Harmonizing IBR Interconnection Requirements in the West

Industry Advisory Group

Meeting # 6

IEEE 2800-2022 Clauses 8, 9, 10, 12

October 23, 2025

WIRAB
Western Interconnection Regional Advisory Body

Meeting Logistics

Please Introduce Yourself in the Chat

- Name
- Organization / Company
- Role or Title

Recording

This meeting is being recorded and **may be posted publicly**. By participating, you consent to your name, voice, and image being part of the recording.

How to Participate

Use the **"Raise Hand"** feature to ask questions or provide input

Feel free to use the **chat** for comments or clarifying questions

We will be using **Slido** later in the meeting to solicit feedback

Audio Etiquette

Everyone came into the meeting muted

Please **mute yourself** when not speaking

If joining by phone, please identify yourself in the chat

Materials & Follow-Up

Slides and materials will be shared after the meeting and available on the webpage

Contact information will be provided at the end for follow-up questions or comments

Outline

Introductions and Background	Overview
Technical Overview	Explore draft FIR template document and IEEE 2800-2022 requirements
Interactive Discussion and Q&A	Open Discussion and Slido Polls
Closing and Next Steps	Confirming upcoming meeting dates and schedule Preview of next meeting topics and expected deliverables

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Review of Template FIRs

Clauses 8, 9, 10, 11, and 12

Ryan D. Quint, PhD, PE, *President and CEO*
Kyle Thomas, PE, VP, *Engineering and Compliance Services*

October 23, 2025

Adoption of Clauses 8, 9, and 10

Company	Phase (if applicable)	Adoption Approach (End)	Retroactive Application on Legacy IBRs	Reference Point of Applicability (RPA)	Performance and Capability?	Clause 1: Overview	Clause 2: Normative references	Clause 3: Definitions, acronyms, abbreviatio	Clause 4: General requirements	Clause 5: Reactive power—voltage contro	Clause 6: Active power—frequency respon	Clause 7: Response to T abnormal condition	Clause 8: Power quality	Clause 9: Protection	Clause 10: Modeling data	Clause 11: Measurement data	Clause 12: Tes and verificatio	Grid-forming Requirements
Ameren IL		Hybrid Reference Customization &	✗	POI	✓	○	○	○	○	◗	○	○	○	○	○	○	○	○
Ameren Transmission Company of Illinois (ATXI)	Interim Phase 1 (ahead of MISO)	Detailed Reference & Customization	✗	POI	✓	○	○	○	○	○	○	◕	○	○	●	○		
	Phase 1 (aligned with MISO)	Hybrid Reference Customization &	✗	POI	✓	○	○	○	●	○	○	◕	○	○	○	○		
Bonneville Power Administration (BPA)		Detailed Reference & Customization	✗	POI	✓	○	○	◗	●	●	●	●	◗	◗	●	◗		
Duke Energy		Hybrid Reference Customization &	✗	POI	✓	○	○	◗	◕	●	●	●	◕	●	●	●	◗	○
ERCOT	Phase 1	Hybrid Reference Customization &	✓	POI	✓	○	○	○	◔	●	○	●	○	●	◔	◔	◔	
	Phase 2	Hybrid Reference Customization &	✓	POI	✗	○	○	○	○	○	○	○	○	○	○	◗	○	○
HECO	Stage 3 Hawaii RFP	Hybrid Reference Customization &	✗	POI	✓	○	○	○	◔	●	◕	◗	●	●	●	●	○	
ISO-NE		Detailed Reference & Customization	✗	POM	✓	○	○	●	◕	◕	◕	◕	○	○	○	○	○	○
MISO	Phase 1	Detailed Reference & Customization	✗	POM	✓	○	○	○	◗	○	○	◕	○	○	◔	○	○	
	Phase 2	Detailed Reference & Customization	✗	POM	✓	○	○	○	◗	◕	◕	◕	○	○	◔	◕	○	
NYSRC		Detailed Reference & Customization	✗	POI	✓													
North American Electric Reliability Corporation (NERC)	Milestone 2	Full Specification & Customization	✓	POM	✓	○	○	◔	○	○	○	◕ PRC-029	○		○	◕ PRC-028	◔ PRC-030	○
Natural Resources Department of Canada	SREPs Program	General Reference	✗	POI	✓	○	○	○	○	○	◗	○	○	○	○	○	○	○
San Diego Gas & Electric Co.		Hybrid Reference Customization &	✗	POI	✓	○	○	○	○	◗	◗	◗	◔	◗	◗	◕	◔	○
SaskPower		Hybrid Reference Customization &	✗	POI	✓	○	○	○	○	◕	●	◕	○	○	○	○	○	○
Southern California Edison (SCE)	Phase 1	Detailed Reference & Customization	✗	POI	✓	●	●	●	●	◗	◗	●	●	●	○	○		
Southern Company	Phase 1	Detailed Reference & Customization	✗	POI	✓	○	○	○	◗	●	●	●	◗	●		◕		○
	Phase 2	Detailed Reference & Customization	✗	POI	✓	○	○	◕	◗	●	●	●	◗	●	●	◕	◔	○
	Phase 3	Detailed Reference & Customization	✗	POI	✗	○	○	◕	○	○	○	○	○	○	●	○	◕	○
SPP	Phase1	Detailed Reference & Customization	✗	POM	✓	○	○	○	◗	○	○	◕	○	○	○	●	○	
SRP	Phase 1	Hybrid Reference Customization &	✗	POI	✓	○	○	●	●	●	●	◕	◕	●	●	●	●	○
Tennessee Valley Authority (TVA)	Phase 1	Hybrid Reference Customization &	✗	POM	✓	●	○	●	●	●	◕	●	◕	●	●	●	○	○

Legend: ○ – not adopted | ◔ , ◗ , ◕ , ● – various adoption degrees | ◔ , ◗ , ◕ , ● – various degrees of own specs

Last Update: May 26, 2025

Please send feedback to jboemer@epri.com

Jens Boemer, EPRI (2025)

Source: EPRI (DOE i2X, May 2025)

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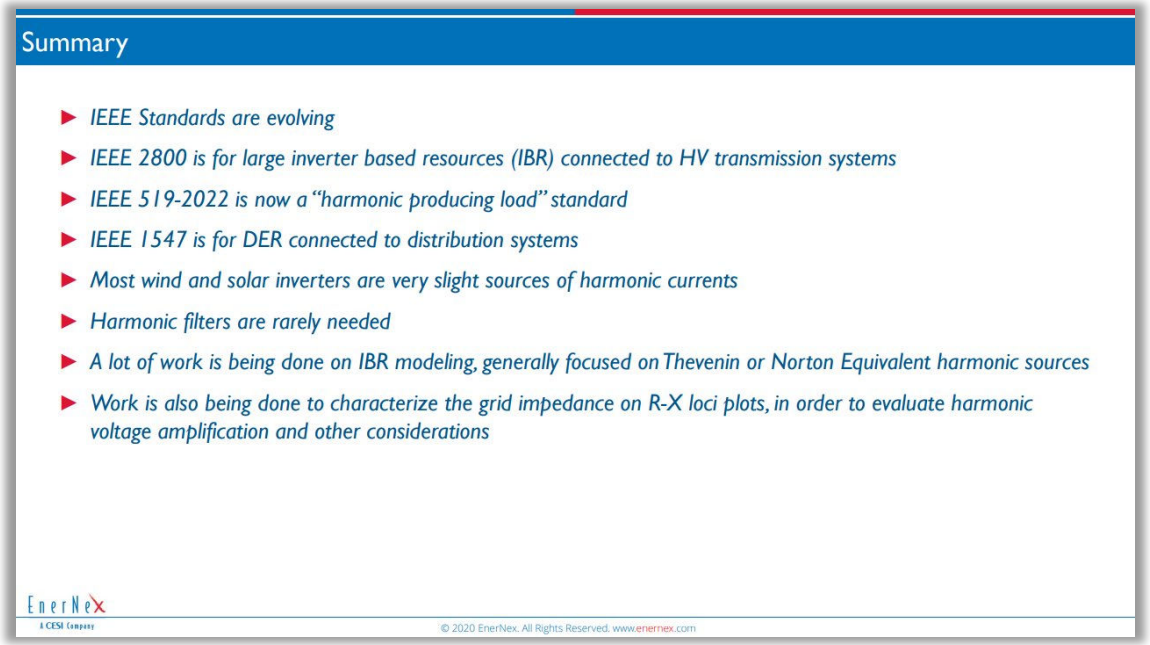
Template FIR Review – Clause 8

CLAUSE 8: POWER QUALITY

[INSERT TRANSMISSION PROVIDER NAME] adopts Clause 8 of IEEE 2800-2022; however, IBR plants shall comply with all other [INSERT TRANSMISSION PROVIDER NAME] power quality requirements. In the event of a conflict between requirements, the [INSERT TRANSMISSION PROVIDER NAME] power quality requirements shall govern.

Default language is to adopt Clause 8, with a clear note that all other utility power quality requirements must also be met and that those requirements override IEEE 2800-2022 adoption in the event of any conflicts.

- Frequent rapid voltage changes (RVC)
- Infrequent RVC
- Flicker
- Limitation of harmonic distortion
- Harmonic voltage distortion
- Limitation of overvoltage contribution



Slides: https://www.esig.energy/wp-content/uploads/2025/02/i2x-FIRST-2.25_Protection-and-Power-Quality-Meeting.pdf
Recording: https://www.youtube.com/watch?v=ES3KXWJA8WM

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Background on Clause 9

- Clause 9 is focused on IBR plant protection systems and functions
  - Does not require specific types of protection to be applied at IBR plant.
- If protection is applied, IBR plant shall meet ride-through requirements
  - Unintentional islanding protection
  - Frequency and ROCOF protection
  - AC voltage protection
  - AC overcurrent protection
- Careful language selection is critical for effective implementation by the interconnection customer

All instantaneous overvoltage protection used within the *IBR plant* shall use filtered quantities (Schweitzer and Hou [B105]) to reduce the possibility of misoperation while providing protection to the desired equipment and system. Any instantaneous overvoltage protection(s) that has the possibility of disrupting the power output of the entire plant shall use at least one cycle (of fundamental frequency) measurement window to reduce such possibility and the related impact on the TS. Protection margin shall be coordinated with the *TS owner*, wherever applicable.

Where instantaneous overvoltage protection is applied on *IBR unit*(s), it shall:

— Be coordinated with transient overvoltage capability of *IBR units*

— Be coordinated with any surge protection implemented within the *IBR plant* and at the RPA

— Allow the *IBR plant* to meet its transient overvoltage ride-through requirements specified in 7.2.3

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Template FIR Review – Clause 9

CLAUSE 9: PROTECTION

[INSERT TRANSMISSION PROVIDER NAME] adopts Clause 9 of IEEE 2800-2022 with the following exceptions and modifications:

All IBR plant protection settings shall be based on design specifications and equipment limits to ensure both operational performance and equipment protection. Any IBR plant protection trip settings shall be coordinated with [INSERT TRANSMISSION PROVIDER NAME] protection settings and with the internal inverter protection settings to maximize IBR ride-through capability within equipment ratings.

The IBR owner shall provide [INSERT TRANSMISSION PROVIDER NAME] with all plant protection trip settings and manufacturer internal trip settings related to meeting ride through requirements.

Clause 9.2: Rate of change of frequency (ROCOF) protection

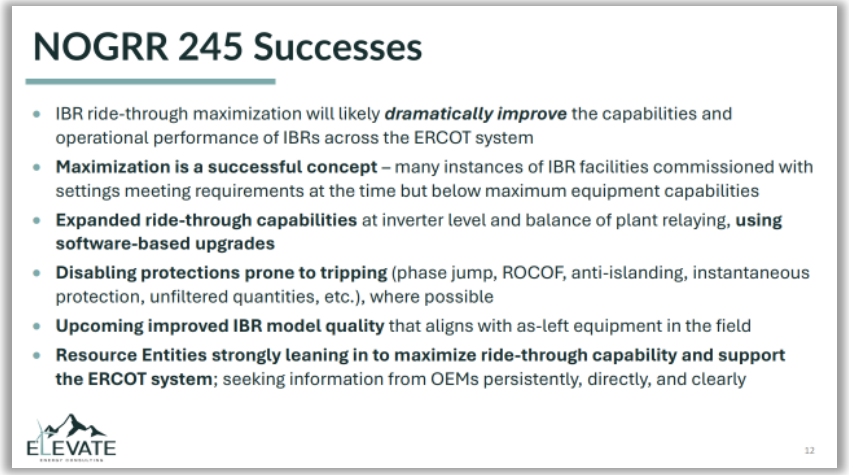
IBR plant rate of change of frequency (ROCOF) protection shall be disabled unless needed per equipment manufacturer hardware-based needs.

Clause 9.5: Unintentional islanding protection

Active and passive anti-islanding protection shall be disabled unless needed per equipment manufacturer requirement or otherwise specified by [INSERT TRANSMISSION PROVIDER NAME].

Adopting Clause 9 by default with some exceptions and clarifications.

Require IBR plant maximization for newly connecting resources → reliability enhancement at no cost



https://www.ercot.com/files/docs/2025/04/17/Elevate_NOGRR245_Lessons_Learned-ERCOT_IBRWG_April_2025.pdf

Disable ROCOF and unintentional islanding protection by default unless needed by OEM or by the utility.

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Template FIR Review – Clause 10

CLAUSE 10: STUDY PROCEDURES AND MODELING DATA REQUIREMENTS

[INSERT TRANSMISSION PROVIDER NAME] adopts Clause 10 of IEEE 2800-2022 with the following exceptions and modifications:

The IBR developer/owner shall provide the following *verified* models:

- Steady-state powerflow model
- Positive-sequence (fundamental-frequency) standard library dynamic model that meets applicable NERC and WECC modeling requirements
- Positive-sequence (fundamental-frequency) user-written dynamic model (with user-written models provided by the equipment manufacturers)
- Electromagnetic transient (EMT) model using industry best practices
- Short-circuit model using industry best practices
- Harmonics model, upon request

Models must be accompanied by documentation such as model user manuals, control narratives, etc., The models must also be accompanied by an IBR unit model validation report (at least for the EMT model) and PPC model validation report. The IBR unit and PPC models must be real code-based or include control hardware in the loop (CHIL) test results demonstrating the model matches actual performance.

Adopting Clause 10 but with additional clarifications.

The full list of required models is included in one singular list of bulleted items.

Documentation should accompany the models and should include IBR unit and PPC model validation reports.

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Template FIR Review – Clause 10

Refer to [INSERT TRANSMISSION PROVIDER NAME] modeling requirements for more details:

- [INSERT INTERCONNECTION MODELING REQUIREMENTS LINKS AND DESCRIPTION]
- [INSERT ONGOING MODELING REQUIREMENTS SUCH AS MOD-032 REQUIREMENTS]

[INSERT TRANSMISSION PROVIDER NAME] will evaluate the modeling package and documentation provided for each interconnection request to ensure the models adequately meet quality and useability requirements.

Verified models may become available later in the interconnection process; changes and technological advancements to IBR plant models are permitted per the FERC Generator Interconnection Agreements and Procedures. However, the following must be adhered to by the interconnection customer:

- Changes that affect the electrical behavior of the IBR plant require a re-submittal of the modeling package and accompanying updates to documentation verifying the model matches the proposed or as-built facility.
- [INSERT TRANSMISSION PROVIDER NAME] will determine whether the IBR plant must be re-studied in the larger system model to ensure reliability and stability.
- Equipment changes throughout the interconnection process may have an adverse impact on interconnection timelines to re-evaluate the models and conduct re-studies. The IBR developer should minimize such changes to the extent possible.

IEEE 2800-2022 is not detailed in terms of IBR modeling requirements (usability, accuracy, verification, benchmarking, etc.). Thus, the template includes a linkage to the utility modeling requirements that likely already exist in some fashion.

It is a worthwhile exercise to re-evaluate IBR modeling requirements when adopting IEEE 2800-2022 because discrepancies likely exist.

Explanation of change management is included and can be adapted based on local needs.

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Template FIR Review – Clause 11

CLAUSE 11: MEASUREMENT DATA FOR PERFORMANCE MONITORING AND VALIDATION

[INSERT TRANSMISSION PROVIDER NAME] adopts Clause 11 of IEEE 2800-2022 with the following exceptions and modifications:

Clarifications for Table 19 of IEEE 2800-2022 include the following:

- Digital fault recording (DFR) data shall capture a duration of 5 seconds, split between 1 second pre-trigger (pre-fault) and 4 seconds post-trigger (during-fault and post-fault)
- Inverter-level dynamic recordings shall capture a duration of 5 seconds, split between 1 second pre-trigger (pre-fault) and 4 seconds post-trigger (during-fault and post-fault)
- Triggered dynamic disturbance recorder (DDR) data capture shall not be used. DDRs shall utilize continuous data recording and storage capability that meet the requirements in Table 19 of IEEE 2800-2022.

[INSERT TRANSMISSION PROVIDER NAME] may request any of the data in Clause 11 of IEEE 2800-2022 for the purposes of forensic event analysis, performance monitoring, model validation, or analyzing any other grid reliability issues. Data shall be furnished by the IBR owner [INSERT TRANSMISSION PROVIDER NAME] within 10 calendar days of the request.

Defined pre- and post-trigger setting defined; commonly used industry values.

Clarification that continuous DDR data required, not trigger-based.

Clarification that the utility may request any of the IBR plant data listed in Clause 11 for various reasons and that data must be provided within a defined timeline.

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Template FIR Review – Clause 11

Table 19—Measurement data—type, points, sampling rate, retention and duration

Provision data type	Measurement/data points (as applicable)	Recording rate	Retention	Duration	Measurement (as applicable)
Plant SCADA data (CSV file)	The plant SCADA system is often a lower resolution repository of information that, at minimum, shall include the following data points: Measurements — *Point of measurement* voltage and medium-voltage *collector system* voltages — *Point of measurement* frequency — *IBR plant* active and reactive power output — *IBR units* active and reactive power output of individual[147] — Shunt dynamic device reactive power output Signals — External control signals from the *TS operator* (BA, RTO, RC, etc.) — External automatic generation control signals — Active and reactive power commands sent to *IBR units*	One record per s	1 year	One year	Subclause 4.4, Table 1
Plant equipment status (tabular log file)	— All breaker statuses, including change of status log — Shunt (dynamic or static) reactive compensation device statuses — Substation transformer status (main step-up and *collector system*) — Status of on load tap changer — Medium-voltage *collector system* statuses — Status of individual *IBR units* — Time stamp — Time synchronization (e.g., GPS status word) or status of the GPS clock signal	Static, as changed	1 year	NA	Not applicable

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Template FIR Review – Clause 12

CLAUSE 12: TEST AND VERIFICATION REQUIREMENTS

[INSERT TRANSMISSION PROVIDER NAME] is not enforcing adherence to Clause 12 requirements; however, [INSERT TRANSMISSION PROVIDER NAME] strongly encourages the IBR developer and/or IBR owner to follow the requirements specified therein. [INSERT TRANSMISSION PROVIDER NAME] reserves the right to request any of the test and verification documentation as outlined in Clause 12; the IBR developer or IBR owner shall provide such documentation in the time specified by [INSERT TRANSMISSION PROVIDER NAME].

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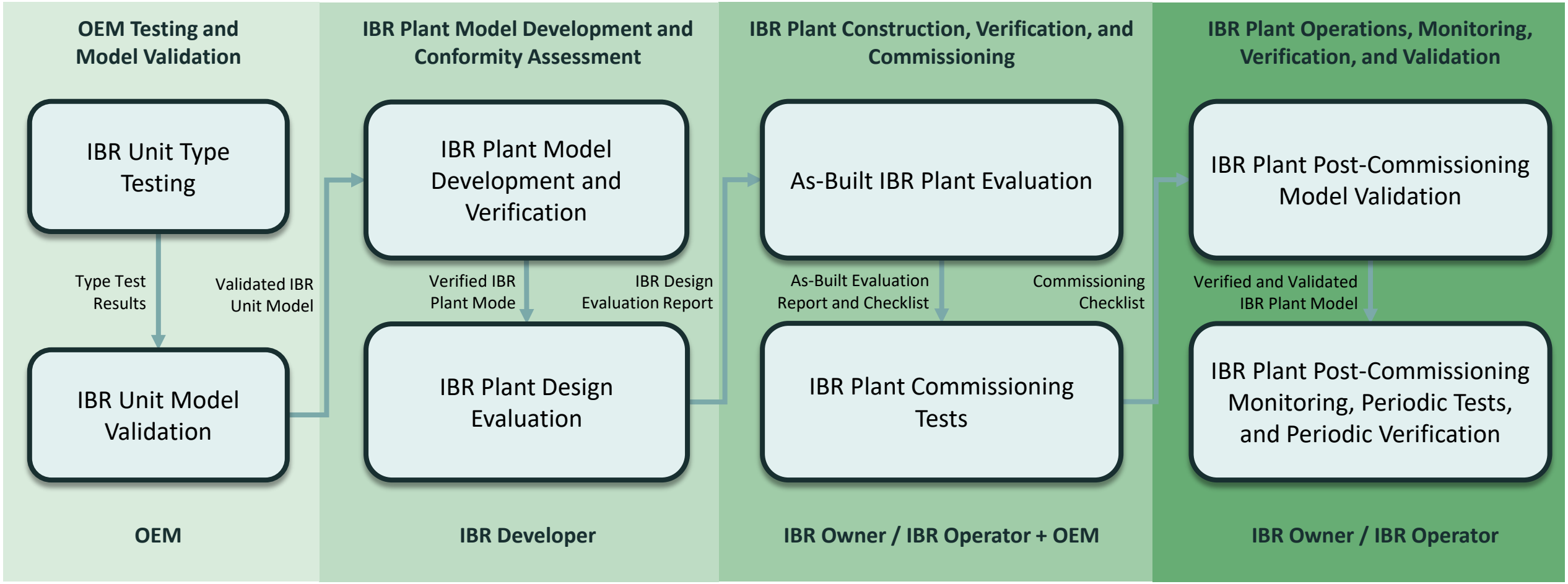
IEEE P2800.2 IBR Plant Performance Conformity Assessment



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Industry Advisory Group Schedule

Date	Topics
✅ May 19, 2025 (3:00–4:00 p.m. MT)	Kickoff: Background, Goals, and Timeline
✅ June 26, 2025 (1:00–2:00 p.m. MT)	IEEE 2800 Overview & IBR Requirements Planning
✅ July 17, 2025 (9:30–10:30 a.m. MT)	IBR Requirements Enhancements – Industry Experience
✅ August 28, 2025 (1:00–2:00 p.m. MT)	Draft Template Review: General Interconnection Requirements
✅ September 25, 2025 (1:00–2:00 p.m. MT)	Draft Template Review: Technical Performance Requirements
✅ October 23, 2025 (1:00–2:00 p.m. MT)	Draft Template Review: Model & Study Requirements
November 13, 2025 (1:00–2:00 p.m. MT)	Final Review & Closeout
December 17, 2025 (1:00–2:00 p.m. MT)	Outreach and Industry Webinar (review of final deliverables)

Thank You!

Next Industry Advisory Group Meeting

November 13, 2025 at 1:00 PM MT

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