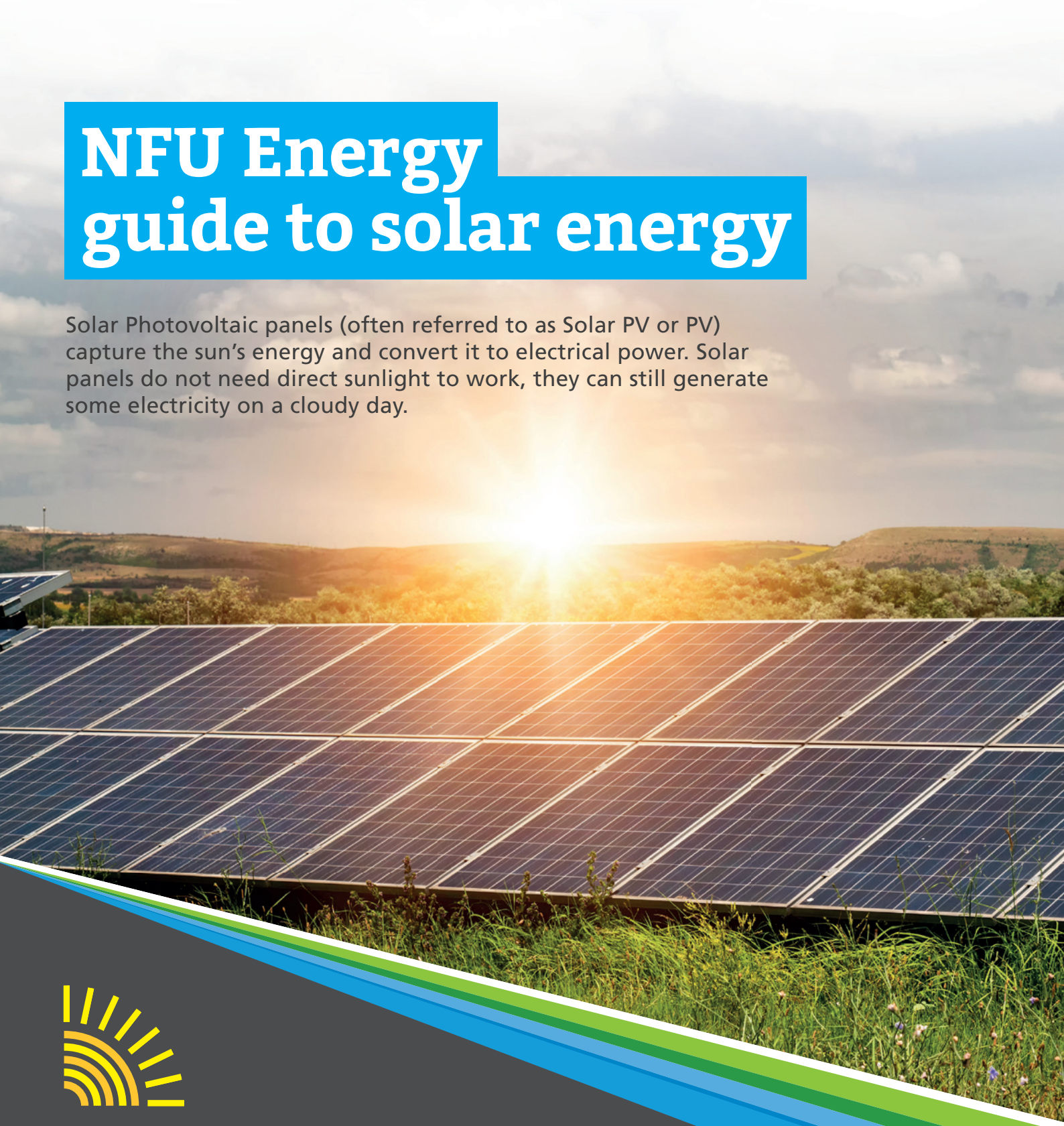
NFU Energy guide to solar energy

Solar Photovoltaic panels (often referred to as Solar PV or PV) capture the sun's energy and convert it to electrical power. Solar panels do not need direct sunlight to work, they can still generate some electricity on a cloudy day.



Benefits of solar PV

- **CUT YOUR CARBON FOOTPRINT:**
  Solar electricity is green, renewable energy.
- **CUT YOUR ELECTRICITY BILLS:**
  Once installed, your electricity costs will be reduced.
- **EXPORT INCOME:**
  If your system is producing more electricity than you need, you can sell the surplus back to the grid.

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Output

The amount of electricity available from a PV installation depends on several factors:

- Orientation in which the installation is to face. South facing is the best, but directions from southeast to southwest or east to west can work too.
- Hours of sunlight per day/year.
- Intensity of sunlight.
- Area of panels.

Solar electricity can be used on-site to offset electricity that would have otherwise been imported, or it can be sold directly through the electricity network (or most likely a combination of both). Storage in batteries can be employed where a stand-alone electricity system is required.

SOLAR PV PERFORMANCE

Solar electricity is generally not stored. Houses and businesses that are best suited to solar PV output use electricity during the daytime, ideally peaking in the summer months (e.g. ventilation of intensive livestock sheds). Approximately three quarters of the energy will be produced from April to September.

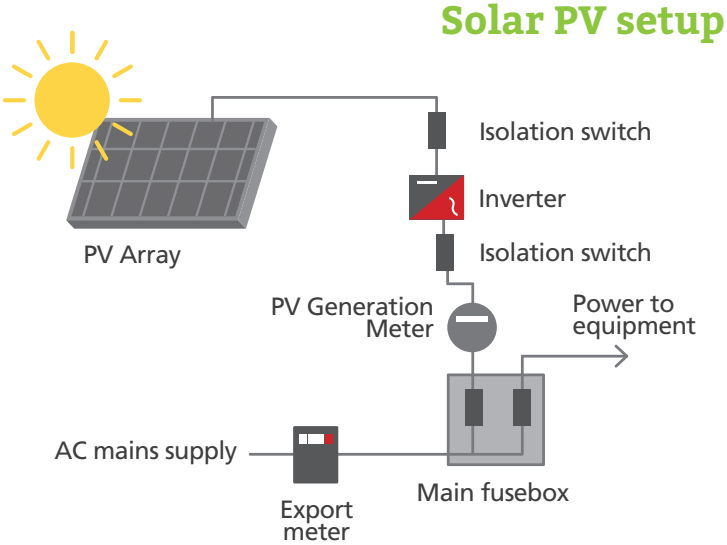
A medium sized array on a rooftop (50 kW) would require 350-400 m² of roof space. Installed on a south-facing slope, this could generate around 42,500 kWh of electricity. Alternatively, a 50 kW system could be ground mounted on metal frames, requiring approximately a third of an acre of land (0.1 ha). The advantage of this is that the system could be aligned due south and angled at 35 degrees to obtain optimal performance. The disadvantage is that planning permission would be required, and this would add time and cost to the project.

SOLAR PV TECHNOLOGY

A photovoltaic (PV) installation usually comprises the following key components:

1. Generating cells (the photovoltaic part).
2. Inverter (to convert the cells direct current (DC) to alternating current (AC)).
3. Cabling to connect to grid and to power equipment.
4. Switching and protection systems to enable the installation to work safely in parallel with the electricity grid.
5. Metering - a generation meter monitors the total output of the system and, where appropriate, an export meter measures the electricity exported to the grid.

Solar PV setup



SOLAR PV SITING

A PV installation is best sited on a large, south facing roof or in open ground. Panels are either pre-constructed encapsulated aluminium and glass or, in some cases, might take the form of roof tiles or semi-transparent PV glazing units.

Systems that track the sun over the course of the day and throughout the year can be used, although the additional cost of installing these can be more than the return from the extra electricity produced.

PLANNING PERMISSION

Roof mounted systems

Installations do not generally require planning permission if they are replacing an existing roof. However, buildings subject to conservation status will require planning permission.

Ground mounted

Any commercial/agricultural ground mount system needs planning permission. Small ground-mounted solar systems are Permitted Development, but only up to 3 x 3 metres in size (about 1.3 kW).

If there is any doubt, it is advisable to contact the local planning officer before any expense is incurred.

GRID CONNECTIONS

Systems up to 3.68 kWp single phase and 11.04 kWp three phase will need no prior permission to connect from your electricity distribution network operator (DNO). However, they must be informed within 28 days of commissioning and the 'protection' system must be G98 compliant.

For larger systems, you need pre-approval and it may be necessary to upgrade your electricity supply. If you are considering an installation, you can get a budget estimate for any work from your DNO.

FINANCIAL RETURNS

Once you have bought your solar panels, maintenance and operating costs are small. You will need to clean the panels, how often will depend on your location and siting, and the inverters will likely need replacing every 10 years or so. Panel output falls at a rate of about 1% per year.

Financial return is mainly tied up with the amount of energy generated that you use.

If, as in most cases, your PV system operates in parallel with your mains supply, it will help to displace the energy you would normally have bought from the grid.

If you are generating more energy than you are using, and your PV system is connected to the grid, the balance will be exported.

It is worth noting that displacing your own energy use is worth more to you than exporting. Therefore, solar energy systems work best if you have a daily energy use to balance your generation, so you can consume the energy you generate.

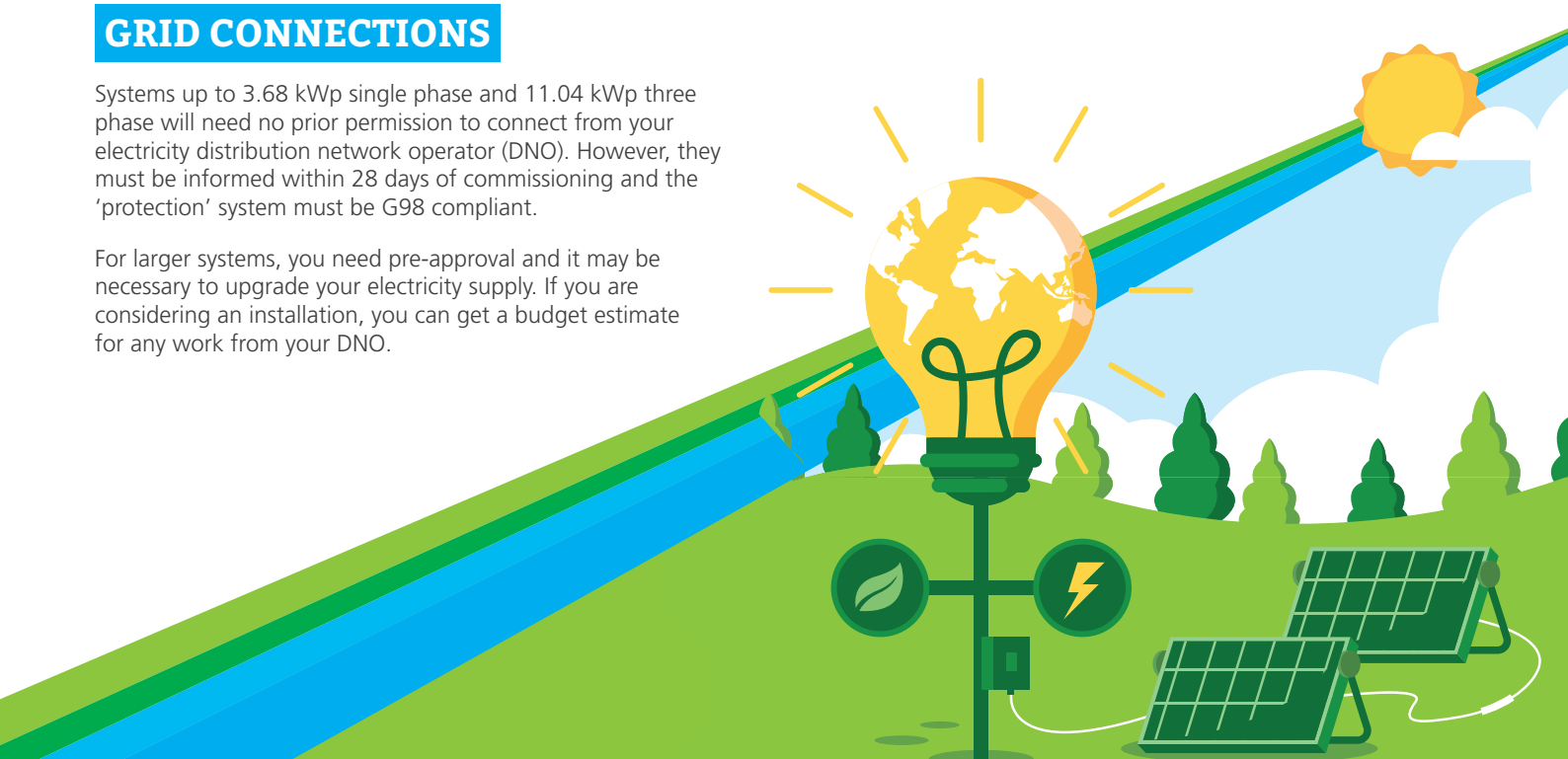
SOLAR HEATING

Solar Hot Water systems, also known as Solar Thermal, can be installed to supplement hot water requirement. Larger installations may be employed to reduce process heating costs, heat swimming pools, etc. The solar hot water system will save you money through reduced energy bills.

Installing solar thermal is a little more challenging than PV, as the heat produced needs to be connected into a new or existing hot water system.

The amount of energy available from a solar thermal installation depends on several factors:

- Direction in which the installation is to face; south facing is the best.
- Sunshine hours per day/year.
- Intensity of direct and diffuse sunlight.



SOLAR THERMAL TECHNOLOGY

Solar thermal systems capture sunlight to heat water through predominantly two types of technology:

- **Flat plate collectors** - thin panels of metal that act as absorbers positioned just below a sheet of glass. The metal panels absorb the sun's heat and this heat is then transferred to a liquid that is pumped through the system. These are robust long-lasting systems.
- **Evacuated Tubes** are basically glass vacuum tubes, which contain thin strips of twisted metal which act as an absorber. The vacuum reduces conduction losses so heat transfer in evacuated tubes is very efficient. By contrast, flat plate collectors tend to lose more heat, especially during cold ambient conditions.

SOLAR THERMAL SITING

Siting requirement for Solar Thermal is a south facing roof at 35 degrees and free from shading. The system should be located as close as possible to your stored hot water cylinders or heaters.

Solar Thermal panels are heavier than PV panels and a structural survey should first be carried out on any residential property or farm building, to determine if the roof structure needs to be strengthened, otherwise it could negate the insurance cover.

SOLAR THERMAL PERFORMANCE

Solar Thermal performance varies in similar ways to solar PV performance. The systems do not require direct sunlight to function as daylight is sufficient. Typically, savings of 30-70% can be made on annual water heating costs and water temperature of 50 to 60°C can be achieved.

A solar thermal system will produce good quantities of hot water in the middle of the summer on hot sunny days, but normally it will only produce warm, rather than very hot water.

Solar Thermal systems are ideal for use in process heating, food processing or production. Typical payback for a Solar Thermal system is highly dependent on subsidy and utilisation of hot water.

Unlike with solar PV, there is no 'grid' to push surplus heat into and so all the energy is used onsite.

A Solar Thermal system will require more maintenance than solar PV but should last in excess of 20 years if properly maintained.

FAQs

How do I know I'm using the power from the PV panels?
If you have the demand at the time of generation, you will use the electricity generated from the system before importing grid electricity, your inverter will control this.

How much electricity will my PV panels generate?
This depends on the variables explained in the guide. Your installer should give you a breakdown of how much you should expect to generate.

How much will I save on my bill?
The more you can utilise your own generation, and reduce the grid supplied power, then the more you will save!

What happens when there's not enough light?
Solar PV will still generate electricity, albeit in lower amounts in low light conditions. By the very nature of solar PV, you need light, and so systems should be sited where they will have maximum exposure – no light, no electricity.

What happens when my panels produce more than I'm using?
You will export unrequired electricity back to the grid. You may or may not get paid for this, depending on whether you have an export contract.

What size system can I fit on my roof?
An installer, or consultant can help you work this out. It's a fairly simple calculation for a basic estimate, however you should consider other siting issues, such as shading, structural demands etc as well.

How long do panels last?
Most panels now come with 20-25 year performance warranties, though they will likely continue for longer than that. Product warranties are usually 5-10 years.

I've got some shading, is that a problem?
It can be yes – the designer of the system should take this into account at the start of your project – a standard system can be affected significantly by shading, but there are now 'optimised' systems, and the effect of shading can be managed very effectively.

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www.nfuenergy.co.uk

Phone: 024 7669 6512 | Email: info@nfuenergy.co.uk

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