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Photovoltaics Quality Assurance Task Force (PVQAT)
A Global Effort to Craft Quality and Reliability Standards

Presented by Ingrid Repins

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Co-Authors:
Sarah Kurtz (University of California, Merced)
David Miller, Peter Hacke (NREL)
PVQAT Steering Committee: Tadanori Tanahashi – chair (AIST); George Kelly (Sunset Technology); Chen Li (China General Certification Center); Ingrid Repins (NREL); Tony Sample (EC Joint Research Centre); Harry Wirth (Fraunhofer ISE)

Outline

PVQAT

International PV Quality Assurance Task Force

1. Introduction to PVQAT (International Photovoltaic Quality Assurance Task Force)
   - History
   - Scope
2. Two Examples of Current Activities in PVQAT
3. How Can I Advance the PVQAT Mission of Crafting Quality and Reliability Standards?

History of PVQAT

METI
Kanto Bureau of Economy, Trade and Industry

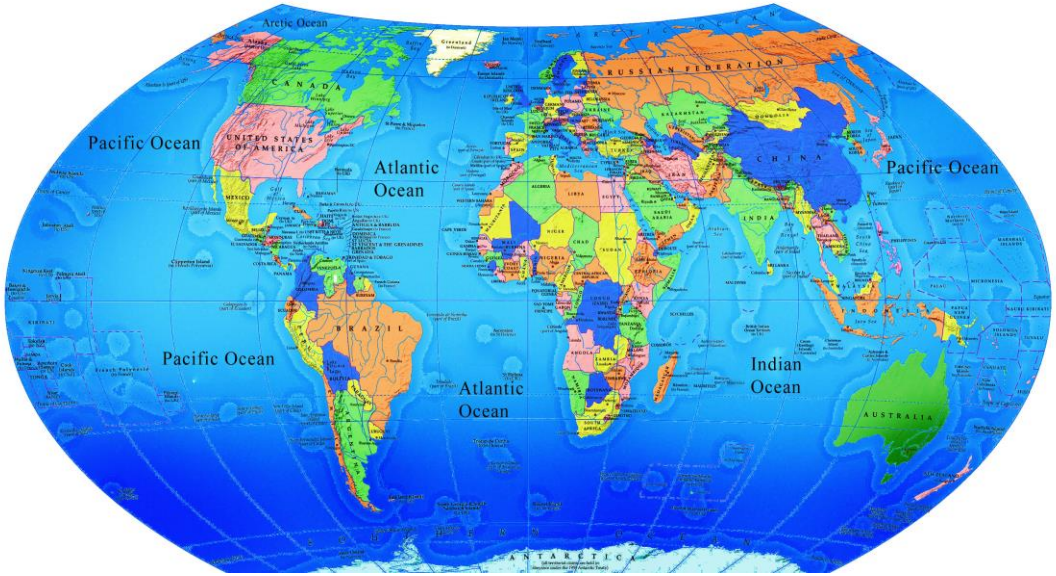
In 2010, Japan wanted to ensure success of their 2nd incentive program for solar systems.

METI asked the United States Department of Energy to join in leading an international effort.

Formation of PVQAT

- Inaugural workshop held in San Francisco, July 2011
  - Representatives from NREL, AIST, PVTEC, METI, DOE, JRC, SEMI, and others
  - More than 100 participants from many countries
- Goals of PVQAT:
  - Improve confidence in PV
  - Ensure module durability, manufacturing consistency, and system verification
  - Achieve these by establishing the scientific basis that can feed into the development of international standards

International collaboration on standards is special opportunity



As the world transitions to renewable energy, we want PV to be reliable!

What if every country created their own requirements for testing of PV modules?

Companies can reduce costs if all countries work from one set of standardized tests.

Tests are vetted by an international group of experts.

IEC

IEC is most widely used in PV

PVQAT supports IEC: Class A Liaison established

PVQAT

International PV Quality Assurance Task Force

PVQAT

- Discussions of problems
- Collaborative research
- Comparison of test results

IEC

International Standards

To facilitate and formalize this interaction a Category A liaison was established January 20, 2017

As a result, PVQAT provides an update at IEC meetings (both at working group and at plenary levels)

PVQAT Lays the Groundwork for New Standards or Revisions

PVQAT collaborations and discussions

- identify new problems,
- compare results of explorations,
- suggest appropriate tests,
- compare results of multiple organizations' attempts to implement a test,
- may introduce a test method into the IEC process when the path is clear,
- are open to everyone,
- uses web conference calls as primary communication to make it easy for researchers to contribute.

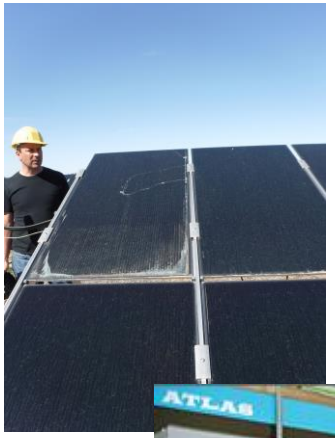
New Observations from field

↓

Scientific studies

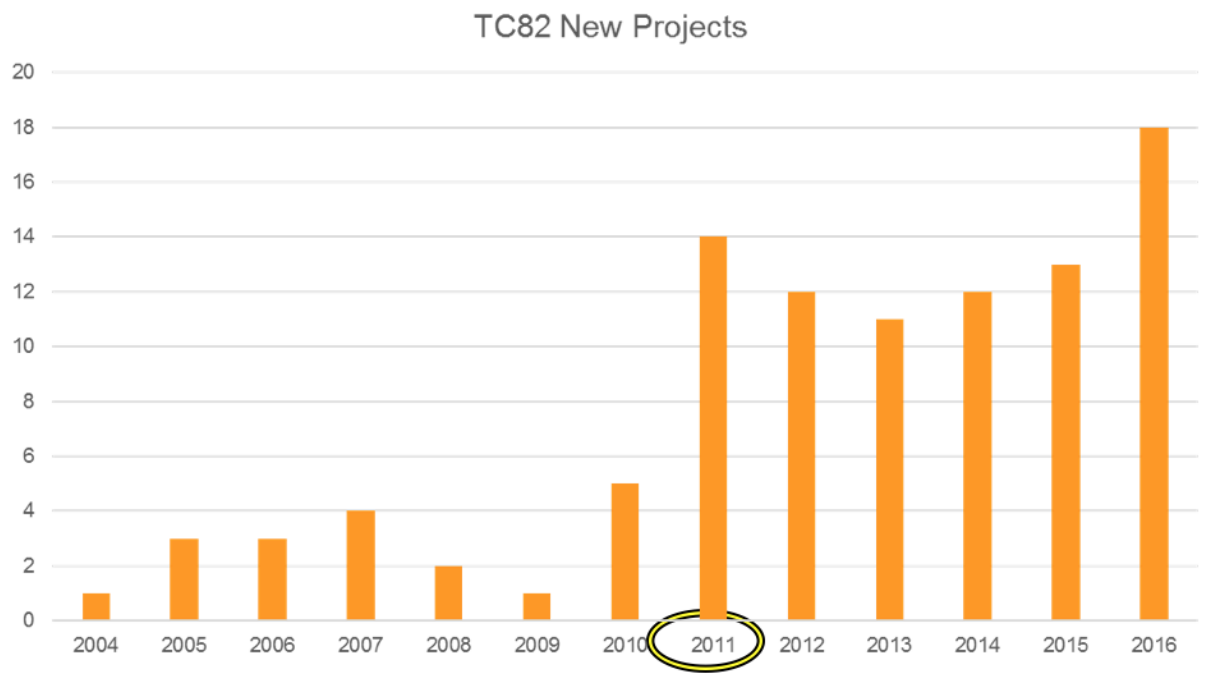
↓

International Standards



PVQAT's Effect on IEC Standards

'PVQAT Effect' on TC82



Remarkable development, demonstrating importance and visibility of IEC standards in PV

From Technical Committee 82 Secretary's Report
Presented at the IEC TC 82 Meeting; Nara, Japan; May 18-19, 2017

PVQAT today

PVQAT

International PV Quality Assurance Task Force

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The International PV Quality Assurance Task Force (PVQAT, "PV cat") leads global efforts to craft quality and reliability standards including:

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MODULE DURABILITY	MANUFACTURING CONSISTENCY	SYSTEM VERIFICATION
A rating system to ensure durable design of PV modules for the climate and application of interest	A guideline for factory inspections and quality assurance (QA) during module manufacturing	A comprehensive system for certification of PV systems, verifying appropriate design, installation, and operation

PVQAT Timeline

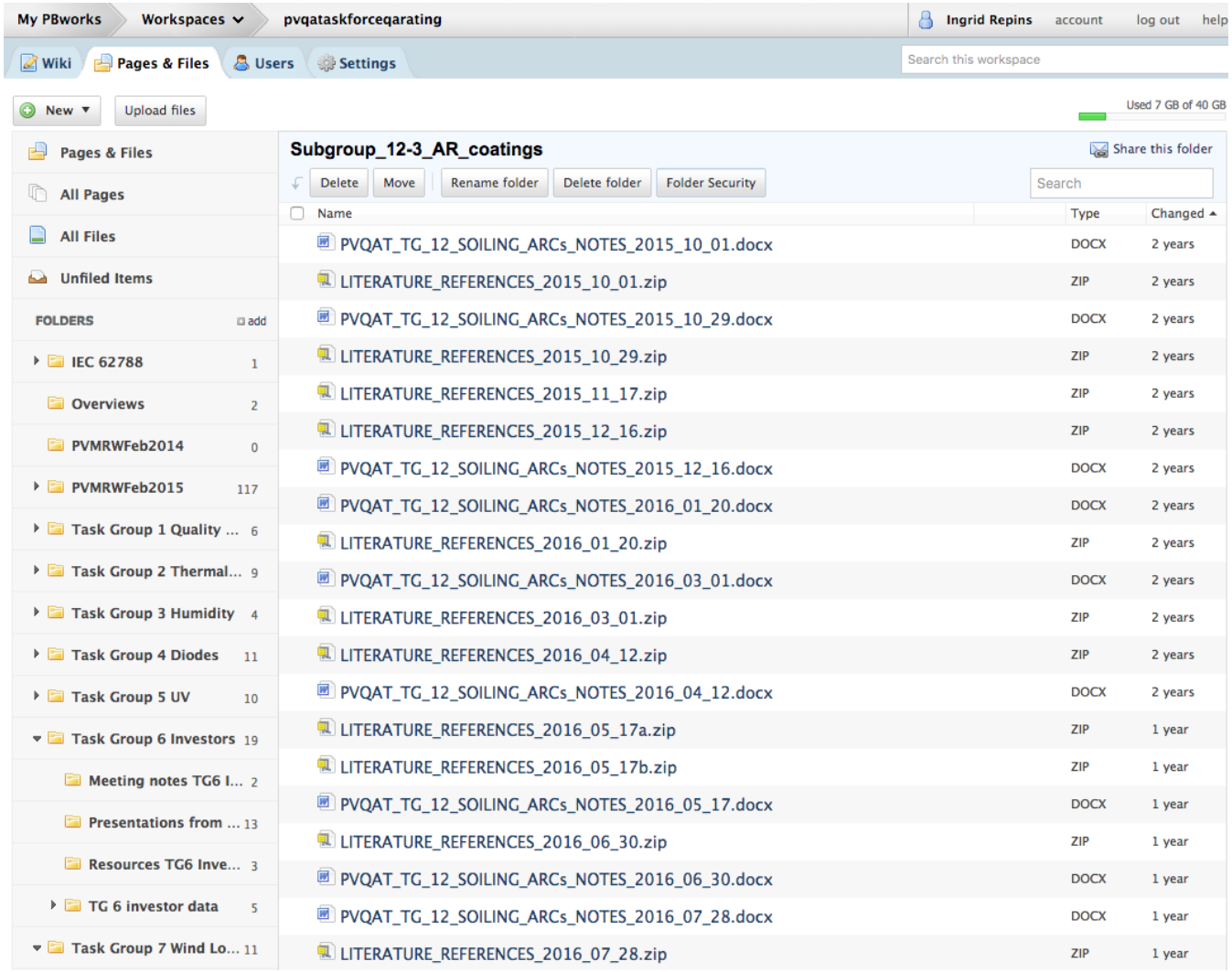
Click to Enlarge

www.pvqat.org

- Website communicates goals and the results of PVQAT and IEC.
- We can post your announcements of meetings or published results.

PVQAT Participants Share Information

- PVQAT participants can share references, presentations, and recordings through the PB Works website.
- Some files relate to task group activities.
- Some files keep PVQAT participants up to date on IEC activities.



PVQAT Task Groups (TG)

English Language

TG1 - Manufacturing Consistency

TG2 - Thermal and Mechanical Fatigue

TG3 - Humidity, Temperature, Voltage

TG4 - Diodes, Shading, Reverse Bias

TG5 – UV, Temperature, Humidity

TG7 –Snow and wind loading

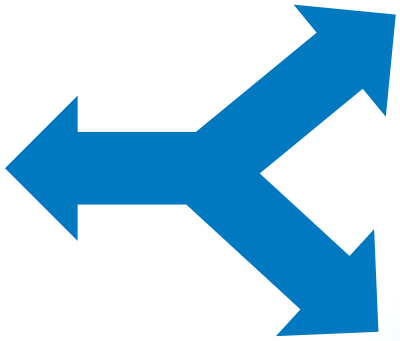
TG8 – Thin Film

TG10 - Connectors and Jboxes

TG11- PV Systems

TG12 - Soiling

- Cross Attendance
- Task group leaders meetings
- Steering Committee



Japanese Language

TG2,3,5 (Joint) - Humidity, Temperature, Voltage, UV

Chinese Language

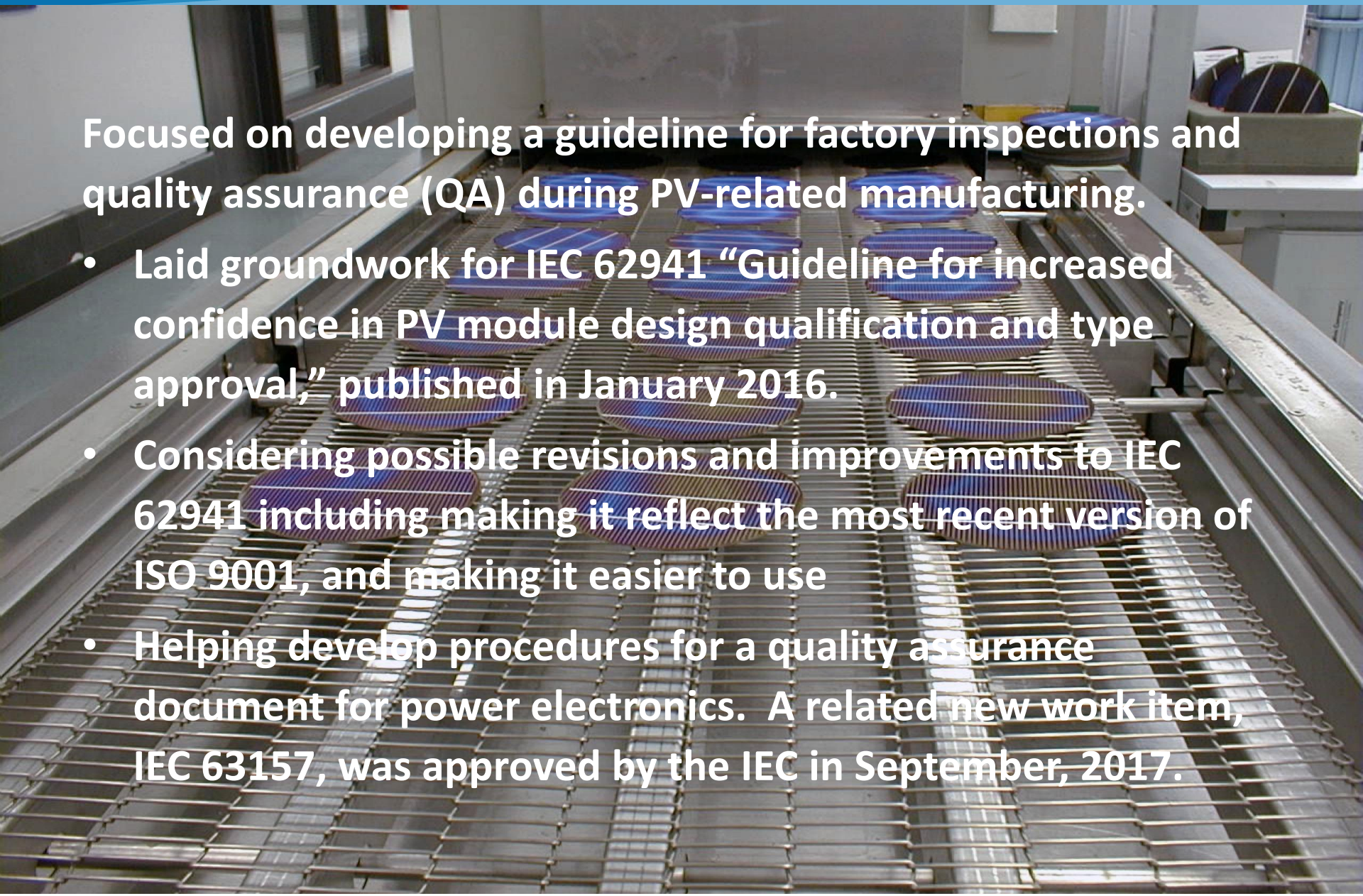
TG5 – UV, Temperature, Humidity

TG7 –Snow and wind loading

TG8 – Thin Film

TG13 - Cells

Task Group 1 – Manufacturing consistency



Focused on developing a guideline for factory inspections and quality assurance (QA) during PV-related manufacturing.

- **Laid groundwork for IEC 62941 "Guideline for increased confidence in PV module design qualification and type approval," published in January 2016.**
- **Considering possible revisions and improvements to IEC 62941 including making it reflect the most recent version of ISO 9001, and making it easier to use**
- **Helping develop procedures for a quality assurance document for power electronics. A related new work item, IEC 63157, was approved by the IEC in September, 2017.**

Success! Manufacturers Have Been Eager to Demonstrate Quality

Home > About Us > Press Releases

Suntech received the IEC TS 62941 certificate which was issued by TUV NORD

Posted on 2017-03-27

JinkoSolar receives IEC TS 62941 PV industry technical specification certification

IEC TS 62941 technical certificatio
quality management system but a

pv magazine

Zertifizierte Qualität

Darüber hinaus werden Solarmodule von unabhängigen Prüfinstituten getestet und zertifiziert.
Als einer der weltweit ersten Hersteller produziert die SolarWorld am Standort Freiberg nachweislich nach IEC TS 62941, der Qualitätsnorm für die PV-Produktion. Seit neuestem hat auch der Verband der Elektrotechnik

Wait - IEC Can Do a Quality Management Inspection?!

Certificates granted through IEC conformity assessment schemes

IEC → Technical standards

- IECEE — Electrical equipment (lighting, toys, some PV module tests, etc.)
- IECQ — Quality assessment system for electronic components
- IECEx — Equipment operating in explosive atmospheres
- New! IECRE — Standardize "system aspect" of complex renewable energy projects.

IECRE was created in 2014. It's now positioned to issue certificates for:

- PV systems commissioning
- Manufacturer factor quality management
- Installation, and O&M quality assurance
- PV system design requirements
- Energy and capacity measurements ……More coming soon!

IECRE Standards

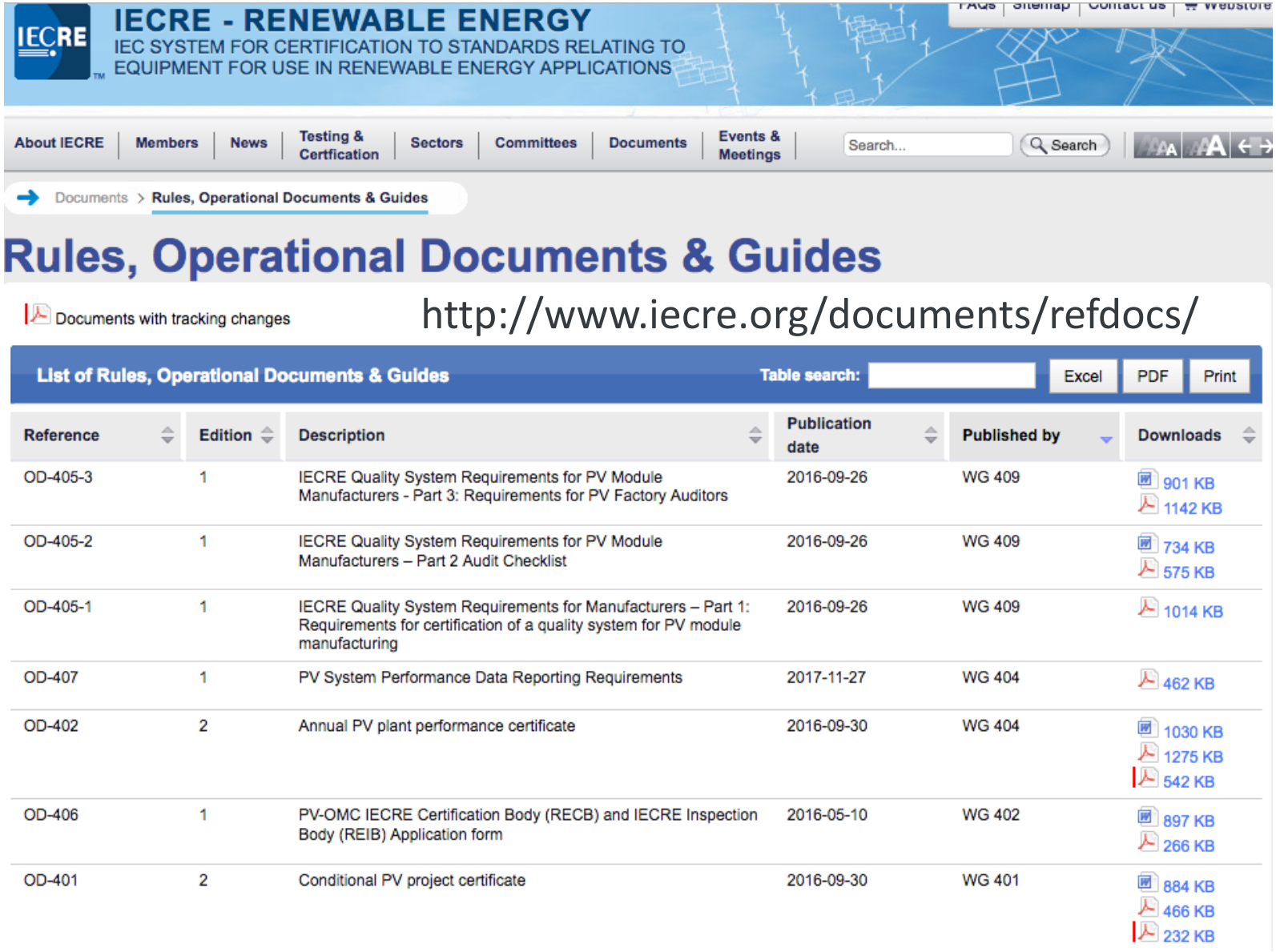
IEC Standards operated by the IECRE

http://www.iecre.org/certification/iecstandards/

List of IEC Standards — Table search: [ ] Excel PDF Print

Standard	Sector	Included in IECRE System
IEC 62446-1:2016 Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 1: Grid connected systems - Documentation, commissioning tests and inspection	PV-OMC REIB	2018-01-15
IEC 62446-2 to be published Grid connected photovoltaic systems - Maintenance of PV systems	PV-OMC REIB	2018-01-15
IEC 62446-3:2017 Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 3: Photovoltaic modules and plants - Outdoor infrared thermography	PV-OMC REIB	2018-01-15
IEC 61724-1:2017 Photovoltaic system performance - Part 1: Monitoring	PV-OMC REIB	2018-01-15
IEC 62548:2016 Photovoltaic (PV) arrays - Design requirements	PV-OMC RECB	2018-01-15
IEC 62738 to be published Design guidelines and recommendations for photovoltaic power plants	PV-OMC RECB	2018-01-15
IEC TS 61724-2:2016 Photovoltaic system performance - Part 2: Capacity evaluation method	PV-OMC RECB	2018-01-15
IEC TS 61724-3:2016 Photovoltaic system performance - Part 3: Energy evaluation method	PV-OMC RECB	2018-01-15
IEC TS 62941:2016 Terrestrial photovoltaic (PV) modules - Guideline for increased confidence in PV module design qualification and type approval	PV-OMC RECB	2018-01-15
IEC 62817:2014 Photovoltaic systems - Design qualification of solar trackers	PV-OMC RECB	2018-01-15
IEC TS 63049:2017 Terrestrial photovoltaic (PV) systems - Guidelines for effective quality assurance in PV systems installation, operation and maintenance	PV-OMC RECB	2018-01-15

IECRE Operational Documents



IECRE - RENEWABLE ENERGY
IEC SYSTEM FOR CERTIFICATION TO STANDARDS RELATING TO EQUIPMENT FOR USE IN RENEWABLE ENERGY APPLICATIONS

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Documents > Rules, Operational Documents & Guides

Rules, Operational Documents & Guides

Documents with tracking changes

http://www.iecre.org/documents/refdocs/

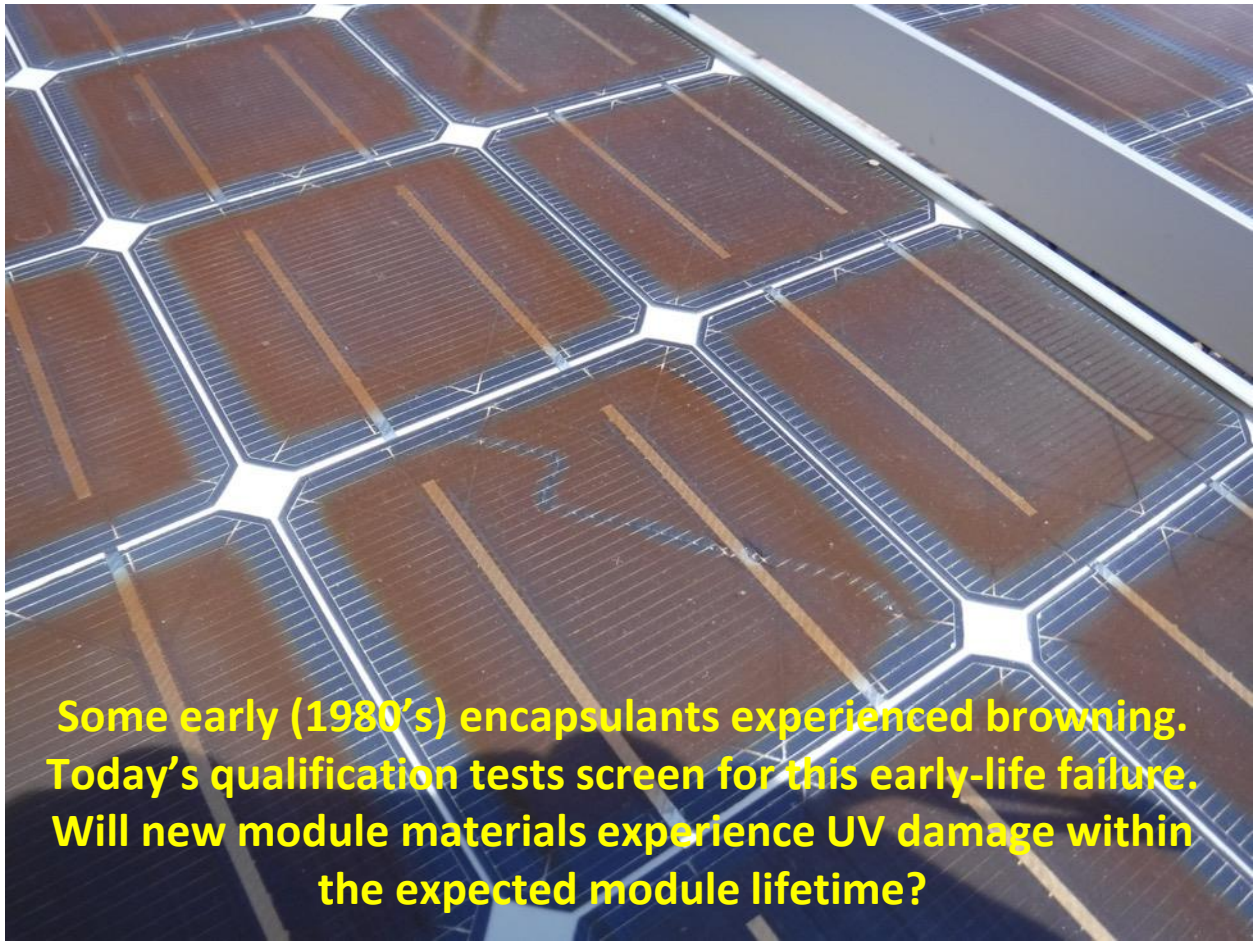
List of Rules, Operational Documents & Guides Table search: Excel PDF Print

Reference	Edition	Description	Publication date	Published by	Downloads
OD-405-3	1	IECRE Quality System Requirements for PV Module Manufacturers - Part 3: Requirements for PV Factory Auditors	2016-09-26	WG 409	901 KB 1142 KB
OD-405-2	1	IECRE Quality System Requirements for PV Module Manufacturers – Part 2 Audit Checklist	2016-09-26	WG 409	734 KB 575 KB
OD-405-1	1	IECRE Quality System Requirements for Manufacturers – Part 1: Requirements for certification of a quality system for PV module manufacturing	2016-09-26	WG 409	1014 KB
OD-407	1	PV System Performance Data Reporting Requirements	2017-11-27	WG 404	462 KB
OD-402	2	Annual PV plant performance certificate	2016-09-30	WG 404	1030 KB 1275 KB 542 KB
OD-406	1	PV-OMC IECRE Certification Body (RECB) and IECRE Inspection Body (REIB) Application form	2016-05-10	WG 402	897 KB 266 KB
OD-401	2	Conditional PV project certificate	2016-09-30	WG 401	884 KB 466 KB 232 KB

Task Group 5 (UV, T, RH)

- **Challenge:** IEC qualification tests (61215, 61646, 61730-2) presently prescribe up to 160 days field-equivalent AM 1.5G UV dose. This is very much less than 25 years of expected deployment!

- **Task Group 5 Activity**: Develop UV- and temperature-facilitated test protocol(s) that may be used to compare PV materials, components, and modules relative to a field deployment.



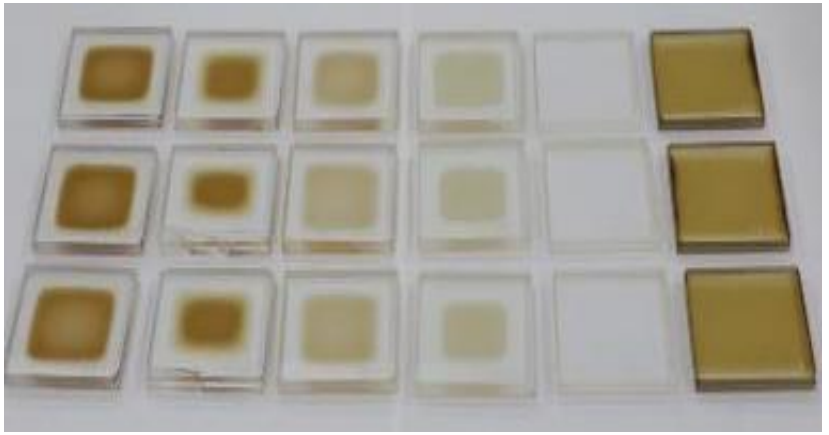
PVQAT TG5 Study 2: 62788-1-7 Optical Durability R-R

Goals of the current study

1. Quantify reproducibility of repeatability of tests used in extended weathering standard (IEC 62788-1-7).
2. Verify pass/fail criteria for IEC 62788-1-7.
3. Quantify activation energies, and acceleration factor in benchmark locations.

Test materials (3 replicates)

1. Contemporary **EVA** (commercial product , **UV cut-off 360 nm**)
2. Contemporary **EVA** (commercial product, **low PID**, **UV cut-off 360 nm**)
3. Contemporary **EVA** (commercial product, **low PID, UV cut-off 230 nm**)
4. A9918 **EVA** (known bad **benchmark** material)
5. **TPO** (R&D formulation, **thermoplastic**, **moderate crystallinity**)
6. **TPO** (R&D formulation, **thermoplastic**, **high crystallinity**)
7. **TPO** (commercial product, **thermoplastic, low crystalinity**)
8. **POE** (R&D formulation, **thermoset**, **with UVA**)
9. **POE** (R&D formulation, **thermoset**, **without UVA**)
10. **PVB** (commercial product, **BIPV** material)
11. **Transparent backsheet** (commercial product) air side
12. **Transparent backsheet** (commercial product) sun side
13. **PS reference** (weathering reference material, SAE J2412/SAE J2527)



Coupon specimens for weathering tests

Weathering The Coupons - Ongoing

Participants (artificial weathering)

1. CREST (Loughborough University)
2. DNP
3. Dow-Chemical
4. DuPont
5. Eye Applied Optics
6. Fraunhofer CSE
7. NREL (A3 & A4 & A5)
8. Q-Lab
9. RenewSys (QUV, B3)
10. Suga
11. Sun Power

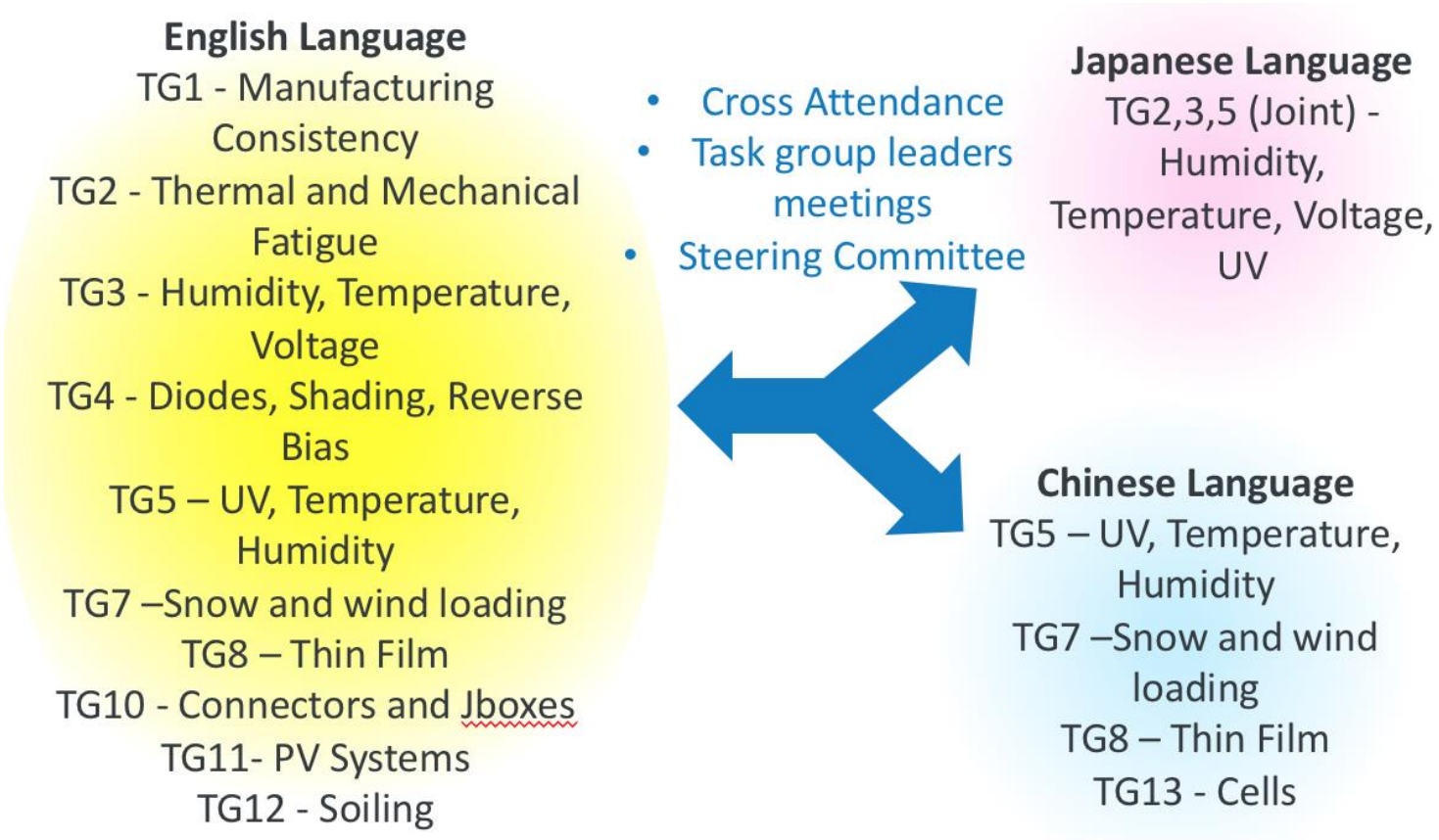
Participants (natural weathering)

a. ATLAS (Miami)
b. ATLAS (Phoenix, 1x)
c. ATLAS (Phoenix, EMMA)
d. KACST (Riyadh)
e. NIST (Gaithersburg)
f. NREL (Golden, 1x)
g. NREL (Golden, EMMA)
h. Q-Lab (Cleveland)
i. SERIS (Singapore)

Contact:
David.Miller@nrel.gov

How Can I Help Advance the PVQAT Mission of Quality and Module Durability, Manufacturing Consistency, and System Verification?

- Participate in a PVQAT task group. (We especially need people with PV problems.)



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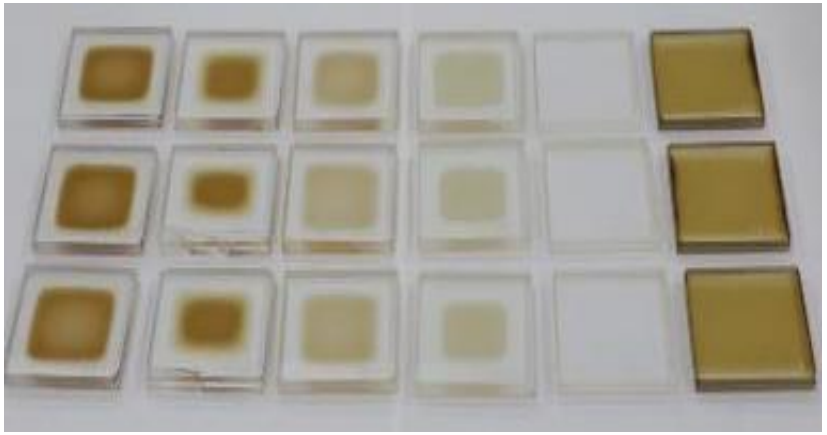

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- Propose or conduct research that uses PVQAT participation or leadership as a milestone.
- If you review research proposals, recognize the value of PVQAT participation.


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