



// Mechanical stress test

## Evaluation of performance, quality and reliability of PV modules according to standards and in customer-specific tests

- // Stress by temperature and/or humidity in climate chambers
- // Potential-induced degradation (PID)
- // STC-Performance measurements
- // Pre-conditioning for thin-film PV
- // Mechanical load, electroluminescence (EL), thermography



// PV generator test, Widderstall, Southern Germany

## Outdoor testing facilities for PV modules and PV systems

- // Highly resolved acquisition of all relevant electrical and meteorological data
- // Energy yield and performance ratio
- // Real module power in outdoor operation
- // Temperature coefficients, operation temperature
- // Short- and long-term stability
- // Outdoor PID testing

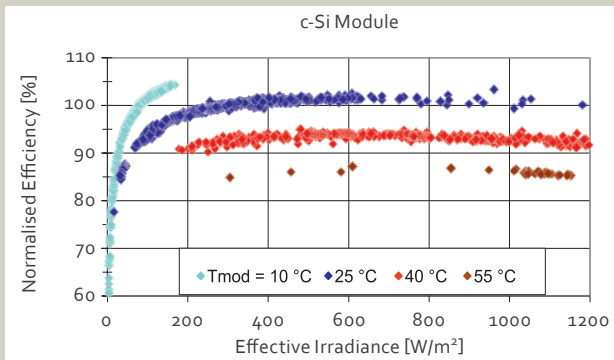


// PV module test, Girona, Spain

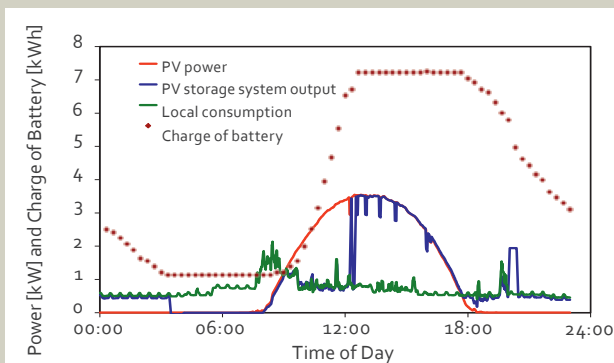
- // Since 1988 in Widderstall, Southern Germany
- // Since 2012 in Girona, Spain

### Contact

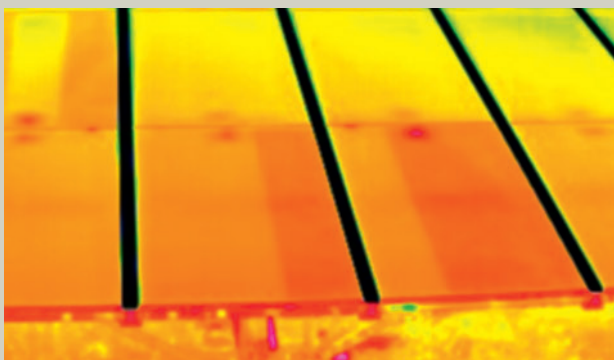
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// Influence of irradiance and module temperature on module efficiency



// Measurement of the PV storage system at the Widderstall testing facility



// Infrared image of defect PV modules installed in a generator

## Development and application of testing methods

- // Precise performance and operation measurements of PV modules and systems
- // Long-term stability of modules
- // Accelerated ageing and test-to-failure
- // Correlation of laboratory and outdoor measurements
- // Input for standardisation procedures

## PV storage systems and grid integration of PV plants

- // Design of PV battery systems
- // Characterisation of battery operation and aging
- // Energy management, optimization of self-consumption
- // Heat pumps for smart grids
- // Strategies to minimize grid loading
- // Smart grids on distribution network level

## Consulting for manufacturers, investors, banks and project developers

- // System measurements and acceptance tests
- // Yield estimates and site appraisals
- // Technical due diligence
- // Troubleshooting

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