

Monitoring Solar Radiation To Improve Plant Performance



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Performance Evaluation without Accurate Radiation Measurement is Meaningless.

A critical component for any solar power project is solar radiation monitoring and measurement. Although this equipment presents a negligible fraction of total project cost (less than 0.1% of total project cost), it is the component most overlooked and overshadowed over other more capital intensive components. However, in this more mature phase of the Indian solar power industry, we are starting to see a shift in market needs when it comes to solar radiation measurements. What's driving the shift? The focus on plant performance where the premise of performance depends on the amount of solar radiation incident on panels and how well the plant is able to convert and harness that radiation into energy.

This sounds simple, but unfortunately conversations around performance tend to focus on the best way of evaluating it. The bottom line is this: plant performance must be benchmarked against the incoming irradiation. If there is an error in measurement of incoming radiation, calculations and estimates of losses are meaningless.

PV Module Performance varies from Standard Test Conditions

Extrapolation of performance ratios based on Standard Test Conditions specified for PV panels is prone to error. As Standard Test Conditions (1000 W/m² of solar radiation, 25 °C, Air Mass 1.5 and no wind) vary widely





from real world field conditions, additional measurements using pyranometers and/or reference cells are required to monitor PV performance.

Monitoring solar radiation under field conditions is not only critical for evaluating performance, but also gives important inputs for maintenance and operational decisions. For example, pyranometers mounted at the tilt angle of the panel array can be used to calculate the array's efficiency. While a gradual decline of efficiency may indicate a need for cleaning panels, a sudden drop of efficiency could signal failing panels.

Installation, Maintenance and Calibration are Important

It is not sufficient to procure good quality instrumentation. Installation becomes key.

We encounter situations in the field where an incorrectly mounted pyranometer (and the instances of how a pyranometer can be incorrectly installed are too many to list in this document), poor cabling, or poor site selection, shading with change of seasons, leads to nonsensical values of performance ratios as the input radiation parameters for calculation of performance is incorrect. Seemingly minor things purlin mounting for a pyranometer should preferably be powder coated in light color, as darker colors like red absorb the heat which radiates and can affect the output of the radiometer.

Routine maintenance such as cleaning dust from the dome of a pyranometer, and changing desiccant where applicable, also becomes critical. Furthermore, all radiation measurement equipment require calibration after certain years of use in the field.

We routinely get requests for assessing

currently installed solar radiation monitoring equipment and our recommendations have a large bearing on the accuracy of measurements and consequently, on the evaluating performance of a plant.

Summary

Solar energy may be a solution for addressing India's energy deficit. Given that solar power plants are capital intensive projects, ensuring project viability over the long term is key. Accurate measurement of incoming radiation is critical to assessing plant performance. WMO certified, NIST traceable instruments when installed, maintained and calibrated correctly, represent perhaps the highest yielding component on investment in solar plants.

