PVEL
MAKE DATA MATTER.

Technical Services for Downstream Companies

Independent testing and engineering services for mitigating risk and optimizing solar and storage project performance and economics

Downstream Services at a Glance

- **Product Qualification Programs**
  Select banakble products among PV modules, inverters and battery energy storage systems that have undergone extensive reliability and performance testing.
- **Batch testing**
  Validate quality, performance and reliability, and identify serial defects in the equipment produced for specific projects.
- **Technical field services**
  Ensure projects meet revenue expectations with advanced EL imaging that reveals latent PV module defects and damage.
- **Engineering and data services**
  Leverage over ten years of accumulated PVEL test data and technical expertise with our consulting services.

Who We Are

Founded over ten years ago as a lab for the downstream solar market, PVEL creates data that matters to the industry. With our extensive test programs and engineering services, we help downstream stakeholders replace modeled assumptions with empirical data for solar and storage projects - from procurement to the field.

PVEL's Downstream Network

PVEL's downstream partners form a global community of project stakeholders who recognize that bankability and product quality are the stepping stones to profitabilty. Companies that sign up to join our downstream community enjoy complimentary access to PVEL test reports.

Through regular engagement with downstream companies, PVEL gathers vital feedback from the field to update to our test programs and services.

PVEL's downstream network comprises more than 400 companies with over 30 GW of collective annual buying power. Our partners operate in every major global market.

Product Qualification Programs (PQPs)

PVEL's PQPs consist of extended reliability and performance tests for PV modules, inverters and battery energy storage systems.

Consistent Data for Procurement

PVEL's PQPs provide valuable data for technical due diligence and bankability assessments. Our test programs allow for leveled comparisons of products and manufacturers.

The empirical data generated through PVEL's PQPs replace performance assumptions in revenue and energy yield models. Results can be leveraged to optimize project financing.

PQP reports are available on a complimentary basis via PVEL's easy-to-search web portal.

Updating Our PQPs

PQP test sequences are updated regularly in response to new research, technology advances and industry feedback. These updates ensure our PQPs remain relevant as buyers' needs evolve.

Key Benefits

- **Testing at the bill of materials (BOM) level**
  PQP BOMs are verified with a factory witness to document raw materials and production processes.
- **Complimentary data on-demand**
  Access PQP data and reports for free in PVEL's web portal.
- **Procurement support**
  PVEL provides complimentary exhibits for specifying tested BOMs in supply agreements.

Batch Testing for Project-Level Product Verification

Batch testing evaluates the quality, reliability and performance of the equipment produced for a given project.

How Batch Testing Works

During project construction, a randomly selected subset of products are sent from the factory to PVEL. The equipment is screened for defects and undergoes performance and reliability testing. Production oversight and BOM verification are frequently added to the scope.

Testing for PV Modules

Testing is available for bifacial, monofacial and thin film modules. Test to the IEC 61215 standard or customize with performance and other testing, such as light and elevated temperature-induced degradation (LeTID) sensitivity, potential-induced degradation (PID), PAN files and/or IAM.

Testing for Inverters

Testing is available for micro, single and 3-phase string products (600V, 1000V and 1500V). Buyers can test to the applicable interconnect (grid code) and DC loading ratios for a project, and validate key operational and performance data.

Key Benefits

- **Optimized sample sizes for faster results**
  PVEL's approach uses a smaller subset of samples for faster testing and results delivery.
- **Identify quality control issues quickly**
  Buyers can identify issues and develop a recourse plan while project production takes place.
- **Evaluate at the BOM level**
  Batch testing is often combined with production oversight and BOM verification for additional quality assurance.

Field Electroluminescence (EL) Imaging

Field EL images reveal latent PV module damage to help asset owners diagnose underperformance, document claims and recoup lost revenues.

The Problem of Latent Damage

Over time, PV module defects and damage that are not visible by eye will reduce system performance. They can also create safety issues that undermine profitability.

EL Images Reveal Unseen Issues

Using a specialized near-infrared camera, PVEL provides images of PV modules that are similar to X-rays. EL images show micro-cracks, defects, mismatch, heat stress, and other issues that cannot be seen by eye.

When to Conduct Field EL

To help asset owners fully quantify latent PV module damage, PVEL conducts field EL images at commissioning, for operational under-performance and after weather events.

Insurance and warranty claims require detailed damage data, and in the case of force majeure events, typically only one claim can be submitted during a narrow timeframe.

Key Benefits

- **Fully quantify damage for insurance and warranty claims**
  EL images reveal manufacturing defects as well as damage from shipping, improper installation, extreme weather and other force majeure events.
- **Assess damage efficiently**
  PVEL's mobile field EL team can image modules in the field during daytime hours with a throughput of 1,000+ modules per day.
- **Compare to baseline project health**
  EL imaging can provide evidence of a project's baseline health before any equipment performance issues start to emerge or force majeure events occur.

Project Engineering and Data Services

With our data and technical expertise, PVEL provides custom forecasting, energy model evaluations and system design optimization for solar and solar+storage projects. Examples include supplier management services, performance model validation and/or comparison, resource data analysis, validation of PAN, IAM, and OND files and bifacial gains analysis.

Ready to get started?

To find out more about PVEL's technical services, contact
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