



# 2015 IECRE: PV System Certification Workshop

IEC System for Certification to Standards Relating to Equipment  
for Use in Renewable Energy Applications (IECRE System)

NREL PV Reliability Workshop

26 Feb 2015

Chair: George Kelly (Sunset Technology)



# Today's Program



- Background and Current Status of the IECRE System (Sandy Butterfield, REMC Chairman)
- Current Status of the PV Sector of IECRE (G. Kelly)
- Stakeholders Perspectives
  - Financers/Investors/Owners
  - Certifying Bodies/Test Laboratories
  - Manufacturers/EPCs/ O&M Providers
- Survey Results (G. Ball)
- **Lunch**
- Review of PV Rules of Procedure
  - Participants rotate in 4 groups
- Issues to be Resolved (John & Alex)



# IECRE PV Survey



- The goal of this workshop is to gather wide input from the PV community, leading to acceptance of the new system by all involved.
- **The survey is intended to solicit input on how a PV certification scheme can help meet your needs.**
- Please complete a paper copy if you didn't fill out the survey online when you registered.

#	SURVEY SECTION	INTENT
1	PV Plant Application	To help scope out whether the standards should govern different types and sizes of PV systems or just one size fits all
2	PV Power Plant Installation Scope	To help identify the governing boundary of the standard i.e., From which point in the plant stage till where
3	PV Plant Certification	Establish <i>certification types and requirements</i> for the certification bodies to follow within the standard's scope
4	Safety and Security of Power Plant	To help identify whether safety and security are areas to address. If so what specifically should be included
5	Performance Verification and Validation	To identify items regarding performance that should be included in standard and how verification is done on data accuracy, assumptions, and metrics on ongoing basis
6	Financial Performance	To identify the factors which contribute most to the successful operation of the asset



# Introduction to IECRE

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Sandy Butterfield



# PV-OMC Status

**Solar PV Operating Management Committee**

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George Kelly



# IECRE PV Forum



- 18-Sep-2014 in Boulder, CO
  - Participation by 28 individuals representing 6 member body countries, including 4 officers of TC 82
- Initiated activities of PV OMC (per REMC Decision 12/2014) pending election of OMC officers
  - Call for nomination of officers issued in October
- Formed 1 permanent Working Group and 3 temporary Task Groups
- Made 2 formal recommendations to REMC



# PV OMC



## Recommendations to REMC

- Recommend WG001 should include as many **common issues** as possible in the RE system rules of procedure.
- Recommend REMC should engage in outreach to **financial stakeholders**  
(e.g., PV OMC is planning a series of workshops in Asia, Europe and North America to collect input that can be used to guide future activities)





# PV OMC Task Groups



- Three temporary task groups for creation of sector documents (task leaders in parentheses):
  - TG401: [Terms of Reference and Scope](#) for PV Rules of Procedure (R. Bedi)
  - TG402: [PV Rules of Procedure](#) and applicable standards to be considered for assessments (G. Kelly)
  - TG403: Assessment procedures and documentation required for [initial acceptance of CB/TL](#) in the PV sector (S. Rai)
- Documents to be presented for review at next PV OMC meeting



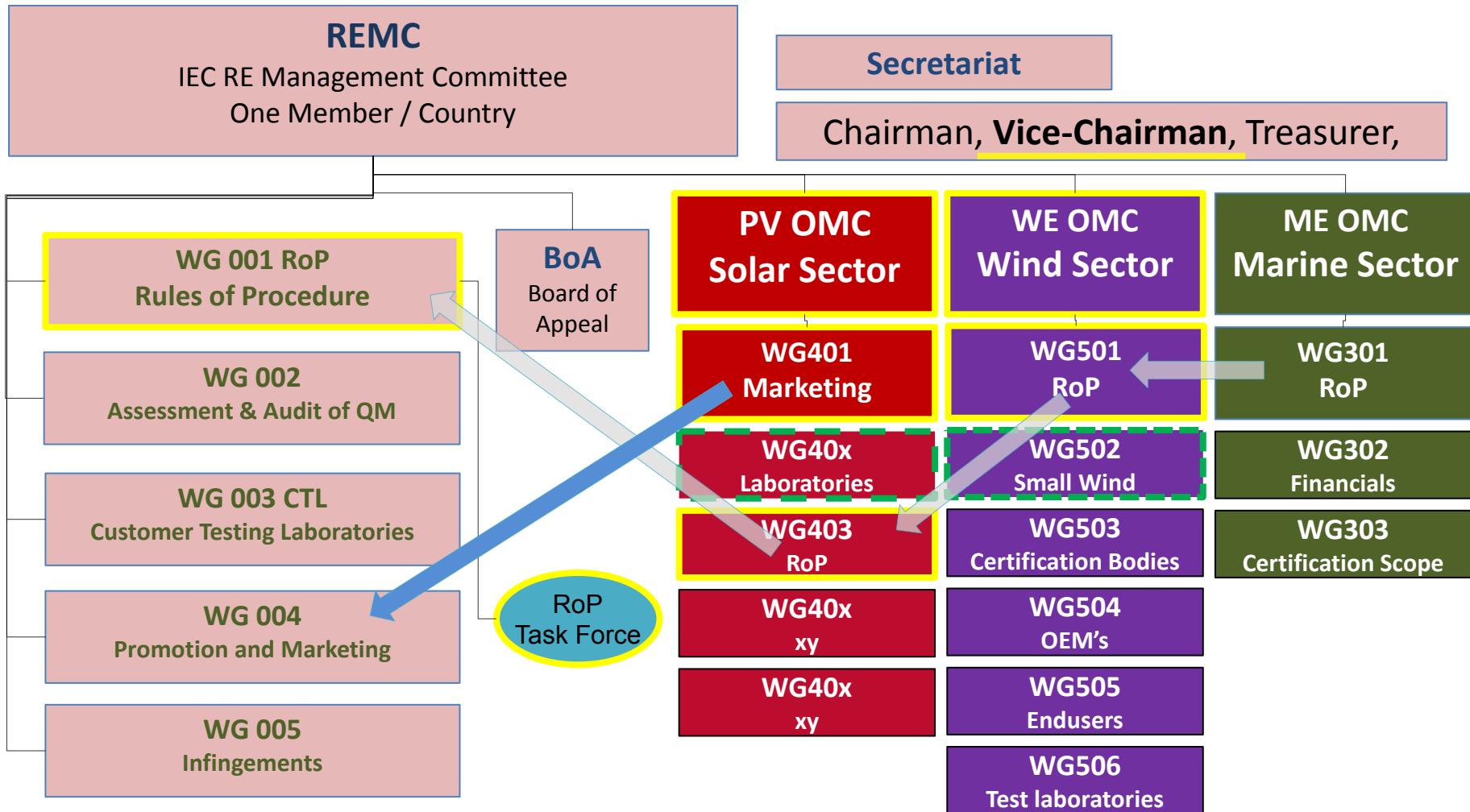
# PV OMC Working Group



- PV OMC formed permanent WG401 on **Market Surveillance** with the following scope:
  - to collect information about problems observed in existing PV systems and
  - to develop statistics over time to analyze trends
- Call for nomination of convenor and WG members circulated to NCs in October
- Some **confusion** about scope and numbering



# Defined Structure of IEC RE REMC + Committees + Working Groups





# WG401 Activities



- **Market Surveillance:**
  - To collect information about problems observed in existing PV systems and to develop statistics over time to analyze trends
- **Marketing:**
  - To promote use of the system within the PV industry
- Agreement to **do both** for now
  - Split into 2 WGs later if needed





# PV OMC Officer Elections



- PV OMC Chairman:
  - [Adrian Häring](#) (Germany)
- PV OMC Vice-Chairman:
  - [Sewang Yoon](#) (Korea)
- Next meeting planned for **May 5-6**
  - Cologne, Germany
  - Hosted by TUV Rheinland



# PV OMC Members



## 11 National Committees as of 17-Feb

Country	Member Body Name
Canada	CANC/IEC
China	Certification and Accreditation Administration of the People's Republic of China (CNCA)
Egypt	New & Renewable Energy Authority (NREA)
France	LCIE by delegation from the IEC NATIONAL COMMITTEE of FRANCE
Germany	IEC National Committee of Germany
Hungary	TÜV Rheinland InterCert kft.
Japan	IEC National Committee of Japan
Korea, Republic of	IEC National Committee of Korea, Republic of
Spain	IEC National Committee of Spain
United Kingdom	IEC National Committee of the United Kingdom
USA	USNC/IECRE



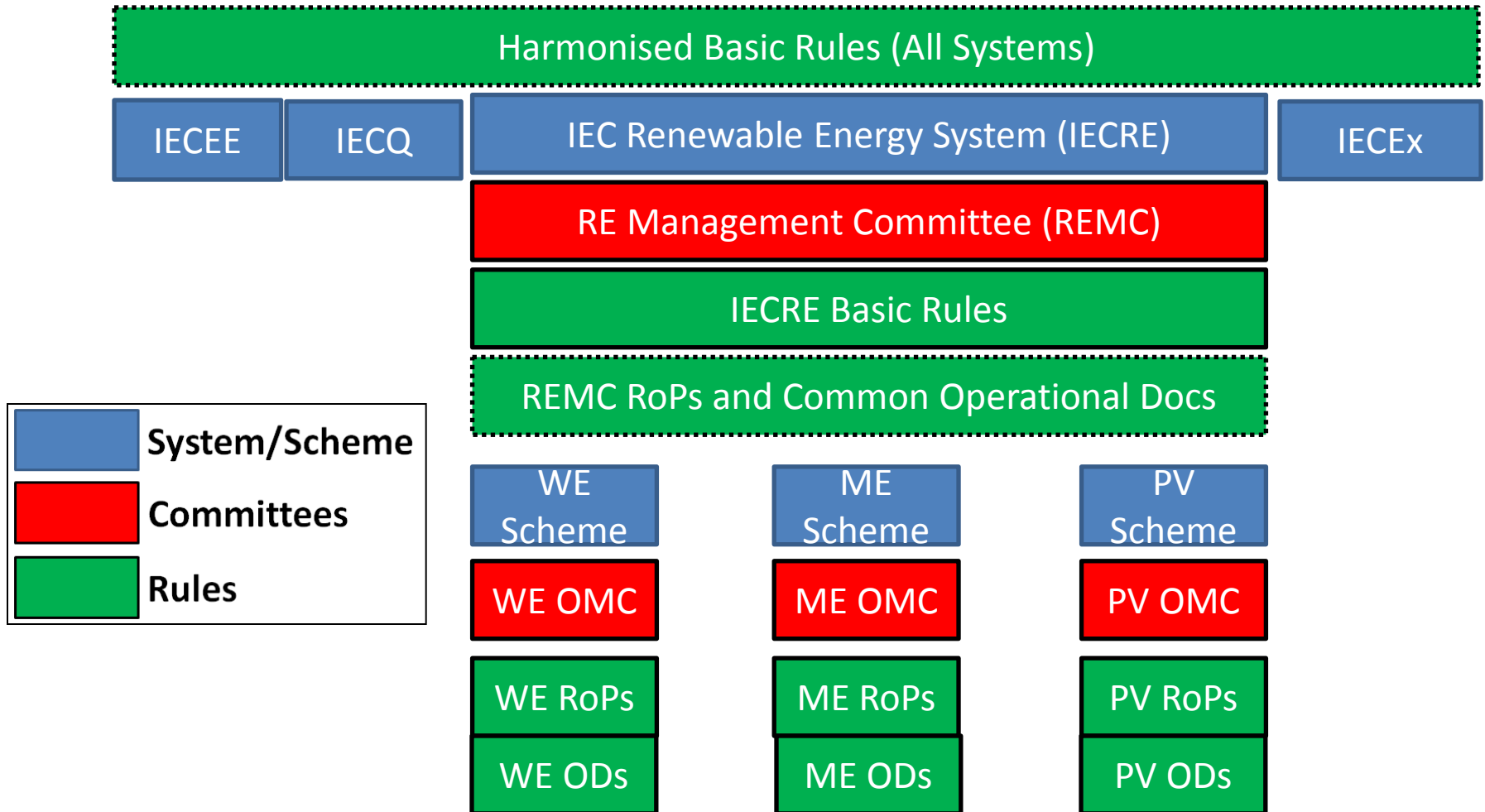
# USNC/IECRE Status



- Established as standing committee of **USNC/CAPCC** (like other IEC systems)
- Kickoff teleconference 9-Jan
  - ~100 participants from 3 industries
- Discussed draft of USNC/IECRE rules
  - Final version to be balloted in March
- Election of officers closes 27-Feb
- Next meeting **8-9 April**
  - Hosted by NEMA (Rosslyn, VA)
  - Contact Joel Solis, USNC Secretary



# IECRE Hierarchy







# IECRE-PV Documents



- PV Rules of Procedure (**RoP**)
  - Specific requirements for certification of PV power plants
  - First draft circulated in March 2014
  - Will combine work of all 3 TGs
  - Final version to be approved by REMC later in 2015
- PV Operational Documents (**OD**)
  - Administrative details for processing requests, record-keeping, etc.



# Operational Documents



- OD 001 (Draft) Procedures for the Issuing of IECRE-PV Certificates of Conformity, IECRE-PV Test Reports and IECRE-PV Quality Assessment Reports
- OD 002 IECRE-PV Scheme rules
- OD 003 Certificate of Conformity rules
- OD 004 IECRE-PV Scheme Fees
- OD 005 IECRE-PV “On-Line” system
- OD 006 Qualification of PVCB auditors
- OD 007 IECRE-PV Test certificates
- Etc., Etc. Copy from IECEx wherever possible



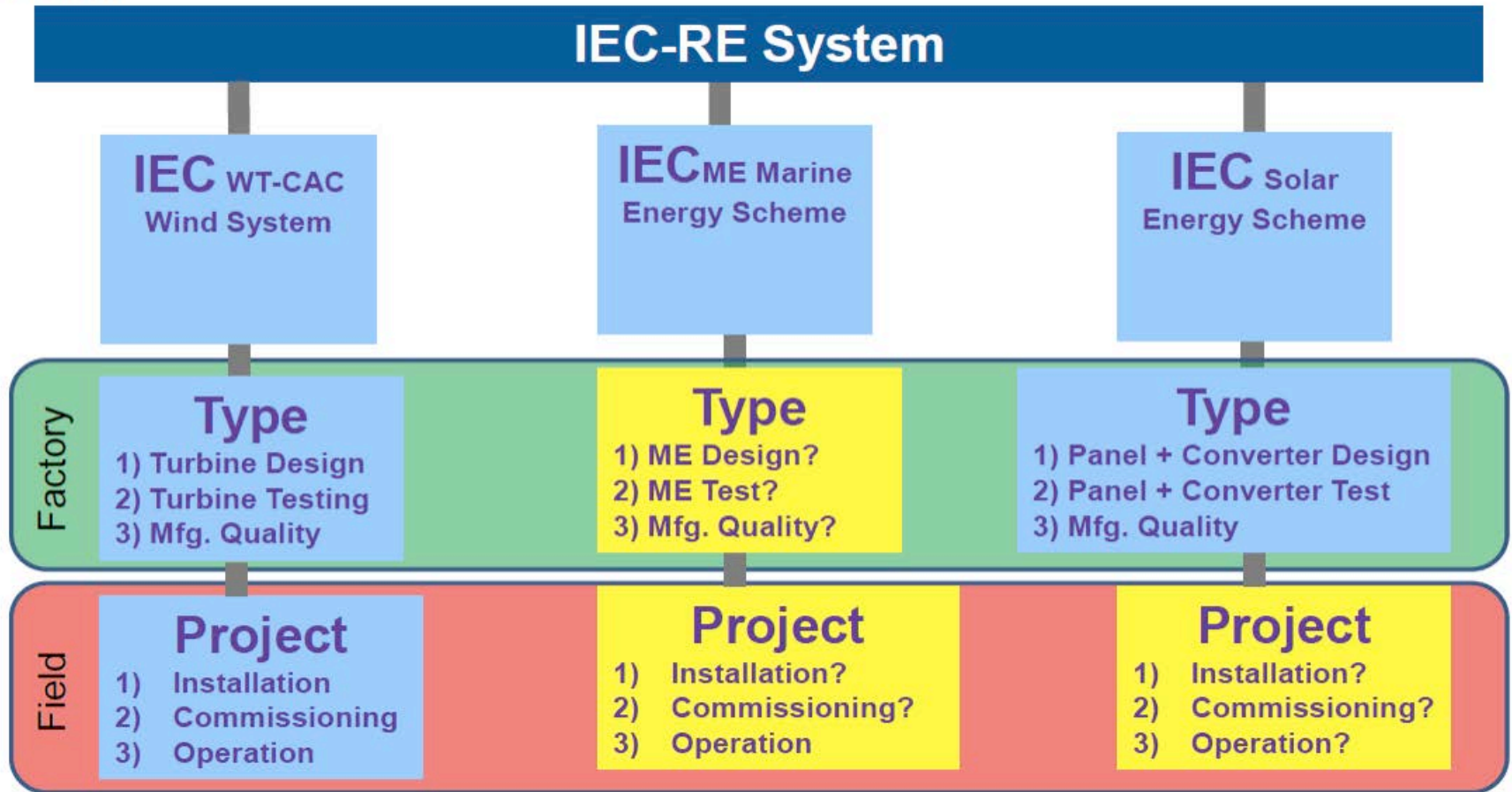
# PV Rules of Procedure



- Scope (TG401)
- Normative references (TG403)
- Terms and definitions (TG401)
- Acceptance of certification bodies (TG402)
- Management of the certification system (TG402)
- Extent of certification (TG401)
- Aspects of certification (TG401/403)
- Final evaluation (TG403)
- Plant certificate (TG402)



# RE System Common Elements



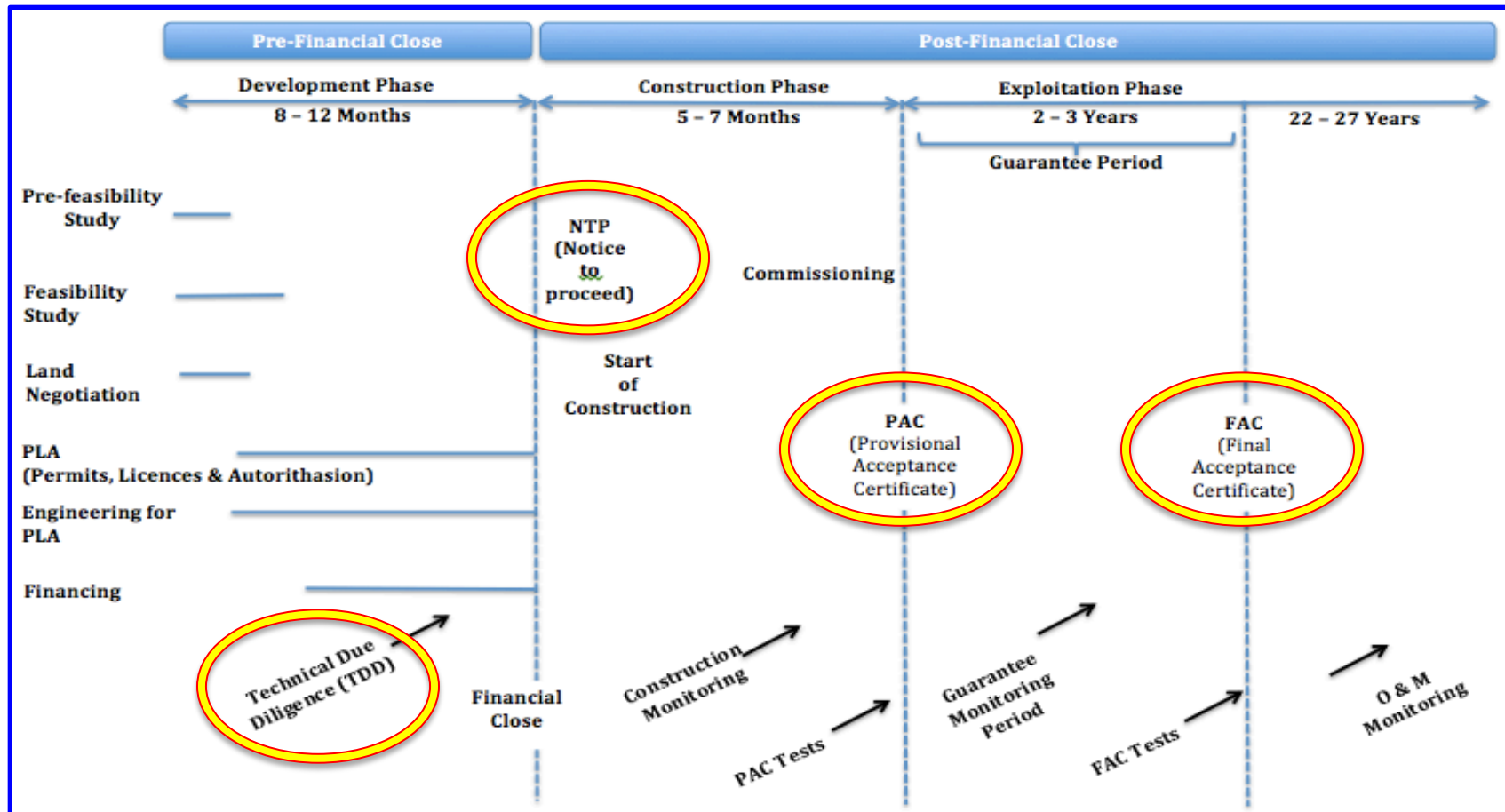


# Aspects of Certification



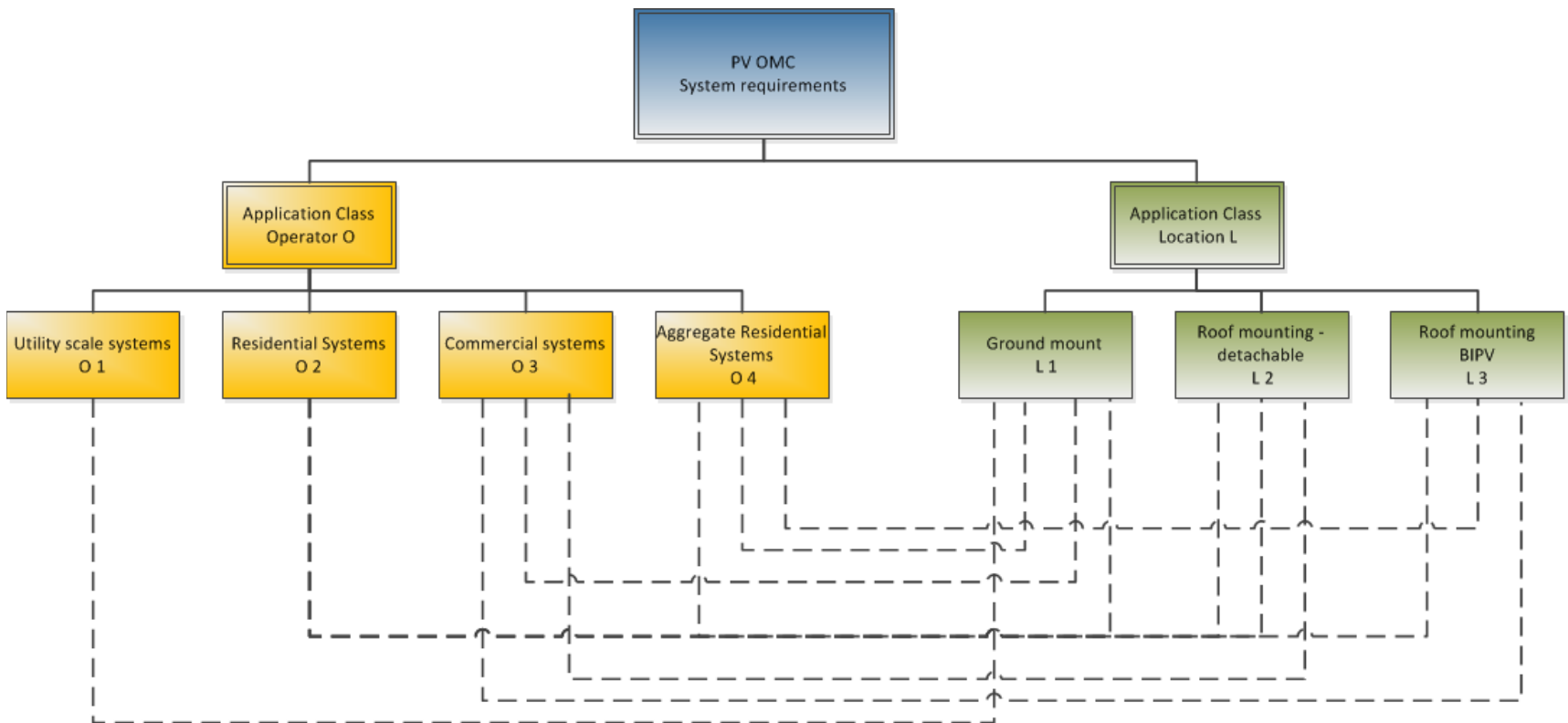
- Conformity assessment will be performed and certificate issued for an individual PV power plant on a specific site
- **Design Phase**
  - General
  - Site conditions evaluation
  - Design evaluation
  - Equipment evaluation
  - Structural and electrical evaluation
- **Implementation Phase**
  - Installation surveillance
  - Output characteristics measurement
  - Commissioning surveillance
  - Operation and maintenance surveillance

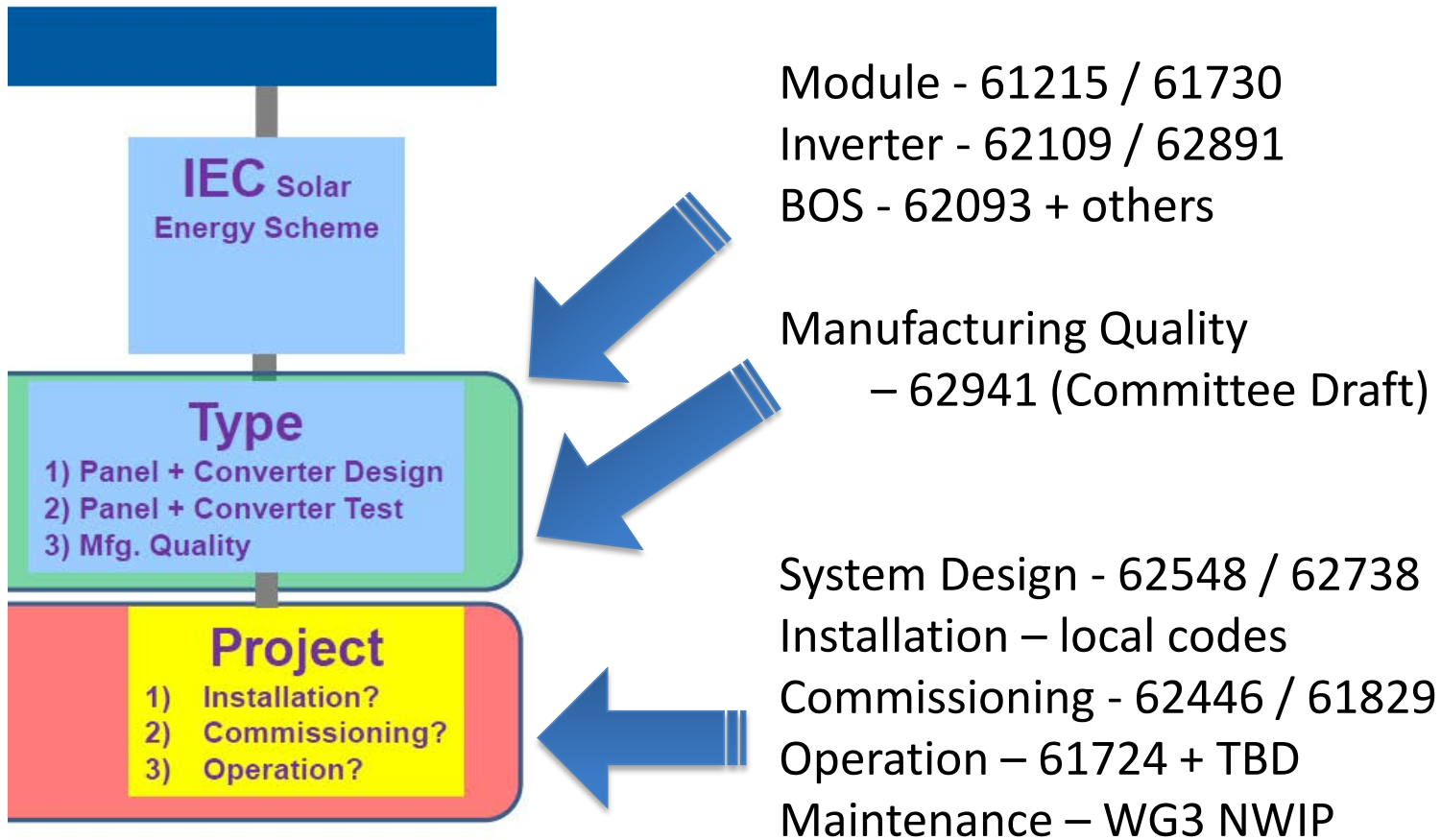
- Different audits may be required at different stages



# System Categories

- Requirements may depend on **Operator Class (O)** and **Location Class (L)**









# IEEE PVSC – June 2014



## Ensuring the reliability of PV systems through the **selection of International Standards** for the **IECRE Conformity Assessment System**

George Kelly, Sunset Technology, USA

Ted Spooner, UNSW, Australia

Guido Volberg, TUV Rheinland, Germany

Greg Ball, DNV GL, USA

Jonas Bruckner, VDE, Germany



# Hardware Assessment



- PV **Modules**
  - IEC 61215 Design Qualification
  - IEC 61730 Module Safety
- PV **Inverters**
  - IEC 62891 Inverter Performance
  - IEC 62109 Inverter Safety
- **Mounting Hardware**
  - UL 2703 Mounting, Clamping, & Grounding Devices
  - TUV PfG 1794 Mounting Systems
- **BOS Components**
  - IEC 62093 BOS Qualification
  - Multiple IEC, EN & UL standards



# QMS Assessment



- Guideline for Manufacturing Consistency
  - NWIP developed by PV QA Task Force ([PVQAT](#))
  - Drafted by collaboration of 4 regional teams; collection of [best practices](#) from across the industry
  - Refers to basic requirements of ISO 9000, plus...
- Focus on [PV-specific](#) manufacturing processes and procedures to ensure quality and consistency
  - Defines key metrics and capabilities needed for PV
  - Modules produced this way will be more likely to perform according to warranty ([25+ years](#))



# System Design Assessment



- IEC/TS [62548](#) PV Array Design Requirements
  - PV system architectures
  - Mechanical design
  - Safety issues
  - Selection and erection of electrical equipment
  - Marking and documentation
- Needs to be coordinated with IEC 60364 series
  - Basic standards for low-voltage electrical installations
- New standard IEC [62738](#) under development
  - Specific to utility-scale plants



# Installation Assessment



- Installation
  - No international standard (partly covered in IEC 62548)
  - Typically controlled by **local** government requirements
    - NFPA 70 US National Electrical Code
    - IEC 60364 series in Europe
    - Multiple building and fire codes (IBC, IFC, etc.)
    - ASTM E2766 for Steep-sloped Roofs
- Commissioning
  - IEC **62446** covers the most important requirements
  - System output measurement
    - IEC 61829 & 61724
    - ASTM E2848 & E2939



# O&M Assessment



- Operation
  - IEC 61724 - guidelines for performance monitoring
  - Solar ABCs report on O&M Fundamentals
  - Sandia Labs O&M working group
  - ASTM Task Group (**ICOMP**)
    - Comprehensive guideline to available standards
    - Focus on power plant operation
- Maintenance
  - **NWIP** started in TC82 Working Group 3
    - Includes preventative and corrective maintenance
    - Both safety-related and performance-related
    - Troubleshooting and documentation of results



# RoP Standards Matrix



Rules of Procedure IECRE PV	phase / aspect									
Applicable Standards	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.11		
	site conditions	design	equipment	struct/elect	installation	commissioning	plant output	ops & maint		
Doc #									responsible group	document status
IEC 60269		x	x						IEC SC32B	published
IEC 60364-5-52		x		x	x				IEC TC64	published
IEC 60721-2-1	x	x	x						IEC TC104	published 2013
IEC 60891							x	x	TC82 WG2	published 2009
IEC 60904-1							x	x	TC82 WG2	ed.3 CDV in process
IEC 60904-2							x	x	TC82 WG2	published 2015
IEC 60904-3							x	x	TC82 WG2	ed.3 FDIS in process
IEC 60947-1		x	x	x	x				IEC SC121A	published 2014
IEC 60947-2		x		x					IEC SC121A	published 2013
IEC 61215 series			x						TC82 WG2	ed.3 CDV in process
IEC 61439-1		x		x	x				IEC SC121B	published 2011
IEC 61683						x			TC82 WG6	published 1999
IEC 61724-1		x				x	x	x	TC82 WG3	ed.2 CD in process
IEC 61724-2		x				x	x	x	TC82 WG3	NWIP in process



# RoP Standards Matrix



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Doc #	site conditions	design	equipment	struct/elect	installation	commissioning	plant output	ops & maint	responsible group	document status
IEC 61724-3		x					x	x	TC82 WG3	CD in process
IEC 61727		x			x	x		x	TC82 WG3	published 2004
IEC 61730-1			x						TC82 WG2	ed.2 CDV in process
IEC 61730-2			x						TC82 WG2	ed.2 CDV in process
IEC 61829							x	x	TC82 WG3	ed.2 CDV in process
IEC 61853-3		x	x						TC82 WG2	FDIS in process
IEC 62093			x						TC82 WG6	ed.2 CD in process
IEC 62109-1			x						TC82 WG6	published 2010
IEC 62109-2			x						TC82 WG6	published 2011
IEC 62116						x			TC82 WG6	published 2014
IEC 62124			x			x	x	x	TC82 WG3	published 2004
IEC 62446-1						x		x	TC82 WG3	ed.2 CDV in process
IEC/TS 62548		x							TC82 WG3	ed.2 CDV in process
IEC 61724-3		x					x	x	TC82 WG3	CD in process





# RoP Standards Matrix



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Doc #	site conditions	design	equipment	struct/elect	installation	commissioning	plant output	ops & maint	responsible group	document status
IEC/TS 62727			x						TC82 WG7	published 2012
IEC/TS 62738		x							TC82 WG3	ed.2 CD in process
IEC 62790			x						TC82 WG2	published 2014
IEC 62817			x						TC82 WG7	published 2014
IEC 62852			x						TC82 WG2	published 2014
IEC 62891						x	x		TC82 WG6	FDIS in process
IEC/TS 62941			x						TC82 WG2	CDV in process
IEC 62446-2								x	TC82 WG3	draft NWIP
IEC/TS 6xxxx	x	x				x	x	x	TC82 WG3	draft NWIP
ASTM E2766					x				ASTM E44	published
ASTM E2848							x	x	ASTM E44	published
ASTM E2939							x	x	ASTM E44	published
ASTM WK43549	x	x	x	x	x	x	x	x	ASTM E44	ballot in process



# RoP Standards Matrix



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Applicable Standards	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.11		
	site conditions	design	equipment	struct/elect	installation	commissioning	plant output	ops & maint		
Doc #									responsible group	document status
EN 50618				x					CENELEC	draft 2014
NFPA 70		x	x	x					NFPA CMP	2017 ed. In process
Solar ABCs								x	Solar ABCs	published
TUV 2Pfg2305			x						TUV-R	published
TUV 2Pfg1794/10.10			x		x				TUV-R	published
UL 489B		x		x					UL STP	published
UL 2703		x		x					UL STP	published
VDE AR-N 4105		x				x			VDE	published
O&M Cost Model		x				x		x	SAPC (E44?)	wish list
O&M Best Practices	x	x				x	x	x	SAPC (WG3?)	wish list
Installer Best Practices				x	x	x			SAPC (WG3?)	wish list
Inverter QMS			x						TC82 WG6?	wish list



# Gaps to be Closed



- International Standards **Needed:**
  - Installation
  - Operation
  - Maintenance
- Standards Development **in Process:**
  - IEC TC82 – WG2, WG3
  - ASTM E44 - ICOMP
  - UL, TUV-R, VDE
  - SunSpec, Sandia, others



# TC82 Areas of activity



- WG2 on Modules
  - Manufacturing quality system guidelines CD
  - Reliability & comparative testing CDs
- WG3 on **Systems**
  - System commissioning & documentation CDV
  - System operation & maintenance NWIP
- Coordination with ASTM E44
  - Installation, Commissioning, Operations & Maintenance Process (ICOMP)



# IEEE PVSC – June 2015



**Ensuring the reliability of PV systems through the **formation** of the IECRE Conformity Assessment System and the **development** of new International Standards**

George Kelly, Sunset Technology, USA

Adrian Häring, SMA, Germany

Ted Spooner, UNSW, Australia

Greg Ball, DNV GL, USA

Sarah Kurtz, NREL, USA



IEC System for Certification to Standards Relating to Equipment  
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# Thank you for your attention

Questions?  
Suggestions?  
Concerns?

Contact [george@sunset-technology.com](mailto:george@sunset-technology.com)





# Stakeholders' Perspectives

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NREL PV Reliability Workshop

26 Feb 2015

Chairs: G. Tamizhmani (TUV/PTL)  
and Govind Ramu (SunPower)



# Stakeholders' Perspectives



- Financers/Investors/Owners
  - Jon Previtali, Wells Fargo
  - Mike Roy, Hartford Insurance Group
- Certifying Bodies/Test Laboratories
  - Peter Bostock, VDE
  - Matthias Heinze, TÜV Rheinland

10-10:30 COFFEE BREAK





# Stakeholders' Perspectives



- Certifying Bodies/Test Laboratories
  - Tadashi Obayashi, JET
- Manufacturers/ EPCs/ O&M Providers
  - Sumanth Lokanath, First Solar
  - Rue Phillips, True South Renewables
  - Joe Cunningham, Centrosolar
  - Eric Daniels, Field Energy Operations



# IECRE PV Survey



- Results presented by Greg Ball (DNV GL)
- **Reminder:**  
**Posters will be on display during lunch break**  
**12:00–1:30**



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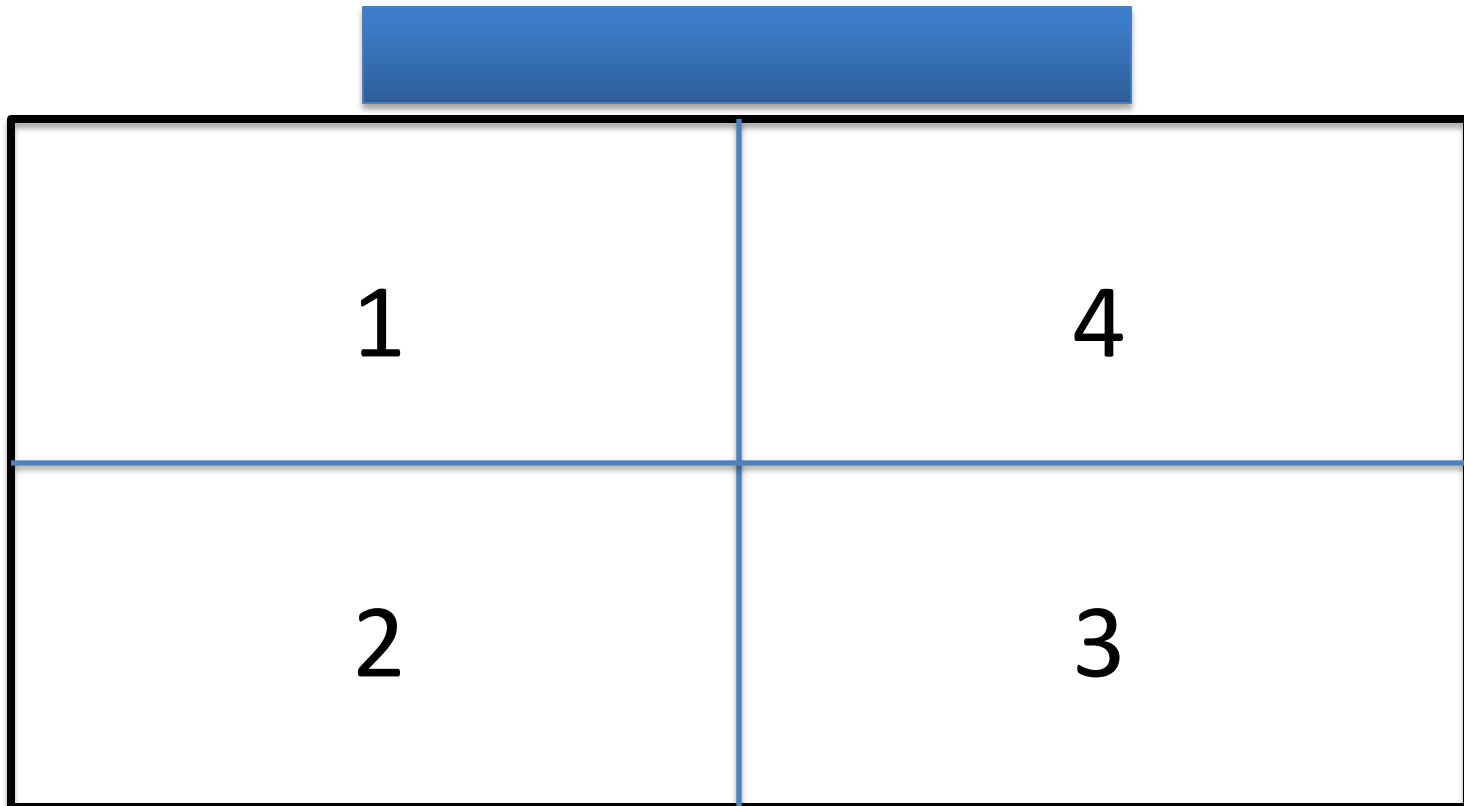
# Review of PV Rules



- Participants will rotate in **small groups** covering key topics:
  1. Scope of Certification—Raj Bedi, First Solar
  2. Applicable Standards—George Kelly, TC82
  3. Mutual Recognition—Sunny Rai, Intertek
  4. Personnel Certification—Don Warfield, NABCEP  
(thrown into the mix by popular demand)



# Small Groups





# Discussion



- John Wohlgemuth (NREL), Alex Mikonowicz (Powermark), and George Kelly (Sunset Technology)
- **“How can the certification system we are proposing be most successful in reducing stakeholders’ risk?”**
- *Are we successfully addressing the issues identified by the participants? What are we missing? What are concerns with the approach? Are we trying to do too much?*



# Review of PV Rules



- Small group discussions:
  1. Scope of Certification—Raj Bedi, First Solar
  2. Applicable Standards—George Kelly, TC82
  3. Mutual Recognition—Sunny Rai, Intertek
  4. Personnel Certification—Don Warfield, NABCEP  
(thrown into the mix by popular demand)



# Summary



- Alex's List





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# Thank you for your participation

Contact [george@sunset-technology.com](mailto:george@sunset-technology.com)

