

Sustainability



Understanding your solar PV system and maximising the benefits



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Purpose of this booklet

The solar panels on your roof convert sunlight into electricity which can be used in your home for free, saving you money.

This booklet explains more about how your solar PV (photovoltaic) system works, when it generates electricity and how to maximise your use of this free electricity.

Useful information – talking electricity - what is a Watt?

The power of an electrical appliance is measured in Watts (W).

1,000W is known as a kilowatt (kW). Many kettles will consume 3kW when running.

If such an appliance operates continuously for one hour it will consume 3 kWh of electricity. The unit for electricity which you are charged for on your electricity bill is the kilowatt hour (kWh).



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Description of your solar PV system

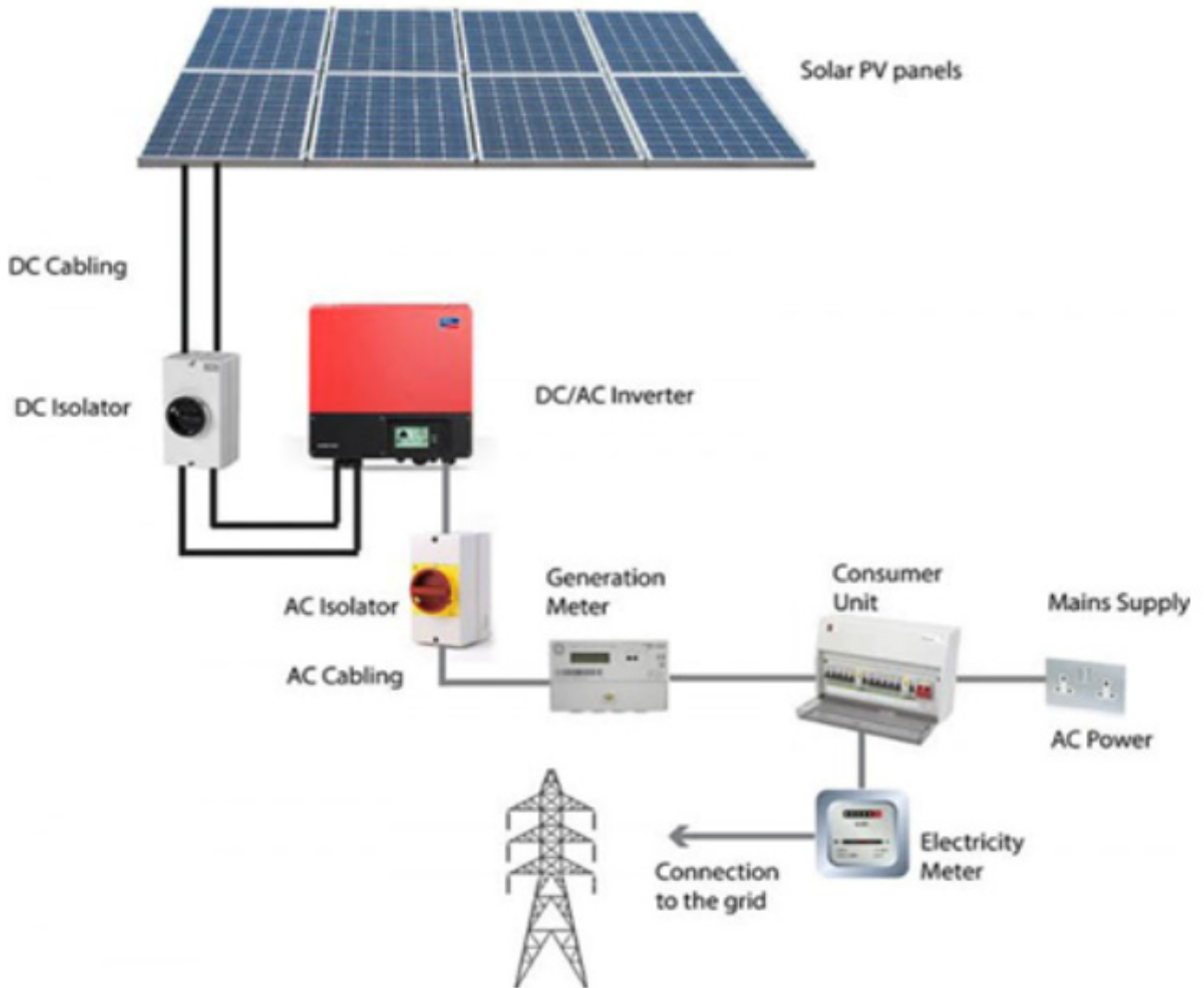


Figure 1 – Diagram showing typical components of a solar PV system

The main components of a solar photovoltaic (PV) system are:

- **Solar PV panels** – convert sunlight into electricity.
- **Inverter** – this might be fitted in the loft and converts the electricity from the panels into the form of electricity which is used in the home.
- **Generation meter** – records the amount of electricity generated by the solar PV system. This may automatically send meter readings back to the system owner. Be careful not to provide your PV generation meter reading when you give your electricity supplier your electricity meter reading.

Using your solar PV system

A solar PV system is easy to use and runs automatically. You can use the electricity at the time its generated for free. If you don't use all the electricity it produces, the remaining amount will be automatically sent on to the electricity grid.

If you consume more electricity than the solar PV system is producing, you will use the additional electricity from your electricity supplier.

Solar PV systems cannot store the electricity they produce unless you also have a battery fitted to your home (which most don't). To use the electricity produced for free, you must use it at the time it is generated – it can't be saved for later in the evening.

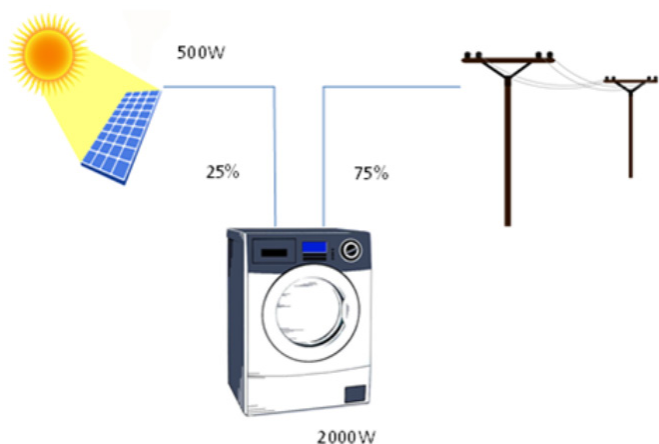


Figure 2– Power generation and usage

Figure 2 shows an example where 500W of power is generated from the solar panels and a washing machine is using 2,000W. More power is being used by the appliance than is being generated by the solar panels so an extra 1,500W is being purchased from your supplier.

On a sunny day in summer, a 3kW solar PV system may generate 2,000 to 3,000W in the middle of the day – about the power of a normal kettle. The power output would be less on a cloudy day, early in the morning, in the evening or in winter.

How much electricity do my appliances use?

To know what appliances can be powered by your solar panels, it helps to know how much power different appliances consume. The electricity used by domestic appliances will vary between makes and models, but typical values are shown in table 3. Most appliances should have an information panel showing their consumption in watts (W) or kilowatts (kW) - 1 kW is 1,000W.

Appliance	Rating (Watts)
Smart phone charger	2.5 - 5
Broadband router	7 - 10
LED light bulb (B22 bayonet)	5 - 10
LCD TV	100 - 200
Fridge freezer	200 - 400
Microwave	600 - 1,500
Electric mower	500 - 1,800
Iron	1,000 - 1,800
Grill / hob	1,000 - 2,000
Oven	2,000 - 2,200
Washing machine	1,200 - 3,000
Immersion heater	3,000
Electric shower	7,000 - 10,500

Table 3 – Typical consumption of domestic appliances (data from the Centre for Sustainable Energy (CSE))

If your solar panels are generating over 1,200W at a particular time, you would be able to power a 300W fridge freezer, an 800W microwave and a number of small appliances like your broadband router and LED bulbs.

If you have a smart meter, it is possible to see how much electricity your home is purchasing from the electricity grid using the smart meter in-home display (IHD). When your solar PV system is generating more electricity than you are consuming, the IHD should show you are not importing electricity. There is more information about smart meters in the monitoring section on page 7.

Figure 4 shows the typical electricity consumption for various appliances and the amount of the electricity consumed that could be provided from the free solar PV compared to that purchased from the electricity grid. This is for a small 1kW solar PV system generating its maximum power at mid-day in summer. With a larger PV system more of the power could be provided by the solar PV system.

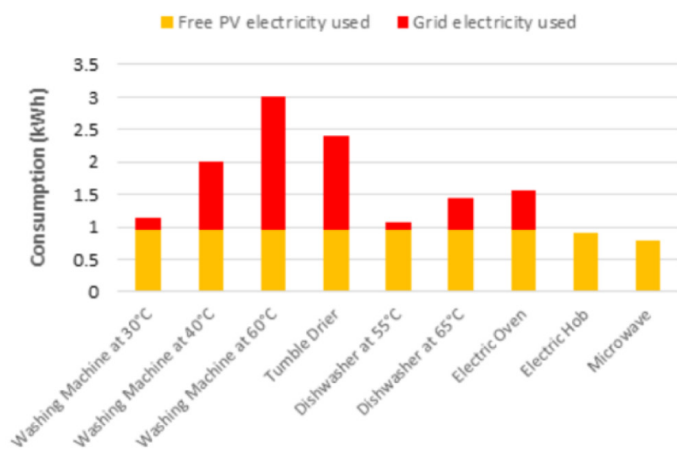


Figure 4 – Comparison of free solar PV and grid supplied electricity used by appliances for a 1kW solar PV system at mid-day in summer

When do the solar panels produce electricity?

Solar panels generate electricity during the day. They generate more electricity when the sun shines directly on the solar panels. Figure 5 shows PV generation in watts for a typical 2.8kW solar PV system on 11 July 2020, when it was sunny throughout the day and on 13 July when there was a mixture of sun and cloud.

A south facing solar PV system will tend to generate more around noon. The sun rises in the east and so east facing PV panels will have maximum generation part way through the morning. A west facing array will tend to generate most electricity part way through the afternoon.

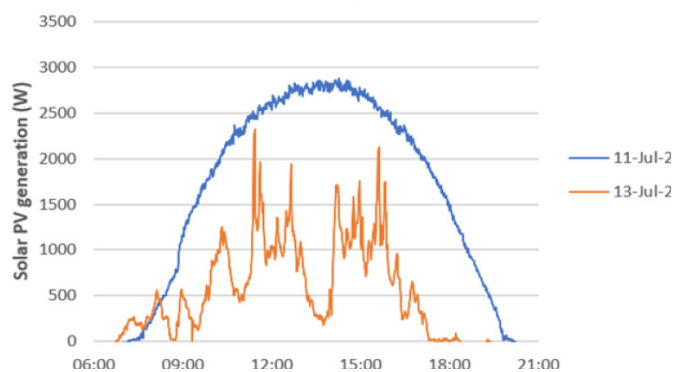


Figure 5 – Solar PV generation for a 2.8kW PV system on a sunny and cloudy day

Solar PV generation is higher in the summer than the winter due to longer days and the sun being higher in the sky. Figure 6 shows the typical monthly values of solar PV generation for a 1kW PV system in Wakefield. From year to year there is variation in the generation for any particular month. There is however less variation in the annual generation from year to year as weather patterns over the year average out.

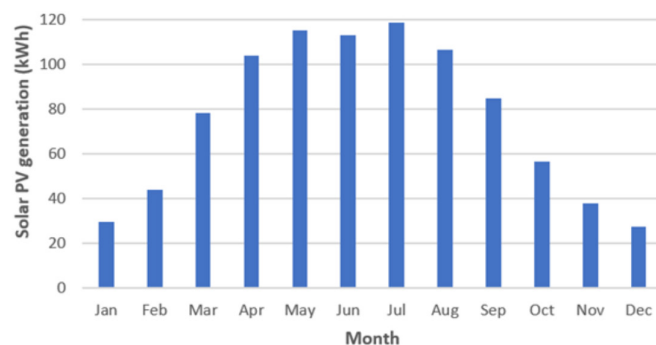


Figure 6 – Typical monthly solar PV generation (in kWh) for a typical 1 kW PV system in Wakefield

Shading

The performance of a solar PV system is affected by shading of the solar panels. This could be from trees or bushes, dirt or leaves on the solar panels, or shadows from chimneys or other buildings. If you have shading of your solar panels from trees or bushes, you should contact your landlord to discuss this rather than attempting to cut them back yourself.

Top tips for maximising savings from your solar PV system

- If possible, use an appliance during the day when the solar PV is generating power rather than in the evening or overnight.
- Greater savings are possible by using high-power electric appliances at times when the solar panels are generating most. This will be in the middle of the day, especially when it is sunny.
- If it is safe, use timers on appliances which can run while you are out during the day.
- Use larger appliances (washing machine, tumble drier, dish washer) one at a time to minimise the electricity coming from the grid.
- Consider getting a smart meter and use the in-home display which comes with it to monitor the electricity you are purchasing from the grid.
- Consider cooking your evening meal during the day over several hours using a slow cooker on low power rather than by using the hob or oven in the evening.

Other energy and money saving tips

- Use energy efficient, ideally A+++ rated appliances.
- Microwaves use less power than an electric oven.
- Only fill a kettle with the amount of water you need.
- Cook with lids on pans so you can turn down the power.
- Wash your clothes on a sunny day and dry them outside on the clothes-line, avoiding use of the tumble drier.
- Turn off appliances when they are not being used.
- Don't leave appliances on standby – turn them off at the wall.
- Switch energy supplier – the solar PV system does not restrict your ability to switch energy supplier to get a better tariff rate.

Minimising your impact on the environment

There is a need to reduce carbon emissions due to climate change. Your solar PV system will generate electricity without producing further carbon emissions. Electricity from the grid can be produced by burning fossil fuels which release carbon dioxide which contributes to climate change. The less we rely on energy produced from fossil fuels, the better it is for the environment.

Monitors for solar generation and household consumption

Solar PV monitors

It is helpful to see how much power the solar PV system is generating, as a guide to how many appliances can be run from the solar PV system - for free.

The inverter is likely to have a display which shows the power output, but this may be inaccessible in the loft.



Monitoring devices can be fitted to the solar PV system to measure the power output. They are available from suppliers like Amazon and may cost between £75 and £100 depending on the model chosen.

Some can be fitted with guidance from an installation manual, but others may require an electrician to fit them.

Monitoring devices can measure the flashes from the generation meter or have a clamp around a cable to measure the current. Some have a display unit, while others may provide data via a phone app or internet web-portal. More advanced systems may show information about household electricity consumption as well as solar PV generation. Some monitors need the household to have broadband internet while others just send data to the display.

Smart meters

As part of a national programme, energy suppliers will be offering all households the opportunity to have a smart meter fitted before the end of 2024. Advantages of smart meters include an end to estimated bills and no more manual meter readings being required.



The meter comes with an in-home display. Energy suppliers have used models from several manufacturers. These allow you to monitor the electricity you are importing from the grid and how much it is costing you.

At times when your solar PV system is sending electricity to the grid, the in-home display would show that your electricity cost each hour is now £0.00 or you are purchasing 0 W of electricity. These are good times to be using your electrical appliances.

The latest models of smart meters will continue to be smart after switching energy supplier.

Maintenance of the solar PV system

Social landlords or the system owner typically monitor performance of the solar PV system by readings from the generation meter. If there is a problem, households are likely to be contacted by the landlord to arrange a visit by an electrician. As having a working solar PV system will save you money on your electricity, it is best to allow access for any maintenance or repairs needed. Residents do not need to agree maintenance contracts or fees with any company.

Solar PV systems have no moving parts and generally require little maintenance. The lifespan of the solar panels is about 25 years, however the inverter may require replacing after about seven to 10 years.

There is likely to be some deterioration in performance over time – solar panels are typically guaranteed to provide 90% power output after 10 years.

How do I know that my solar PV system is working?

The generation meter has a red-light and this will flash when the solar PV system is generating electricity. It might be fitted in the loft and we do not advise going in the loft if this is the case. The faster the red-light flashes, the more electricity is being produced. Overnight, when the panels are not generating, the red light will stay on constantly.

The generation meter reading increases during the day as the solar PV system generates electricity from sunlight. On very dull days in winter, the light may rarely flash and the meter reading may not increase for a few days if the amount of electricity generated is too small to register.

If there is no change in the meter reading over a week, then the system may not be working and you may need to report this to your landlord or the system owner.

Will the system work during a power cut?

No, for safety reasons, in the event of a power cut, the PV system inverter will automatically switch off. This safety feature protects engineers working on the fault, as they could be put at risk if electricity was being supplied to the grid during a power cut. The solar panels should automatically switch back on when safe to do so.

This booklet was produced by National Energy Action (NEA), the fuel poverty charity in partnership with Gentoo, WDH and the London Boroughs of Camden and Waltham Forest.

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Action for Warm Homes

