**TÜV Rheinland: Solar check - long-term trends: 10-year comparison of test data**

Degradation: differences between different PV-technologies / Nominal power: increased percentage of underperforming PV Modules / Maintain customer trust: important to carry out early testing in manufacturing process – TÜV Rheinland supports with independent testing / [www.tuv.com/solar](http://www.tuv.com/solar)

Many PV modules deliver less power than manufacturers claim. This is the result of a long-term data comparison by TÜV Rheinland over a period of 10 years. In the 2015/16 test period, well over two-thirds of the PV modules tested performed better than claimed. Less than a third failed to meet their rated output. Today, ten years later, the ratio has reversed: Only one third of the modules tested deliver more, two thirds less than specified. Most of the results are within the laboratory uncertainty of 1.5% percent, but: "If modules deliver less than what manufacturers claim, this can lead to a loss of confidence among buyers," explains Dr. Christos Monokrousos, Global Business Segment Coordinator Solar & Commercial Products at TÜV Rheinland. "This makes it all the more important for manufacturers to involve independent expert testing, such as that provided by TÜV Rheinland, at an early and regular stage in the manufacturing process. This helps to avoid performance deviations and delays in the market launch of new products".



**Degradation: Differences between different PV technologies**

In the area of degradation testing, TÜV Rheinland has compared different PV technologies in terms of their susceptibility to heat, humidity, voltage spikes, sunlight and UV radiation. These include both the conventional, usually cheaper PERC and TOPCon technologies, and the newer, often more expensive BC technology.

The results show that, on average, BC modules performed best in all test categories, followed by TOPCon and PERC - with one exception: heat resistance, where TOPCon performed best. “It is important to note that these are averages. There were indeed individual module types, PERC, TOPCon and BC, that performed better, but also a lot worse than the median values“, says
Dr. Monokrousos. In addition, the different initial costs of the different technologies make a recommendation for or against a particular technology unreliable. More importantly, "solar projects are a costly investment. Our results show that there can be significant quality differences - both between technologies and between manufacturers. Especially for large projects, we therefore recommend that investors carry out a preliminary check of the modules in question. This anaboles planning certainty and saves money“, says Dr. Monokrousos.

**About TÜV Rheinland Solar**

TÜV Rheinland has been supporting the development of solar technology for more than 40 years and employs more than 700 experts worldwide to minimize technical and quality risks in solar energy systems. Each year, the experts of TÜV Rheinland perform tens of thousands of tests worldwide on solar, battery, storage, power electronics solutions, machinery, and components. The experts develop new test methods, work on research and development projects, and participate in standardization committees. They provide global services for the feasibility, financing, quality assurance and warranty processing of photovoltaic power plants, and facilitate international market access by testing and certifying photovoltaic modules, components, inverters, energy storage systems and solar thermal collectors. As a leading provider of testing services for solar systems and their components, TÜV Rheinland operates laboratories in Bangalore (India), Cologne (Germany), Milan (Italy), Budapest (Hungary), Sao Paulo (Brazil), Shanghai, Shenzhen (China), and Boston and Pleasanton (USA), among others. The Solar Energy Competence Network also includes 15 competence centers in Africa, the Americas, Asia, Australia and Europe. For more information visit [www.tuv.com/solar](https://www.tuv.com/solar)

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