

PV WaRD Technical Assistance Request

In making technical partnerships through the Solar Prize, we have several primary goals:

1. Gain access to fielded modules from various climates to evaluate their moisture content and related performance losses.
2. Study moisture-related reliability issues in test modules with various absorbers, architectures, and bills of material.
3. Leverage engineering resources to refine our design.
4. Connect with project development and financing experts regarding value-added from quantifying moisture-related reliability.

Our quantitative module moisture measurements will simultaneously provide valuable data to partners and inform design of our team's moisture imaging tool.

Background

Our team has developed and demonstrated a non-contact, non-destructive technique for measurement of moisture content within standard solar modules. This technique provides foundational data to forecast power loss from long-term module degradation modes such as encapsulant yellowing, layer delamination, and contact corrosion, each of which is accelerated by the presence of moisture within the module. Module degradation risk can be evaluated as a function of moisture content at multiple stages throughout the module lifetime, enabling evaluation of deployed modules for insurance or utility purposes. Measurement of module moisture content provides the opportunity to avoid significant losses in power generation across a module's lifetime.

To transition our technique from the research and development phase into industry-facing applications, we need partnerships with interested industrial partners. Specifically, these partners would include module manufacturers, test centers, banks/insurers, and utility-scale developers. We envision our technique being applied in two ways – first, as an assessment tool for determining moisture impact on fielded modules, and second, as a quality control tool for module manufacturing.

We seek technical assistance in the following areas:

1. Measuring Moisture in Fielded + Tested Modules

In the first case, the moisture content of fielded modules would be assessed to forecast efficiency and remaining service lifetime. Partnerships with utility companies managing

solar farms would provide access to fielded modules for moisture and performance testing, all of which could be done without interruption to normal service. Additionally, national labs are already working on accelerated testing and module durability and stand to gain deeper understanding of moisture's role in their tests with the help of our tool. Ideally, we would get access to fielded and test modules with various bills of material (encapsulant polymers, glass, cell suppliers, etc.), device architectures, and absorbers (silicon, CdTe, perovskites, etc.). Access to the samples and testing infrastructure of national labs will allow us to quantify the impact of moisture on various industry-relevant module technologies.

2. Measuring Moisture in the Manufacturing Process

In the second case, moisture content would be measured at various points of interest during the module manufacturing and quality control testing phases, with a focus on before and after damp heat testing. The results from moisture characterization could trigger secondary processes to remove excess moisture. Partnering with module manufacturers would allow us to evaluate the potential cost savings, yield improvements, and impacts on throughput presented by moisture monitoring.

3. Engineering Resources

As we refine our prototype toward field- and drone-operation, we envision leveraging the wide network of engineering resources available as part of the Set! contest. In particular, we seek partners for custom machining and digital signal processing.

4. Engaging Industry Financial Stakeholders regarding Bankability

Finally, we would like to discuss the impact of moisture-related degradation forecasting on costs of module installation and insurance. Solar project developers could provide invaluable insight into the practicality of making implementation decisions on the basis of moisture measurements in their modules. Additionally, moisture measurements will allow for greater confidence in insuring of new warranties and overall project underwriting. These measurements can establish cause for failure in fielded modules when claims are filed – for example, quantitatively showing losses from the impact of a storm vs. pre-existing moisture content and projected impact on future performance. Our network does not extend to project developers and underwriters, and we would appreciate the help of the American-Made Network in facilitating such connections.