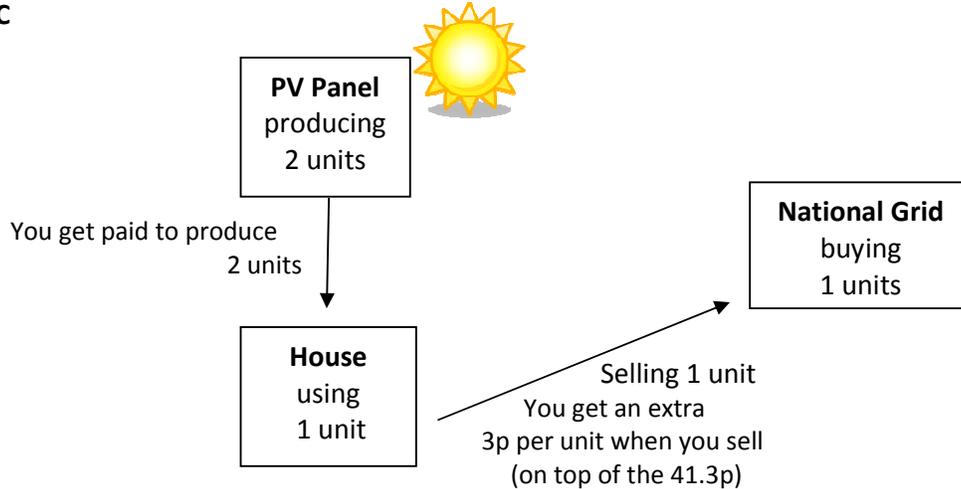
If the sun is shining and I am in my house using 2 units of electricity and my panel is producing 2 units of electricity, then I will get paid  $2 \times 41.3p$  and I will not need to buy anything from the grid because I am using the same amount of energy as I am generating from the roof.

### Example B



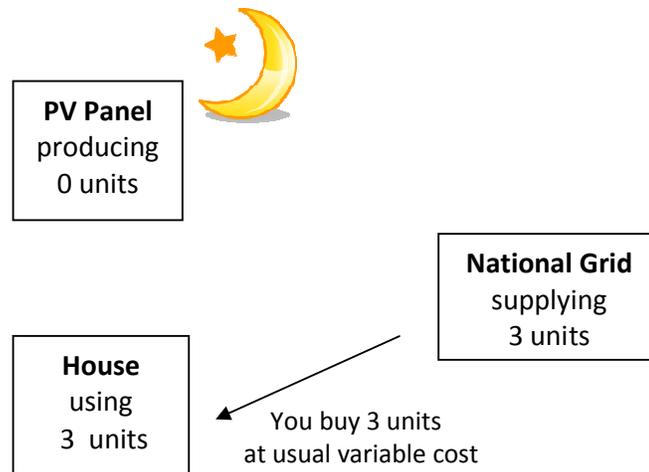
If the sun is shining and I am in my house using 3 units of electricity and my panel is producing 2 units of electricity, then I will get paid  $2 \times 41.3\text{p}$  but I will need to buy 1 unit of electricity from the grid at the normal price from my electricity company because I am using more electricity than my roof is generating.

### Example C



If the sun is shining and I am in my house using 1 unit of electricity and the panel is generating 2 units of electricity, then I can sell the surplus 1 unit to the national grid for other people to use. I will get paid  $2 \times 41.3\text{p}$  (for generating the energy) and rather wonderfully I will get  $1 \times 3\text{p}$  extra (on top of the 41.3p) for the energy I sell.

### Example D



If it is night-time I will not be making any electricity and therefore if I am in my house using 3 x units of electricity – then I will have to buy 3 x units of electricity from my electricity company – the same as people without a PV panel.

### Some useful contexts

#### Example A

The Energy Savings Trust website gives some good advice and one of the examples they give is:

A typical domestic solar electricity system, with an installation size of 2.2 kWp could earn around:

- £770 per year from the Generation Tariff
- £30 per year from the Export Tariff
- £120 per year reduction in current electricity bills.

This gives a total saving of around £920 per year.

This assumes 50% of the electricity generated is exported. 50% is the expected amount unless you have an export meter fitted.

#### Example B

I think that the bit that is hard to get my head round is that the energy trickles into the system from the home PV. With the National Grid you can draw a massive amount at any time as there is a huge reservoir of energy and huge energy generators to feed your demand. With your little PV system, it is trying to make electricity from the sun and as it makes it, it passes it to you for use. If you don't use it immediately the electricity passes through your system and into the grid (you can't store it). Therefore if you want to use more than you are making, you will need to pull extra from the grid.

## What do all the deals mean?

OK, at the moment, there is supposedly money to be made via PV installations and the worry is that people do not fully understand the options and so may not make the best decision for their situation.

These examples below will not cover all the options out there, but they will explain some of the main ones.

### Deal number 1 - Ownership

You own the PV panel so you get all the feed-in tariff money.

A system will cost an average house about £7,000 – 15,000.

Pay back (when you get your money back and are in profit) variable depending on how much you generate but typically about 12 years..

The scheme will last 25 years and the panels probably a lot longer.

Obtain a clear financial breakdown from all companies making this offer.

You should also be aware that at the moment they do not have the mass equipment available to measure what you are sending to the grid and so they assume that half of what you generate will be sold across the grid (50%). The whole country is going to go over to 'smart meters' and they will be able to work out all the energy use / generation for the future.

If you move home the PV stays with the owner of the property and it will therefore be sold with the house. The tariff rate will also transfer across so the new people will have the same deal you had. This could be a real incentive as it could add considerable value to your property a few years down the line.

### Deal number 2 – rent a roof

You allow a company to put a PV panel they own onto your roof.

When the roof is making electricity, you can use what it is making for free. If you use more than the roof is making, then you will need to pay for the extra as usual. If you use electricity at night then you will need to pay for all your electricity use at that time.

The moral of this story is – this is a good deal if you are at home during the day and this is when you do your washing, cooking and other chores. If you work all day, you may not get much of a benefit. Having said that, something is better than nothing when it is free.

Remember that you need to look at the contract as it is likely to be for 25 years, so it could cause problems if you want to sell the house, - or a new owner could see this as an added benefit

- Check that the new owners of your home can take on your system, tariff and rent a roof contract easily – the contract is attached to the specific system along with the tariff.
- See if there is an option for people purchasing your home to purchase the panel (and at what % deduction of original cost).
- Some people predict it will add value to homes in the near future.
- Some firms will agree in the contract to remove the panel if a new owner does not want it.

Some firms also state that if your roof needs re-tiling or something similar, they will remove and reinstall the system free of charge.

Make sure they are an approved installer – see guidance below.

### **Deal number 3 – rent a roof with a profit share**

Same as above where the company own the panel but they may also offer you added income in the form of a share in the profit gained from the feed-in-tariff.

### **Conclusion**

If you have spare cash or want to invest some money then 'Deal 1' may be the best deal for you. If you have no money but you own your own roof (or house) then 'deal 2 or 3' are obviously the better option. Research all offers thoroughly and do not sign without thinking it through for a few days.

## **Getting PV installed on your roof**

You cannot install this as a DIY system and get FITS – unless you are a fully qualified installer.

As with all other products that you buy, make sure that you shop around. You would not buy a car without understanding what you were doing and also looking at what other garages are selling – do the same when buying PV.

### **NEVER SIGN ANYTHING FROM SOMEONE KNOCKING ON YOUR DOOR**

Ask a company to come to your house and check that a PV system makes sense for your situation and home. Then get several free quotes.

### **What should I ask the companies giving me the quotes?**

- How much will the system cost?
- How long until it will pay for itself (get my money back)?
- Ask for the breakdown of the financial information.
- How much maintenance will it need?
- Will the maintenance cost me extra money?
- Will I need replacement parts and what will the cost be?
- How long before I am likely to need replacement parts?
- How much CO2 will I save going into the atmosphere?
- Be aware if the company says they will knock 10% off your VAT of 17.5% - VAT on PV is only 5%.
- Ask about the size of the inverter (the mechanism that converts the DC current generated by the panels into 240VAC for domestic usage or export to the National Grid) – it will need to be placed somewhere. It is about the size of a bread-maker and is attached to a strong wall. In an under-stairs cupboard is ideal but if you don't have one you will need to think carefully about where you will want it to go.
- The inverter is better placed somewhere cool as it increases its life if it is not allowed to run at too high temperature – lofts get very hot in summer – allow plenty of ventilation.
- When the company quote the amount of energy you will create and the amount of money you will make – check they have used a reliable design package – for example PVSYST or PVSOL.
- Get in writing what is the expected lifetime of the PV system and what maintenance and replacement costs are likely to be, and when these are likely to kick in.

- You will need to make sure that your system is registered in a central database through the energy regulator Ofgem. To register the system your installer must be registered with the Microgeneration Certification scheme ([www.microgenerationcertification.org](http://www.microgenerationcertification.org)) or listed on <http://www.solar-trade.org.uk/findAMember.cfm>
- Make sure the cost of any scaffolding required for installation is included in the quote – some installers add this later
- Ask how long the scaffolding is likely to be up for
- Ask if the scaffolding will need to go into a neighbour's garden – you will need to negotiate with your neighbour regarding access and keep them informed of what is likely to happen and for how long.
- Ask if your present wiring system is going to need replacing – some companies charge extra for this but do not include it in the quote.
- Ask if your present fuse box is going to need replacing or moving – some companies charge extra for this and do not include it in the quote.
- Get them to state in writing that there will not be any additional costs on top of the quote.

### **How to know a good installer?**

- Registered with the UK micro-generation installer certification scheme.
- Listed on [www.microgenerationcertification.org](http://www.microgenerationcertification.org)
- Check with your council
- Use the internet and see if any blogs relate to them – good and bad
- The installer should visit the site to carry out a survey including shading, tilt of roof, orientation (some try and give a quote based on information from satellite mapping services – this is not adequate or accurate)
- They should ask questions about your present electricity supply
- All equipment the installer uses can be found on [www.microgenerationcertification.org](http://www.microgenerationcertification.org) or <http://www.solar-trade.org.uk/findAMember.cfm>
- They should be prepared to provide addresses for installations they have done nearby – not just pictures
- Make sure they are willing to guarantee performance of equipment for its lifetime, or at least until payback has taken place.

### **What should be in my contract?**

- Make sure that the actual individual Installer is Part P approved to do electrical work on homes – some companies get one person qualified to get the company registered and then send out people that are not fully trained
- List of all equipment being used
- Manuals are included
- Full warranty including for inverter, modules and mounting system
- Full drawing of the array and all electrical additions etc
- Details on predicted performance
- Contractor will have put in writing that it is their responsibility to get all legal approvals for building regulations, planning permissions and feed-in tariff
- All structural, electrical and mechanical work is the responsibility of the installer
- Warranty on materials and workmanship
- Contractor will replace any defective equipment at their own cost.
- An easy way for you to check what you are generating and have generated to date (eg digital display)

- Terms and costs for maintenance
- You do not have to pay in full until 30 days after completion (eg retain 10%).
- You will also get a certificate to hand to your supplier which confirms your FIT status

## Some extra information that may help

These are just some points that may help clarify some extra questions or reduce some confusion

- A collection of PV panels is known as an array.
- When someone describes a 100W panel output, this is what the panel will produce under the best circumstances – this is very rare to achieve – most panels achieve at least 20% less than the stated full potential as there are unavoidable losses in the wiring and the inverter.
- PV panels do not use the light of the sun, but solar radiation.
- Solar irradiance or 'G' - the intensity of the solar radiation falling onto the panel, this affects the amount of power you get from the panel.
- Remember the arc of the sun differs at different times of the year, creating a different range of shadows. There are special systems to help you plot the shadows for your PV system.
- If you put shade on one corner of a panel, it affects the working ability of the whole panel, and the efficiency of the whole array.
- If you do not have a suitable roof, you could mount your system on the ground using either a frame or a pole. These sometimes include tracking systems so the optimum face of the sun is always at its best. However, this is likely to add considerably to the cost and the payback time.
- Most people do not pay tax on the FITS earnings
- Your tariff payments will come with your electricity bill or you can appoint a person to claim them for you. The installer will advise on this.
- When you own the PV you will need to provide your supplier with quarterly (usually) meter readings. You will have an additional meter which will display what you have generated.
- The carbon footprint of a good make of panel should be fairly low in comparison to the amount of energy it will generate. The carbon payback is about 5 years and the panel should generate energy for a minimum of 25 and possibly much longer.
- Any maintenance on the system should be carried out by the contracting company.
- Condition of your roof – you will also need to have the condition of your roof assessed and if it is not in good enough order to bear the weight (and this is not just the weight but 'lift' from strong winds etc) then you will have the added cost of putting this right.
- Access to the loft space is essential to allow assessment of the situation (full access is essential with a slate roof)

## Different roof mounting systems

*Integrated roof system* – where the PV system forms part of the roof and looks like tiles or slates etc

*Non-integrated system* – A bolt on system that is a flat plate that is fixed to the pitched roof on the top of the tiles.

*Flat roof arrays* – where PV is fixed to a flat roof using a frame to lift the panels so that they are at an angle to the sun.

In all the above cases the strength of the roof will need to be established to make sure it is strong enough

**DANGER** – some people think that if they turn off their mains switch the electricity is off. If you install PV you may have two ‘mains’ or isolator switches – one to the grid and one to your PV panel. If it is sunny you will get a big shock if you do not turn off the supply from the PV panel when carrying out electrical maintenance jobs.

If you decide to install a PV system, I would strongly advise that you purchase the book

**‘Choosing Solar Electricity – a guide to photovoltaic systems’ Brian Goss**

Please go to our website [www.greening-campaign.co.uk](http://www.greening-campaign.co.uk) and click through to the Green Shopping Bookstore at the top of the page.

Some of my installer information came from this book.

**If you found this information useful**, we would be really grateful if you would **make a donation** to help cover our costs so we can afford to produce more guidance like this. We are a not-for-profit organisation. Go to [www.greening-campaign.co.uk](http://www.greening-campaign.co.uk) and click on ‘donate’ or send a cheque to ‘The Greening Campaign’ The Old Tractor Shed, Heath Farm, Heath Road East, Petersfield, GU31 4HT. **Suggested donation £2.** Or please email us your thoughts at [info@greening-campaign.co.uk](mailto:info@greening-campaign.co.uk)

Please pass this information to whoever you feel it may help.

**Thank you – good luck!**

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