The new REC TwinPeak Series: The combination of different technologies maximizes the power from a polycristalline platform and optimizes long term panel performance

The REC TwinPeak Series is a brand new solar panel development that features innovative design with high panel efficiency, i.e., higher watt classes. Based on a polysilicon platform, the REC TwinPeak Series encompasses a number of new and innovative technologies that ensure the panel can compete strongly with mono p-type and n-type products on the market.

What is the REC TwinPeak Series?

The REC TwinPeak Series is a new solar panel with an innovative layout and different cell technology that increases the power available from a polysilicon cell up to 275 Wp. In combination, the technology inherent in the new REC TwinPeak Series delivers an increase of 10 Wp per panel compared to REC's current REC Peak Eenrgy Series panel.

The most obvious difference in the REC TwinPeak Series compared to a standard solar panel is the cell design. The new panel is based on standard sized cells of 156 x 156 mm that have been cut into two equally sized pieces (156 x 78 mm), to give 120 half-cut cells.

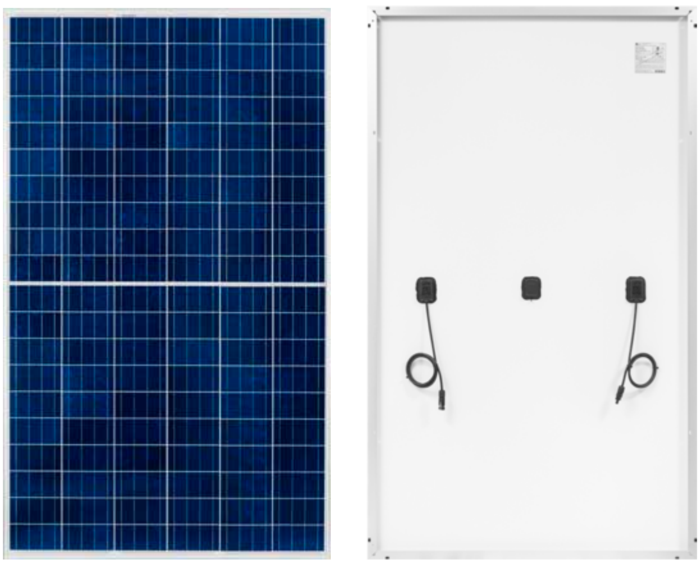
The panel is then split into two 'twin' sections of 60 cells each, connected in series, in three strings. The two sections are then connected in parallel in the center to give a panel of 120 cells (fig. 1). This new design and layout is supplemented by a collection of other enablers:

- PERC (Passivated Emitter Rear Cell, also known as Backside Passivation)
- Four bus bars
- Split junction box design

For which markets is the new panel suitable?

The higher power and efficiency afforded by the new panel means customers will be able to boost their overall energy yield from the same surface area; this makes the REC TwinPeak Series ideal for the residential and C&I markets where rooftop space is often limited. The increase in power per m² allows customers to generate the most energy out of their installation reducing the balance of system costs for installers and system owners and ensuring solar energy remains cost-efficient.

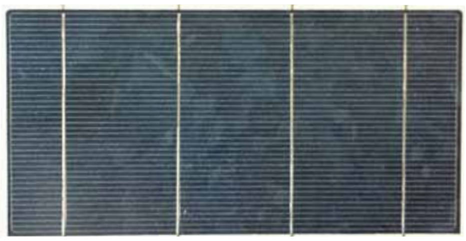
Fig 1: Front and rear view of the REC TwinPeak Series solar panel, showing the twin section design enabled by the half-cut cell layout, 4 bus bar cells and split junction box on the rear



What advantages do half-cut cells offer?

As mentioned above, a half-cut cell is a standard cell that has been split into two equal pieces to produce smaller cells (fig. 2). Through this, the current per cell is also reduced by half. With the reduction in current, comes a reduction in resistance and therefore power loss internal to the cell. Power loss is generally proportional to the square of the current, therefore power loss in the complete REC TwinPeak Series panel is reduced by a factor of four ($Ploss = R \cdot I^2$, where R is the resistance and I is the current).

Fig 2: A half-cut cell showing the 4 bus bar cell design

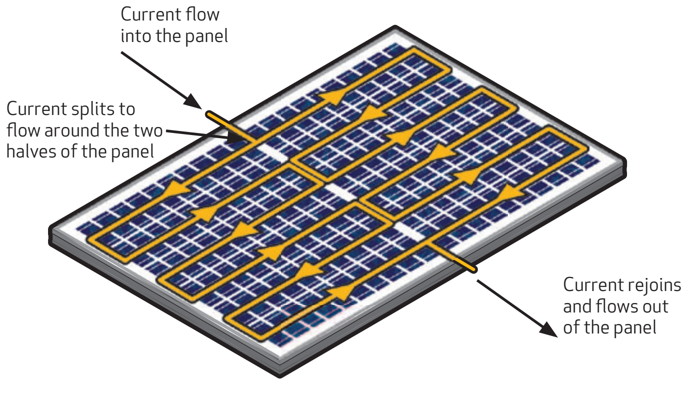


The reduced loss of power in a half-cut cells produces a higher fill factor and higher cell efficiencies resulting in better energy yields, especially at times of high irradiance. Panels with a higher fill factor have a lower series resistance meaning reduced loss of current internally in the cell.

Additionally, the new layout improves the shading performance of the TwinPeak design compared to a standard panel. For example, if a standard panel is installed in portrait orientation and the bottom is shaded, the power output of the complete panel is zero, due to the bypass diodes closing the internal strings. The layout of the REC TwinPeak Series ensures that in the same conditions, due to the separate twin sections, the power output is at least 50% (fig. 3).

The improvements made in the reduction of resistance through half cut cells add an overall around 4 Wp per panel extra power output.

Fig 3: Flow of electricity in the REC TwinPeak Series. The two twin sections reduce internal resistance and ensure continued production of energy when partially shaded.



What advantages do four bus bars offer?

The use of four bus bars to a cell, as shown in figure 2, decreases the distance between them. This proximity means electrons have less far to travel to reach the ribbon, vastly improving the flow and the reliability performance of the panel. This reduced distance lowers the resistance in the cell, increasing current; in turn, this allows finger width to be reduced, exposing more cell surface area to light and generating more current, as well as keeping the fill factor high. The reduction in cell resistance seen through adding a fourth bus bar improves cell efficiency by over 0.2% per cell and adds 2 Wp per panel.

During the stringent qualification performed by REC, a major improvement in the test performance of the four bus bar panels has been seen, especially in the thermal cycling and mechnical load tests. This is attributed to the lower cross section of the ribbon permitted by the smaller size, which creates less stress on the cell.

What advantages does a split junction box offer?

A standard junction box is generally a single plastic housing which contains three bypass diodes and connection options to enable the panel to be connected to the rest of the system. The term 'split junction box' describes where these functions are split into three smaller boxes, one per internal string, with one bypass diode each (fig. 1).

The major advantage of this is to enable the new cell layout seen in the REC TwinPeak Series. Use of the split junction box principle uses one less cross-connector than a standard panel, which reduces internal panel resistance and saves space. This extra space can then be used to give a larger gap between cells, increasing internal reflection of light onto the cell surface and subsequently increasing light capture.

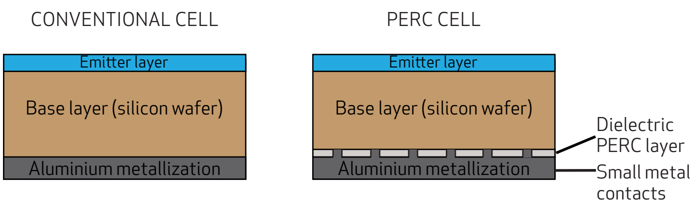
Tests have also shown a reduction of between 15 and 20°C in heat build up behind the three new boxes compared to the single box on a standard panel. The cooler temperatures achieved help increase panel reliability and produces a power gain of around 1 Wp per panel.

In the REC TwinPeak Series, the junction box will be in the center of the panel and the cable lengths will be same as today.

What advantages does PERC technology offer?

Although PERC technology cannot be seen in the cells and makes no difference to the visual appearance of the panel, it offers a major boost to overall production. PERC technology is an additional step which REC has introduced to the cell production process. Based on a change in the design of the rear of the cell, a special dielectric PERC layer is coated on the backside of the cell and the aluminum metallization layer, providing contact to the silicon wafer only through laser-made microscopic holes (fig. 4).

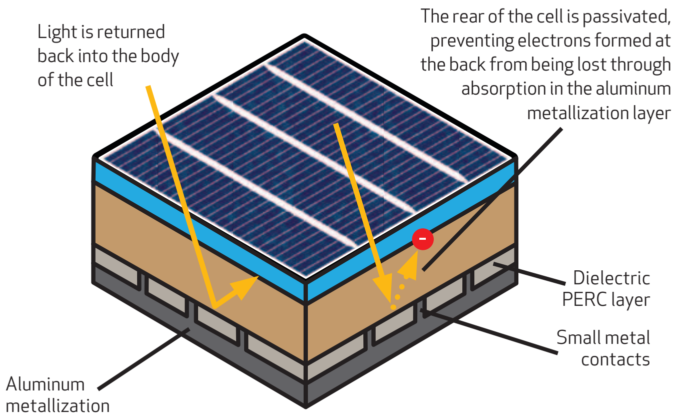
Fig. 4: The simplified structure of a conventional solar cell (l) compared to a cell with PERC technology (r)



The addition of the PERC layer enables increased capture of light falling on the cell surface increasing the overall performance and efficiency. PERC technology works by reflecting back into the body of the cell any wavelengths of light that have passed through without generating electrons. This minimizes the recombination of atoms at the aluminum metallization layer, reducing the heat generated in the cell, allowing it to work more efficiently. Through this, the cell will also be able to absorb more infrared light (wavelengths of between 1000 and 1180 nm), increasing production in low light conditions and improving overall energy yield (fig. 5).

A second way in which PERC technology contributes to increased yield is by the passivation of the back of the cell. This means that any electrons generated near the bottom of the cell are less likely to be lost to the aluminum metallization layer. Unattracted by the mettalization, they can rise back through the cell structure, reaching the interface between the base and emitter, contributing to cell current (fig. 5).

Fig 5: A cross-section of a cell showing the 'reflective' properties of PERC technology



The overall benefit of PERC technology to the output of the panels is to add 4 Wp higher power at Standard Test Conditions.

How will the consumer benefit from the technology in the new panel?

Through the combination of these technologies into one new solar panel, the REC TwinPeak Series has enabled a power increase of around 10 Wp per panel. This has been achieved through reducing resistance at both cell and panel levels, exposure of more cell area to sunlight and increasing the amount of light absorbed. Together, these technology enablers ensure that the REC TwinPeak Series provides a higher energy yield throughout the day when compared to standard panels, and a higher energy yield, means a higher rate of return on a solar installation.

Furthermore, the increase in power per m² of the REC TwinPeak Series will shift REC's watt class production upwards, helping customers reduce overall balance of system costs compared to standard panels over the same surface area. This is of particular importance to the C&I and residential market segments and allows customers to generate as much energy out of their installation as possible, based on the cost-effective position provided by the polysilicon platform. These benefits are of course in addition to REC's industry-leading product quality, the fact that REC's panel production is 100% PID free, and the reliability of a strong and established European brand.

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