Optimise solar the smart way

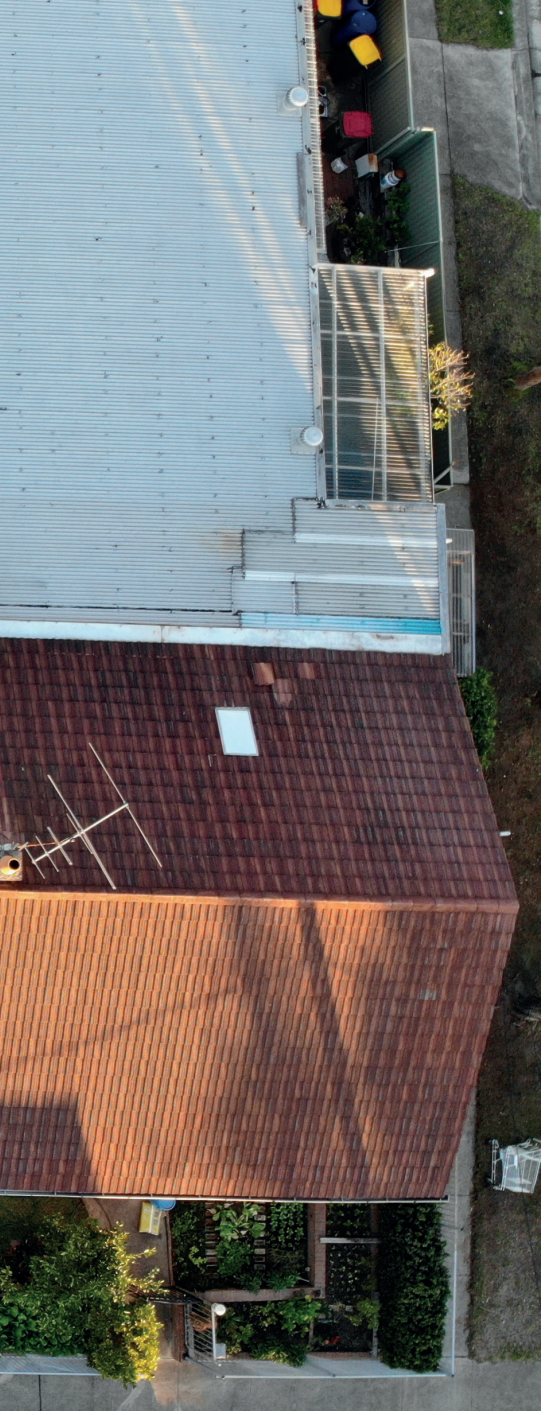
The history of the global PV industry is one that is defined by innovation. And now, more than ever, the continuing growth and sustained health of the solar sector is further enabling companies to invest in R&D. From tech start-ups to global electronics companies, new components that deliver marginal improvements or game-changing solutions, the efficiency and performance of PV systems across the world continues to be advanced by technological innovation.

One characteristic that unites innovators across the solar industry is the unwavering focus on optimizing solar PV systems, always looking to deliver higher yields, reduce O&M costs and increase the ROI for system owners. So, it's perhaps unsurprising that in recent years there has been a significant increase in the use of module-level power electronics (MLPE), such as power optimizers or microinverters. As the name suggests, MLPE place power electronics on the modules of the PV system, with the aim of isolating individual panels in order to improve overall system performance.

The introduction of MLPE marks a shift from the conventional PV system design, where the inverter would be responsible for handling so many of the functions and processes that a PV plant is required to carry out. The proliferation of MLPE has in part been driven by the strong levels of sustained growth that the residential PV segment has witnessed in recent years. Given the huge variety of customer requirements and differing residential layouts that need to be accommodated, the increased flexibility that MLPE facilitates means that they are being increasingly incorporated into residential PV systems.

The rise of MLPE

The two main MLPE that are currently being used across the solar industry are microinverters and power optimizers. Microinverters are smaller inverters placed on each solar module, either integrated into the panel or placed on the panel mount.



With PV systems utilizing microinverters, there is no need for a separate string or central inverters, as the DC current generated by the array is converted to AC right at the site of the panel. Power optimizers are also installed at each panel, though instead of converting the DC energy to AC, they increase the power yield of the module before sending an optimized DC voltage to the system inverter for conversion. They do this by tracking the maximum power point of each individual module, fixing the voltage of the DC energy so that the inverter can convert it more efficiently to AC, fully utilizing the rooftop and removing restriction concerns.

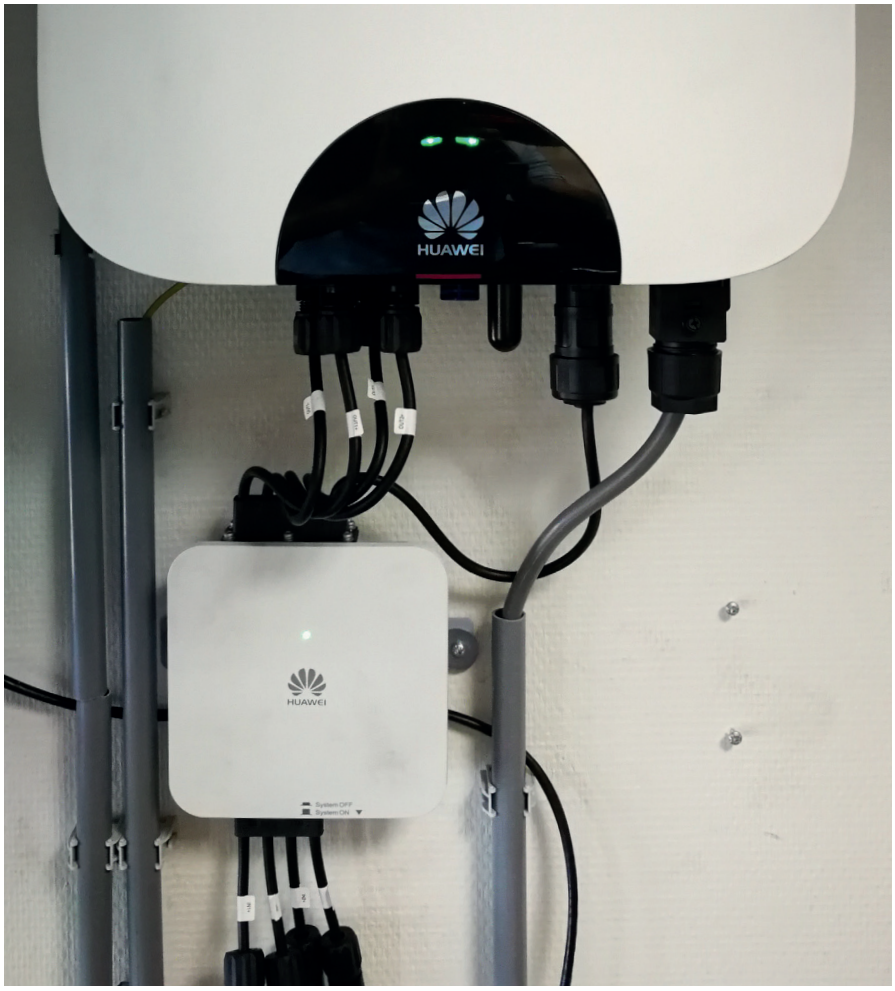
The increase in uptake of MLPE can also be attributed to well-informed customers wanting to get the most from the solution they have. In the age of fitness applications monitoring steps walked each day to smart meters monitoring energy usage in real time, there is a want from customers for more detail on many aspects in our life and none more so than in the solar industry. MLPE help to facilitate module-level monitoring, providing the customer with the ability to assess the performance of the modules and subsequently maximize efficiency and improve ROI.

So just as with so many aspects of PV systems available today, MLPE presents yet another choice for installers and homeowners as to which technology to opt for. Yet recent analysis from IHS Markit has shown that power optimizer solutions have begun to gain favor with PV installers over microinverters, with one of the main reasons being the flexibility of system design that they enable. For installers and customers alike, the benefits of flexible residential systems are obvious. Being able to offer a solution that they know can cope with the full range of requirements across the market means that they no longer need to purchase multiple solutions from different suppliers, which helps to significantly reduce operational costs.

An optimal solution

If we consider the variability of rooftops across the residential segment, there are several characteristics which need to be considered, including the multiple-orientated roof layouts, shading and the most efficient string configuration. These factors can be compounded further by limitations with respect to PV system design that result in a sub-optimal use of roof space. Previously, PV systems would require that all PV modules in one string had to face the same direction and could not be located in shade-prone areas. Similarly, individual strings would require identical module type while parallel strings had to be identical in length. Without the appropriate PV system design these factors can have a significant impact on both the upfront cost and energy yields over the lifetime of the system, having a direct effect on a customer's ROI.

It is perhaps no surprise there is a trend of installers favoring PV systems that are able to cope with the huge variety of residential layouts, enabling customers to maximize rooftop kWh yields in all scenarios. Systems that can accommodate the use of PV optimizers on selected modules that may have shading or different roof orientation, such as Huawei FusionHome, help to effectively avoid module mismatch caused by dust, shadows, PV module



FusionHome SUN2000L Inverter and Smart PV Safety Box

Illustration of PV layout with optimisers installed only on modules affected by shade.

attenuation, and hot spots, maximizing the energy yield from each PV module. Taking a rooftop that may have a chimney-shaded area equivalent to the size of four modules, for example, FusionHome allows homeowners to install modules with optimizers in the shaded area enabling them to fully utilize their rooftop. Over 25 years these four modules can generate around 22,400 – 33,600 kWh in additional yields, comfortably covering the upfront cost of the modules.

However, the MLPE debate is one that shouldn't be solely characterized by microinverters versus power optimizers. How a PV system interacts with optimizers can make a huge difference in terms of cost to the homeowner. Most PV systems require optimizers to be installed across an entire array even though they may only be needed on one module. This means that homeowners are required to spend significant amounts of money on optimizers for modules that do not actually require them. Furthermore, in overcast or rainy conditions, optimizers can operate in light load mode, meaning power is converted at a low efficiency and eventually results in a greater loss of power. This is in contrast to Huawei FusionHome, with its high inverter efficiency and unique functionality to enable customers to only add optimizers where they are needed, helping to keep upfront costs and improve their ROI.

Referring to the article 'Outdoor characterization and comparison of string and MLPE under clear and partially shaded conditions', issued jointly by the Solar Energy Application Centre and the Copernicus Institute of Utrecht University in the Netherlands, after carrying out various experiments, it concluded that 'string and distributed MPP architecture compared and evaluated under unshaded and partially shaded conditions, which are often found in the urban built environment. During operation under shaded conditions the efficiency of the MLPE devices is reduced by 1–2% depending on the voltage input.

At system level, traditional architecture seems to perform better in unshaded conditions, whereas MLPE solutions offer up to 35% better energy yields at certain partially shaded conditions.

'The conclusion is definitely in line with the Huawei FusionHome partial optimizer solution. The modules are connected in strings in unshaded areas of roofs and with the optimizer only connected in the shady area, to maximize the energy yields.

Meeting customer needs

The increase in use of optimizers and other MLPEs are just one example of how innovation within the industry is facilitating customer choice and optimizing the performance of PV systems. If customers are truly to benefit from the increased functionality of MLPEs, the flexibility that they offer must be matched by the PV system. Enabling customers to install MLPE only on modules where required ensures that the increased revenues and higher yields that they deliver are not undercut by unnecessary installation costs. This is an important consideration and one that companies will increasingly need to make. As the technology advances, the benefits brought by the innovative partial optimizer solution are becoming clearer, enhancing their value and better meeting the needs of the modern customer. It is truly a solar solution that you 'pay less' but get more.

www.solar.huawei.com

A happy customer with a Huawei FusionHome installation.