

Reliability of Modules Deployed in the Field in India (PV-5)



A joint India-U.S. research consortium funded under the *Joint Clean Energy Research & Development Center (JCERDC)*

Scientific Achievement:

We performed a survey of over 1,000 modules in the field in different climatic zones of India. This extensive survey yielded performance and reliability data, enabling a scientific analysis of degradation mechanisms.

Significance and Impact:

To achieve India's 100-GW solar energy target, clear knowledge is imperative of the reliability and durability of modules in India's sometimes harsh climatic conditions. This study provides such an understanding and also correlates power degradation to visual degradation seen in the modules.

Research Details:

- A joint team from IIT Bombay and National Institute of Solar Energy (NISE) surveyed 1,148 modules at 51 different sites in all 6 climatic zones of India.
- Modules show an average degradation rate of 1.33%/year, although there is a wide distribution on the rates (top figure).
- The climatic zone variation shows that modules in "hot" climates degrade faster than those in moderate and cold climates (middle figure). This is cause for concern because most of India's deployment is occurring in hot climatic zones.
- A "Normalized Discoloration and Delamination Index" (NDDI) has been defined that captures the extent of visual degradation. Current short-circuit current (I_{sc}) degradation correlates well with NDDI (bottom figure).
- This work complements work by SERIUS partners ASU and NREL in the U.S.

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Contact(s): O. S. Sastry (os.sastry@nic.in) and Juzer Vasi (vasi@ee.iitb.ac.in)

