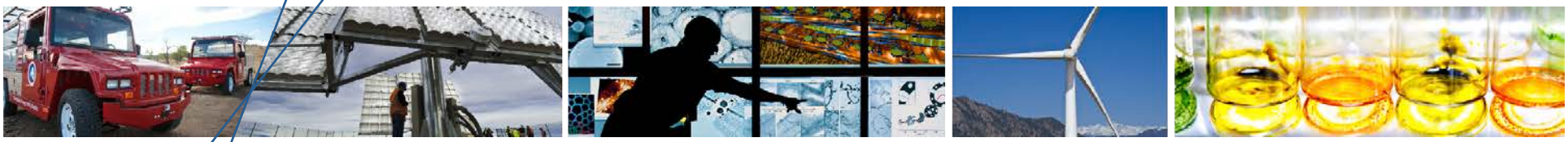
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Photovoltaic Quality Assurance Task Force

PVQAT



John Wohlgemuth

October 23, 2014

Solar ABCs Stakeholders Meeting

Outline

- What is PVQAT?
- History
- Goals of PVQAT
- List of Task Groups
- Efforts Underway
  - Comparative Testing
  - PV Quality Management System

PVQAT

- Effort to develop a PV module rating system that meets needs of all countries and customers – A Single Test Protocol
- Define concepts for creation of standards that allow stakeholders to quickly assess a module's ability to withstand regional stresses.
- Participation open to all who want to contribute to the effort.
- Program relies on research done by volunteers around the world.
- Effort is to guide world wide research to answer important questions related to testing that predicts outdoor performance of PV modules.

History: International PV Module QA Forum

- Held in San Francisco, CA July, 2011.
- Approximately 150 people from around world participated.
- Established the International PV Module QA Task Force – now PVQAT.
- Defined goals of PVQAT
- Prioritized field failure modes observed for crystalline silicon modules
- Established 6 Task Groups, 4 of which were specifically chartered with addressing the prioritized failure modes.
- Provided for future creation of additional Groups.
- Established a Steering Committee and Team Leaders for each Task Group.

Goals of PVQAT

1. ***To develop a QA rating system that provides comparative information about the relative durability of PV modules to a variety of stresses as a useful tool to PV customers and as a starting point for improving the accuracy of quantitative PV lifetime predictions.***
   1) Compare module designs
   2) Provide a basis for manufacturers' warranties
   3) Provide investors with confidence in their investments
   4) Provide data for setting insurance rates
2. **Create a guideline for factory inspections of the QA system used during manufacturing.**

Task Groups in PVQAT

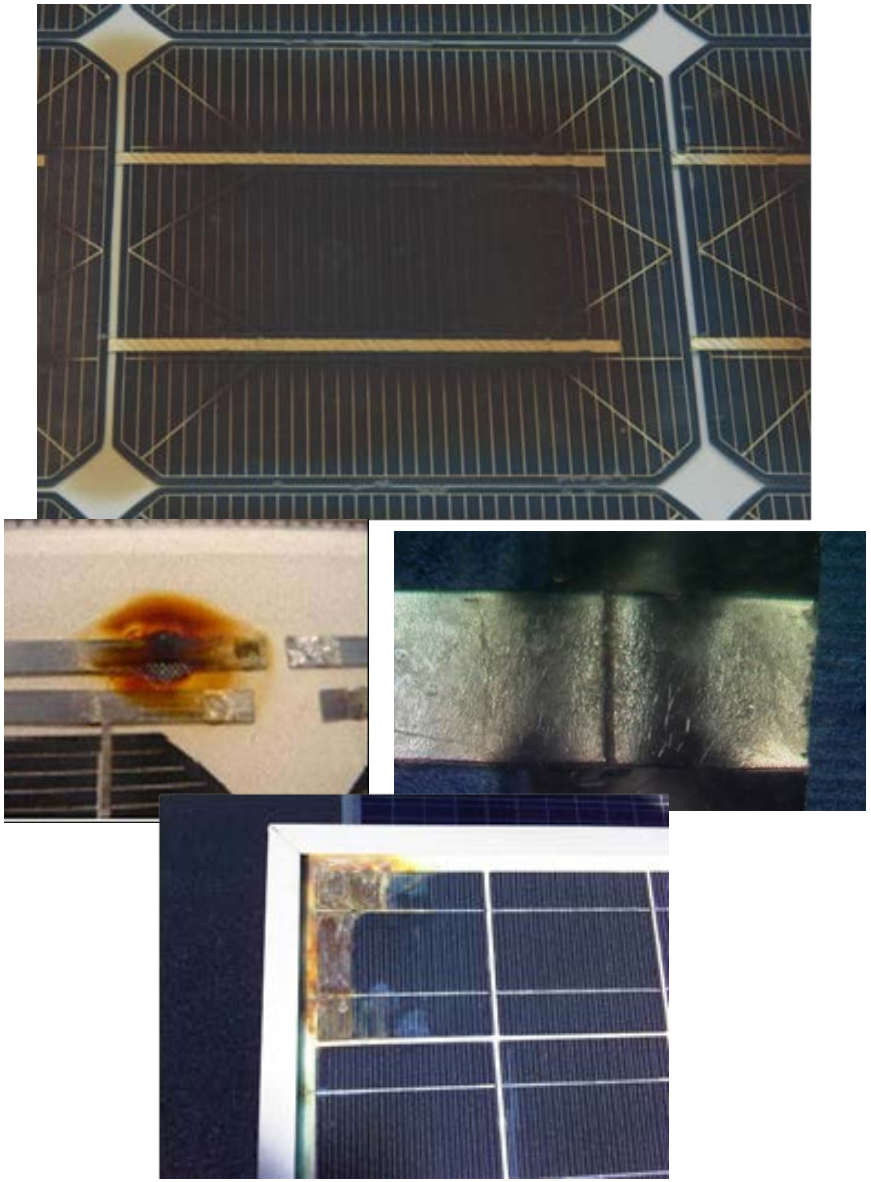
1. PV QA Guidelines for Module Manufacturing
2. Testing for thermal and mechanical fatigue
3. Testing for humidity, temperature and voltage
4. Testing for diodes, shading and reverse bias
5. Testing for UV, temperature and humidity
6. Communications of rating information
7. Testing for snow and wind load
8. Testing for thin film modules
9. Testing for CPV
10. Testing for Connectors
11. QA for PV Systems

Three Major Efforts Underway

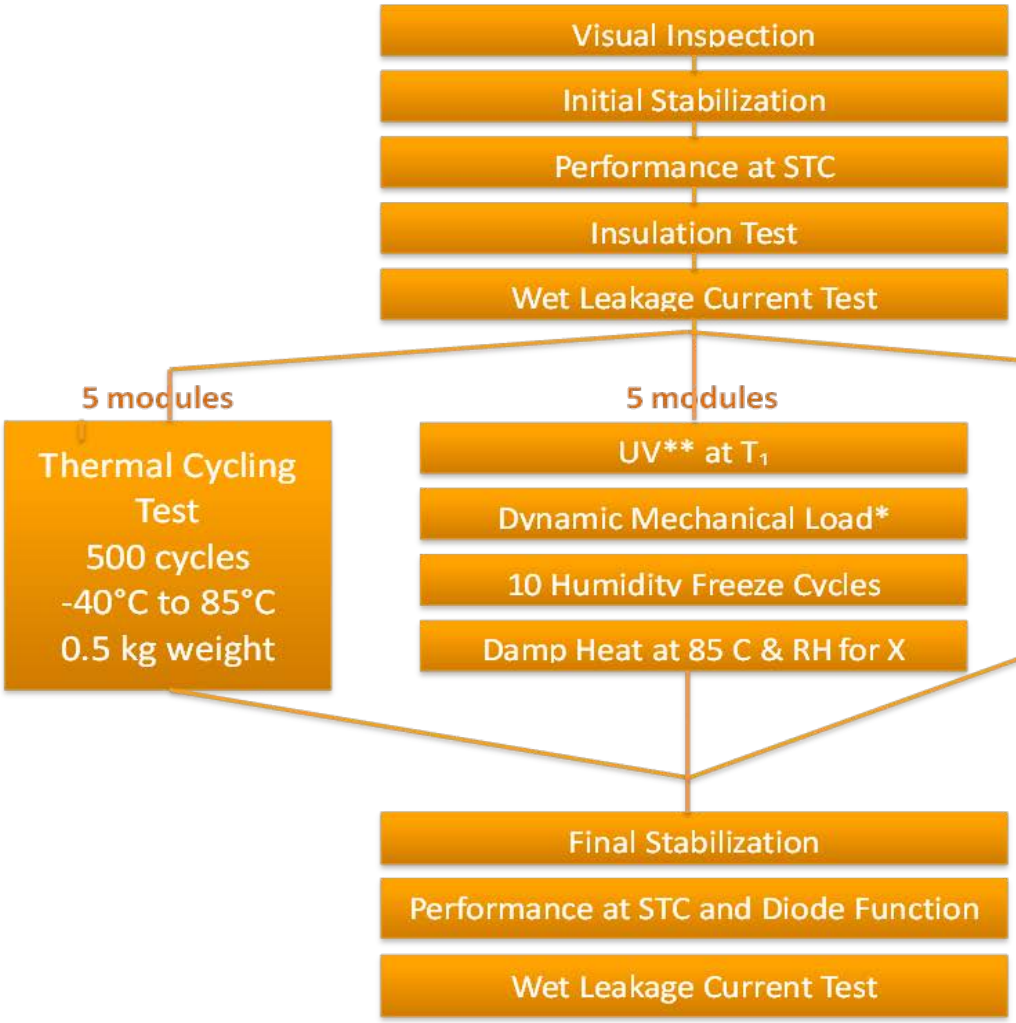
1. *Qualification of durability of design of products* for chosen climate and mounting - Testing
2. *Guide for audit of consistent manufacturing* of products built to that design – QA System
3. *Certification process for system verification* to ensure adequacy of design, installation, and operation – IECRE **(Assume GK told you about this)**

Key Result 1: Comparative Testing

- Selected 3 climate zones & 2 mounting configurations.
- Identified 3 major field degradation modes:
  - Discoloration of encapsulant
  - Breakage of solder bonds and interconnect ribbons
  - Delamination of encapsulant from glass and/or cells
- Developed test sequence to address these 3 issues



Flow Chart of Proposed Comparative Test Plan



Material Test

UV Test**

Climate	Mounting Class	
	Rack	Roof
Moderate	T_1 = 60 °C	T_1 = 80 °C
	RH = 85%	RH = 85%
	X = 500 h	X = 500 h
Warm Damp	T_1 = 80 °C	T_1 = 80 °C
	RH = 85%	RH = 85%
	X = 1000 h	X = 1000 h
Hot Dry	T_1 = 80 °C	T_1 = 100 °C
	RH = 40%	RH = 40%
	X = 1000 h	X = 1000 h

*Details specified in Draft Standard

** UV Exposure TBD

Proposed Rating System

IEC 60721-2-1 Climate	Mounting Class	
	Rack Mount	**Roof Mount**
Moderate (Temperate)	Leg 1: 500 thermal cycles Leg 2: Increased UV exposure at 60 °C followed by DML, 10 cycles of HF and 500 hours of Damp Heat (85/85)	Leg 1: 500 thermal cycles Leg 2: Increased UV exposure at 80 °C followed by DML, 10 cycles of HF and 500 hours of Damp Heat (85/85)
Warm Damp Equable (Tropical)	Leg 1: 500 thermal cycles Leg 2: Increased UV exposure at 80 °C followed by DML, 10 cycles of HF and 1000 hours of Damp Heat (85/85)	Leg 1: 500 thermal cycles Leg 2: Increased UV exposure at 80 °C followed by DML, 10 cycles of HF and 1000 hours of Damp Heat (85/85)
Extremely Warm Dry (Desert)	Leg 1: 500 thermal cycles Leg 2: Increased UV exposure at 80 °C followed by DML, 10 cycles of HF and 1000 hours of Damp Heat (85/40)	Leg 1: 500 thermal cycles Leg 2: Increased UV exposure at 100 °C followed by DML, 10 cycles of HF and 1000 hours of Damp Heat (85/40)

Comparative Testing

- **Agreement from thin film Task Group 8 that the proposed testing sequence is as relevant to thin film modules as to crystalline Si.**
- **Has become an approved IEC TC82 project.**
- **Committee Draft (CD) has been written and submitted to Working Group 2 for review at Oct WG2 meeting.**

PV Quality Management System

- **Task Group 1 wrote "Proposal for a Guide for Quality Management Systems for PV Manufacturing: Supplemental Requirements to ISO 9001-2008". This document can be found on NREL's website.**
- **IEC Central Office indicated that a document with this title and scope could not be developed as an IEC standard.**
- **Name changed to "IEC 62941 TS – Guideline for increased confidence in PV module design qualification and type approval" and approved as TC82 project.**
- **Combination of Task Group 1 and WG2 project team prepared a new version as a Committee Draft (CD).**
- **CD is now out for review by National Committees within TC82 with vote and comments due Oct. 29.**
- **Provide comments to me for inclusion in official US response.**

Questions?

http://www.nrel.gov/pvqat