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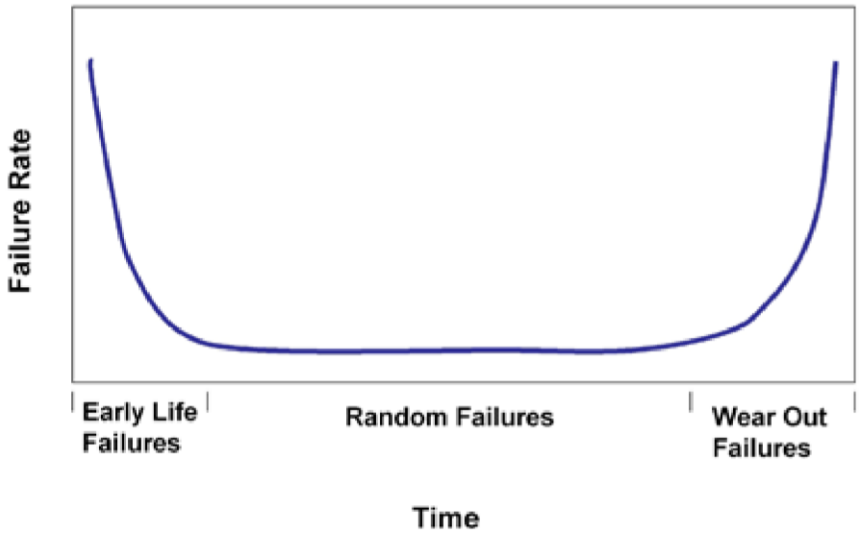
EUROPEAN TECHNOLOGY & INNOVATION PLATFORM

# ETIP PV ANNUAL CONFERENCE 2018

## 'Quality and Sustainability of PV Systems'
## 3 May 2018, Brussels

### Proceedings

***"Bathtub curves" – the typical pattern of failure rates in a sample of modules and inverters***




Several speakers displayed charts like the one above. The chart has three distinct areas. It applies to modules and inverters. Interpreted for modules, cell cracks are the failure dominating in the first two years, PID by shunts in 3-4 years. The failure rate then stays low for a few years. Discoloration occurs over time and causes modules to fail after about 18 years, a time when failure rates return to a high level.

DNV GL offers a Product Qualification Programme, which aims to identify modules at risk of wear-out failures and warn manufacturers of them: the programme involves extended reliability testing at 2 to 4 times IEC durations.

It was claimed that 50% of the things that go wrong happen during installation, meaning it is important to train installers well. A video was shown of warehouse staff stepping on the front side of stacked modules, and an anecdote was shared of a TüV-inspected site where 90% of modules had not been put in the right position.

### *Buyers should have a greater appreciation of quality*

Buyers of PV modules often don't care about quality, claimed a speaker. There are tools for high quality (indeed "a euro invested in quality pays back tenfold in performance"), but the market isn't demanding it. "Low-quality batches from fabs that are ramping up in Vietnam and other sites are sent to Africa where customers accept low-quality or they don't test. Rejected modules are resold, not sent back to China."

The picture is different if the module supplier takes its customer seriously. If the buyer announces that it will test the modules it receives, they get good batches. "The Tier 1 module manufacturers travel to the customer's warehouse to determine the level playing field with the importer."

"Large purchases give you leverage with suppliers. Then they give you the info." Monitoring production at different parts of the line and testing samples of modules on delivery adds cost. "With an order of 20-50MW you can demand to know the bills of materials for the components."

### *Changing bills of materials*

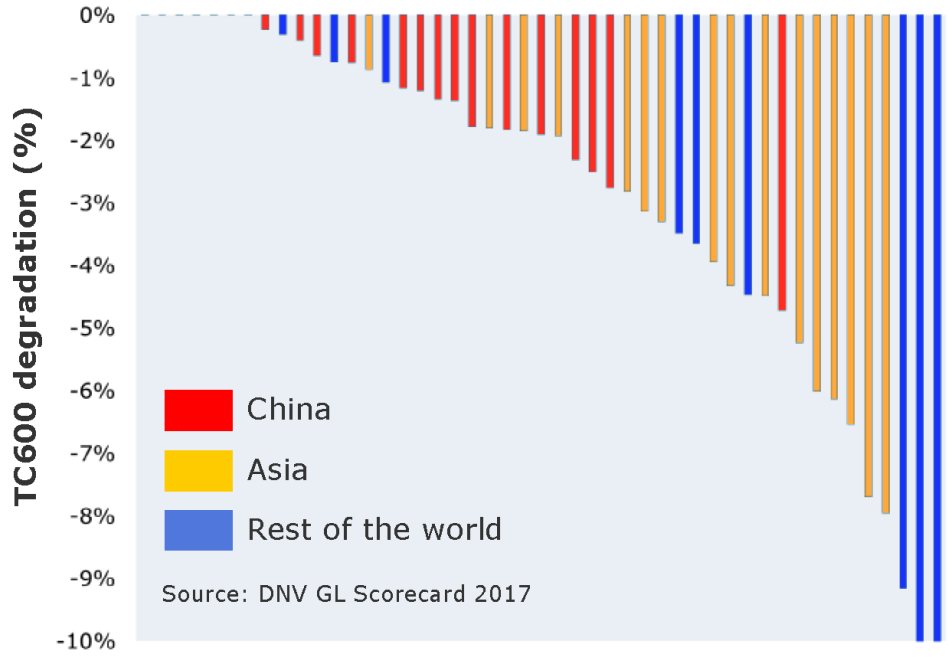
"We need traceable products," said one speaker, echoed by another: "We want to trace back a fault to manufacturing faults or problems with the material." The bill of materials may be difficult to obtain. They typically change every 3-6 months for modules, often without the customer knowing. Modules made with different materials are liable to be combined in the same shipment.

"Insist on 3rd party accelerated ageing reports and sure the b-o-m for your supply is among the b-o-m that scored well," was the advice of one speaker. "Do an EL test on reception of modules."

### *Place of manufacture is no guide to quality*

China is the place of manufacture of some of the modules exhibiting lowest TCO degradation, as shown in DNV GL's chart below. Manufacturers that track module quality in detail were mentioned: First Solar and Hanwha Q-Cells.

## Key Finding 3 – Location is not a good proxy for quality




**Some good and bad results in all regions of the world**



### *Inadequate sharing of data on reliability*

Plenty of data on reliability exists, much of it in the hands of the owners of PV systems, but it is kept secret. NREL and IRENA have negotiated access to some of it, which they publish in an aggregated, anonymised form. The information, supplied under NDA, relates to technical defects, never financial information such as lost revenue.

Data sharing is an integral part of DNV GL's PQP (mentioned above), but the conference pleaded for more mechanisms to share data internationally. "The gas turbine industry shared problems and solutions in 1980s. Now PV, as a mature industry, should learn to do the same."

Data retentiveness affects inverter manufacturers, too. "Servicing of inverters is sometimes only allowed by one contractor allied to the inverter manufacturer."

### *Ecolabel/ecodesign*

Some stressed the urgency of creating an EU-recognised ecolabel for PV, building on France's attempts. Solar Power Europe representative Wolfgang Storm was more cautious, saying his organisation would await the results of an EC study[1] before deciding to campaign for such a label. He would like the sustainability of the kWh from a module to be the thing that the ecolabel certifies. The EC said it wanted to proceed carefully to avoid making a mistake.

### *#pvqualitymatters?*

Quality does matter, or should do, to system owners. Most insurance policies for plants cover material loss or damage, but degradation (even if it is accelerated due to a quality problem) does not fall in these categories.

Quality is important to get long term debt-finance for an installation. The component supplier might be out of business by the time that faults start to appear. Typically, insurance policies are for less than the lifetime of a system: "10 construction insurance + 3 years operation +12 months renewable year by year".

The value of warranties was disputed. When choosing what investment rating to give a PV installation, the representative of a ratings agency said her company preferred to look at whether a technology can be replaced than the warranties of the project's components. But another speaker insisted they were crucial. "Bankability is a dynamic and fluctuating bar reflecting demand in the market but quality is an absolute. For modules, a guarantee of 98% of the quoted output at the time of purchase, with 0.5% decline annually over 25 years is pretty standard."

### *Artificial intelligence (AI) for higher quality*

Assessing when a component will wear out could lead to big savings. Inverters, "often a costly component in a system and the weakest link," are assumed to last for 10 years, but some experts say they could last for 14. The difference is important: if they last 14 years, then in an installation where the remaining components, such as the modules, last for 25 years, they would only need to be replaced once, not twice. 3E uses AI to detect the need for inverter replacement.

[1] EC / JRC Preparatory study on sustainable product policies for PV modules, inverters and systems

"I look forward to the 50-year module," said one speaker. "We need to need to learn how to make predictions from our observations." Another said, "we need to prevent rather than correct faults and failures." ENEL said it collected data from factories, which it processed with AI to make predictions about component lifetimes.

### *New standards*

The NSF/ANSI 457 standard was recently launched for modules and will be extended in 2019 to balance-of-system components and inverters[2]. But some PV quality standards have yet to catch on: IECRE was the example given by one speaker and the 'orange button' of Sunspec Alliance was another. The button is awarded to inverters meeting a certain level of compliance with 'official and de facto communication standards'.

Bifacial modules need a standard.

Whole-systems standards are needed to prevent individually good components from being mismatched or misconnected.

Standards for inverters might be particularly valuable. Because the main manufacturers are European, said a speaker, they are in a strong position to negotiate standards that suit them and therefore maintain their advantage.

[2] Presentation of Nancy Gillis, Green Electronics Council