

CASE STUDY

COULD 20% OF YOUR RECEIVED MODULES BE AFFECTED BY DETRIMENTAL MICROCRACKS?

The engineering, procurement, and construction (EPC) firm in this case received approximately 17 MW of PV modules from a manufacturer in Asia for install on a portfolio of solar projects in the United States. The EPC offers a performance guarantee for the projects they construct, and therefore has a practice of conducting module inspection before installation to ensure the modules were received in good condition. The EPC identified a concerning number of defective modules during the initial examination of a small sample of the modules, prompting the project developer to engage CEA as their third-party investigator to perform additional testing on a larger number of modules.

INITIAL TESTING AND RESULTS

CEA conducted visual and EL testing on a sampling of 500 modules and found 29% of the modules to be defective per the manufacturer EL inspection criteria. Electro Luminescence (EL) testing is similar to an X-ray for the module. CEA also compared the EL images of the defective modules with the EL images taken at the factory pre-shipment. It was found that 36% of the defective modules (10.5% of the total modules inspected) were defective. The rest are assumed to have been damaged during packaging at the factory, during shipping, or while in the warehouse in the US. There are several key takeaways from this finding. First, **the high rate of defects present in the modules before shipment emphasizes the need for quality assurance inspections during module manufacturing, especially for less established manufacturers.** Second, the majority of the defects observed, occurred after the factory EL images were taken. **This emphasizes the value of conducting a post-shipment inspection and the need for attention to the shipping and handling conditions of purchased modules.**

CEA determined that the entire batch of modules could not be installed without significant risk to system performance. Microcracks have the potential to develop into a loss of active area and reduce the output of not only the modules containing microcracks but the entire strings containing a defective module. Over time microcracks can lead to diode activation or hot spots that represent a safety risk. Therefore, CEA recommended efforts to remove the defective modules.

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“CEA’s Field Testing Services kept over 10,000 modules with detrimental microcracks from being installed.”





100% WAREHOUSE EL INSPECTION OF 53,500 PV MODULES

The module manufacturer elected to proceed with a 100% inspection and requested on-site evaluation and sorting of the modules in the warehouse. For this unprecedented task CEA designed and built a temporary production line at the warehouse which allowed up to 2,000 modules to be EL tested per day. Each module was taken from the received shipment box and placed into the EL chamber for imaging. Each EL image was examined and evaluated on-site according to a microcrack focused EL criteria that had been agreed upon by the manufacturer and developer with CEA's assistance. Each module was then removed from the EL chamber, sorted and repacked into crates containing only unacceptable modules.

In order to manage the multiple inspection lines and significant amount of data, CEA designed and implemented a database system that allowed traceability of every module inspected also tagging each module with the EL inspection designation. The EL image of each module was reviewed on the floor by CEA's quality assurance team. CEA inspected and qualified all 53,500 PV modules in less than two months. CEA's Field Testing Services kept over 10,000 modules with detrimental microcracks from being installed.

WHAT HAPPENS NEXT?

The good modules will be installed by the EPC and the manufacturer has accepted the return of the defective modules. The EPC was able to avoid accepting defective modules and risking being held responsible for their poor performance.

EXECUTIVE SUMMARY

When modules are installed without post shipment inspection, the EPC and/or developer are taking a risk on the quality of the modules. Inspections performed by CEA found that almost 20% of received modules had detrimental microcracks. Had these modules been installed, the results could have been disastrous as the modules would not have performed as expected and could result in a potential safety risk. The EPC offered a performance guarantee. If the EPC chose not to inspect the modules, they would have been held responsible for issues caused by modules that were defective before they arrived onsite.

