

INTERNATIONAL RENEWABLE ENERGY AGENCY



Extending the Frontier of PV Reliability: The Role of Quality Infrastructure

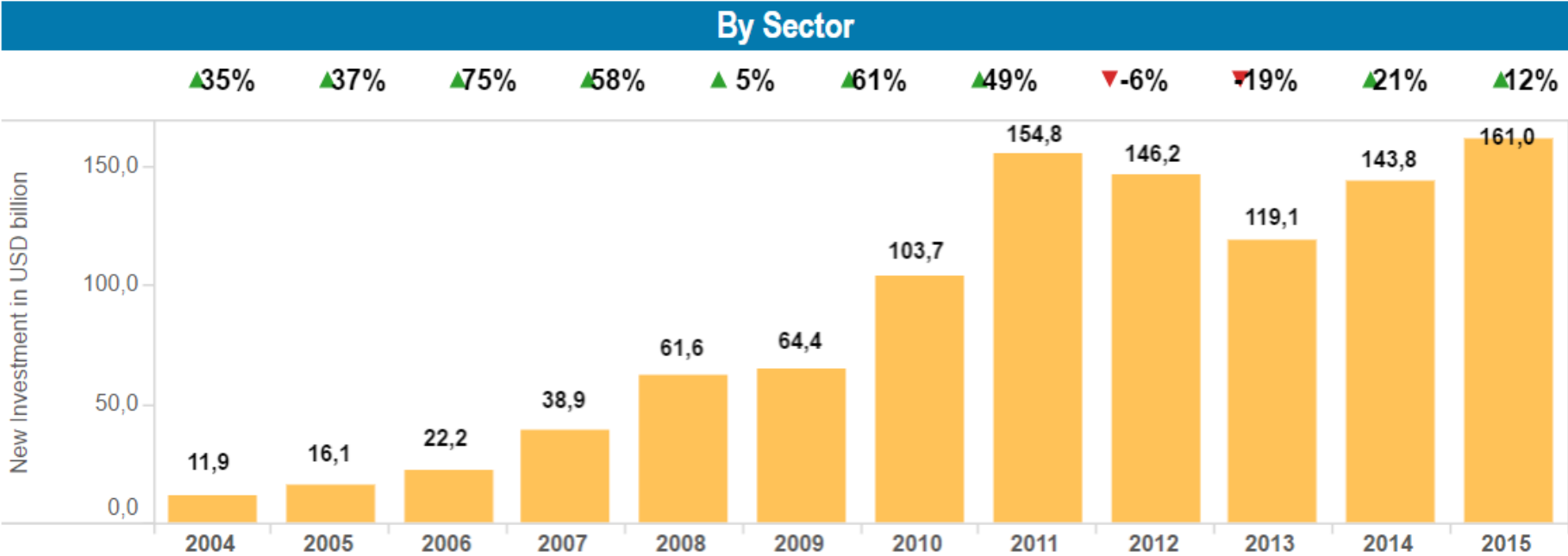


WFES - Letting in the Light

17 January 2017
Abu Dhabi, UAE

Solar power investments

Global Trends in Renewable Energy Investment 2016

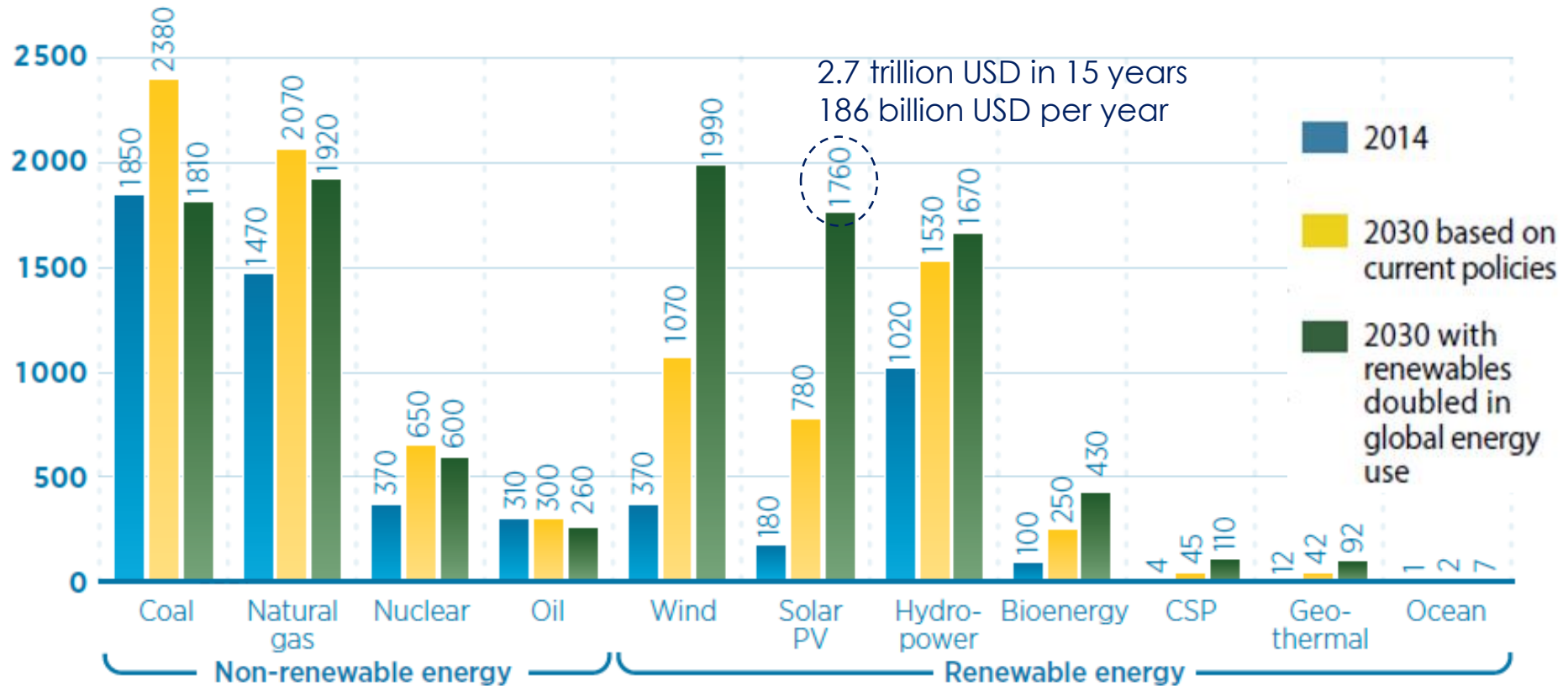


Source: Frankfurt School-UNEP Centre/Bloomberg New Energy Finance (2016), *Global Trends in Renewable Energy Investment*.
 Note: Investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.

2015: 161 USD billion

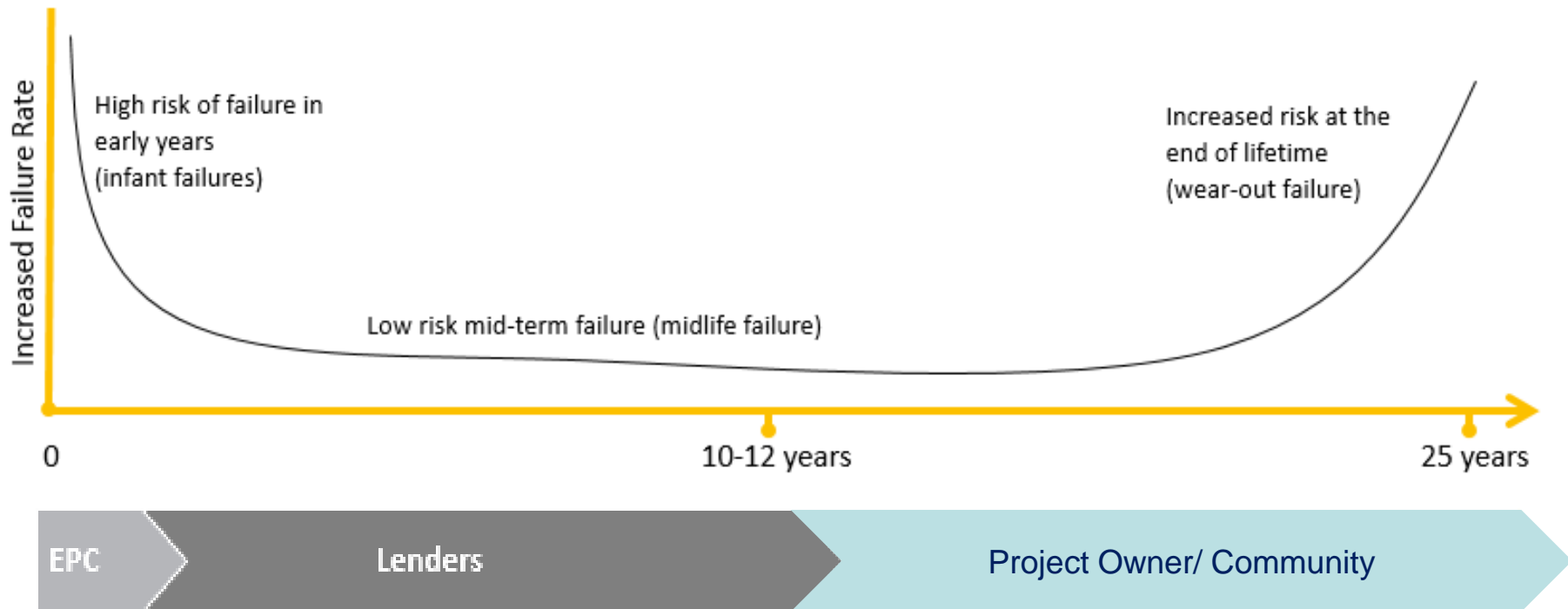
PV mobilising trillions of USD in coming years

Power generation capacity (GW installed by 2030)



Failure risks present in their majority at early and mature stages

Life expectation of Modules is 25+ years, however they have to deal with failure PV curve



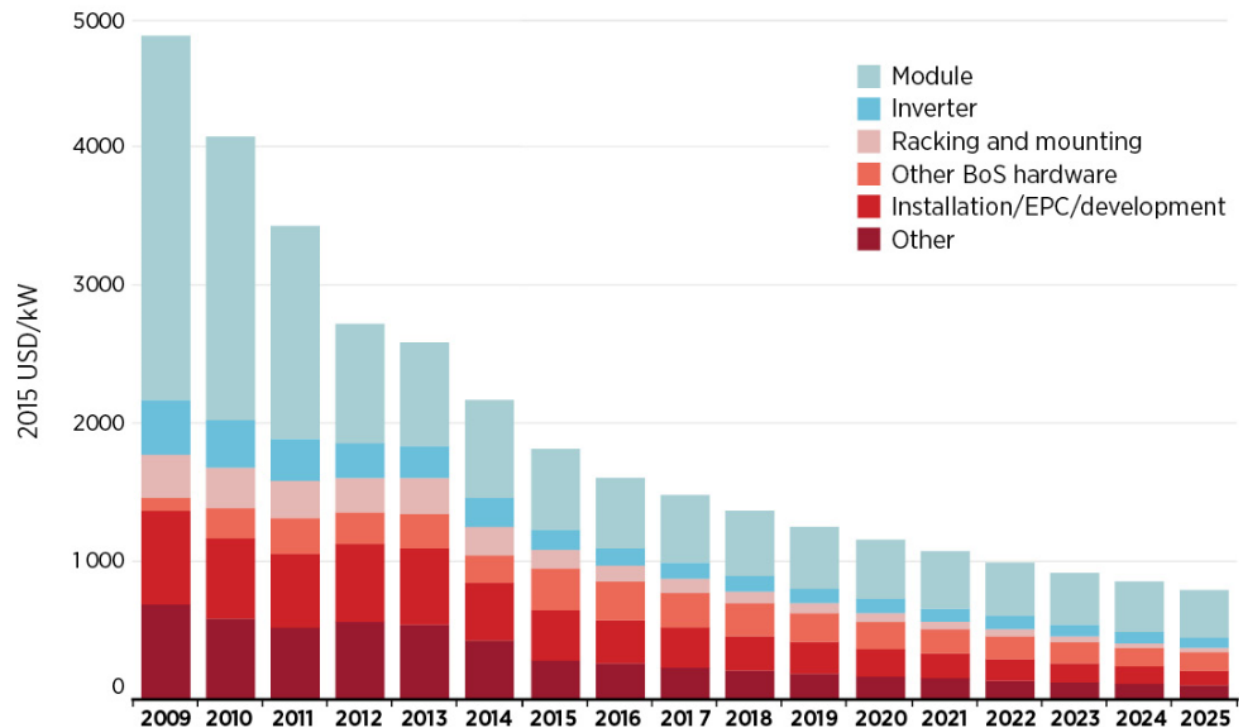
Equipment selection considering quality aspects

PV Modules represent around a third of PV installed costs

Performance of PV modules is dependent to:

- Module technical characteristics
- Quality of manufacturing facility
- Manufacturing process
- Quality of materials used
- Testing procedures

UTILITY-SCALE SOLAR PV: GLOBAL WEIGHTED AVERAGE OF TOTAL INSTALLED COSTS, 2009-2025



More than half of non schedule hardware repairs happen due to equipment selection

Holistic View - Quality Covers the Whole System, not Hardware only

Implementation of Quality Schemes covers not only equipment but whole systems
Including Design, Installation, O&M services

TÜV Rheinland analyzed the faults in 125 large-scale solar: *“Every other fault that we detect is due to incorrect installation. Poor or even dangerous cable routing, incorrect foundation or installation of the support frame, faults in the connections or grounding and so on. One in five systems exhibits (mainly safety-relevant) faults that are so severe that immediate action is required. And a further 10% of systems have a large number of defects,”*

Source: TÜV Rheinland



Quality is a key aspect to mitigate environmental impact

High failure rates lead to a significant amount of waste

In Germany:

1 MW represents approximately 100 tons of waste
Current installed capacity is 40 GW = 4 million tons

With ca. 1% failure = 40K tons of additional waste to be disposed

The QI Payback



Positive Energy Balance

Higher revenues

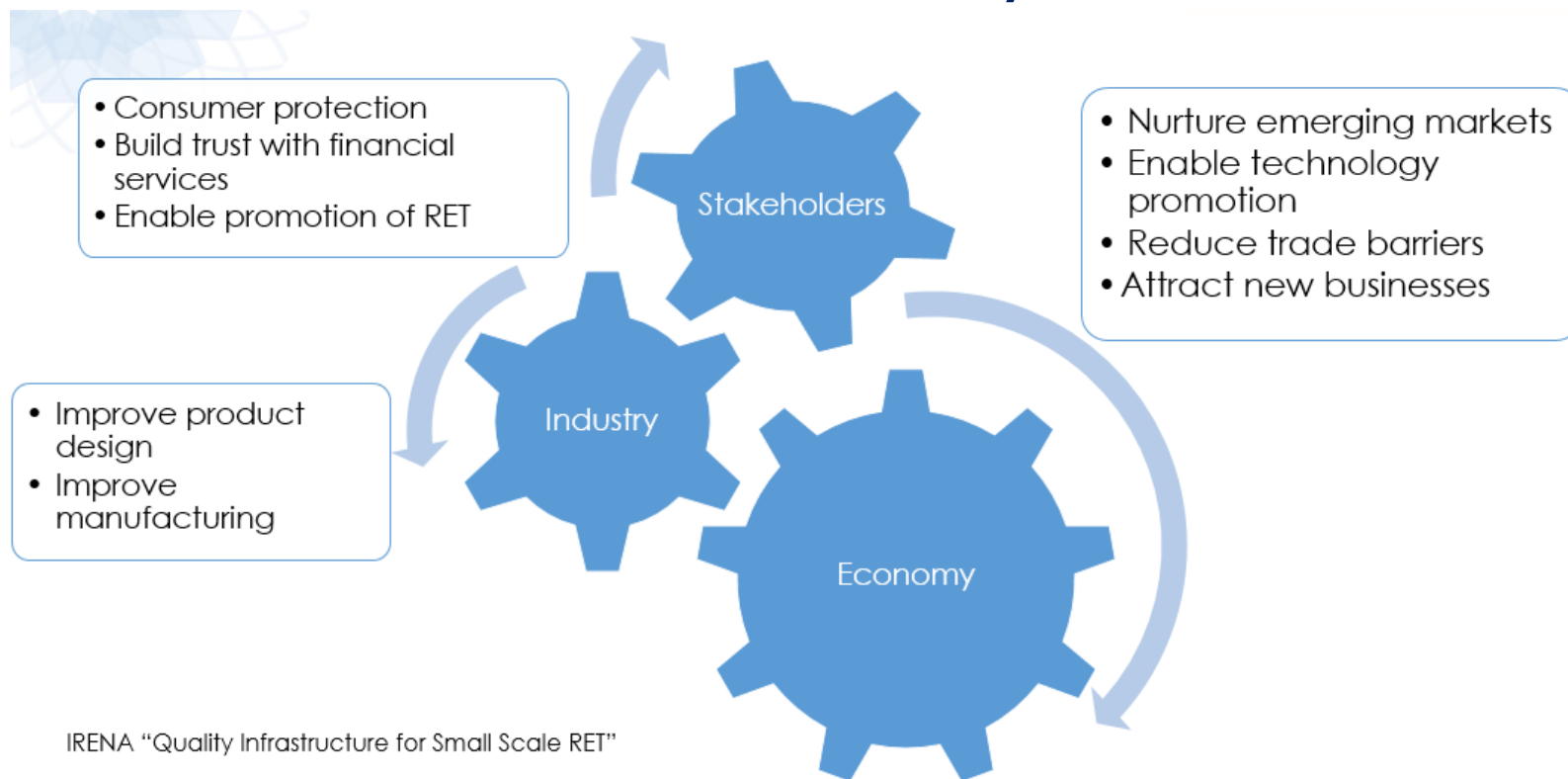
Consumers protection

Mitigate Carbon Footprint

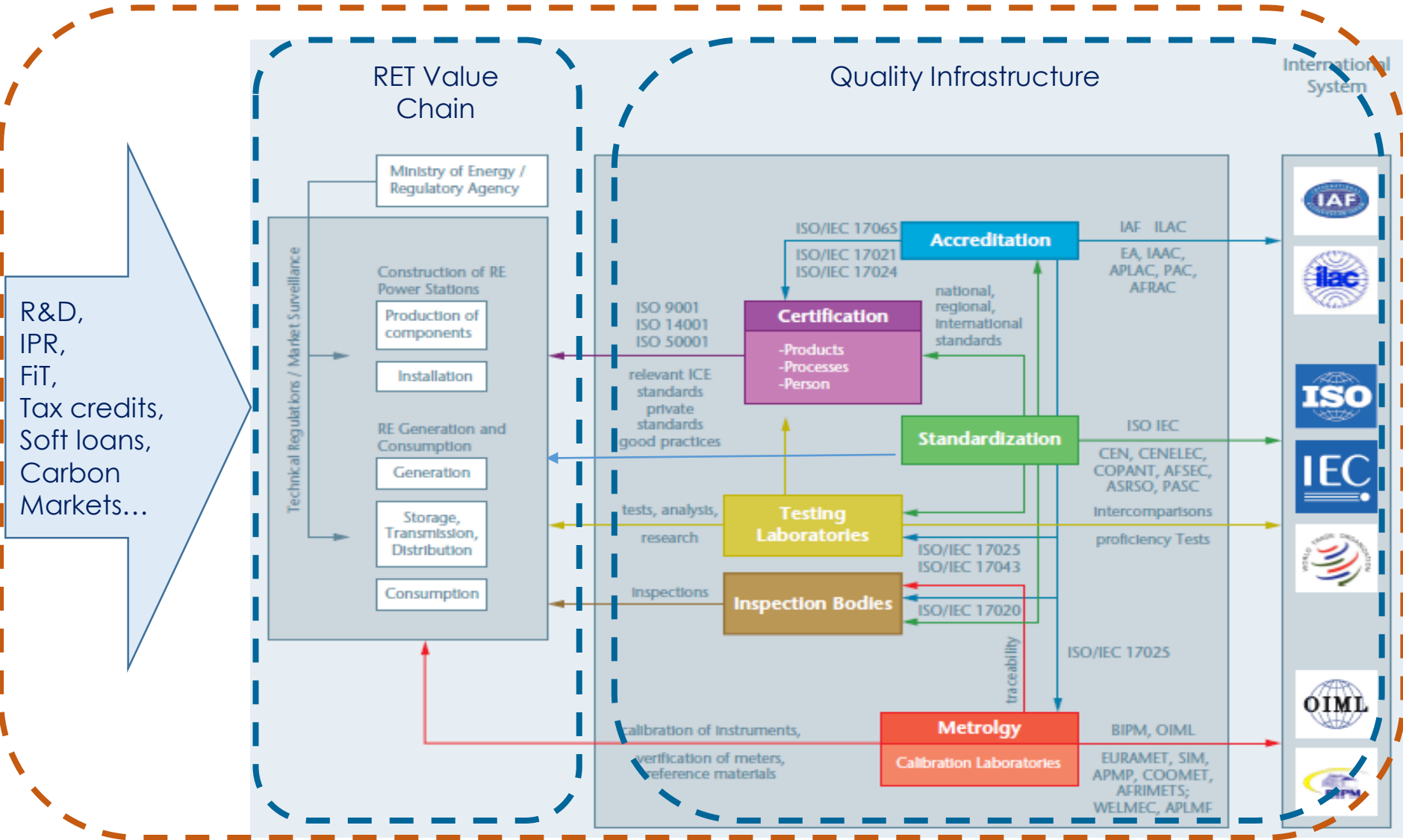


Which **instruments** do we have to mitigate technical risk, attract investment and public acceptance, and meet expectations by all stakeholders in a USD trillion market?

International standards and conformity assessment schemes



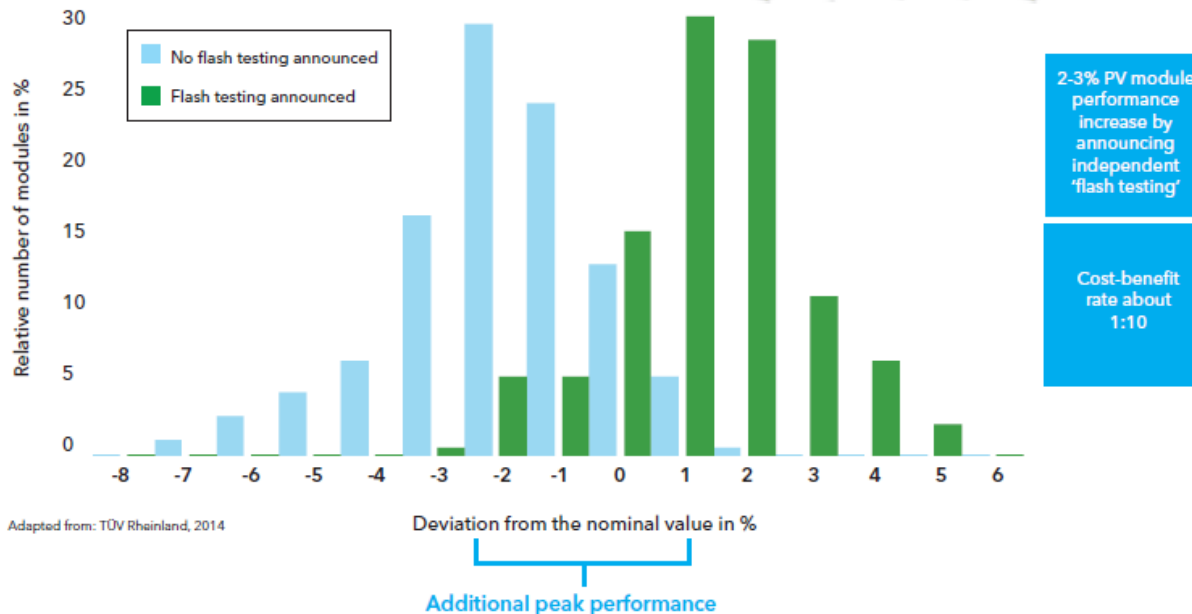
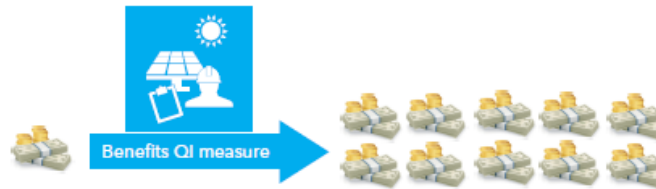
Implementation requires a Quality Infrastructure



The benefits of QI services outweigh their costs – QA in EPC contracts

Example: Higher plant outputs due to module performance testing

Higher outputs due to announced performance testing



Adapted from: TÜV Rheinland, 2014

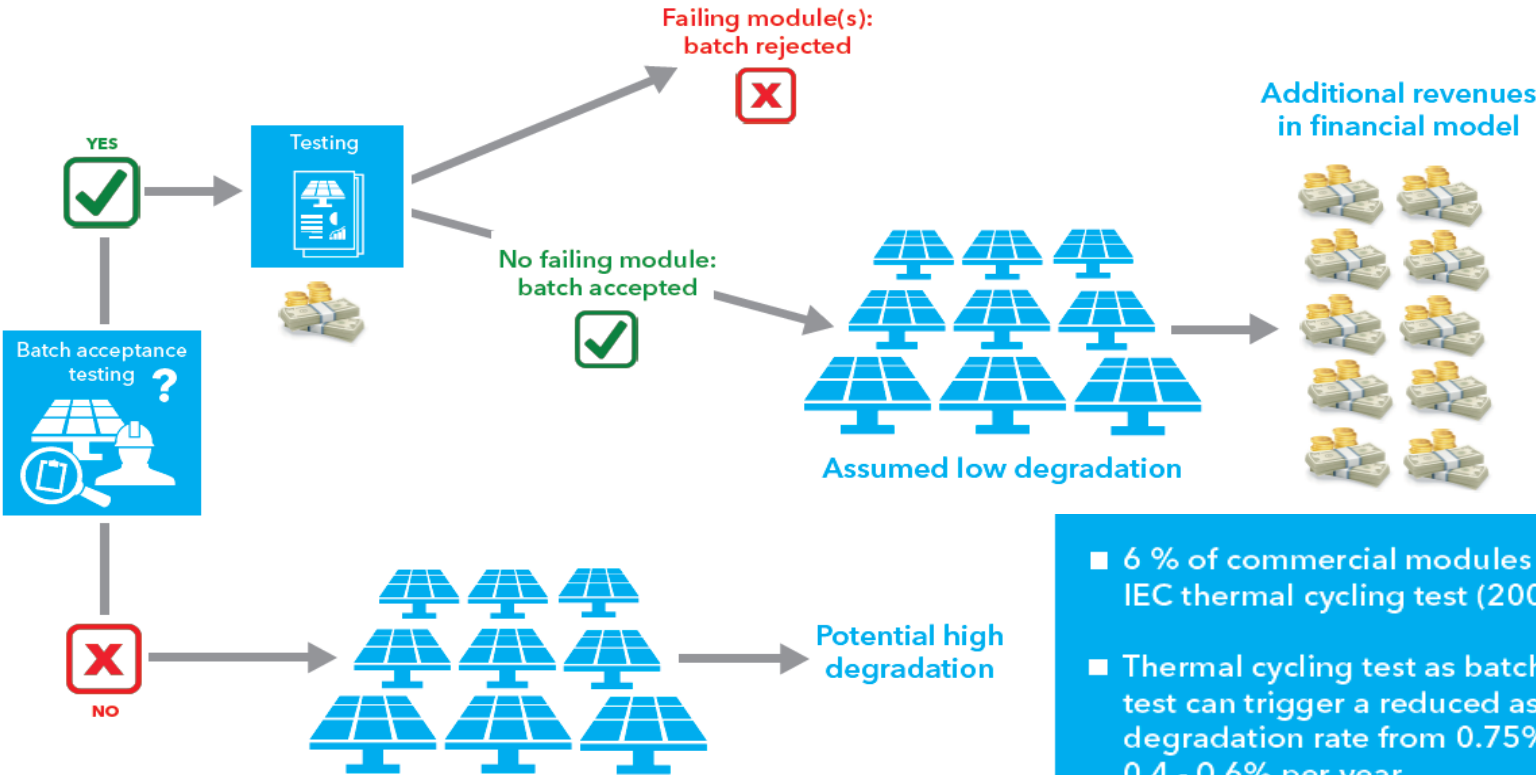
Monetary case

- 20 MW PV plant in southern Europe
- kWh-sales price of 10 ctEUR
- 2-3% higher performance
- Measurement cost 5 – 10 kEUR
- Annual revenue increase 75 – 115 kEUR

The benefits of QI services outweigh their costs – acceptance testing

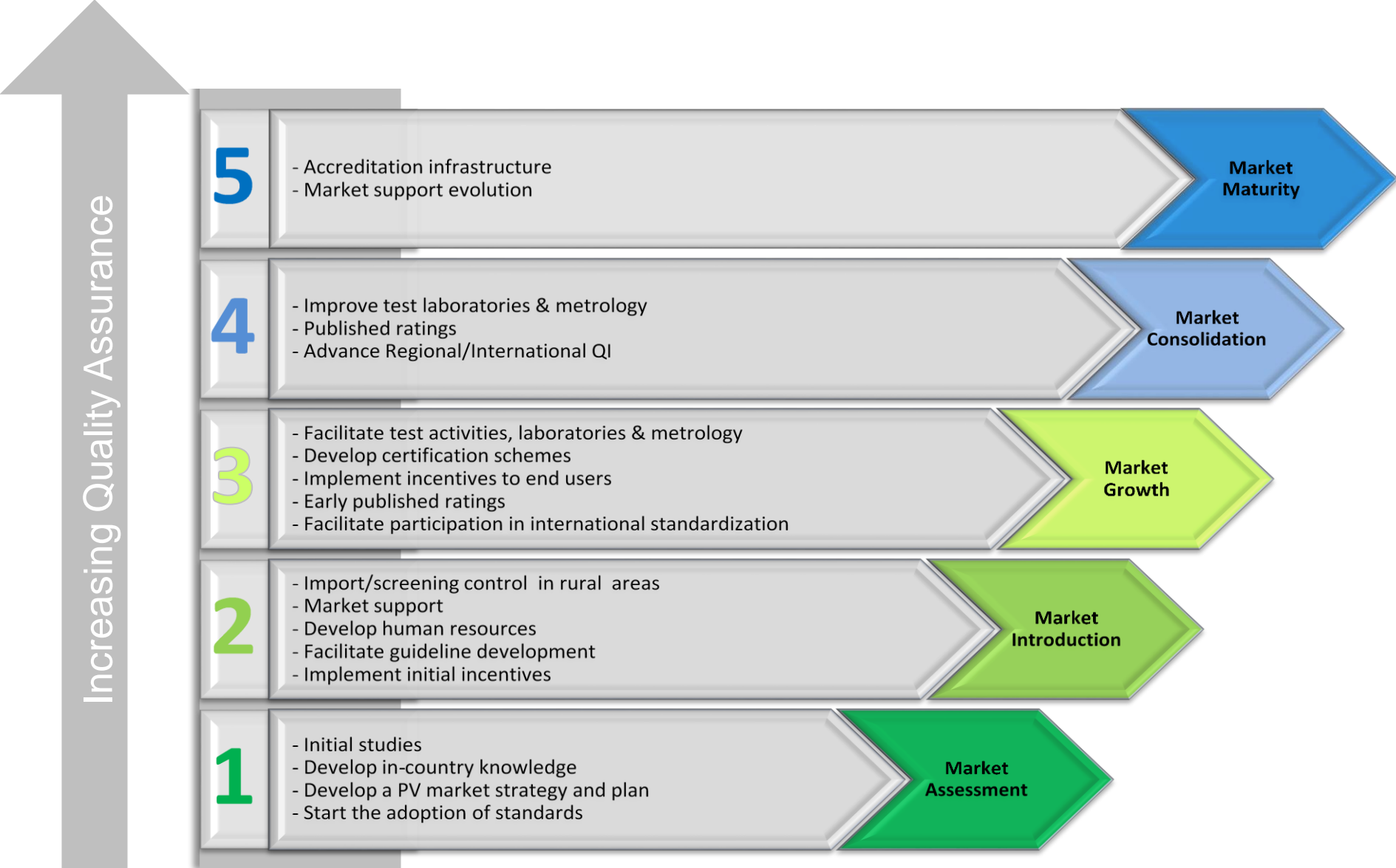
Example: batch acceptance testing


Pre-construction PV module batch acceptance testing allows for additional revenues in financial model



- 6 % of commercial modules do not pass IEC thermal cycling test (200 cycles)
- Thermal cycling test as batch acceptance test can trigger a reduced assumed degradation rate from 0.75% per year to 0.4 - 0.6% per year
- Higher revenues in the financial model
- Cost-benefit rate about 1:10

IRENA uses a five-stage approach for the development of QI





Database of State Incentives for Renewables & Efficiency

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

IREC INTERSTATE RENEWABLE ENERGY COUNCIL

NORTH CAROLINA Solar Center

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solar policy information

PUERTO RICO

Incentives/Policies for Renewable Energy

Printable Version

Puerto Rico - Solar and Wind Contractor Certification

Last DSIRE Review: 12/19/2012

Program Overview:

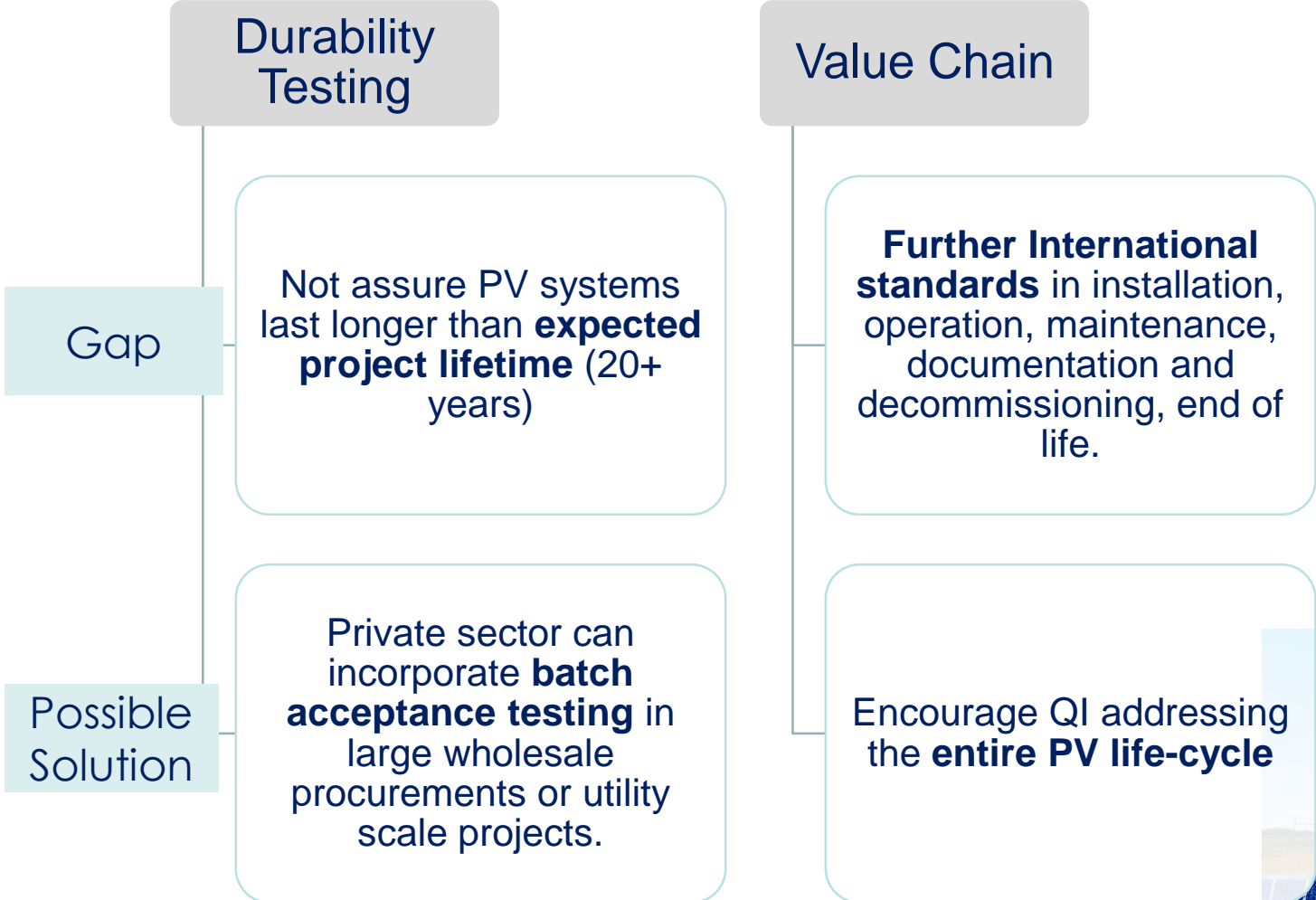
State:	Puerto Rico
Incentive Type:	Solar/Wind Contractor Licensing
Eligible Renewable/Other Technologies:	Photovoltaics, Wind
Applicable Sectors:	Commercial, Installer/Contractor
Web Site:	http://www.aaepn.net/
Authority 1:	C3268 (2008) Act No. 248
Date Enacted:	08/10/2008
Date Effective:	08/10/2008
Authority 2:	Reqlamento 7796 (Certification of Renewable Energy Systems - In Spanish)
Date Enacted:	01/19/2010

USA

- 14 states: Contractor Licensing Requirements for Renewable Energy
- 4 States: Equipment Certification Requirements for Renewable Energy

Source: <http://www.dsireusa.org/>

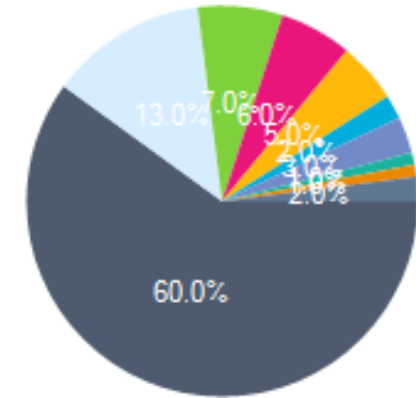
Acting on quality now and in the short future



INSPIRE Platform - Search of International Standards



The screenshot shows the IRENA INSPIRE website. At the top, there is a navigation menu with 'Home', 'Patents', 'Standards', 'Networking', and 'Contact us'. Below the menu is a large banner with the text 'LEARN ABOUT RENEWABLE ENERGY STANDARDS' and an image of wind turbines. Underneath the banner, there are three main sections: 'Interested in RE patents?' (green), 'Learn about RE standards' (orange), and 'Networking and more' (teal). Each section has a 'Read More' button. At the bottom, there is a copyright notice for 2014-2015 IRENA and social media icons for Facebook and YouTube.



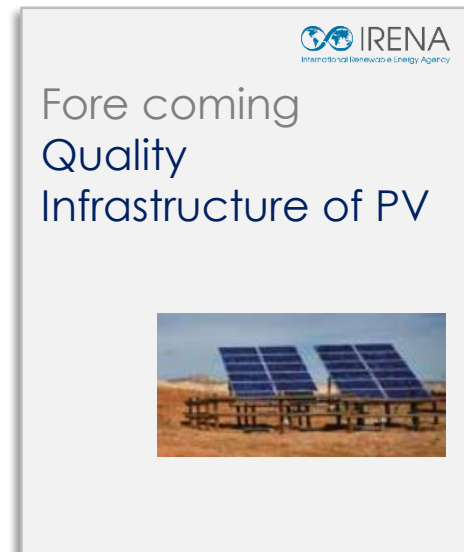
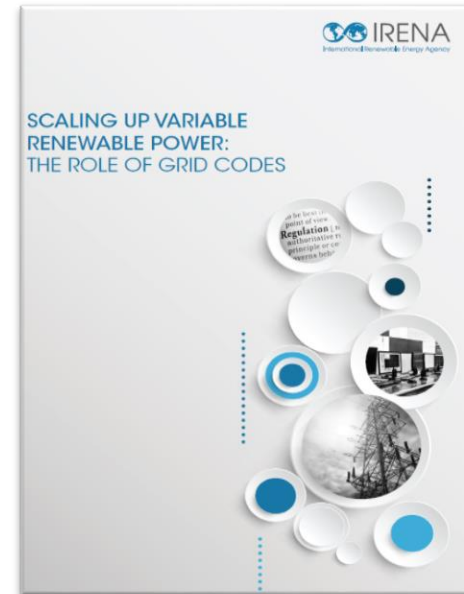
- Testing, Sampling and Analysis
- Product
- Performance
- Pre-Installation
- General
- Installation
- testing, Sampling and Analysis
- Cross-cutting / Performance
- Certification
- Cross-cutting

Access for free:
www.irena.org/inspire

Webinar about INSPIRE:
<https://www.youtube.com/watch?v=O2AOwZH5sxM>

INSPIRE facilitates in a simple way a catalog of the applicable standards for Solar Technologies

Supporting countries to develop and implement QI for RET





Workshop – Developing quality infrastructure for solar water heating systems in LAC

ICE- PTB LAC Project – IRENA -

Green Quality Dialogue

PTB -IRENA



Planning and Technical Standards Development for China's Renewables

IRENA – CREEI – IEC – IECRE



Thank you

We are collecting illustrative cases on the impact of standards and CA on RE markets.

Interested in sharing your case?

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