Solar inverters

Solar inverters, also called grid-tied inverters, convert the direct current (DC) electricity produced by your solar PV panels to alternating current (AC) electricity that can be used in your home and exported back to the grid.

Solar invertors also:

- ensure compliance with regulations about feeding electricity into the grid, for example by immediately disconnecting if there is a power cut
- maximise electricity production by constantly varying its resistance (load).

Solar inverters are very efficient, usually 93–96 per cent depending on the make and model - never 100 per cent because they use some of the input DC power to run, generally around 10-25W. Their efficiency can be improved by an electronic technique known as Maximum Power Point Tracking (MPPT). The point of maximum power output of a solar PV cell is dictated by a combination of current or voltage. Where it is will vary constantly according to light levels, shading, temperature and the characteristics of the solar PV panel. A MPPT system continually searches for this point to extract the maximum power available from the cell. Multiple MPPT systems can maximise yield even if part of the array is shaded. Find out more about MPPT at the YouGen blog.

Inverter sizing

There are many different makes and sizes of inverters on the market. The key characteristics are:

- maximum amount of DC electricity (expressed as max DC power in Watts) the maximum number of watts the inverter has been designed to convert
- maximum input voltage – this is the maximum voltage the inverter can manage before its electronics are damaged
- initial input voltage (sometime called start-up voltage) – the minimum number of volts the solar PV panels need to produce for the inverter to start working
- maximum power point (mpp) voltage rang - the voltage range at which the inverter is working most efficiently.

Many solar PV systems in the UK have an inverter with a power rating that is smaller than the array. For a 3kWp array, this equates to an inverter size of between 2.4kW and 3.3kW (often expressed in watts: 2400W to 3300W). This is because the panels are not likely to be generating at their rated efficiency for long periods of time, and to ensure that the initial input voltage and maximum power point voltage range are reached as often as possible.

Inverter manufacturers often provide guidance to installers on solar inverter sizing, typically through providing system sizing software. As each inverter is manufactured to cope with a pre-determined maximum input voltage, the final choice of inverter will also be influenced by what is available on the market, particularly if your installer prefers to work with a limited number of makes.

Types of solar inverter

Grid-tied inverters can either be linked to a number of solar PV panels (referred to as string or central inverters) or be linked to one or two solar PV panels - these are called micro-inverters.

Standard string inverter warranties are usually between 5 and 10 years; as this is less than the warranties on solar PV panels it would seem sensible to budget for at least one string inverter replacement during the lifetime of your solar PV system. If you have micro-inverters installed instead this may not be necessary.

String invertors

A string inverter works most efficiently when all the solar PV panels have the same characteristics and are operating under the same conditions. If it is known from the start that some of the panels are not likely to be operating under the same conditions - for example, they are not all orientated in the same direction or some of them will be shaded for a part of the day - this would be a good reason to install two or more inverters as part of the system. An alternative would be to install an inverter that has been designed to cope with more than one string of solar PV panels operating in different conditions.

Micro-inverters

Micro-inverters get around the need for all panels to have the same characteristics and be operating under the same conditions by having an inverter installed to the back of each panel. This means when the performance of a panel is affected, for example by natural shading or from obstructions from leaves or debris, it will not affect the overall performance of the system, as would a string invertor – particularly one without MPPT.

Micro-inverters also include MPPT which micro-inverter manufacturers claim works more effectively than it does in string inverters where something as small as an antenna could reduce the performance of the whole system.

Test requirements

This requirement to test inverters in groups of 3-4kW is included in the latest version of G83.

Benefits of micro-inverters

Benefits claimed for micro-inverters include:

- performance of the solar PV array is optimised and reports claim the system could have improved energy harvest of between 5 per cent and 20 per cent over the lifetime of the system
- improved energy harvest should result in increased income
- the potential for enhanced monitoring as the performance of each individual panel can be monitored separately
- greater reliability - if one micro-inverter fails, it will not affect the whole system
- installation of micro-inverters is cheaper and easier as wiring is simpler and no high voltage DC equipment is required, which also makes them safer to install.
- it may be easier to increase system size by adding new panels.
- Increased lifetime – the single most common cause of failure in a solar PV system is the string invertor, which normally requires replacement at least once over the lifetime of the array. The latest micro-inverters have fewer life-limited components, and manufacturers claim a lifetime of 25 years to match the panels
- the cost per watt is more for micro-inverters but is offset by a simpler installation and increased energy harvested.

Drawbacks of micro-inverters

The claimed drawbacks of micro-inverters include:

- still a relatively new technology and there are only a small number of manufacturers

- more expensive than string invertors
- potentially costly to replace as roof access required
- only useful in situations where shading is a significant issue
- lack of expertise should things go wrong – relatively small market thus reliance on small pool of installers and manufacturers
- some DNOs are still not sure about them (see the test requirements above).

Energy Saving Trust recommends that you check with your DNO before having micro-inverters installed.