

# PV Qualification

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## About Us

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- DNV GL is the world's largest renewables advisory firm
  - Solar advisory since 2003
  - 13 major global offices focused on Solar
  - Advised on over 25 GWs of PV power plants
- Independent Engineering / Owners Engineering / Module & Inverter Testing
- Supports Banks, Developers, IPPs, EPCs, and manufacturers
- Module & Inverter Testing: PV Evolution Labs acquired by DNV GL March, 2014

## Module & Inverter Testing

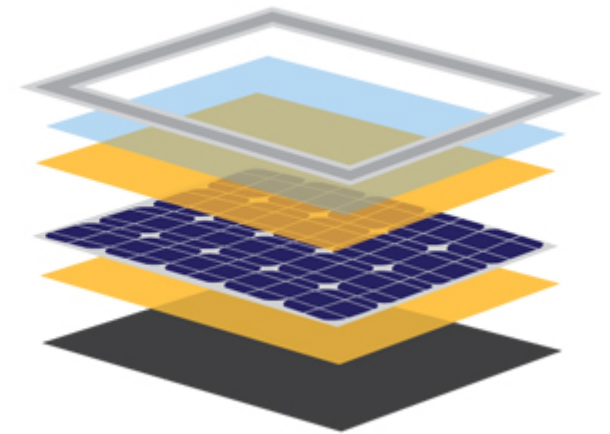
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- Focused in two areas
  - Qualification Testing
  - Batch Testing
  
- **Qualification**
  - Comprehensive 3<sup>rd</sup> party testing evaluation
  - Apples to apples across many manufacturers
  - Large downstream partner network
    - ~90 companies: banks, IPPs, developers, EPCs

## PV Module Construction

- PV modules are made of metal, silicon, glass and polymers and are expected to last a LONG time.
- Your unborn kids will be graduated from college before your PV module warranty expires.

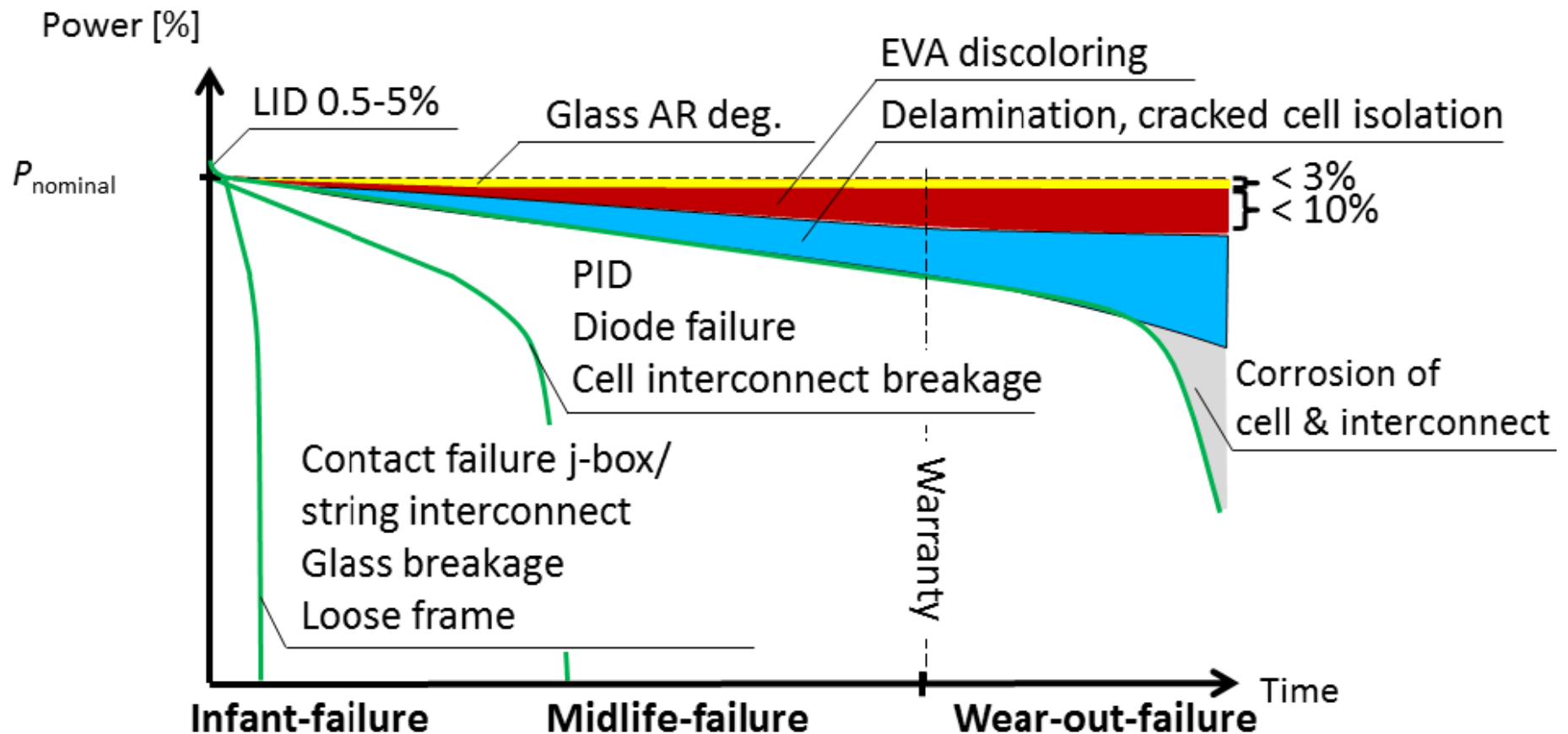
- Aluminium frame
- Solar glass
- Encapsulant
- Cells
- Encapsulant
- Backsheet
- Junction box



- Each of these materials expands and contracts at different rates when heated or cooled causing interfacial fatigue
- The package must stay adhered
- The electrical conductors must stay isolated from the environment
- The cells must continue to operate and the circuit must continue to carry current

## PV Module Degradation Scenarios

- *Review of Failures of Photovoltaic Modules*, IEA PVPS 2014



## Compared to IEC

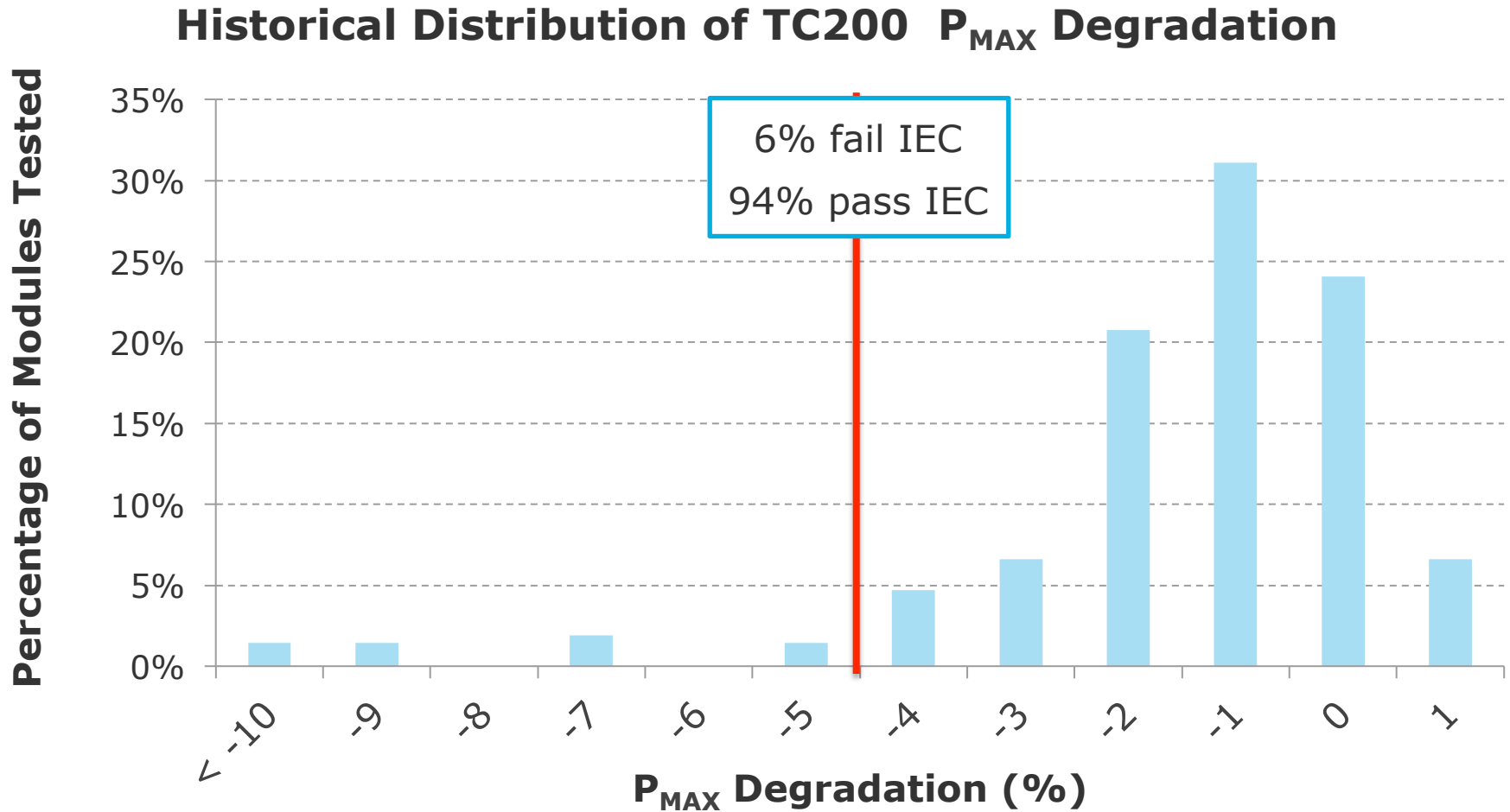
### ■ Reliability Tests

	Thermal Cycling	Damp Heat	Humidity Freeze	UV Exposure	Mechanical Load	PID
DNV GL Qualification Test	800 TC cycles	3,000 DH hours	30 HF cycles	90 kWhs of UV	Dynamic Load	600 hours
IEC 61215 Standard	200 TC cycles	1,000 DH hours	10 HF Cycles	15 kWhs of UV	Static mechanical load	None

### ■ Performance Tests

- PAN Files: for energy estimates in PVSyst or Helioscope
- IAM: Incidence Angle Modifier
- LID: Light Induced Degradation

## Lab Experience



## DNV GL Qualification Expertise

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- Our Product Qualification Program covers
  - Modules
  - Inverters
  - Racking
  
- Contact me to sign up if you are an
  - Equipment Manufacturer
  - Buyer
  - Investor
  
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