Summary of the San Francisco Forum

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Aims

To create a QA rating system to differentiate the relative durability of module designs
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

To create a guideline for factory inspections of the QA system used during manufacturing.

Hosted by
NREL
AIST
PVTEC

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JRC
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SEMI PV Group
International PV Module QA Forum was held on July 15-16, 2011, at the Moscone Center in San Francisco, CA, USA.

Agenda
Session I. Defining the Need
Session II. Existing Standards
Session III. Regional and Application-Specific Requirements
Session IV. Proposed New Tests
Session V. Proposals for Manufacturing QA Guideline and QA Rating Methodology
   Including breakout discussions
Session VI. Prioritization of Failure/Degradation Mechanisms
   Including breakout discussions

The detailed agenda and presentations made over the two days are available on the forum websites in English and Japanese;
http://www.nrel.gov/ce/ipvmqa_forum/
Manufacturing process QA

- A manufacturing QA guideline for defining factory controls and guiding inspections will be developed to become a part of the certification process.

- A PV QA Task Group is being formed to:
  - Work with IEC to define factory inspections and retest guidelines that would become part of the IEC 61215 certification process
  - Work with SEMI and other standards organizations to develop standards for material, component and equipment qualification and in-line testing
**QA Rating Methodology**

The breakout discussions of Session V identified a list of important stresses and added any missing stresses to those already in the table.

<table>
<thead>
<tr>
<th>Stress</th>
<th>Rating system</th>
<th>Environmental definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Numeric value for maximum system voltage</td>
<td>System voltage</td>
</tr>
<tr>
<td>Temperature</td>
<td>Class Hottest, Hot, Warm, Cool</td>
<td>Use Arrhenius behavior and create maps for rack and roof mounting</td>
</tr>
<tr>
<td>Thermal cycling</td>
<td>Class A, B</td>
<td>Thermal cycling comes from changes in irradiance and weather</td>
</tr>
<tr>
<td>Humidity</td>
<td>Class Humid, Dry</td>
<td>Average humidity; make map</td>
</tr>
<tr>
<td>Snow</td>
<td>Numeric rating for kg of static load</td>
<td>Snow load from local building code</td>
</tr>
<tr>
<td>Salt spray</td>
<td>Numeric severity rating</td>
<td>Distance from ocean</td>
</tr>
<tr>
<td>Hail</td>
<td>Numeric rating for size of hail</td>
<td>Size of hail balls experienced locally</td>
</tr>
<tr>
<td>UV</td>
<td>Class A, B</td>
<td>Class A indicates high-altitude or high-irradiance site</td>
</tr>
<tr>
<td>Wind</td>
<td>Numeric rating for maximum wind gust</td>
<td>Maximum wind speed seen during gusts</td>
</tr>
<tr>
<td>Transportation</td>
<td>Rough/Smooth</td>
<td>Paved/unpaved roads, train, etc.</td>
</tr>
<tr>
<td>Farmland</td>
<td>Pass/Fail</td>
<td>Ammonia in agricultural area</td>
</tr>
</tbody>
</table>
Session VI. Prioritization of Failure/Degradation Mechanisms

The breakout discussions of Session VI concentrated on a priority list of known failure and degradation mechanisms.

It will not be possible to test for every failure mechanism; as such the breakout discussions of session VI prioritized the failure and degradation mechanisms that are most important in determining a module’s service life.
The PV QA Task Force was formed at the conclusion of the Forum and consists of five Task Groups;

**Task Group 1:** PV QA Guideline for Manufacturing Consistency  
(leader Ivan Sinicco)

**Task Group 2:** PV QA Testing for Thermal and mechanical fatigue including vibration (leader Chris Flueckiger)

**Task Group 3:** PV QA Testing for Humidity, temperature, and voltage  
(leaders John Wohlgemuth and Neelkanth Dhere)

**Task Group 4:** PV QA Testing for Diodes, shading and reverse bias  
(leaders Vivek Gade and Paul Robusto)

**Task Group 5:** PV QA Testing for UV, temperature and humidity  
(leader Michael Köhl)
Want to Volunteer!

To volunteer for **Task Group 1**, individuals may contact the leader directly or request access to the website at

http://pvqataskforcemanufacturingqa.pbworks.com/

To volunteer for **Task Groups 2-5**, individuals may contact the leaders directly or request access to the website at

http://pvqataskforceqarating.pbworks.com/
Roadmap-Goals and Milestones

- **Goals:** to create a single set of QA standards and guidelines.
  - A QA rating system
  - A manufacturing QA guideline

- **Milestones (interim):**
  - QA standards and guidelines for Si PV Modules
    - Task Group proposal (s) to IEC TC82 WG2 Spring 2012
    - Task Group proposal (s) to IEC TC82 WG2 Fall, 2012
    - Testing under the international QA standard begins Spring 2012.

- **Meetings:**
  - #1 International QA Forum @ San Francisco, USA Jul.15-16, 2011
  - Introductory EU meeting @ Hamburg, Germany Sep.8, 2011
  - APEC meeting @ San Francisco, USA Sep. 15-16, 2011
  - APEC meeting @ Taipei, Taiwan Oct. 12-13, 2011
  - #2 International QA Forum @ Tokyo, Japan Dec. 7, 2011
  - #3 International QA Forum @ Europe Spring, 2012
PV Module QA is one of the most critical challenges for healthy growth of the industry; Improved PV QA reduces risks for PV system users and investors.

A single international approach is needed to find effective solutions. International PV Module QA Forum, managed jointly by NREL, AIST, and EU DG-JRC, to define the need and create an action plan.

International development of a QA rating system and a guideline for a QA system for the manufacture of crystalline Si PV modules are of highest priority.

The PV QA Task Force (currently with 5 Task Groups) is being formed to tackle these tasks and will work with IEC, SEMI and other standards organizations.

Further work will be required to extend this approach to thin-film and CPV testing and to quantify the meaning of the test results.