

PV Reliability: Database and Lifetime Prediction



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

Objective:

To develop a comprehensive reliability database for the lifetime prediction of PV technologies, especially in the context of the environment of India and the United States.

Achievement:

Four power plants in a desert climate of United States and several systems in five climatic zones of India have been evaluated for reliability and durability—and catalogued for the SERIUS reliability database.

Research Details:

- ASU has evaluated four power plants (4–16 years old) installed in a desert climatic condition of Phoenix, Arizona, through: visual inspection, infrared (IR) imaging, diode testing, and current-voltage (I-V) testing, as shown in the flow diagram.
- IITB and SEC have evaluated various PV systems covering five climatic zones in India.
- The data processing and analyses of all the PV systems and power plants investigated in this study will be completed.
- All modules in the rooftop PV system at FSEC will be examined for reliability and durability.
- Complete the construction of small-scale setup for reliability testing of unencapsulated cells.

Publication(s):

Six publications from ASU, FSEC, and IIT-B were presented at the IEEE PVSC, Tampa, Florida, June 2013 (see www.SERIUS.org).

Levelized Cost of Energy (LCOE):

$\$/kWh$

Performance

Reliability and Durability

“ $\$/kW$ ” dictated by:

- Materials and process cost per unit area
- Module efficiency per unit area

“ h ” dictated by:

- Failures rate over time (obsolete; reliability)
- Degradation rate over time (underperform; durability)

LCOE dictated by performance, reliability, and durability

Review:

Previous Reports and System Layout

Visual Inspection:

All modules per NREL checklist

IR Imaging:

All modules

I-V Test:

All strings (before cleaning)

IV Test:

All hotspot modules

I-V Test:

All modules in the best, worst and average strings (before cleaning)

Diode Test:

All modules

I-V Test:

All modules in the best, worst and average strings (after cleaning)

IV Test:

All diode-failed modules

Various tests performed at the older power plants in India and U.S. to populate the reliability and durability database

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