Harmonizing IBR Interconnection Requirements in the West

WECC RAC Meeting

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October 23, 2025

WIRAB's 2025 Strategic Initiatives

WIRAB Western Interconnection Regional Advisory Body

Transmission Planning (WestTEC)

Initiative 1: Advise WECC to work collaboratively with the Western Power Pool and Western stakeholders to develop an investment-grade transmission plan that effectively improves reliability in the Western Interconnection.

Inverter-based Resource Risk

Initiative 2: Advise WECC to work collaboratively with Western regulators and stakeholders to address and proactively mitigate risks associated with the uncoordinated interconnection of inverter-based resources in the Western Interconnection.

Inter-regional Transfer Capability

Initiative 3: Advise WECC regarding a process for ongoing assessments and prudent upgrades for inter-regional transfer capabilities in the Western Interconnection to ensure reliable power flow when the system is stressed.

Extreme Weather Event Analysis

Initiative 4: Advise WECC to conduct a systematic review of recent extreme weather events that have tested the grid, focusing on the challenges of maintaining grid reliability during increased demand, unexpected outages, system stress, and near-miss incidents in the Western Interconnection.

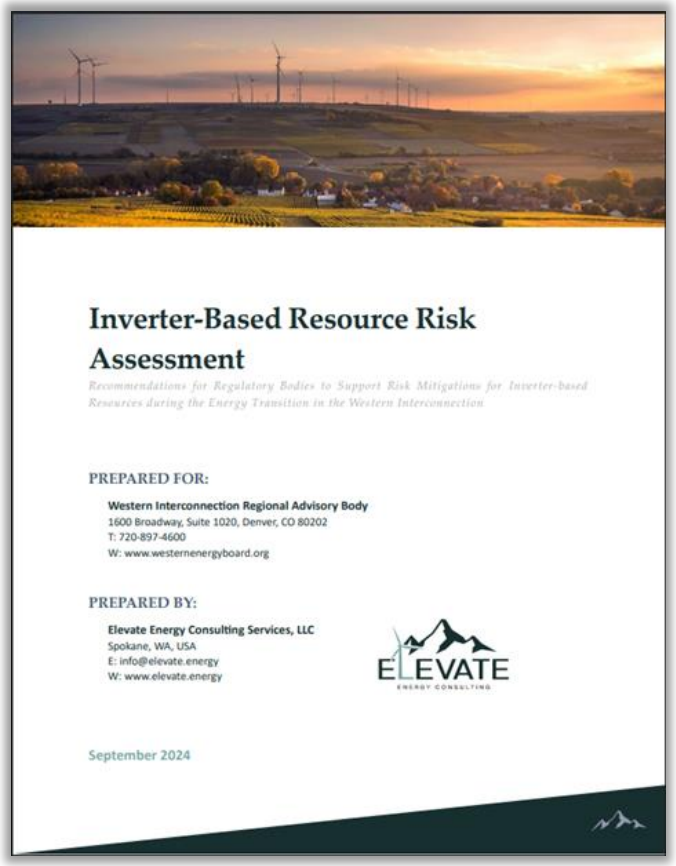
Grid Enhancing Technologies for Reliability

Initiative 5: Advise WECC to assess the reliability implications of innovative grid solutions used to maximize the potential of the existing transmission system as utilities modernize the grid in the Western Interconnection.

Inverter-Based Resource Risk Assessment Report

Western Interconnection Regional Advisory Body

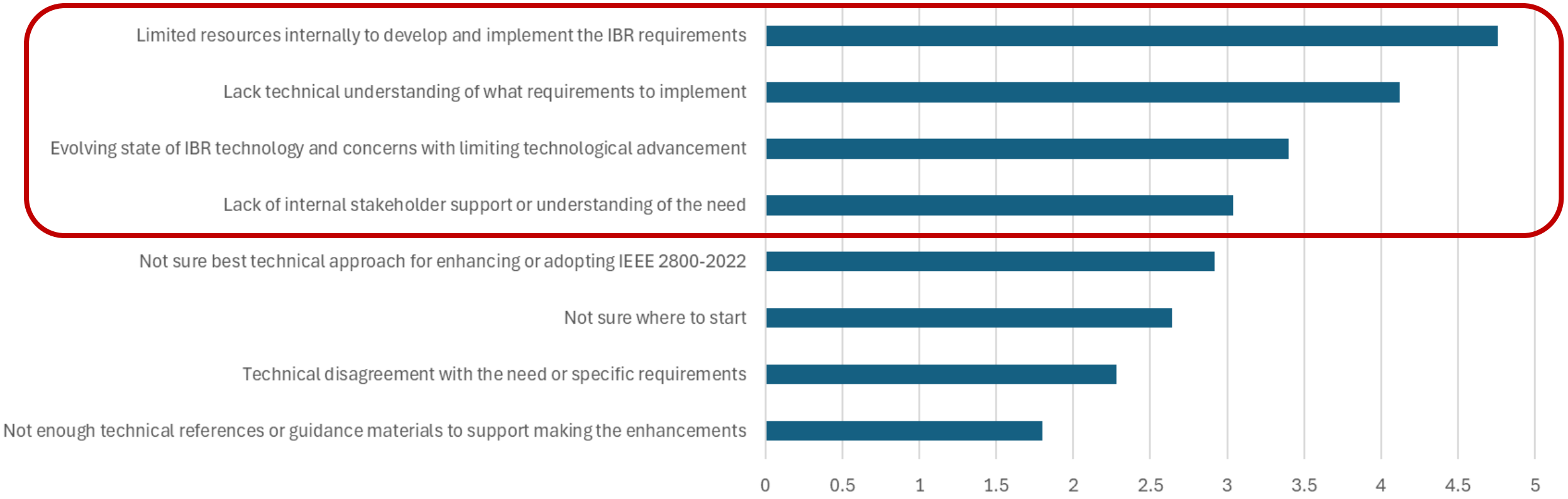
- **Developed Elevate Energy Consulting**
- **Report and Recommendations Endorsed by WIRAB.**
  - WIRAB to collaborate with WECC and other key stakeholders to prioritize and implement the recommendations outlined in this report.
- **Key Recommendation:** Create a standardized template for FIR enhancements, ideally implementing IEEE 2800-2022 standard.



Key Recommendations

- Harmonize requirements for IBRs across the West
- Leverage IEEE 2800-2022 and latest implementation learnings
- Enhance Facility Interconnection Requirements for IBRs
- Produce a standardized template for requirements enhancements
- Conduct regional training, education, and engagement
- Lead proactive, stakeholder-engaged risk mitigation efforts
- Focus on both observed risks and future challenges
- Support smaller entities, allow utility/system-specific flexibility
- Consider related requirements development for large loads

“What have been the main challenges and/or barriers for enhancing IBR interconnection requirements?”

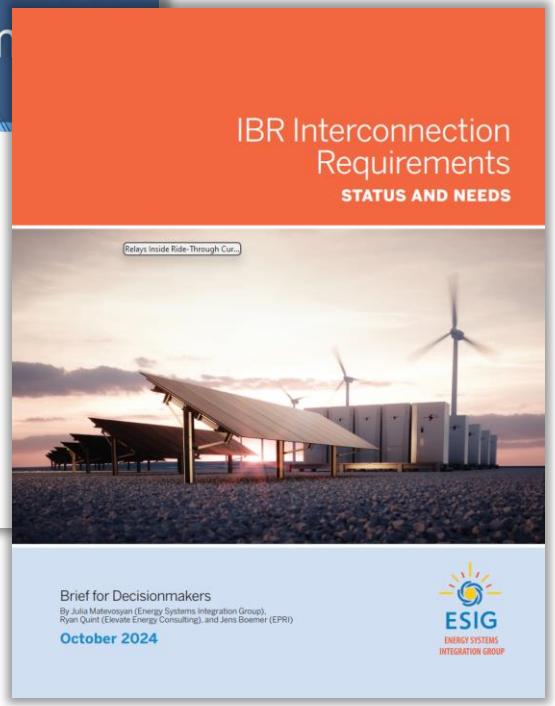


"What would you like to get out of this IAG forum? How can it provide the most value to you, your department, and your organization?"

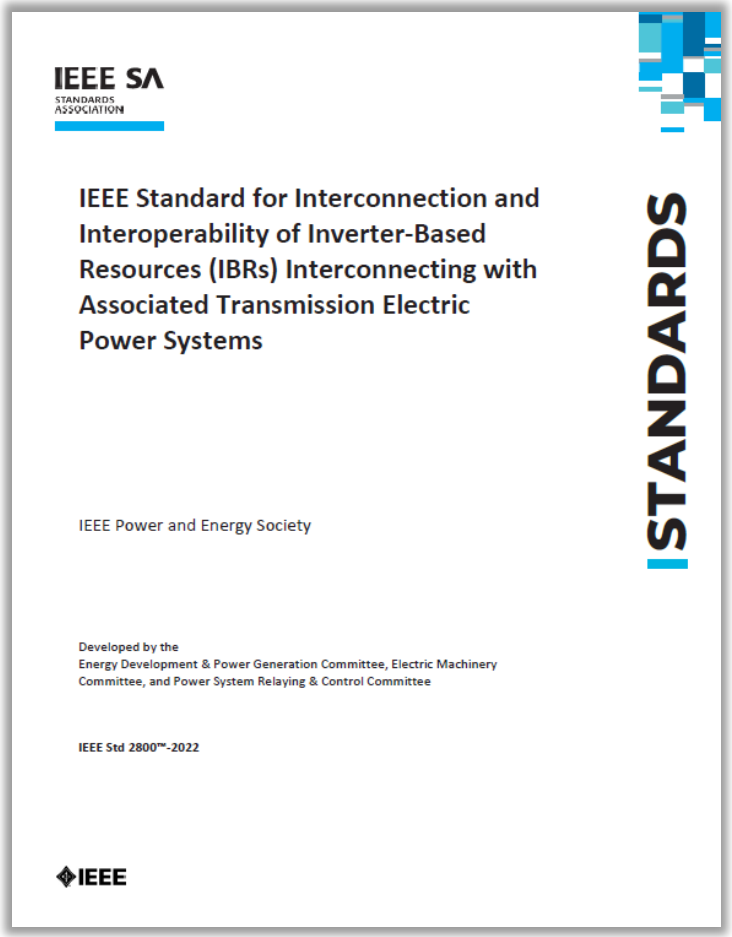
- Guidelines on the implementation of IEEE 2800; "best practices" template that can be used as a starting point
- Deeper understanding of technical requirements in standard
- Learning from others – obstacles, challenges, successes
- Identification and sharing of best practices (developing requirements and implementing such requirements)
- Visibility of and confidence in interconnected IBR plant settings and conformity with NERC and IEEE 2800 standards
- Alignment with FERC Order 901 activities – what's missing or different

DOE i2X FIRST Initiative

https://www.esig.energy/i2x-first-season-1/
https://www.esig.energy/i2x-first-forum/
Register for Season 2



ESIG Brief: IBR Interconnection Requirements



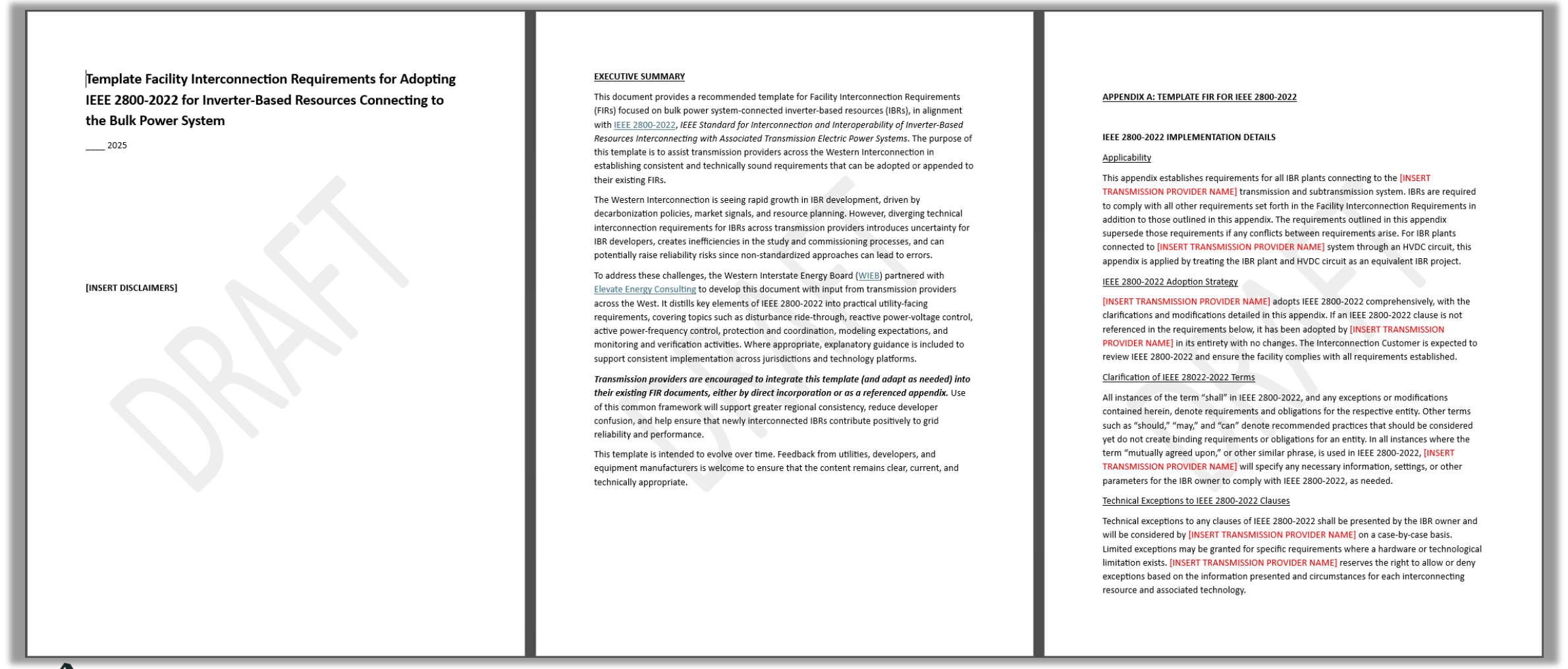
IEEE 2800-2022

This Industry Advisory Group Initiative

- Forum to educate and inform stakeholder about IEEE 2800-2022 adoption
  - Improve adoption of industry-recommended standards like IEEE 2800-2022
- Sharing experience and lessons learned among transmission entities
- Fostering harmonization of interconnection requirements across the West
- Supporting smaller entities or entities maybe further behind
- Sharing drafts and responding to stakeholder input; align on common vision
- ***Goals:***
  - Develop and publish "template" Facility Interconnection Requirements (FIRs) that entities can adopt and adapt, as needed (***Action: adopt the template and harmonize!***)
  - Open, engaging, informal, collaborative, and respectful environment – share and learn

Learn more here

Template Facility Interconnection Requirements



Template Facility Interconnection Requirements for Adopting IEEE 2800-2022 for Inverter-Based Resources Connecting to the Bulk Power System

___ 2025

[INSERT DISCLAIMERS]

EXECUTIVE SUMMARY

This document provides a recommended template for Facility Interconnection Requirements (FIRs) focused on bulk power system-connected inverter-based resources (IBRs), in alignment with IEEE 2800-2022, *IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources Interconnecting with Associated Transmission Electric Power Systems*. The purpose of this template is to assist transmission providers across the Western Interconnection in establishing consistent and technically sound requirements that can be adopted or appended to their existing FIRs.

The Western Interconnection is seeing rapid growth in IBR development, driven by decarbonization policies, market signals, and resource planning. However, diverging technical interconnection requirements for IBRs across transmission providers introduces uncertainty for IBR developers, creates inefficiencies in the study and commissioning processes, and can potentially raise reliability risks since non-standardized approaches can lead to errors.

To address these challenges, the Western Interstate Energy Board (WIEB) partnered with Elevate Energy Consulting to develop this document with input from transmission providers across the West. It distills key elements of IEEE 2800-2022 into practical utility-facing requirements, covering topics such as disturbance ride-through, reactive power-voltage control, active power-frequency control, protection and coordination, modeling expectations, and monitoring and verification activities. Where appropriate, explanatory guidance is included to support consistent implementation across jurisdictions and technology platforms.

Transmission providers are encouraged to integrate this template (and adapt as needed) into their existing FIR documents, either by direct incorporation or as a referenced appendix. Use of this common framework will support greater regional consistency, reduce developer confusion, and help ensure that newly interconnected IBRs contribute positively to grid reliability and performance.

This template is intended to evolve over time. Feedback from utilities, developers, and equipment manufacturers is welcome to ensure that the content remains clear, current, and technically appropriate.

APPENDIX A: TEMPLATE FIR FOR IEEE 2800-2022

IEEE 2800-2022 IMPLEMENTATION DETAILS

Applicability

This appendix establishes requirements for all IBR plants connecting to the [INSERT TRANSMISSION PROVIDER NAME] transmission and subtransmission system. IBRs are required to comply with all other requirements set forth in the Facility Interconnection Requirements in addition to those outlined in this appendix. The requirements outlined in this appendix supersede those requirements if any conflicts between requirements arise. For IBR plants connected to [INSERT TRANSMISSION PROVIDER NAME] system through an HVDC circuit, this appendix is applied by treating the IBR plant and HVDC circuit as an equivalent IBR project.

IEEE 2800-2022 Adoption Strategy

[INSERT TRANSMISSION PROVIDER NAME] adopts IEEE 2800-2022 comprehensively, with the clarifications and modifications detailed in this appendix. If an IEEE 2800-2022 clause is not referenced in the requirements below, it has been adopted by [INSERT TRANSMISSION PROVIDER NAME] in its entirety with no changes. The Interconnection Customer is expected to review IEEE 2800-2022 and ensure the facility complies with all requirements established.

Clarification of IEEE 28022-2022 Terms

All instances of the term "shall" in IEEE 2800-2022, and any exceptions or modifications contained herein, denote requirements and obligations for the respective entity. Other terms such as "should," "may," and "can" denote recommended practices that should be considered yet do not create binding requirements or obligations for an entity. In all instances where the term "mutually agreed upon," or other similar phrase, is used in IEEE 2800-2022, [INSERT TRANSMISSION PROVIDER NAME] will specify any necessary information, settings, or other parameters for the IBR owner to comply with IEEE 2800-2022, as needed.

Technical Exceptions to IEEE 2800-2022 Clauses

Technical exceptions to any clauses of IEEE 2800-2022 shall be presented by the IBR owner and will be considered by [INSERT TRANSMISSION PROVIDER NAME] on a case-by-case basis. Limited exceptions may be granted for specific requirements where a hardware or technological limitation exists. [INSERT TRANSMISSION PROVIDER NAME] reserves the right to allow or deny exceptions based on the information presented and circumstances for each interconnecting resource and associated technology.

Template FIRs – Next Steps

- Continuing group discussions and alignment on draft template requirements
- Seeking to finalize toward year-end
- Plan to engage with utilities across West to share findings, recommendations, and intended use of the template

- ***Interested to learn more about how to effectively bring the work to fruition within utilities – feedback welcome from RAC!***

Industry Advisory Group Schedule

Western Interconnection Regional Advisory Body

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)	Draft Template Review: SCADA, Monitoring, Compliance
December 17, 2025 (1:00–2:00 p.m. MT)	Final Review & Closeout

Resources for State Regulators on IBR Risks

Technical Resource for State Regulators and Commissioners: Oversight of Inverter-based Resources

September 9, 2025

Purpose

This document is a technical resource designed to support state regulators in exercising informed oversight amid the rapid growth of inverter-based resources (IBRs) and the evolving resource mix. The guiding questions included are intended to assist regulators in engaging with utilities and stakeholders during integrated resource planning, rate cases, and other regulatory proceedings. This effort aims to help regulators protect consumers, ensure just and reasonable rates, oversee prudent utility investments, and advance public policy goals—all while maintaining a reliable and resilient electric grid in the face of accelerating technological change.

Applicability

Although state regulators have primary authority over state-jurisdictional resources, they can also play a critical role in supporting the reliability of FERC- and NERC-jurisdictional resources that directly impact local grid reliability, system operations, and ratepayers. Regulators can press utilities to explain how they are implementing NERC recommendations, adopting industry standards, and dedicating sufficient resources to meet the challenges ahead. Without adequate measures, retail customers face notable risks: inefficient processes, costly investments to offset unreliable operations, and rework caused by inaccurate data or information, driving up consumer costs. In many cases, utilities may spend unnecessary time and money fixing avoidable problems—problems that could instead be addressed through clearer requirements, modern technology, automation, and improved processes.

While the topics described in this document apply to bulk power system (BPS) resources connected to the transmission system, states should also recognize the importance of distribution-connected resources. BPS-connected IBRs are guided by IEEE 2800 while distribution-connected distributed energy resources (DERs) adhere to IEEE 1547. Both standards share similar goals but differ in technical implementation. For example, BPS resources must provide large-scale grid support functions (e.g., ride-through, dynamic response characteristics, frequency response), whereas DER standards emphasize interoperability, coordination with local systems, and safe integration at smaller scales. State regulators should understand both frameworks: most of the topics and questions raised here apply to the BPS, but parallel questions—appropriately modified—are also relevant at the distribution level. Regulators have a key role to play in staying engaged, informed, and aligned across both domains to ensure reliability for all customers (see Table 1).

Table 1: Similarities and Differences between State and FERC/NERC-Jurisdictional Resources

Aspect	State-Jurisdictional *Distribution-Connected*	FERC/NERC-Jurisdictional *BPS-Connected*
Regulatory Authority	State PUCs, local regulators	FERC and NERC
Applicable Technical Standards	**IEEE 1547** and other distribution utility requirements	**IEEE 2800** and transmission utility requirements
System Scale	Typically < 20 MVA (e.g., rooftop solar, distributed storage, etc.)	Typically > 20 MVA, often 100's of MWs per site
Primary Goals	Safety, reliability, and power quality at local distribution level	Reliability and stability of the BPS; ensuring grid services
Grid Services	Fairly limited – ride-through, protection coordination, voltage/reactive power, interoperability	Comprehensive – ride-through, frequency response, voltage control, dynamic response, fault current injection, etc.
Interconnection Process	State/utility-led processes; varies by jurisdiction; generally streamlined but less standardized	FERC-jurisdictional LGIP; standardized, technical with detailed modeling and studies
Regulatory Leverage	States shape DER interconnection rules, resource aggregation policies, and incentives	FERC/NERC set mandatory standards; entities subject to ongoing compliance, audits, and penalties
State Regulatory Role	Actively shape DER interconnection requirements; direct oversight of DER connections	Engage in discussions with utilities; ensure alignment with industry best practices; drive minimization of risks and reduced costs for ratepayers

Background

The unprecedented growth of IBRs—including solar photovoltaic (PV), wind, battery energy storage systems (BESS), and hybrid configurations—is one of the largest drivers of grid transformation across North America.[1] In the Western Interconnection, this shift is occurring at a scale and pace that introduces new and complex reliability challenges for the bulk power system (BPS). In response, the Western Interconnection Regional Advisory Body (WIRAB) commissioned a study focused on the implications of widespread IBR integration across the Western Interconnection. Published in 2024, the *IBR Risk Assessment Report* recognized the benefits of an IBR-rich grid yet also identified emerging reliability risks across the IBR lifecycle including interconnection, modeling, control settings, protection coordination, and post-event performance. The report provided a series of near-, medium-, and long-term recommendations for federal, regional, and state-level action. Notably, it emphasized the critical role that state regulators and commissions play in shaping the technical requirements and oversight practices that govern IBR integration at the utility level.

As a follow-on to that report, WIRAB has developed this set of technical resources and guiding questions specifically for state regulatory bodies. These materials are designed to support meaningful engagement with utilities during Integrated Resource Plans (IRPs), Integrated System Plans (ISPs), transmission and distribution investment reviews, and other regulatory proceedings such as Certificate of Public

[1] NERC 2025 State of Reliability Report

Convenience and Necessity dockets, transmission siting and location approval dockets, line extension dockets, and distribution interconnection agreement and tariff compliance documents. The goal is to ensure that IBR-related decisions are made with transparency, technical rigor, and accountability—protecting consumers, promoting grid reliability, and supporting state individual public policy objectives during a time of rapid change in the electric resource mix.

Why It Matters to the West

The Western Interconnection is at the forefront of the energy transition, with some of the highest penetrations of inverter-based resources (IBRs) in North America. Approximately 85% of new generation capacity over the next 10 years in the Western Interconnection will be solar, wind, and battery energy storage systems[2]—resources that interface with the grid through power electronics rather than traditional synchronous generators. While these technologies are central to achieving some states' decarbonization goals and present unique opportunities and benefits from a reliability perspective, they may also introduce new reliability risks that are not always adequately addressed by legacy planning, interconnection, and operational frameworks.

Recent grid disturbances across the West and broader North American system—including large-scale IBR tripping events—have highlighted vulnerabilities in how these resources are modeled, interconnected, and operated. These events have underscored the urgent need for improved oversight, consistent technical requirements, and stronger accountability across all jurisdictions. For state regulators, this transformation presents both a challenge and an opportunity: to ensure utilities are making prudent, forward-looking investments and to align utility practices with evolving standards like IEEE 2800-2022 and NERC's inverter-based resource standards.

This deliverable empowers state commissions to engage more effectively in technical discussions, ask informed questions, and shape regulatory expectations that reflect the realities of a rapidly changing grid. Ensuring that IBRs are integrated in a way that supports or enhances—not threatens—reliability is essential to maintaining public confidence, affordability, and grid resilience across the West.

Recommendations for Regulators and Decision Makers

Acknowledging these challenges is only the first step. Regulators must transition from reactive assessment to preemptive mitigation—leveraging regulatory tools, multi-agency coordination, and technically sound interconnection approaches to ensure reliability, resilience, and affordability as the West continues to integrate increasing levels of IBRs.

Thus, state regulators and decision makers should consider and engage utilities in the following recommendations:

1. **Adopt and Enforce Modern Interconnection Standards:** Inquire and strongly encourage utilities to adopt IEEE 2800-2022 and subsequent versions (or derivatives of it) as the minimum technical standard for IBR interconnection to ensure consistency and reliability across the state and region

[2] WECC 2024 State of the Interconnection Report

Thank You!

Next Industry Advisory Group Meeting

October 23, 2025 at 1:00 PM MT

TODAY!

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Western Interconnection
Regional Advisory Body