Enhancing the Efficiency of PV Solar Module

The Efficiency of Poly and Monocrystalline PV solar modules vary between 19 and 21% respectively. In installations where there is no peak power generation, the complete Module efficiency is not achieved. Thus, enhancing the efficiency of solar PV module is the need of the hour.

Techniques to enhance the efficiency of PV Solar Module

❖ Avoid Shadows

During site visit the shaded region should be analyzed and installation should be designed avoiding the shaded areas. Even a single panel erected under shade will affect the whole string, because it will act as resistor and will resist the power generated from the other panel on the string. At inevitable locations, **Optimizers** will be a solution.

The optimizers should be connected on the output of each panels. The optimizer will then give maximum possible output from the panel, which is shaded, without affecting the other panels in the string. Thereby, even if the panel is affected 75% by shade, it would not affect other panels on the same string.

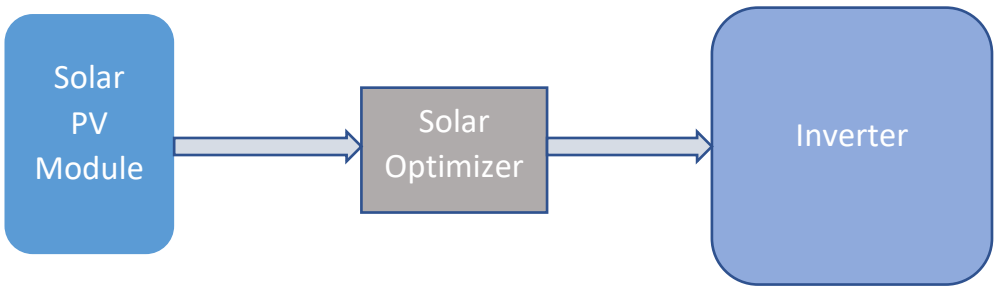


Fig 1: Solar Optimizer

❖ Install in proper Tilt angle and Direction

Tilt angle: The location's latitude is chosen as the Panel's tilt angle

Example: Consider Chennai as the Plant location - the latitude would be 13°, and so the Panel Tilt angle should be 13°.

Panel Orientation: To get the maximum efficiency out of a solar panel, the panels should face the sun's travelling path. The sun travels along the Equator line; therefore, the panel should be oriented towards south for the countries in the northern hemisphere and vice versa.

Example: In India – Panel should be oriented towards South.
In Australia – Panel should be oriented towards North.

* The Tilt angle and panel orientation will vary country to country.

❖ Make proper Series and Parallel connection.

Series Connection: Check the MPPT Voltage range of Inverter and then connect the PV module in series until the voltage reaches that range. Generally, Solar PV Modules can have a +'ve or –'ve tolerance.

For better generation in large scale solar plants, collect all the modules with +'ve tolerance in a single string and connect it to a dedicated MPPT of the inverter. Likewise, for the modules with –'ve tolerance.

Example: Consider 400Wp module, if you are connecting 398Wp & 402Wp on the same string, then the panel with 398Wp module will resist the excess production on the 402Wp module. So, the 402Wp module will generate only 398Wp power.

*For small scale projects, this technique may not have a considerable impact on the generation.

Parallel connection: Connect Strings with equal number of modules to the same MPPT.

What Not to Do: *For better generation, strings with 19 Panels & 20 panels should not be connected to the same MPPT, likewise the string on the east roof and string on the west roof should not be connected on the same MPPT.*

❖ Adapt cooling technique to maintain module temperature.

The increase in module temperature will reduce the generation drastically. The below table is the result of various experiments.

S.No	Time	Temperature in °C	Voltage (V)	Current(A)	Power (W)
1	10.30	47	37.3	8.43	314.44
2	11.00	50	37.2	8.42	313.22
3	11.30	57	37.1	8.42	312.38
4	12.00	64	36.9	8.38	309.222
5	12.30	68	36.5	8.41	306.97
6	13.00	69	36.4	8.41	306.12
7	13.30	69	36.3	8.40	304.92
8	14.00	67	36.4	8.41	306.1

Overcome this problem with below methods:

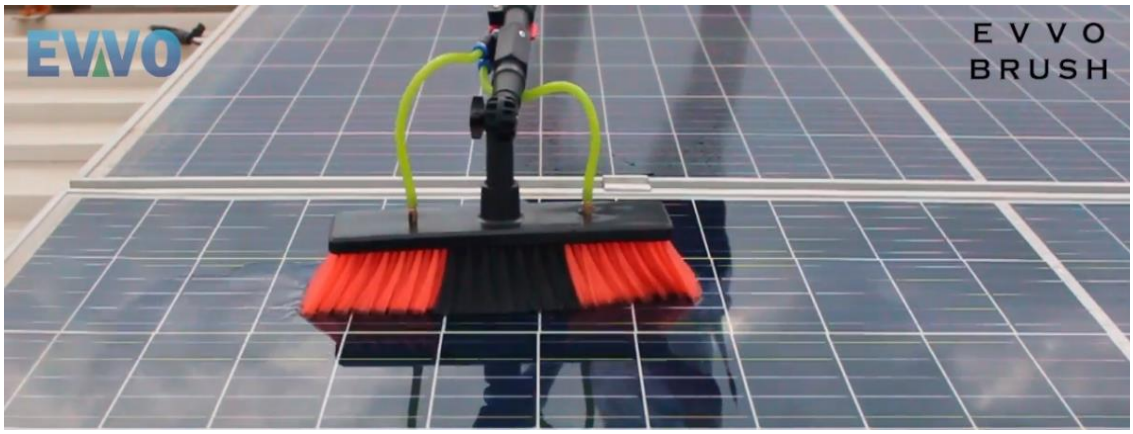
Method 1: During installations, always make gaps for air flow between roof/ground and the PV module. Air acts as a cooling medium and it will reduce the heat of module.

Method 2: Install a water-cooling system on top of the Module, the water acts as a cooling medium and reduce the temperature of the Module. This in turn will also keep your panels clean.

❖ Keep the panel Clean

Last but not the least, make sure the modules are clean for better generation. More the dirt, lesser would be the generation. So, Clean the module in regular interval based on your location. If the plant is in industrial area or highly polluted area, it is suggested to clean the module every 10 days. If the Plant in rural area or Slightly polluted region then clean the module on monthly basis.

Use only the Purified water and Soft brushes to clean the Solar modules.



Following the above listed techniques will greatly improve the generation and efficiency of the Solar Modules.

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