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Minimise Rooftop Underperformance

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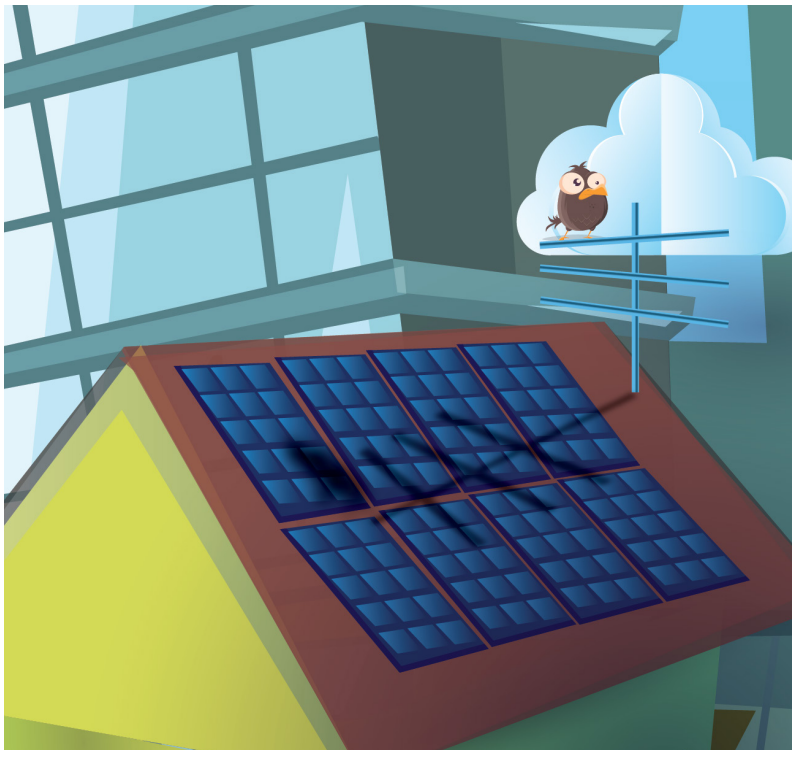
Minimise Rooftop Underperformance

What are the physical causes of solar system's underperforming?

When facilitating on-site inspections or designing systems on PV software, sometimes you can face the following optimisation problems.

MULTIPLE ROOF DIRECTIONS

(Mismatch of sun irradiation on a string)

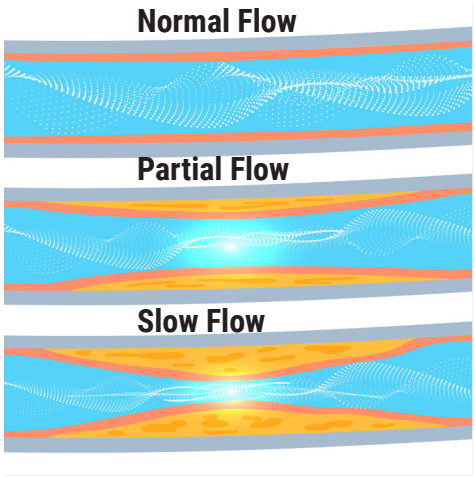


SHADING DUE TO CHIMNEY/ANTENNA

Any other roof top object like a TV Antenna, satellite dish or chimney can affect the performance of PV panels with cast shadows.

Minimise Rooftop Underperformance

All these scenarios lead to mismatch among panels generation and as a result drag down system performance of the whole string or array of panels. When connecting a string of panels together in series they must operate at a mutual current and if one of the panels are generating less power because of the effects then the whole array suffers.



This phenomenon can be explained using a water pipe analogy, the flow rate of water through the pipe is constant, much like the current through a cell string. When there is mismatch among panels, this is like a water pipe getting partially blocked and flow rate of water through this pipe becomes slower, and it affects the flow rate of all other pipes connecting to it. Similarly, the current through the entire string will reduce when there is mismatch

SHADING DUE TO NEIGHBOUR'S HOUSE
Homes that catch shade from nearby neighbour's houses or other buildings should also consider shade management systems to minimise under performance.

SHADING DUE TO TREE, LEAF OR BIRD DROPPING
Bird dropping can reduce panel output affecting the efficiency. Optimised systems account for this until cleaning.

Why you should pay attention to Shading

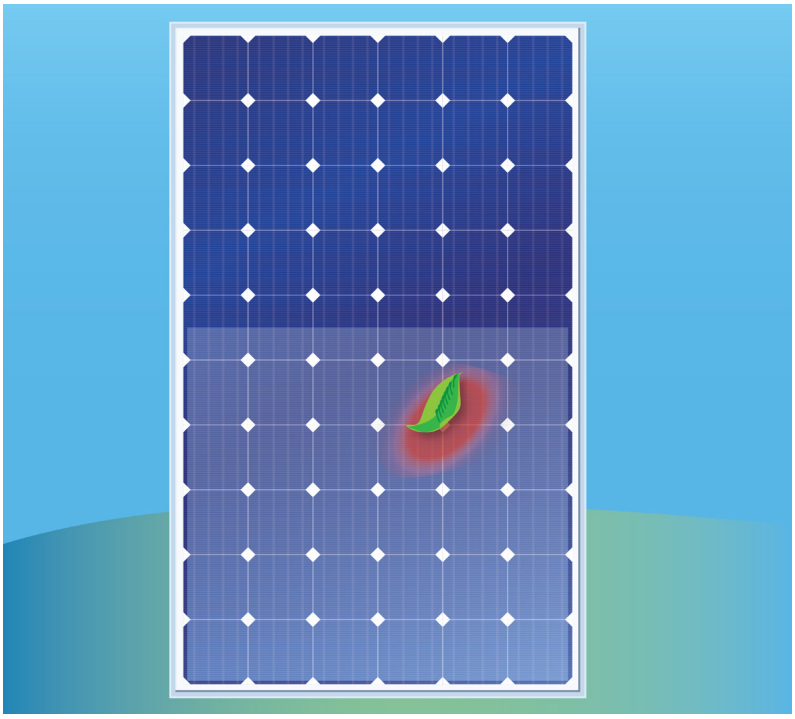
HEATING ISSUES

Furthermore, shading leads to mismatch in panel or among panels in the string. Not only power output will be reduced, but mismatch can cause some serious damage to the panel called hot spot heating and in the extreme case can even cause a fire.

Turning to our analogy again, imagine the water pressure will keep building up on the affected pipe and may explode if pressure is high enough.

ROOF DIRECTION

Based on market research, every 2 houses out of 10 need to take shading and different roof directions into consideration. If the system designs cannot avoid tight roof space, unpredictable physical obstructions such as a new building next to the house or nearby trees can affect performance.



SHADING CAN CREATE HEAT SPOTS
Leaves will reduce panel output. They prevent the sunshine through to the panel in that spot and will affect the efficiency.

ROOF TOP OBSTACLE
Any obstacle that cast shade on panels like chimneys, pipes and vents can affect panel performance. Keep this in mind when planning panel layout on your home.

Solutions for minimizing performance loss and gaining better yield

PANEL LEVEL SOLUTIONS

Traditional panels assembled with full cells and all connected in series, see below electrical diagram showing the interconnecting fashion of solar cells within the panel.

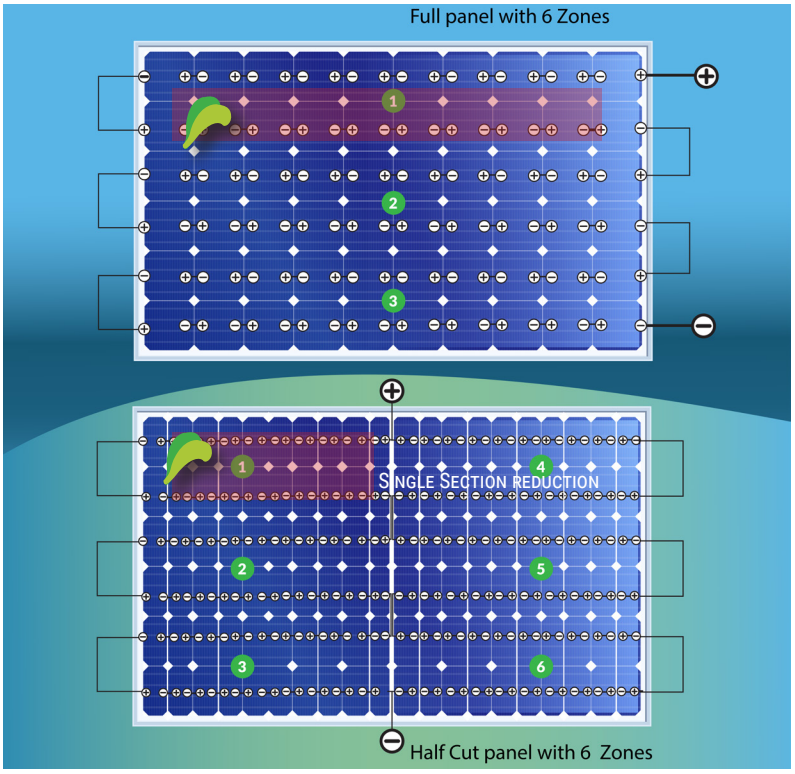
Half-cut solar panel can be treated as 2 independent traditional panels (all half-cut cells connecting in series) are in parallel connection.

• If the shading blocks one entire column, the performance will be reduced like the full cell panels, 1/3 of the performance will decrease and the cell temperature will rise.

• However, when the shading blocks one entire row, only 50% of the panel performance will get affected, the other half panel will still be working perfectly, as opposed to the traditional panel losing all power.

• When the shading only blocks one cell, only one string will get affected (1/6 loss), compared to the full cell panels which will lose 1/3 power. The loss is effectively half as much.

VERTICAL PANEL ARRANGEMENT
Less than 90% of panels installed on roof in vertical direction in Australia.



FULL PANELS VS. HALF CUT PANELS
A half cut solar panel has 6 separate cell-strings, offering better partial-shade tolerance. If half of the panel is shaded, the other half can still operate

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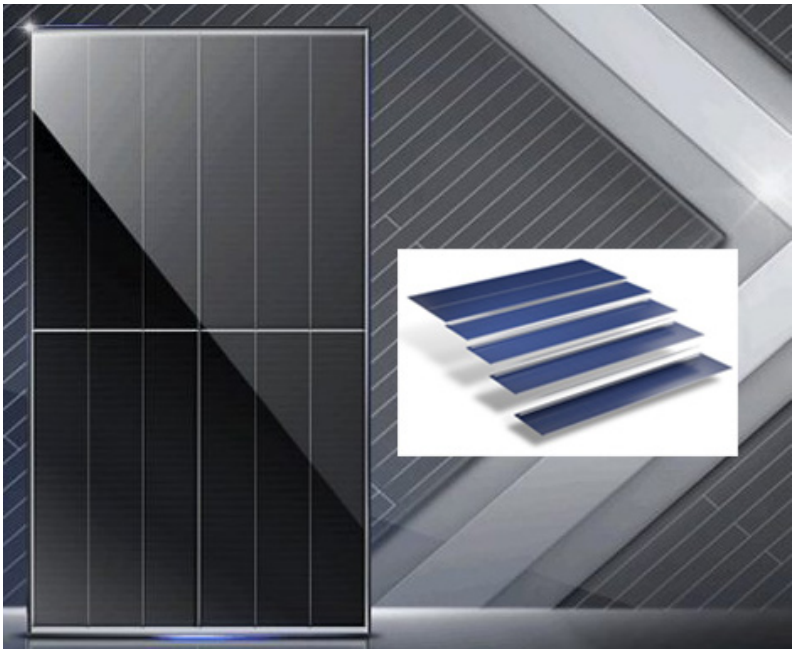
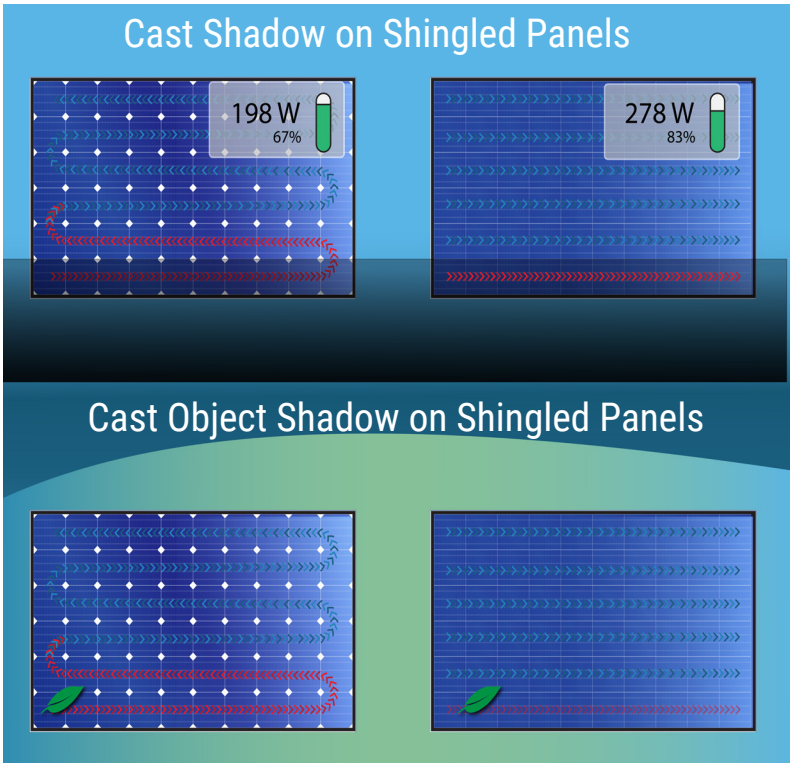
Solutions for minimizing performance loss and gaining better yield.



Shingled Solar Panels

Shingled panels have different solar cell layout. Use LONGi HiMO-X as example, the solar cells are formed in 6 strings and all strings are connected in parallel and work independently.

When the shading blocks one entire string or just one cell, the performance will only drop 16.7% while a traditional panel will lose 33.3%.

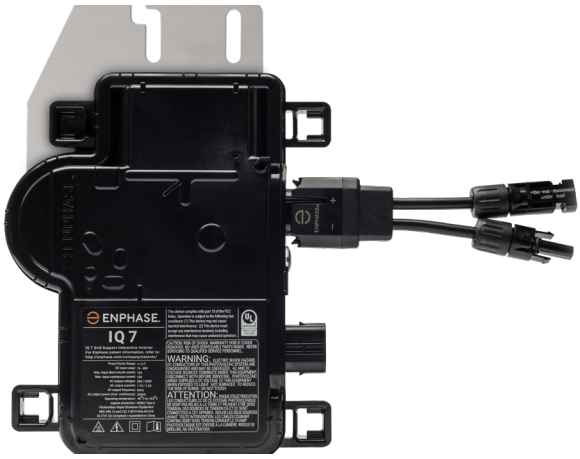


Module Level Power Electronics (MLPEs)

MLPE solution can be another loss minimization method for the solar system. Both microinverters and power optimisers can help the solar panel work independently, so the overall system performance will not get dragged down by the affected panel/panels. MLPE solution can be another loss minimization method for the solar system.

	Enphase	SolarEdge	Huawei	Tigo
MONITORING	Module Level Monitoring			
SAFETY	Module Level Rapid Shutdown			
SHADING	Optimization			

ENPHASE



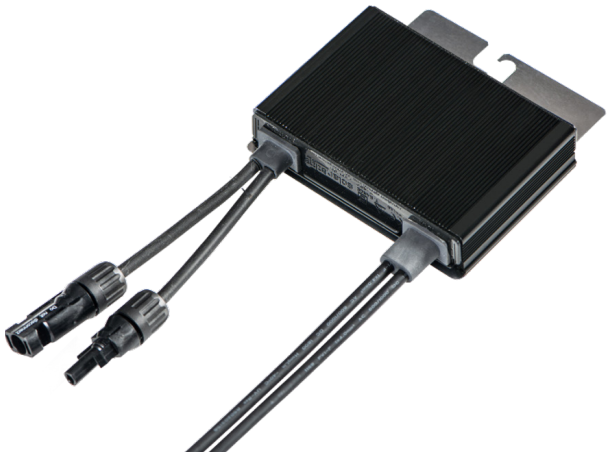
ENPHASE IQ SERIES MICROS

- Microinverter, one per panel;
- Comes with 10 years warranty;

PRODUCT DATA SHEET

OTHER RESOURCES

solaredge



DC OPTIMIZER

- DC optimiser, only compatible with SolarEdge inverters;
- Must install with all panels;
- Comes with 25 years warranty;

PRODUCT DATA SHEET

OTHER RESOURCES

HUAWEI

HUAWEI DC OPTIMISER

- DC optimiser, only compatible with Huawei inverters;
- Comes with 25 years warranty;
- Can do partial optimization;

PRODUCT DATA SHEET

OTHER RESOURCES

Tigo®

TIGO OPTIMISATION 500W

- DC optimiser, compatible with all inverters except SolarEdge;
- Comes with 25 years warranty;
- Can do partial optimization;

PRODUCT DATA SHEET

OTHER RESOURCES

YOUR COMPLETE WHOLESALER OF SOLAR ENERGY EQUIPMENT

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