Solar PV and wind turbine systems connection to the grid

Getting the most out of your solar PV or wind turbine system

Now that you have had your solar photovoltaic (PV) or wind turbine system installed this guide will help you get the most out of it.

One way of making the most of your system is to use more of the electricity it generates at home rather than exporting it back to the grid.

Financially this makes sense because electricity bought from your electricity supplier costs more than what you get back through the Feed-in Tariff.(Note that import rates vary and export rates depend on your FIT eligibility date.) To work out how much you may get under the Feed-In Tariffs, check our Solar Energy Calculator for PV or our Cashback calculator for wind turbines.

You'll need to be careful how you do this, though, as increasing your electricity usage to more than your wind turbine or solar PV panels generate at any given moment can increase your electricity bills and not reduce them. Aim to reduce your electricity use first, and only after that to time your use to gain the maximum benefit.

Reducing electricity demand

Minimising the amount of electricity you consume may increase export but will reduce the amount of electricity that is bought back from your supplier. This can be done by improving your home's energy efficiency:

- use efficient lighting systems and high-rated appliances
- check the level of insulation and airtightness of your home

If you don't have an export meter fitted (normal if your solar PV system is less than 30kWp), you are deemed to be exporting 50 per cent of the electricity generated back to the grid. FIT payment will be based on this amount no matter what your actual export is.

Reducing the amount of electricity you export

Steps that you can take to reduce the amount of electricity that you export in order of ease are:

- Use electrical appliances during the day while your PV system is working or when the wind turbine is generating, rather than at night or when the wind turbine is still – for example washing machines and dishwashers (easy).
- Use the excess electricity generated to generate heat (medium).
- Use the excess electricity generated to generate hot water (medium).
- Store the electricity generated in batteries (hard).

Use electrical appliances while you are generating electricity easy

You can adjust your behaviour so that you use appliances with a high energy demand such as washing machines, dishwashers, irons and vacuum cleaners when you are generating electricity on site. At the same time you can charge up devices such as laptops and mobile phones which run on batteries.

For a PV system this is during the day when your PV system is generating more electricity. You can buy electrical appliances with a timer delay that will let your appliances start working without your needing to turn them on, if you are out during the day.

For a wind turbine system this can be a bit more complicated because the turbine can work and stop throughout the day and the pattern may not be repeated. However, the wind behaviour at a particular location may have general trends of high and low wind speeds, which you can match to your appliance use. It's also worth checking the local weather forecast in case a windy day is predicted, and many websites can give you an hourly forecast, including timeanddate.com and the BBC weather website. You can use timer delays to let appliances operate at night.

Energy management systems

Shifting appliance use to times when electricity is being produced is known as 'demand side management' (DSM) or 'demand response' (DR) (similar techniques are used for people on Economy 7 or 10 tariffs with storage heaters, whereby the heaters only work at night when the network remote switches them on). Work is ongoing to establish technologies to automate this process.

Energy management systems are designed to prioritise and control the power generated by your micro-generator so you can choose how to use excess electricity and even create a plan for switching on or off particular appliances. During sunny or high wind conditions you can use the excess electricity to switch on electrical appliances, heat up hot water, or provide extra heating to your house. During holiday periods you can get maximum benefits by prioritising export power to the grid. Advanced management systems also let you switch off some appliances for short periods of time when microgeneration is low.

There is large variety of demand side management systems (EMMA, ImmerSun, GEO, Green Energy Options, the Solent Electronic Home and so on). Some of them have a web-based or smart phone monitor system that allows you to control electricity consumption in your house or adjust your settings according to the outdoor temperature.

If you don't install a full management system, even a monitoring system can help you understand your patterns of electricity generation and consumption.

Use the excess electricity generated to generate heat (medium)

You might also consider using any excess electricity to top up the likes of electric storage heaters. If you do this you have to be particularly careful not to use more electricity than would otherwise be exported if you currently buy your electricity on Economy 7 or 10. This is because any extra electricity consumed during the day will cost you more than electricity consumed during the cheaper rates available at night using Economy 7 or 10 – making you worse off.

Use the excess electricity generated to generate hot water (medium)

One way of using excess daytime electricity in a more controlled way is to use it to generate hot water via an immersion heater. In order to be able to do this you will need:

- a standard hot water cylinder with an immersion heater fitted
- a PV (or wind) system ideally rated at 2kWp or more
- the PV (or wind) system and immersion heater connected to the same consumer unit
- an immersion relay to reduce the electrical consumption of your immersion heater from the usual 3kW to 1kW (alternatively to replace the existing 3kW immersion heater with a 1kW heater). If the electrical consumption of your immersion heater is not reduced in this way, there is a significant risk that you have to buy in electricity to make up the shortfall – costing you more rather than saving you money. But if your immersion heater is currently used to provide all your hot water (even if only at some times of the year), down-rating its output in this way is unlikely to be useful as you may find you have insufficient hot water for your daily needs.
- a current sensing relay unit to detect how much electricity is being generated by your inverter and to switch over to

the immersion heater at a set point – usually 1kW. This is done on the assumption that no more than 1kW is being consumed within the home and that any excess would normally be exported to the grid.

The advice in the UK is that hot water stored in a cylinder should be kept above, or periodically rise to, above 60°C to avoid the danger of Legionella bacteria. If your down-rated immersion heater cannot do this, you will need to ensure that your boiler comes on from time to time to provide this top-up heat.

This work needs to be done by a suitably qualified heating engineer, it is not a DIY job. The cost of having this kind of system installed is likely to be £300 to £500 including VAT. The amount that can be saved in this way will depend on the type of fuel that you would normally use to heat your hot water. The highest savings will be made if you currently use oil, LPG or electricity; the lowest if you use gas.

If you normally use gas to heat your hot water you will need to consider carefully whether it is more cost-effective for you to use the surplus electricity generated in this way - even taking account of the fact that your immersion heater will be more efficient than your boiler, the payback time is likely to be twice as long as for other fuels.

Store the electricity generated in batteries (hard)

Excess electricity generated by your PV system can be stored in batteries even if your system is grid connected. However, good quality batteries are expensive and will need replacing every 5 to 10 years depending on the amount they are used and the depth to which they are discharged.

Batteries are used mainly for off-grid systems; backup, grid-connected systems, and grid-connected systems.

Off-grid systems

These systems are for homes that do not have mains electricity supply and usually run a diesel generator. Read more about generating energy off-grid.

Backup, grid-connected systems

This type of system is used in areas where power cuts are common or where any power cut is critical (e.g. hospitals). There are systems (sold as system backups or power routers) on the market that can automatically switch over to battery power in the event of a power cut.

Grid-connected systems

This is becoming more attractive as electricity rates increase and the initial costs of battery technology go down. In a grid-connected wind or PV system the batteries do not need to store electricity for a long period of time. The function of the battery is to close the gap between when electricity is produced and when it is needed; this reduces the amount of electricity that is sold and then bought back later.

Batteries are not 100 per cent efficient, so you do not get all of the energy out that you put in. So if your batteries and associated components have an overall efficiency of 50 per cent, putting 1kWh into the batteries will give you out 0.5kWh.

For example, the average cost of one unit of electricity from your supplier is 13.52p/kWh and the Feed-in Tariff is 4.77p/kWh, which means that if you sell 1kWh to your supplier for 4.77p and buy 1kWh back at 13.52p, the cost becomes -8.75p. If you store 1kWh with 50 per cent efficiency and get 0.5kWh out to offset buying from your supplier you save 7.66p (0.5kWh x 13.52p = 6.76p).

	Feed-in-Tariff p/kWh	Cost of electricity from your supplier p/kWh	Saving from using own electricity	Total
Selling	4.77	-13.52	0	8.7p
Storing	0	0	6.67p	6.67p

Batteries and auxiliary equipment cost money and therefore the extra cash saved through installing batteries has to be

enough to pay back your initial costs. With grid-connected systems the storage capacity of the batteries can be much less and therefore they can have a lower capital cost.

This web content was developed by the Energy Saving Trust in partnership with the OCTES project, with funding from the Northern Periphery Programme (NPP) and the Scottish Government. Go to the OCTES website.