

PV RESILIENCE: ADDRESSING WEATHER VULNERABILITIES

Step-by-step guidance to conducting a field audit to identify vulnerabilities and actions that can be taken to address them

PV PERFORMANCE

How have PV Systems performed over time?

PV IS RELIABLE

IN AN ANALYSIS OF 100,000 PV SYSTEMS, 80% TO 90% PERFORMED WITHIN 10% OF PREDICTED PRODUCTION OR BETTER¹

IMPACT OF 2017 HURRICANE SEASON

What was the major vulnerability found across PV arrays in Region 2?

BERKELEY LAB AND NATIONAL RENEWABLE ENERGY LABORATORY assessed the impact of the 2017 hurricane season on 5 PV arrays in the Caribbean



INADEQUATE FASTENERS FOUND ACROSS ALL SITES

SMALL UP-FRONT INVESTMENT IN LOCKING HARDWARE, CLAMPS, AND THROUGH-BOLTING CAN HELP PROTECT PV ARRAYS²

DEVELOPING GUIDANCE

Addressing weather vulnerabilities

BERKELEY LAB worked with the Federal Energy Management Program (FEMP) to identify additional weather vulnerability risks

RISK ASSESSMENTS
FOR SAFETY, PERFORMANCE AND FINANCIAL³

27 CORRECTIVE ACTIONS
MANY ARE LOW COST⁴

CONSULT QUALIFIED ENGINEERS
TO INTEGRATE BEST PRACTICES⁵

KEY VULNERABILITIES AND POTENTIAL SOLUTIONS

What are the key vulnerabilities that lab researchers identified?

Structural vulnerabilities

Top down clamps loosening or bending
To correct: Use through-bolting or top-down clamps with improved features⁶

Inadequate structural attachments to building in roof arrays
To correct: Add mechanical attachments to improve structural integrity⁷

Electrical vulnerabilities

Improper wire management
To correct: Protect wires from weather, support every 12 inches with clamps, clips or ties⁸

Inadequate electrical enclosures
To correct: Use proper NEMA-rated enclosures based on the site's environmental conditions⁹

Site vulnerabilities

Unobstructed wind forces
To correct: Use a wind calming fence to reduce wind forces on the PV system¹⁰

Loose debris and equipment
To correct: Secure or remove loose equipment and debris from the area around the PV system¹¹

Structural vulnerabilities exhibit the greatest safety, performance and financial risks. Wind is the most damaging weather factor and also the most complex to understand and plan for.

¹Jordan, DC, Marion, B, Deline, C, Barnes, T, Bolinger, M. PV field reliability status—Analysis of 100 000 solar systems. Prog Photovolt Res Appl. 2020; 28: 739–754 ²Solar Array Inspection, Failure Analysis, Specifications and Repair Scopes of Work, Caribbean Region. Gerald Robinson (LBNL), Andy Walker and Ran Fu (NREL) April 2018, p.9 ³Federal Solar Photovoltaic Arrays, Gerald Robinson (LBNL) December 2020, p.6 ⁴Ibid, p.14 ⁵Ibid, p.8 ⁶Ibid, p.19 ⁷Ibid, p.32 ⁸Ibid, p.39 ⁹Ibid, p.50 ¹⁰Ibid, p.55 ¹¹Ibid, p.58



The Center for Emerging Building Technologies' three programs, Green Proving Ground (GPG), Pilot to Portfolio (P2P), and Applied Innovation Learning Lab (AILL), enable GSA to make sound investment decisions in next-generation building technologies based on their real-world performance.