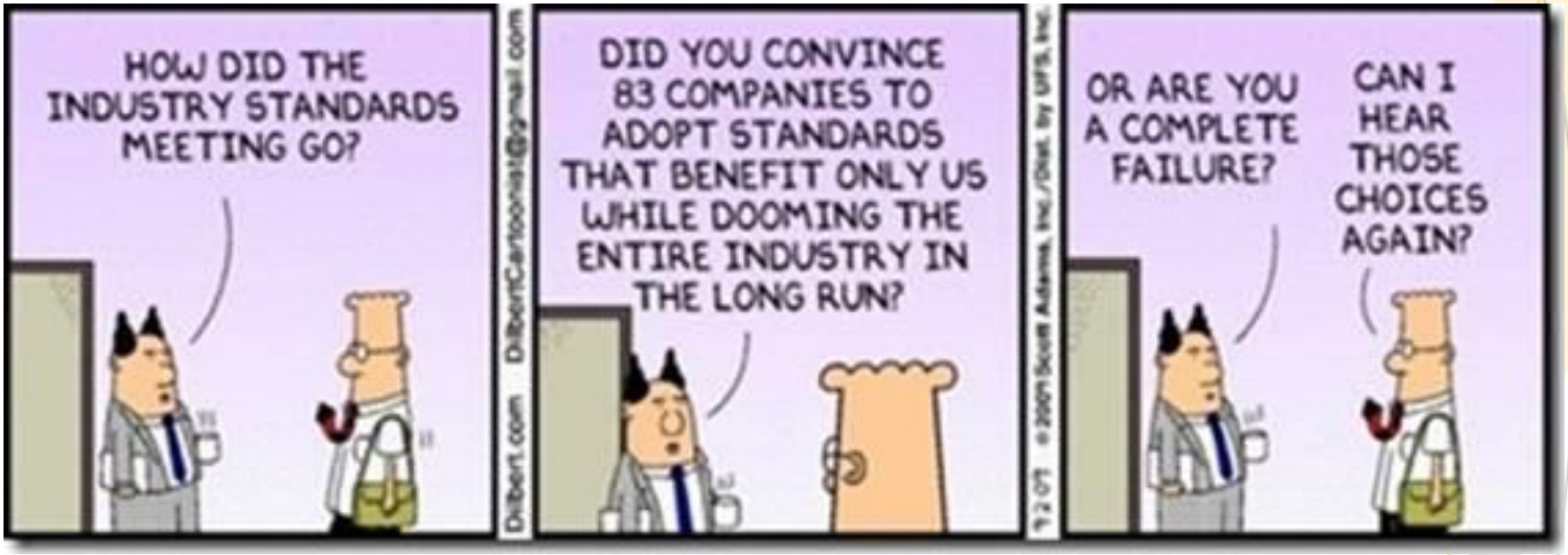
Solar Standards Development

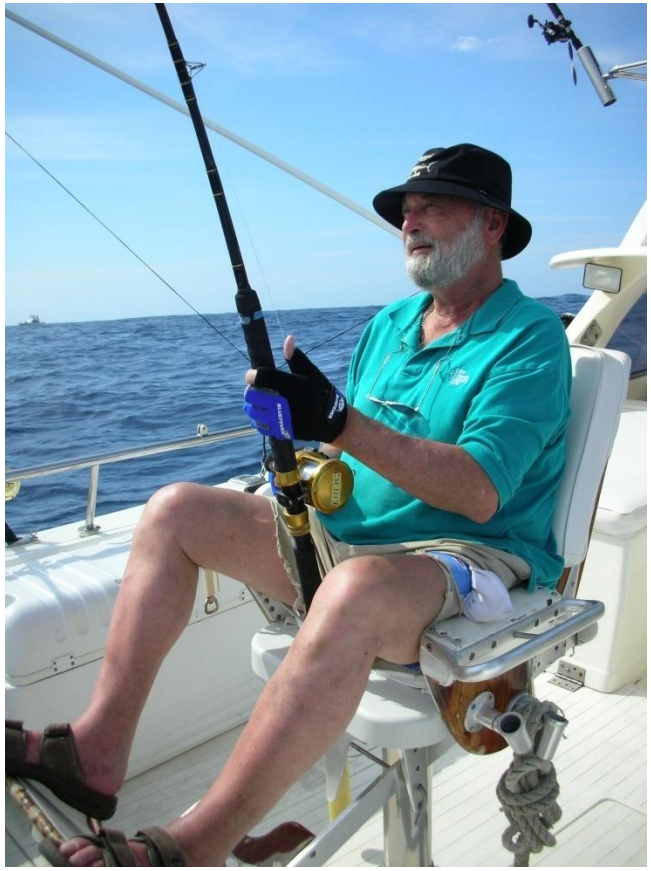
Apex 2010

Dave Torp, IPC

Standards Development



Solar Standard Initiatives



- Industry Review of Solar Standards
- Gaps Analysis – Identification of Needs
- IPC Solar Standards Initiatives- Filling the Gaps

Review of Industry-General Standards

ISO 9845-1, Solar energy - Reference solar spectral irradiance at the ground at different receiving conditions, Part 1: Direct normal and hemispherical solar irradiance for air mass 1,5

DIN 5034-2, Daylight in interiors; principles.

IEC 61725, Analytical expression for daily solar profiles

Review of Industry Cell & Module Standards

EN 50380, Datasheet and nameplate information of photovoltaic module.

IEC 60891, Procedures for temperature and irradiance corrections to measured I-V characteristics of crystalline silicon photovoltaic devices

IEC 60904-1, Photovoltaic devices. Part 1: Measurement of photovoltaic current-voltage characteristics

IEC 60904-2, Photovoltaic devices. Part 2: Requirements for reference solar cells

IEC 60904-2/A1, Photovoltaic devices. Part 2: Requirements for reference solar cells, Amendment 1

Review of Industry-Cell & Module Standards

IEC 60904-3, Photovoltaic devices. Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data

IEC 60904-5, Photovoltaic devices - Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method

IEC 60904-6, Photovoltaic devices - Part 6: Requirements for reference solar modules

IEC 60904-6/A1, Photovoltaic devices - Part 6: Requirements for reference solar modules, Amendment 1

IEC 60904-7, Photovoltaic devices - Part 7: Computation of spectral mismatch error introduced in the testing of a photovoltaic device

IEC 60904-8, Photovoltaic devices - Part 8: Measurement of spectral response of a photovoltaic (PV) device

Review of Industry Cell & Module Standards

IEC 61829, Crystalline silicon photovoltaic (PV) array - On-site measurement of I-V characteristics

IEEE 929, Recommended practice for utility interface of residential and intermediate PV systems

IEEE 1262, Recommended practice for qualification of PV modules

IEEE 1513, Recommended practice for qualification of concentrator photovoltaic modules

Review of Industry-System Standards

IEC 60364-7-712, Electrical installations of buildings - Part 7-712: Requirements for special installations or locations - Solar photovoltaic (PV) power supply systems.

IEC 61194, Characteristic parameters of stand-alone photovoltaic (PV) systems

IEC 61702, Rating of direct coupled photovoltaic (PV) pumping systems

IEC 61724, Photovoltaic system performance monitoring - Guidelines for measurement, data exchange and analysis

IEC 61727, Photovoltaic (PV) systems - Characteristics of the utility interface

IEC 61683, Photovoltaic systems - Power conditioners - Procedure for measuring efficiency

Review of Industry-System Standards

IEC/TR2 61836, Solar photovoltaic energy systems - Terms and symbols

IEC 62124, Photovoltaic Stand-Alone Systems – Design Qualification and Type Approval.

IEEE 928, Recommended criteria for terrestrial PV power systems

IEEE 1373, Recommended practice for field test methods and procedures for grid-connected PV systems

IEEE 1374, Guide for terrestrial PV power system safety

Review of Industry-Test Methods

ASTM E 927, Standard Specification for Solar Simulation for Terrestrial Photovoltaic Testing.
ASTM E 973, Standard Test Method for Determination of the Spectral Mismatch Parameter Between a Photovoltaic Device and a Photovoltaic Reference Cell.
ASTM E 1021, Test Methods for Measuring Spectral Response of Photovoltaic Cells.
ASTM E 1143, Standard Test Method for Determining the Linearity of a Photovoltaic Device Parameter with Respect To a Test Parameter.
ASTM E 1596, Test Methods for Solar Radiation Weathering of Photovoltaic Modules.
ASTM E 1799, Standard Practice for Visual Inspections of Photovoltaic Modules.
ASTM E 1802, Standard Test Methods for Wet Insulation Integrity Testing of Photovoltaic Modules.

Review of Industry-Test Methods

ASTM E 1830, Standard Test Methods for Determining Mechanical Integrity of Photovoltaic Modules.
ASTM E 2047, Standard Test Method for Wet Insulation Integrity Testing of Photovoltaic Arrays.
ASTM E 2236, Standard Test Methods for Measurement of Electrical Performance and Spectral Response of Nonconcentrator Multijunction Photovoltaic Cells and Modules.
ASTM G 173, Standard Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 37° Tilted Surface.

Review of Industry-Safety Standards

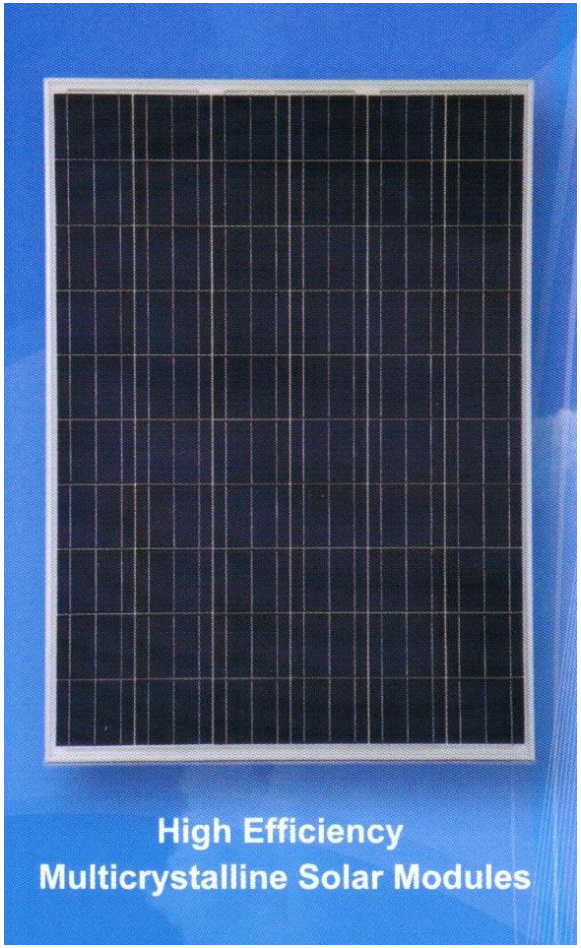
UL 1703, Standard for Flat-Plate Photovoltaic Modules and Panels.

UL 1741, Standard for Inverters, Converters, and Controllers for Use in Independent Power Systems.

Gap Analysis

- Many standards exist for solar industry.
- Existing standards do not address assembly of solar modules and panels.
- IPC standards focus on the assembly requirements of solar modules and panels.

IPC Solar Initiatives



- Lamination Standard
- Final Assembly Standard
- Tabbing and Stringing Material Standard

IPC Solar Initiatives

- Lamination Scope

  – This subcommittee will develop Acceptance Standards for the Lamination of Glass-Backside-Foil Solar Modules with crystalline solar cells using encapsulation sheets as an adhesive material.

  The Standard will include visual and other performance criteria for encapsulation sheets, glass, photovoltaic cells, ribbons, bus bars and backside foil as they relate to creating the basic laminated assembly.

  The post laminated assembly would need to have specific visual criteria for uniformity of lamination, cell position within the fabrication and evidence of structural sealing. Criteria will also be established for the photovoltaic cell visual quality after undergoing the stresses of the lamination process.

IPC Solar Initiatives

- Final Assembly Scope
  - This subcommittee will develop visual acceptance standards for the solar panel in final module assembly. This will include junction boxes and other attributes which would need to be inspected. For example for the junction boxes used in solar panels this would include inspection criteria for sealants and potting compounds used in the attachment. The sealants and potting compounds used could have cracking and moisture ingress so a visual inspection quality system would need to be put in place to determine acceptability which this subcommittee will help to address.

Solar Initiatives

- **Tabbing and Stringing Material Scope**
  - Solar panel modularization relies upon the creation of a reliable, low resistance electrical interconnect between the individual cells. It is therefore crucial that the two main aspects of the interconnect (the connection between the solar cell and the conductor, and the conductor itself) are reliable. This specification defines means of ascertaining the acceptability of use of the conductive materials in module assembly. Included in this are PV interconnect ribbon and silver conductive paste.

IPC Solar Initiatives

- New market segment for IPC.
- Focused on assembly operations of solar modules panels.
- Looking for a few good volunteers to help with development.