Establish trust as a manufacturer – with dependable performance data based on precise measurements. Safeguard your PV yield and return as an investor or operator.

For a PV module manufacturer, precise and dependable performance information constitutes a mandatory quality standard in a heavily contested global PV market with constantly increasing quality requirements. Valid data give investors and end consumers security on yields and return on investment. Manufacturers establish a relationship of trust when the performance data and the necessary measurements are based on a high quality level. This implies that they are traceable to measurement standards of a laboratory accredited by TÜV Rheinland, and likewise that they are systematically and repeatedly checked. All of this should be confirmed by TÜV Rheinland on the basis of clear-cut criteria.

As long as the validity of performance data is not clear, each participant at the user end (investors, dealers, project planners, etc.) is advised to initiate independent measurements.

TÜV Rheinland maintains state-of-the-art accredited test laboratories with the latest, comprehensive high-tech measuring equipment. We employ qualified class AAA solar simulators with minimum measuring uncertainty. All performance measurements and electrical characterisations are conducted according to the applicable international and national standards. Our intensive research means that you can rely on our measuring procedures and results.

Our regular participation in international round-robin comparisons yields continuously monitored and traceable precision. By employing ultra-precise calibrated reference cells based on the World PV Scale (WPVS), we attain the lowest measurement uncertainties.

TÜV Rheinland enjoys a high reputation in the solar industry. Our expertise as well as our measurements are accordingly recognised worldwide.
Short throughput times, even for large batches, high measurement accuracies and even measurements in different climate zones are possible through the global networking of TÜV Rheinland laboratories, and make us a powerful partner with the flexibility for adjusting to customer-specific requirements.

The performance characterisation basically comprises the following technologies and subsidiary tests:

**Crystalline silicon modules:**
- Performance measurements under standard test conditions for individual modules or large batches
- Performance measurements with different irradiance levels and module temperatures (matrix measurements) as part of yield calculations
- Determination of temperature coefficients, NOCT, performance measurements with reduced irradiance
- Determination of light-induced power degradation (LID, initial degradation)
- Determination of potential-induced power degradation (PID)

**Thin-film modules:**
- Non-destructive determination of the spectral response (SR) and mismatch calculation, with module sizes up to 120 cm x 200 cm
- Performance measurements under standard test conditions on all thin-film technologies
- Time-dependent and temperature-controlled light soaking for performance stabilisation or performance activation
- Determination of light-induced power degradation (LID)
- Determination of the module conversion and aperture efficiency
- Outdoor measurements with tandem and triple cells
- Determination of temperature coefficients, NOCT, performance measurements with reduced irradiance

**Characterisation services for module manufacturers**
- Precision calibration of crystalline silicon reference modules for use in flasher calibrations
- Electrical characterisation for specifying important parameters in data sheets
- Calibration of thin-film PV modules following previous performance stabilisation
- Non-destructive measurements of the spectral sensitivity at PV modules

**Power Controlled certification for module manufacturers**
- The Power Controlled qualification system ensures that the manufacturer’s rated module performance is maintained, thanks to optimised and tested quality assurance at the flasher measuring stands and regular comparative measurements at the TÜV Rheinland laboratory.
- To this end TÜV Rheinland issues a quality certificate for precisely tested and monitored PV module performance.

**Characterisation services for investors, banks, insurance companies, dealers and facility operators**
- Exemplary random sample measurements
- Quick performance checks
  - Scientifically established random measurements for quality control before the commissioning of a PV system and for performance checking of PV systems already set up
  - Analysis of the PV modules through high-resolution electroluminescence imaging

Our experience – your advantage

You can rely on our 30 years of experience in solarenergy. Take advantage of the achievement potential of our test laboratories offering you fast and first-class service around the world. Gain a partner with worldwide acceptance. Document test quality and the safety of your PV modules with the test mark from TÜV Rheinland.

Always a good sign.

This mark stands for all the information about products, services and systems that are tested, certified or inspected by TÜV Rheinland. Transparent, available anytime worldwide – powerful and unique.

The TÜV Rheinland test mark.