Energy & Homeland Security

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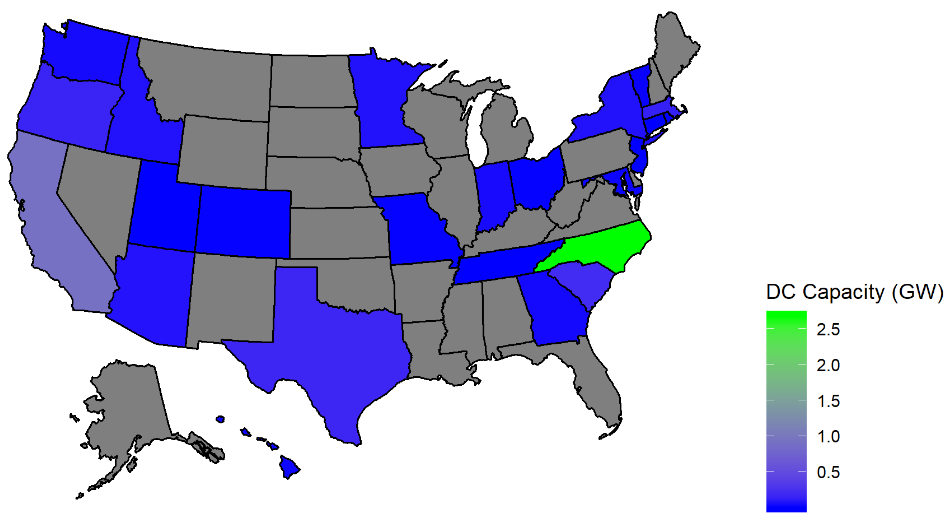
DATA-DRIVEN CHARACTERIZATION OF PV O&M ISSUES



BACKGROUND

The growth of the PV industry has been remarkably strong over the last two decades. However, the industry is seeing changing trends, including a relative increase in soft costs driven by decreasing hardware costs. Additionally, challenges related to data management and aging systems are influencing performance optimization practices.

PVROM

A world leader in PV systems reliability and performance modeling, Sandia National Laboratories has been partnering with industry, National Renewable Energy Laboratory (NREL), Lawrence Berkeley National Laboratory (LBL), and others to improve PV systems performance using data-driven methods. The analyses are informed by the Sandia-maintained PV Reliability Operations Maintenance (PVROM) database, a collection of PV work orders from 800+ sites across the U.S.

The PVROM database contains O&M records for 800+ sites across 24 U.S. states.

Although often overlooked, these maintenance records can provide valuable insights into fleet- and industry-wide patterns. Details about the events (such as timing and response actions) are used in a number of research activities aimed at improving PV system operations.

	PVROM
Number of Sites (Utility Sites)	819 (529)
Total Sites DC Size (GW)	4.6
Total Sites AC Size (GW)	3.6
States Covered	24
Oldest Site	Jan 2008
Newest Site	May 2019
Number of O&M Tickets	44,212

RESEARCH ACTIVITIES

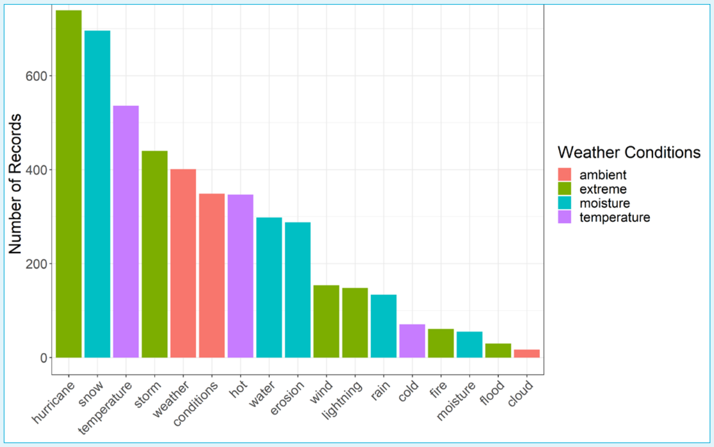
Multiple research activities are informed by the PVROM database, including quantification of weather impacts, identification of failure modes, and development of failure distributions.

Outcomes from these efforts can inform ongoing PV activities, which are critical for reducing unplanned shutdowns and maximize system operations...leading to lower life-cycle costs!

More details about these efforts and associated methodologies can be accessed at:

- https://pv.sandia.gov

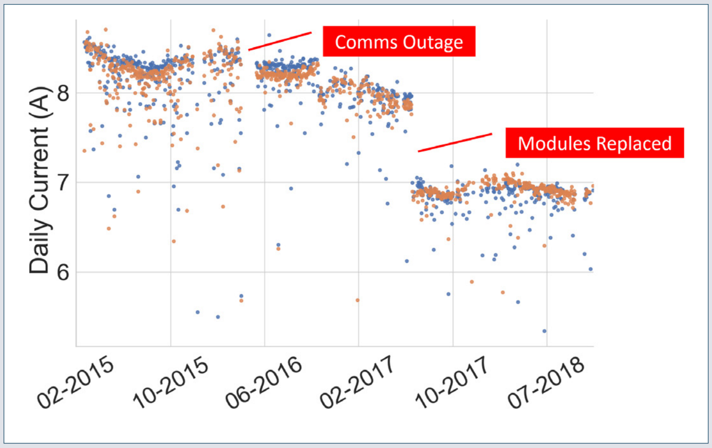
WEATHER IMPACTS



Weather is a leading cause of utility-scale PV failures. Our researchers are working to characterize how extreme weather and ambient conditions are impacting PV system operations.

Information regarding the timing, frequency, and severity of impacts can be used to inform planning activities. Findings will be integrated into a best practices in O&M report.

FAILURE MODES



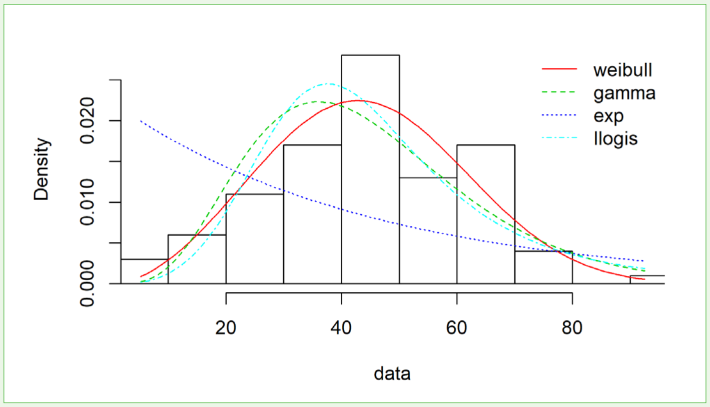
Our researchers are also applying text analytics and machine learning to identify prominent failure modes, classify them into consistent categories, and juxtapose the records onto performance data.

Outputs will help guide data cleaning activities and inform ongoing industry discussions on data standardization.

DISTRIBUTION ANALYSES

Event information about the failure and repair times can be used to conduct survival and age-of-failure analyses. Distributions of failure likelihoods (including time-to-failure and time-to-repair metrics) are currently being developed for common failure modes in PV systems.

Distribution parameters can be used to characterize and identify systemic failures, such as infant mortality issues. These parameters are also used as an input for O&M Cost model calculations.



GET INVOLVED!

If you are interested in contributing to PVROM or learning more about these research activities, please contact Thushara Gunda, tgunda@sandia.gov or (505) 845-3440. We are always interested in hearing from PV industry and data experts!

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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