

# IEEE P2800.2 Overview for EDPG Wind and Solar Power Plant Interconnection and Design Subcommittee

IEEE PES General Meeting

**ANDY HOKE, P2800.2 WG CHAIR**

**MANISH PATEL, SECRETARY**

**JENS BOEMER, BOB CUMMINGS, DIVYA CHANDRASHEKHARA,**

**JULIA MATEVOSYAN, MAHESH MORJARIA, STEVE WURMLINGER, VICE CHAIRS**

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Some content derived from IEEE 2800 WG and Jens Boemer, 2800 WG Chair

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- General disclaimer:
  - The views presented in this presentation are the personal views of the individuals presenting it and shall not be considered the official position of the IEEE Standards Association or any of its committees and shall not be considered to be, nor be relied upon as, a formal position of IEEE, in accordance with IEEE Standards Association Standards Board Bylaws 5.2.1.6.
- Draft standard disclaimer:
  - P2800.2 is an unapproved draft of a proposed IEEE Standard. As such, the document is subject to change, any draft requirements and figures shown in this presentation may change.
- For those working group members whose effort on the standard was partially or fully supported by the U.S. DOE's National Renewable Energy Laboratory, the following statement applies:
  - This work was supported in part by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Solar Energy Technologies Office and Wind Energy Technologies Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government.

# IEEE P2800.2 Objective: Filling Gaps in North American Interconnection Standards for Inverter-Based Resources

	Performance	Conformity Assessment
<b>BES<sup>1</sup></b> <b>BPS<sup>3</sup></b> Transmission	<ul style="list-style-type: none"> <li>• FERC Orders</li> <li>• NERC Reliability Standards &amp; Guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• NERC compliance monitoring &amp; enforcement</li> </ul>
Sub-Transmission	<ul style="list-style-type: none"> <li>• IEEE 2800 ✓</li> </ul>	<ul style="list-style-type: none"> <li>• Not available</li> </ul>
DER <sup>2</sup>	<ul style="list-style-type: none"> <li>• IEEE Std 1547-2018 ✓</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 1547.1-2020 ✓</li> <li>• UL 1741 (SB) ✓</li> <li>• IEEE ICAP</li> </ul>



<sup>1</sup> NERC definition of Bulk Electric System: ≥100 kV with gross individual / aggregate nameplate rating greater than 20 MVA / 75 MVA

<sup>2</sup> DER connected at typical (radial) primary and secondary voltage levels

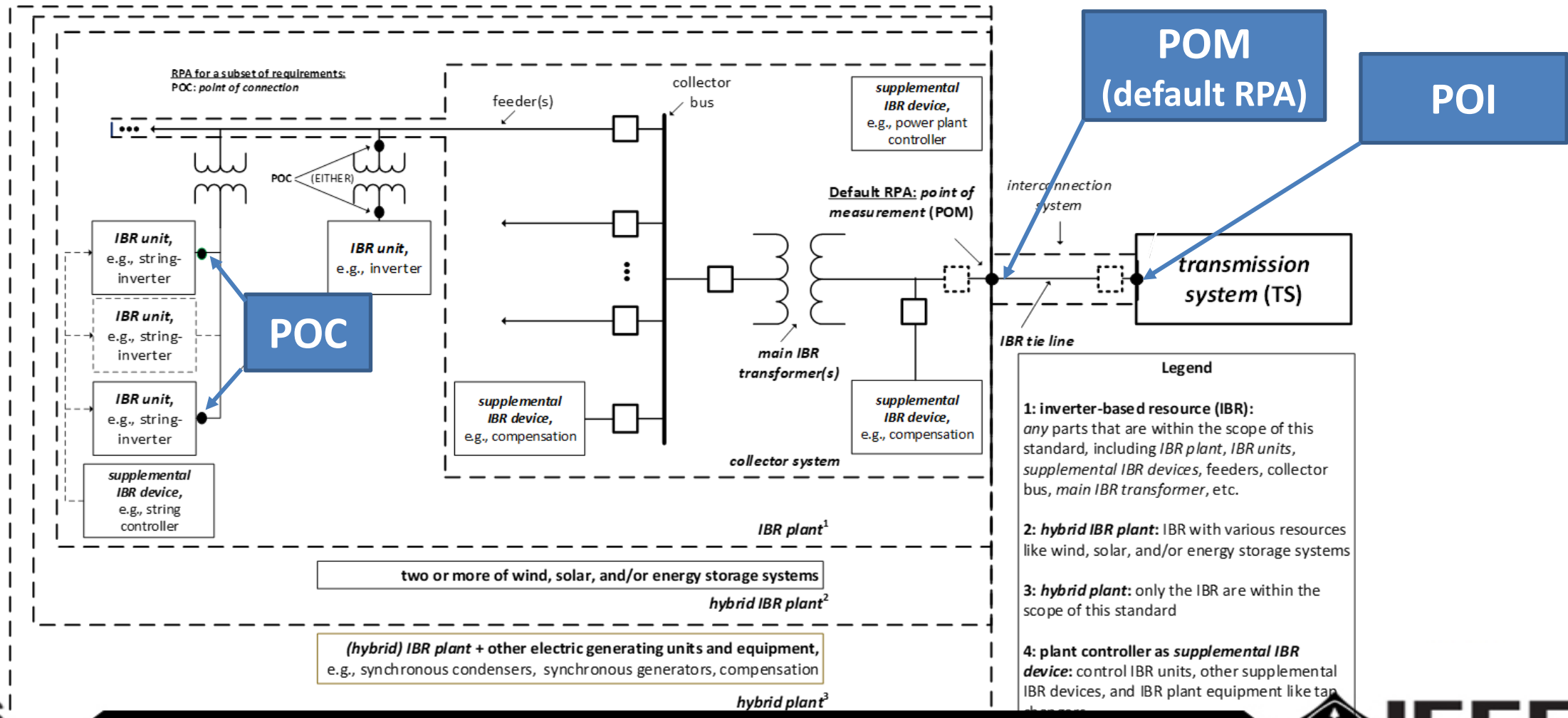
<sup>3</sup> transmission and meshed sub-transmission

Slide modified from Jens Boemer, EPRI

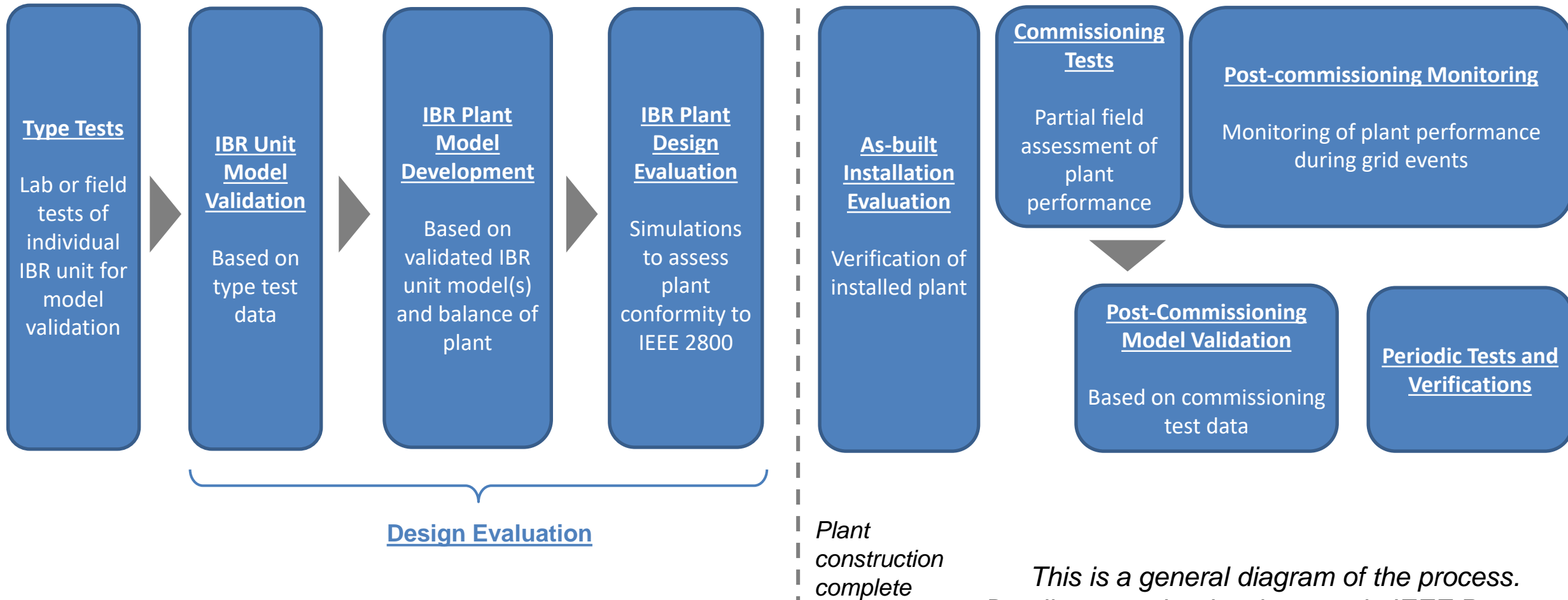
IEEE standards are voluntary industry standards and must be adopted by the appropriate authority to become mandatory (e.g., Transmission Owners, NERC, FERC).

# Role of P2800.2 in IEEE 2800 Adoption

Almost all requirements of IEEE 2800 apply at Point of Measurement (POM) by default



# Overview of conformity assessment steps in IEEE P2800.2



*This is a general diagram of the process. Details are under development in IEEE P2800.2. Some variations permitted.*

# Equipment certification?

- Almost all requirements in IEEE 2800 apply to the IBR plant (not the inverter/WTG)
- The type tests in IEEE P2800.2 do not generally have pass/fail criteria.
  - Instead, they generate data (e.g. test waveforms) to validate the unit-level model.
- Certification of inverters/WTGs to 2800 is not applicable because compliance is at the plant level
  - Required unit-level capabilities depend strongly on balance of plant
- Therefore **an “IEEE 2800 certified inverter/WTG” probably will not exist**
  - Instead, inverters/WTGs could perhaps be considered “2800 compatible” if 2800 requirements have been taken into consideration so that they can be used to build a 2800-compliant plant.
- This is different from the IEEE 1547/1547.1/UL 1741 paradigm on the distribution system, where pass/fail type tests and NRTL certification play a large role in conformity assessment

# IEEE P2800.2 Subgroup Scopes

**SG 1**  
Overall document and general requirements

Excerpt of 2800 Table 20: Verification Methods Matrix

**Power Quality Task Force**

Requirement	RPA at which requirement applies	SG 2	SG 3	SG 4		SG 5				
		Type tests	Design Evals.	Commissioning and As-built		Post-commissioning model validation, monitoring, etc.				
		IBR unit-level tests (at the POC)		IBR plant-level verifications (at the RPA)						
		Type tests <sup>152</sup>	Design evaluation (including modeling for most requirements)	As-built installation evaluation	Commissioning tests	Post-commissioning model validation	Post-commissioning monitoring	Periodic tests	Periodic verification	
		Responsible Entity								
		IBR unit or supplemental IBR device manufacturer	IBR developer / TS owner / TS operator	IBR developer / TS owner / TS operator	IBR developer / TS owner / TS operator	IBR developer / IBR operator / TS owner / TS operator	IBR operator / TS owner / TS operator	IBR operator / TS owner / TS operator	IBR operator / TS owner / TS operator	
4.12 Integration with TS grounding	POM	NR	R	R	NR	NR	NR	D	NR	
Clause 5 Reactive Power—Voltage Control Requirements within the Continuous Operation Region										
5.1 Reactive power capability	POM	R	R	R	R	R	D	D	D	
5.2 Voltage and reactive power control modes	POM	D	R	R	R	R	D	D	D	
Clause 6 Active-Power—Frequency Response Requirements										
6.1 Primary Frequency Response (PFR)	POC & POM	NR <sup>153</sup>	R	R	R	R	D	D	D	
6.2 Fast Frequency Response (FFR)	POC & POM	R <sup>154</sup>	R	R	R	R	D	D	D	
Clause 7 Response to TS abnormal conditions										
7.2.2 Voltage disturbance ride-through requirements	POC <sup>155</sup> & POM <sup>156</sup>	R	R	R	NR	R	R	D	D	
Clause 8 Power quality										
8.2.2 Rapid voltage changes (RVC)	POM	NR	R	R	R	D	R	D	D	
8.2.3 Flicker	POM	NR	NR	NR	R	D	R	N/A	D	
8.3.1 Harmonic current distortion	POM	R <sup>157</sup>	R	R	R	D	R	N/A	D	
8.3.2 Harmonic-voltage distortion	POM	D	D	D	D	D	D	D	D	
8.4.1 Limitation of cumulative instantaneous over-voltage	POM	R	R	R	NR	NR	R	NR	NR	
8.4.2 Limitation of over-voltage over one fundamental frequency period	POM	D	R	R	NR	NR	R	NR	NR	

# IEEE P2800.2 Structure and Leaders

Subgroup	Vice Chair	Subgroup Chair(s)
<b>2: Type tests</b>	Steve Wurmlinger <a href="mailto:Stephen.Wurmlinger@sm-a-america.com">Stephen.Wurmlinger@sm-a-america.com</a>	Pramod Ghimire, Michael Ropp
<b>3: Design evaluations</b>	Jens Boemer <a href="mailto:j.c.boemer@ieee.org">j.c.boemer@ieee.org</a>	Andrew Isaacs, Alex Shattuck
<b>4: Commissioning and as-built evaluation</b>	Divya Chandrashekhara <a href="mailto:DKUCH@orsted.com">DKUCH@orsted.com</a>	Chris Milan, Dave Narang
<b>5: Post-commissioning model validation and monitoring, and periodic tests and verifications</b>	Julia Matevosyan <a href="mailto:julia@esig.energy">julia@esig.energy</a>	Jason MacDowell, Brad Marszalkowski

Lead subgroup and coordinate with other subgroups

Facilitate subgroup calls

Draft specific verification procedures with subgroup input

*Most of the detailed work occurs in the subgroups and task force via periodic calls*

<b>Chair</b>	Andy Hoke <a href="mailto:Andy.Hoke@nrel.gov">Andy.Hoke@nrel.gov</a>
<b>Secretary</b>	Manish Patel <a href="mailto:Manish.P@ieee.org">Manish.P@ieee.org</a>
<b>Vice Chair</b>	Bob Cummings
<b>Vice Chair</b>	Mahesh Morjaria

Lead overall WG

Compile drafts; Lead Subgroup 1 (overall document and general requirements)

Power Quality Task Force	
<b>Co-Lead</b>	Eugen Starschich
<b>Co-Lead</b>	David Mueller

Provide input to subgroups on PQ requirements verification

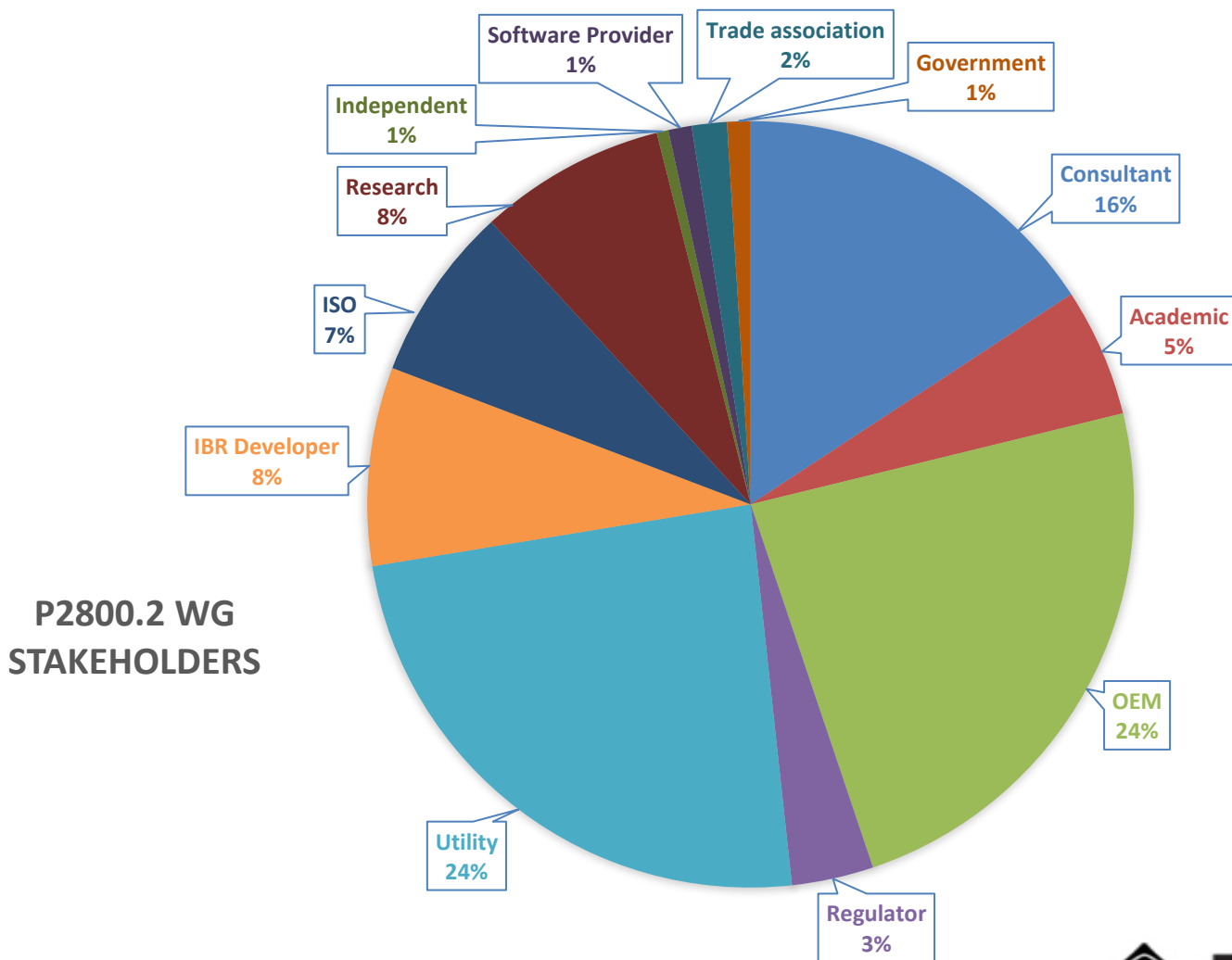
Frequency Scanning Team (informal for now)	
<b>Co-Lead</b>	Wes Baker
<b>Co-Lead</b>	Shahil Shah

Develop frequency scanning content



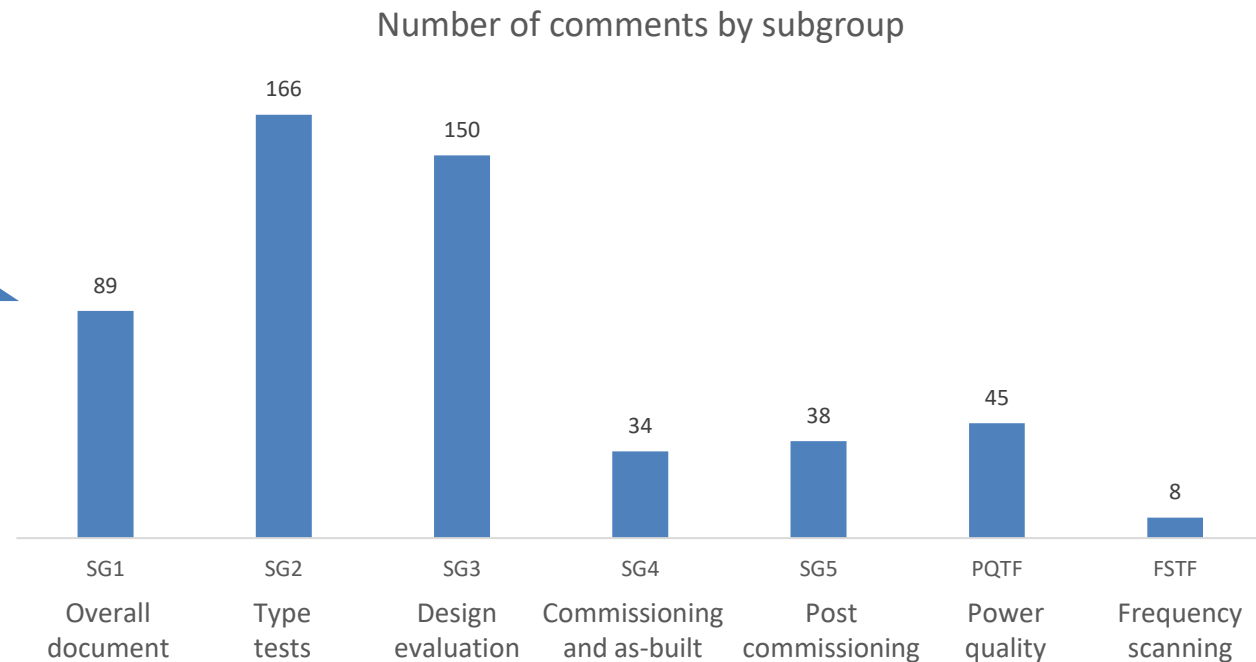
# P2800.2 Working Group Membership

- 160 Voting members
- 45 Non-voting members
- All major stakeholder groups represented

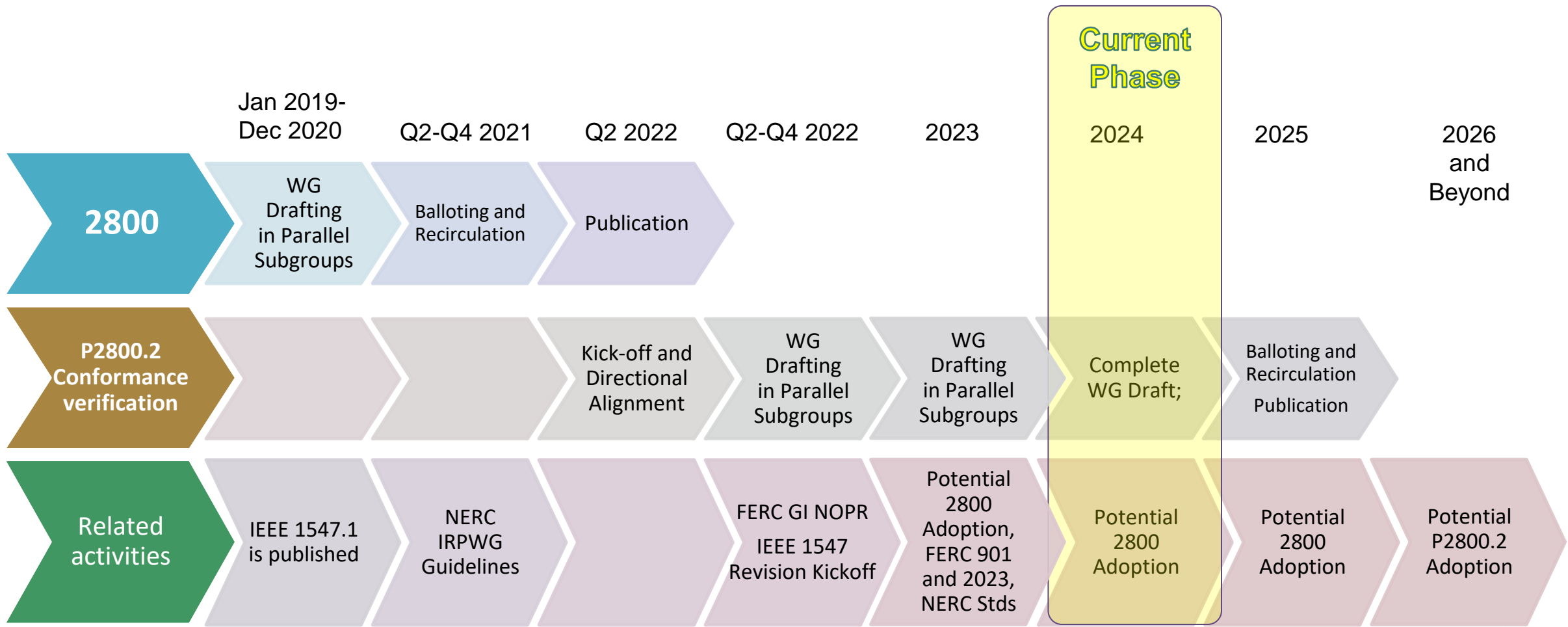


# P2800.2 status

- >90% of content is complete
- 7<sup>th</sup> Working Group meeting held April 30-May 2, 2024
- 530 formal comments received on May 22
  - First round of comments on nearly complete draft
- Over next 3-4 months, subgroups and task force will:
  - Address comments
  - Fill in remaining content
- Near-final draft expected in early fall



# Potential Adoption Timeline



# To get involved in IEEE P2800.2:

- To join Working Group:
  - If you have attended two WG meetings and want to be a WG voting member, email Manish Patel: [Manish.P@ieee.org](mailto:Manish.P@ieee.org); CC [Andy.Hoke@nrel.gov](mailto:Andy.Hoke@nrel.gov)
  - If not, attend two meetings and request membership
- Join listserv for any subgroup or task force of interest
- WG member iMeet site: <https://ieee-sa.imeetcentral.com/p2800-2/home>
  - Contains draft documents, subgroup documents, references, etc.
- Public website: <https://sagroups.ieee.org/2800-2/>

# IEEE P2800.2 Email Listservs

- Overall listserv “P2800-2” will be used to communicate meeting dates, agendas, etc.
- Each subgroup and PQ task force each have listserv – sign up to get involved in that group:
  - Overall Working Group: P2800-2
  - Subgroup 1 (overall document): STDS-P2800-2-SG1
  - Subgroup 2 (type tests): STDS-P2800-2-SG2
  - Subgroup 3 (design evaluation): STDS-P2800-2-SG3
  - Subgroup 4 (commissioning and as-built): STDS-P2800-2-SG4
  - Subgroup 5 (post-commissioning): STDS-P2800-2-SG5
  - Power quality task force: STDS-P2800-2-PQTF
- To join a listserv, send an email message to [listserv@listserv.ieee.org](mailto:listserv@listserv.ieee.org)
  - In first line of email body, write: **SUBSCRIBE <list name> <Your Name>**

For example, “**SUBSCRIBE STDS-P2800-2-SG1 Andy Hoke**”