



Regional Variations in Solar Power Plant Performance

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Solar radiation along with local meteorological parameter measurements is the basis for accurately analyzing the performance and financial viability of any solar power project. To the best of our knowledge, in India, a large scale analysis of solar power plant performance has not taken into account environmental parameters. Instead, plant performance measures are based on Capacity Utilization Factor (CUF), which is a crude estimate, at best, of a plant's output with respect to the total installed capacity. Now, we are seeing a shift towards increased demand for more accurate solar and weather monitoring. As plants become operational, people are evaluating performance, and therefore, accurate solar radiation measurements are critical. It serves as the baseline for how much energy a plant can expect to produce, as the amount of solar radiation incident on a panel is almost directly related to how well the plant is able to convert and harness that radiation into energy.

There is also increased awareness that local environmental conditions affect plant performance. The effect of dust on power production of solar plants in Rajasthan and the unanticipated costs associated with cleaning of panels is well known. Likewise, high

ambient temperatures are not always predictive of high performance and module performance starts to decrease with high temperature depending upon the panel technology as we see in plants in Northern India. We have recently looked at how relative humidity affects plant performance in Gujarat. Wind also impacts the performance of solar power plants and their impact will come to light with time as data from plants in coastal regions of Tamil Nadu become available.

In summary, there is increasing awareness that basing investments on solar radiation maps alone may not be the best approach. So we now see an increased demand for solar resource assessment for choosing plant sites. Moreover, customers are commissioning us to measure solar and weather parameters for extended periods before a plant is set-up, as well as once a plant is up and running to arrive at a meaningful measure of plant performance.

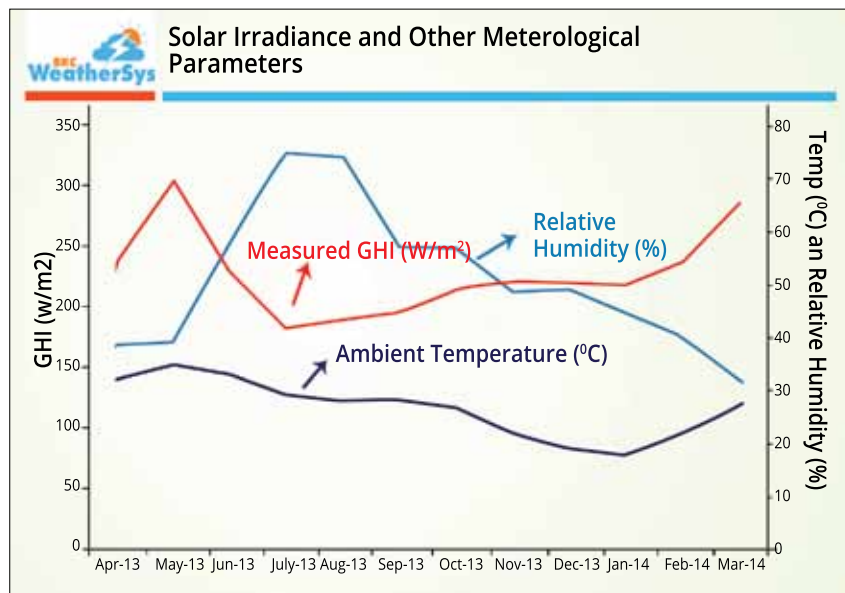
Meteorological Parameters Effect Solar Power Plant Performance

As the availability of solar energy is affected by latitude, longitude, elevation, and local weather con-

ditions, we compared irradiation and meteorological parameters for plant sites in five different districts of Gujarat. This analysis was presented in detail in a white paper with RESolve earlier this year. Here, we present a summary of the findings.

We chose the five districts in Gujarat that have the highest number of solar power plants to date: Surendranagar, Kutch, Patan, Rajkot, and Porbander. Modeled GHI, ambient temperature and relative humidity values for sites these five districts have been compared as a function of plant performance.

Of these five districts, Kutch appears to be the district with optimal environmental conditions for solar power generation: a. GHI values are amongst the highest (Figure 1); b. Ambient temperatures are below 25 °C for almost the entire year, saving the summer months of May, June and July. Even then, temperatures did not exceed the peak of ~27 °C observed in June. These temperatures are close to or within the temperature range of the Standard Test Conditions (STC) specified by most module manufacturers, ensuring high module performance. Lastly, Kutch also appears to have lower values of relative humidity than the other four sites for most of the year. It is no surprise then that 3 of the top five performing plants in this report are in Kutch. While there are multiple contributing factors for performance, local environmental and weather conditions



seem to have a significant impact on plant performance.

This article provides a window into showing how meteorological and local environmental conditions may affect energy production. In summary, we can safely

conclude that energy yields of solar power plants vary not only according to plant design and technology, but local weather and environmental conditions have significant impact on plant output ■



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