

Capability 5: Field-Aged Module Library

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Project Overview

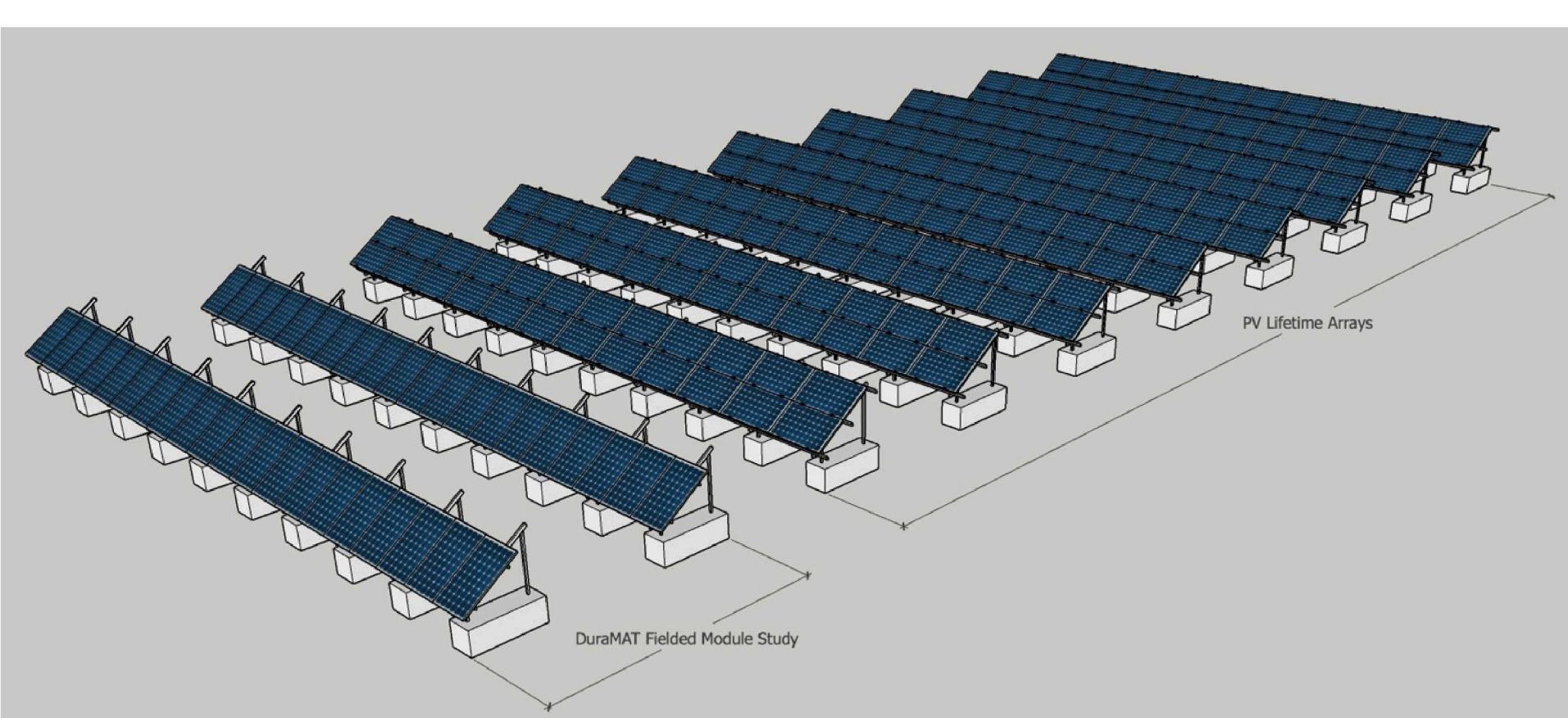
Characterize material degradation from natural aging in commercially relevant PV modules.

Summary

Most fielded PV degradation studies focus on measuring changes in electrical output over time, whereas material degradation processes likely begin before electrical impacts are seen. In this project, we will address this gap by characterizing and fielding commercially relevant modules. The output of this project will be a set of module material samples from a range of manufacturers as well as a range of field exposure times. These samples will be investigated by our project but also available for other researchers in the DuraMAT consortium to use for their specific research.

This project will be conducted in coordination with the separate PV Lifetime project. A key distinction between these two projects is that PV Lifetime is focused on precise measurement of power production and accurate determination of the rate of degradation in power. With the challenging goal of measuring values of <0.5%/year, it is critical that the PV Lifetime arrays not be altered. This project is highly complementary to PV Lifetime, as it will add a strong materials science component that is missing from that study. In turn, the DuraMAT Fielded Module study will benefit from detailed system performance data available from PV Lifetime. The combination of the two will be globally unique in a publicly available data set.

Modules and Deployment



Existing PV Lifetime Arrays installed at Sandia. 12 Modules of each type will be purchased for the DuraMAT Fielded Module Library and deployed adjacent to these arrays. 2/3 of the modules are either on-hand or enroute

Manufacturer	Model	Cell Type	Status
Suniva*	OPT 270-60-4-1BO	Mono-Si	Old Stock
Jinko	JKM270PP-60	Multi-Si	Shipped
Trina†	TSM-260PD05.08	Multi-Si	NLA?
Canadian Solar	CS6K-300MS Quintech	Mono-Si	Received
Canadian Solar	CS6K-270P	Multi-Si	sourcing
Hanwa Q-Cells	Q.Peak-G4.1 300	Mono-Si	Received
Hanwa Q-Cells	Q.Plus BFR-G4.1 280	Multi-Si	sourcing
LG	LG320N1K-A5	Mono N-type	Shipped
Panasonic	VBHN330SA17 HIT	HIT N-type	Pending

Get Involved!

- We want input from the community....what modules would YOU find valuable to be part of this study?
- Core samples will be made available to the DuraMAT consortium. Please contact us if you're interested in participating in the characterization work.

Tasks

Task 1: System Planning and Module Acquisition

- Modules will be procured on the open market, ensuring industrial relevance and removing restrictions regarding confidentiality.
- In the first phase of the project, modules matching a subset of the existing PV Lifetime arrays will be acquired.
- Future installations will be aligned between the two projects and guided by available BOM's and recommendations from the DuraMAT IAB.
- A minimum of 12 modules of each type will be acquired, with the intent that the relevance of this project could extend for 10 years or more.

Task 2: Baseline Characterization

- Divided between non-destructive and destructive analysis.
- Non-destructive analysis will include indoor flash testing, electroluminescence (EL) and infrared (IR) imaging of all modules in the study.
- Destructive testing will be performed on one module of each type to

characterize module construction materials. Tests may include Raman Spectroscopy and Differential Scanning Calorimetry (DSC) among others.

- Other tests may be applied, as recommended by the DuraMAT Early Career Scientists group.

Task 3: Outdoor Deployment

- Modules will be deployed outdoors at fixed latitude tilt with module-scale power optimizers.
- Power generation data will be collected using the on-board monitoring system of each optimizer, aggregated via digital communications, and uploaded to the DuraMAT data hub.

Task 4: Annual Characterization

- One module of each type will be retrieved from the field each year for recharacterization.
- Recharacterization will include the same characterization regimen as used for baseline characterization prior to deployment..