HOW PVEL IS ADDRESSING CELL CRACKING: IN THE LAB AND IN THE FIELD

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PVEL is the Independent Lab for the Downstream Solar Market

Our mission is to support the worldwide PV buyer community by generating data that accelerates adoption of solar technology.

Global
300+ downstream partners worldwide with 30+GW of annual buying power

Comprehensive
Testing for every aspect of a PV project from procurement to O&M

Experienced
Pioneered bankability testing for PV products nearly a decade ago

Market-driven
Continuously refining test programs to meet partner needs
The solar industry needs an action plan for extreme weather

More Severe Weather

Insurance Landscape

Returning to Operations

Observed U.S. Trends in Heavy Precipitation

GCube reports their weather-related claims in the renewables sector doubled in 2018.

Source: National Climate Assessment 2014

Source: GCube, “Global Extreme Weather Losses Mount”

Source: Strata Solar, “Force Majeure & Energy Modeling: 1 Hurricane, 81 PV Plants Down”
Understanding cell cracking in PV modules

- Cells are *quite* thin (<0.2 mm)
- Glass thickness is 3.2 mm
- Causes of cell cracks:
  - Manufacturing defects
  - Transportation and shipping
  - Improper installation
  - Force majeure/extreme weather events

The Main Challenge:
Power loss is realized *over time* – not right away
Evaluating power loss and financial loss due to cell cracks

The bottom line: impact varies

› The potential for power loss varies by the type of crack
› Financial losses depend on model assumptions

Certification testing for cell cracks

 › IEC 61215
   - Static mechanical load testing at 2400 Pa with options for up to 5400 Pa
   - Includes minimum hail testing: 1” hail balls at 50 mph

 › Challenges
   - No thermal cycling after stress
   - No dynamic mechanical loading
   - A pass means:
     - <5% power loss
     - No physical damage
     - **EL imaging not required**
PVEL’s Module Product Qualification Program (PQP) Test Sequences
PVEL’s mechanical stress sequence for cell cracking

Step 1: Creates cell cracks in susceptible modules

Step 2: Articulate cracks, opening them in susceptible modules

Step 3: Reduces power output in susceptible modules
New Incident Response testing combines advanced field and aerial inspection to safeguard against financial losses

Field testing:

PVEL’s aerial inspection partner:
Incident Response: A better way to manage force majeure events

Fires | Tornadoes | Hurricanes | Lightning | High Wind | Hail

Incident Response helps you:

1. Quantity the full extent of damage to a site
2. Prioritize repairs to quickly return sites to operation
3. Receive full insurance compensation
Hypothetical: A 100 MW site is hit by major wind and hail storm

› 270,000 370W modules on site are visually inspected
› 5% show visible damage and must be replaced – 13,500 modules
› Assumptions:
  − $0.35 USD/watt for PV modules
  − $50/module for labor

Value of insurance claim for visually inspected PV modules: $2.42M
Insurance payout based on Incident Response

› EL imaging reveals that 15% of the modules on site have significant cell cracks

› An additional 40,500 modules must be replaced

Total payout for all damaged PV modules: $9.69M – nearly 4x
QUESTIONS, AND THANKS!

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