



# 12th SOPHIA PV-Module Reliability Workshop

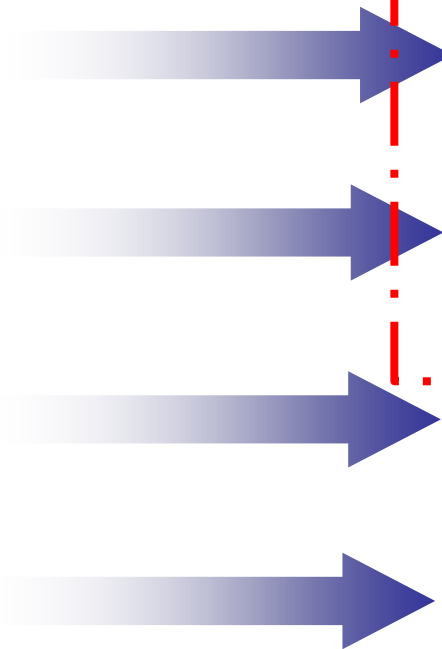
*How to regulate the durability of PV modules  
and inverters with Ecodesign requirements*

June 30<sup>th</sup> 2022

**DG GROW**  
**European Commission**



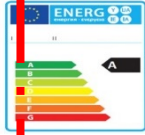
Concept: ONE  
research  
process for  
different  
policies



• *Ecodesign minimum requirements?*



• *Energy Label classes?*



• *Ecolabel criteria?*



• *GPP criteria?*

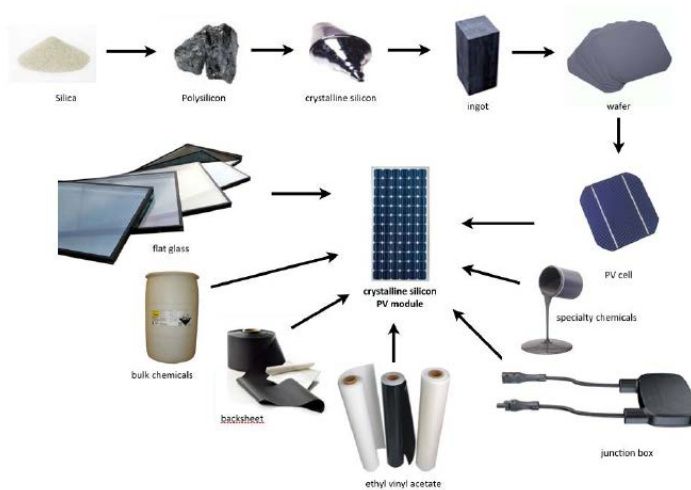


The results: a policy mix with mandatory instruments + Green Public Procurement

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## Modules, inverters and systems

*In-depth analysis: market (residential, commercial, utility), technologies, performance measurement, life cycle cost and environmental impacts.*



# Objectives of regulatory initiatives on environmental aspects

- Foster module and inverter designs that have improved life-time performance, durability, and meet circularity objectives;
- Take products off the market that are of low quality and have higher life cycle costs;
- Close the information gap on PV products available on the EU market to enable informed consumer/investors choices.



# Requirements/labelling under preparation

## PV modules

- energy yield (information)
- Durability & Quality assurance of the production process
- Performance long-term degradation
- Repairability
- Recyclability
- Carbon footprint

## PV inverters

- Efficiency (quantitative)
- Durability & Quality assurance of the production process
- Smart readiness
- Repairability
- Recyclability

## Energy label

- PV modules

# Products scope

## *PV modules*

### *Scope exclusions*

- Modules with a DC output power of less than 50 Watts under Standard Test Conditions (STC)
- Building integrated photovoltaics (BIPV)..but BAPV in scope
- PV module designs integrated into consumer electronic products, or other multifunctional applications requiring specialised designs for which energy production is not the only purpose/functionality e.g. street furniture, large-area shading, specific agri-PV applications or other similar.
- photovoltaic modules based on new technologies entering the market with a cumulative yearly global production less than 500 MW (with the aim of not dissuading innovation)
- PV modules based (only) on organic perovskite layers

### *Special consideration for:*

- modules containing integrated or embedded micro-inverters (compliance integration)



# Products scope

## *PV inverters*

### *Scope exclusions*

- *Central inverters that are packaged with transformers (sometimes referred to as central solutions) as defined in Commission Regulation (EU) No 548/2014 on Ecodesign requirements for small, medium and large power transformers.*



# REQUIREMENTS FOR PV MODULES - RELIABILITY



# Requirement on reliability

- Relevance of this module feature -> module in operations for ~30years
- Quality of the production process for PV modules is of paramount importance for ensuring the actual durability of all modules placed on the market (and thereby their conformity with the requirement).



A 'dual' approach is proposed

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- Compliance with a testing method (in line with the EN IEC 61215 series) that involves subjecting 10 modules to the relevant tests (outdoor exp, hotspots, damp heat, hail..).
- Build on the standard conformity assessment modules set out in the Ecodesign Directive by requiring manufacturers to additionally have a third-party verified quality assurance system in place.

# Quality and degradation: EN IEC 61215

Standard	Subject covered
EN IEC 61215-1	Design qualification and type approval - Part 1: Test requirements
EN IEC 61215-2	Design qualification and type approval - Part 2: Test procedures
EN IEC 61215-1-1 to -4	Specific requirement for each PV technology

## Specific tests covered:

- *Thermal cycle test*, with temperature and electrical current as stressors;
- *Damp heat test*, combination of effects due to temperature and humidity;
- *Humidity freeze test*, on sealing materials and components;
- *UV test*, for polymeric components;
- *Static mechanical load test* simulates loads such as those by constant wind or homogeneous snow accumulation;
- *Hot spot test* linked to partial shading on modules;
- *Hail test*.

Conformity assessment  
with possible NB  
involvement  
(documentation, basis  
for DoC)



Placing on the  
market



Market surveillance  
(based on product or  
documentation)

## Requirement on reliability (conf. ass.)

Article 8(2) of the Ecodesign Directive foresees the **possibility to take account of such specificities** by adapting the relevant conformity assessment procedure, **e.g. by involving independent third parties.**

Specificity: **deviations from the expected production quality** (e.g. for precision manufacturing) easily cause defects that

- are **not detected in standard product tests**; and
- **undermine product's resistance to the environmental stressors** covered by the proposed reliability requirement.

## Requirement on reliability (conf. ass.)

It is proposed to:

1. Use module D1 of Decision 768/2008/EC = **internal production control + quality assurance system approved by a notified body**:
  - initial **on-site audit** of quality system
  - subsequent **surveillance** (periodic audits + unexpected visits)
2. Base the **more detailed requirements** for the quality system on **IEC EN 62941 (for modules) and IEC TS 63157 (for inverters)**,  
--> see next slide

## Requirement on reliability (conf. ass.)

- In practice, the system should include e.g. :
  - quality objectives + control plan and process flow diagram
  - evaluation of the **quality performance of key materials**
  - ongoing **production monitoring program** with tests for the known failure mechanisms of the product
  - maintenance of **quality records**
  - definitions of product problems and rules and processes to minimize their impact
  - **change management system** for materials and processes
  - procedures for conducting a systematic material review



# REQUIREMENTS FOR PV INVERTERS - RELIABILITY

# Requirements on reliability

- The above topics emerged as relevant (in terms of env. impacts) from the preparatory study
- The formulation of these requirements follows an approach conceptually similar to the one used for PV modules
- The test on durability would be based on EN IEC 62093 "Photovoltaic system power conversion equipment – Design qualification and type approval"
- The quality assurance system could be based on IEC TS 63157 "Photovoltaic systems - Guidelines for effective quality assurance of power conversion equipment"



# Quality and degradation: EN IEC 62093

Standard	Subject covered
EN IEC 62093	Photovoltaic system power conversion equipment Design qualification and type approval

## Specific tests covered

- Voltage (dielectric strength) test
- Bus link capacitor thermal test
- Power transistor module thermal test
- Humidity freeze test
- Thermal cycling test
- Damp heat test
- Dry heat test
- UV weathering test



**Thank you for your attention!**