REC's TwinPeak Technology: Raising the power of multicrystalline solar panels to levels only recently thought impossible!

Employed across a whole range of products, REC's innovative TwinPeak Technology is a cutting edge solar module development for high panel efficiency and high power products. Based on a polysilicon cell platform, REC's TwinPeak product range combines new and ground-breaking developments that ensure it can compete strongly on power with monocrystalline products on the market.

What is REC's TwinPeak Technology?

REC's TwinPeak Technology is a revolutionary advancement in multicrystalline solar panel technology that delivers a power boost of up to 20 Wp per panel compared to standard multicrystalline panels. The technology inherent in REC TwinPeak products increases the power of 60-cell modules up to a world record 300 Wp for 60-cell sized modules.

The most noticeable difference in REC TwinPeak products is the cell design. Due to the implementation of new wafer production techniques, REC TwinPeak cells have a larger surface area to capture more sunlight. These cells are then cut into two equal pieces (156.75 x 78.375 mm), known as 'half-cut cells', which reduces internal resistance and increases overall power.

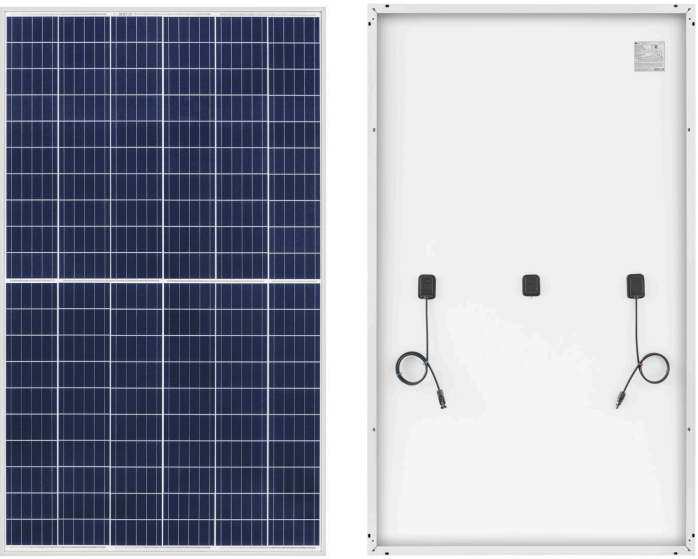
Once the half-cut cells have been connected in strings, the panel is laid out in two 'twin' sections with equal numbers of cells connected in series - appearing as a top and a bottom half (fig. 1). This innovative layout is supplemented by a number of other enablers:

- Five bus bars
- Split junction box design
- PERC (Passivated Emitter Rear Cell) technology

For which markets is the new panel suitable?

The higher power and efficiency provided by REC's TwinPeak Technology means customers can boost their energy yield by generating the same amount of power with fewer modules, or through generating higher system yields from the same surface area. This makes REC TwinPeak modules the most cost-effective and ideal choice where space is limited, for example on residential, commercial, and industrial rooftops.

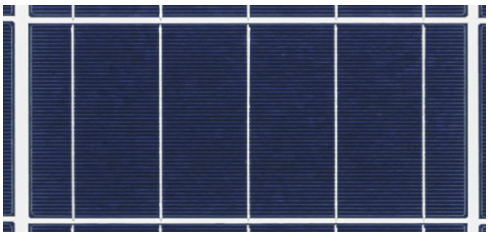
Fig 1: Front and rear view of the REC TwinPeak 2 Series solar panel, showing the twin section design enabled by the half-cut cell layout, 5 bus bar cells and split junction box on the rear



What advantage do half-cut cells deliver?

A half-cut cell is a standard square cell that has been split into two smaller rectangular cells (fig. 2). Splitting cells in this way reduces the internal current by half and therefore also reduces the power loss . As power loss is proportional to the square of the current, the power loss in a half-cut cell is actually reduced by a factor of four ($Ploss = R \cdot I^2$, where R is the resistance and I is the current).

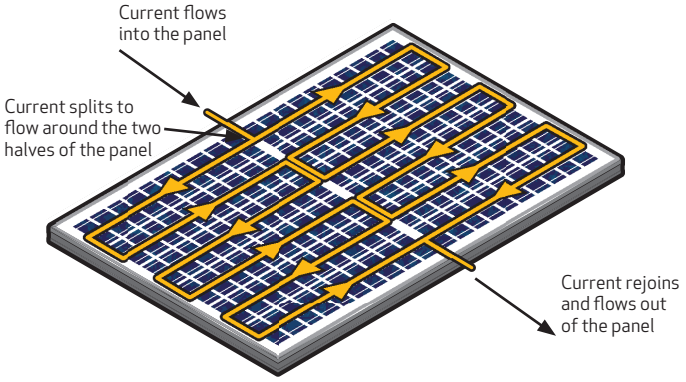
Fig 2: A half-cut cell showing the 5 bus bar cell design



By reducing losses in this way, the fill factor, an indicator of cell quality, is increased which gives higher light conversion efficiencies. This means more sunlight is captured by the cell and produces improved energy yields, especially at times of high irradiance. Such enhancements to the cell quality and the reduction of resistance add up to 6 Wp extra power output to a 60-cell panel.

Additionally, the new cell layout improves the performance of the TwinPeak module in reduced irradiance conditions, e.g., when shaded. For example, if a standard panel is installed in portrait orientation and a single row of cells is shaded, the output of the complete panel is zero, due to the bypass diodes closing the internal strings. The layout of an REC TwinPeak module with its twin sections ensures that in the same conditions the power output is at least 50% (fig. 3).

Fig 3: Flow of electricity in an REC TwinPeak 60-cell solar module. The two twin sections reduce internal resistance and ensure continued production of energy when partially shaded.



What advantage do five bus bars deliver?

Using five bus bars on a cell, as shown in figure 2, decreases the distance between them, meaning electrons have less far to travel to reach the ribbon. This vastly improves the electron flow and the reliability of the panel. The reduction in distance again lowers the internal resistance in the cell, increasing current and allows the width of the bus bars to be reduced, exposing more cell area to light for increased current generation. The reduction in cell resistance through adding a fifth bus bar improves cell efficiency by over 0.2% per cell and adds 2 Wp more to the panel output.

Panels with five bus bars have also shown major improvements in durability during the stringent qualification testing performed by REC, especially in the thermal cycling and mechanical load tests. This is attributed to the lower cross section of the ribbon permitted by the smaller size, easing the amount of stress on the cell.

What advantage does a split junction box deliver?

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

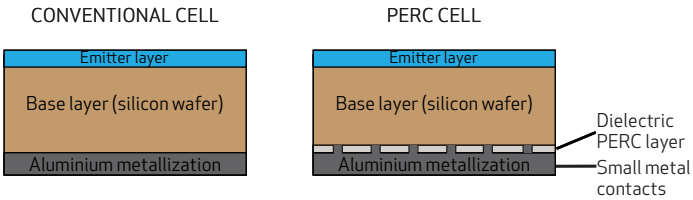
It is this innovative design change that is key to the distinctive new cell layout seen in REC TwinPeak products. Use of a split junction box uses less metallization than a standard panel, which reduces internal resistance and saves space. This extra space then allows larger spacing between individual cells, which subsequently increases the internal reflection of light from the backsheet onto the cell surface.

Tests have also shown a reduction of between 15°C and 20°C in heat build up behind a split junction box compared to a single box on a standard panel. The cooler temperature increases panel reliability and produces a power gain of 1 to 2 Wp per panel.

What advantage does PERC technology deliver?

PERC is an additional step at cell level which REC was the first module manufacturer in the world to introduce into mass production. REC was the first module manufacturer in the world to introduce PERC into mass production on multicrystalline cells and although it cannot be seen in the cells and makes no difference to the visual appearance of the panel, it boosts overall module power in two distinct ways. Consisting of a design change at the rear of the cell, where a special dielectric layer is coated on the backside of the cell above the aluminum metallization layer, with contact to the silicon wafer provided 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)

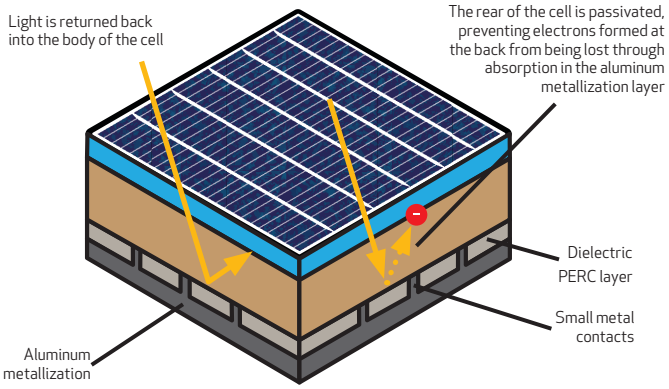


PERC works by reflecting back into the body of the cell any wavelengths of light that have passed through without generating electrons, minimizing the recombination of atoms at the aluminum metallization, keeping the cell cooler and allowing it to work more efficiently. PERC also enables the cell to absorb more light at the infra-red end of the spectrum (wavelengths between 1000 and 1180 nm). This increases production in low light conditions, e.g., dawn and dusk, and improves cell efficiency as well as overall energy yield (fig. 5).

PERC further contributes to increased power through the passivation of the rear of the cell. Acting like a shield, any electrons generated near the bottom of the cell are less likely to be attracted to the aluminum metallization pole and lost to recombination. Unattracted by the mettalization polarity, the electrons are free to rise back through the cell structure, to be captured by the interface between the base and emitter and contribute to cell current (fig. 5).

Overall, PERC technology can add more than 10 Wp more to the output of a panel at Standard Test Conditions.

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



How do customers benefit from REC's TwinPeak Technology?

Advancing the ability of the multicrystalline cell platform to levels once thought impossible just a few years ago, REC's TwinPeak Technology provides customers with high power products at very competitive prices, helping to reduce balance of system costs and lower the levelized cost of energy for investors in solar.

The application of the advancements in REC's range of TwinPeak modules increases module power by up to 20 Wp per panel! This is achieved through reducing resistance through the module, exposing more cell area to sunlight and increasing the amount of light absorbed. Together, these enablers ensure that REC TwinPeak modules provide a higher energy yield throughout the day when compared to standard panels, and a higher overall energy yield means a higher rate of return on a solar installation.

Such an increase in power per m² is of particular importance to the residential, commercial, and industrial markets as it allows customers to generate more energy from their installation area than was previously possible with 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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Founded in Norway in 1996, REC is a leading vertically integrated solar energy company. Through integrated manufacturing from silicon to wafers, cells, high-quality panels and extending to solar solutions, REC provides the world with a reliable source of clean energy. REC's renowned product quality is supported by the lowest warranty claims rate in the industry. REC is a Bluestar Elkem company with headquarters in Norway and operational headquarters in Singapore. REC employs more than 2,000 employees worldwide, producing 1.4 GW solar panels annually.

NE-18-14 - Rev C 11.2017

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