Quantitative Determination of Performance Loss due to Cell Cracks using EL Images (PV-5)

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

Scientific Achievement:

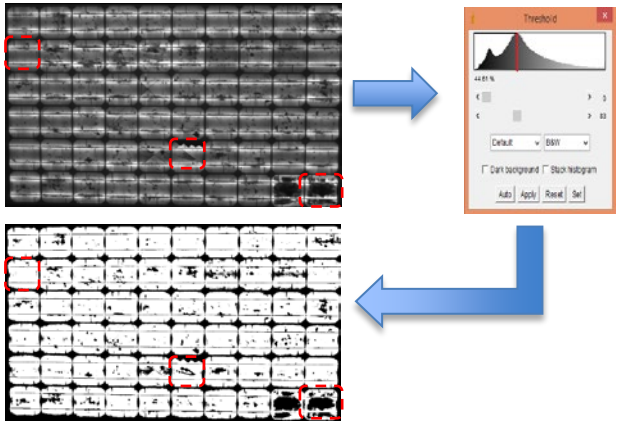
We correlated inactive areas in an electroluminescence (EL) image to the short-circuit current loss of the solar cells.

Significance and Impact:

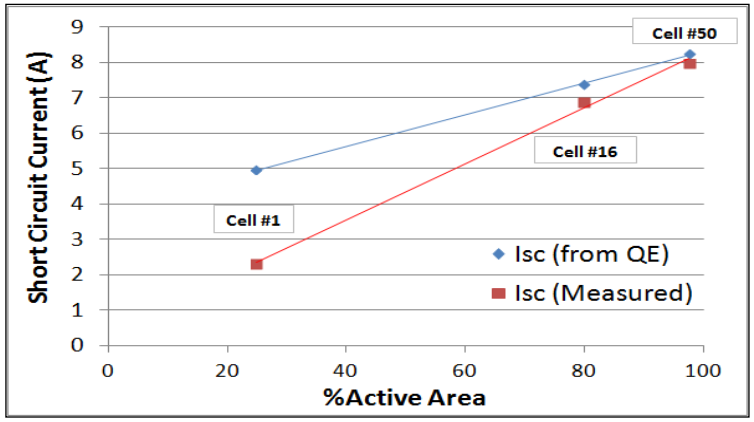
Electroluminescence images can be used to estimate the degradation in the module current. *In-situ* EL imaging can emerge as an alternative to module I-V measurements for fielded PV systems.

Research Details:

- EL image of a PV module is converted into binary image using thresholding function, considering the mode of the image histogram as the threshold limit.
- Calculated the active cell area from the binary EL image.
- For quantum efficiency (QE) and I-V measurements, three cells were selected (worst, medium, and best in EL image) and their cell interconnects accessed by cutting through the backsheet.
- Each cell is divided into three sections demarcated by the two busbars, and the QE is measured at 30 different points in these three sections (in the three selected cells).
- The average QE is calculated for each cell, and based on it, the short-circuit current is calculated.
- For each cell, the short-circuit current is also measured on a solar simulator.



Conversion of EL image into binary image using thresholding technique



Short-circuit current (I_{sc}) based on integrated QE and direct measurements, plotted against the percentage active area of cell

Publication: Carlos Castaneda *et al.*, Field Inspection of PV Modules: Quantitative Determination of Performance Loss due to Cell Cracks using EL Images, NREL PV Module Reliability Workshop, Denver, CO (2017).

Contact: G. Tamizhmani (*manit@asu.edu*)