# Harmonizing IBR Interconnection Requirements in the West

*WECC RAC Meeting*

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July 9, 2025

# Who is WIRAB?

Western Interconnection Regional Advisory Body

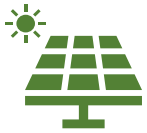
- **Statutory Authority:** Established in 2005, as an independent body with statutory authority under Section 215(j) of the Federal Power Act to Advise FERC, NERC, and WECC on reliability matters in the Western Interconnection.
- **Membership:** All state and provinces with load served in the Western Interconnection
- **Funding:** Assessments approved by FERC to load serving entities under Section 215 of the Federal Power Act.

# 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.

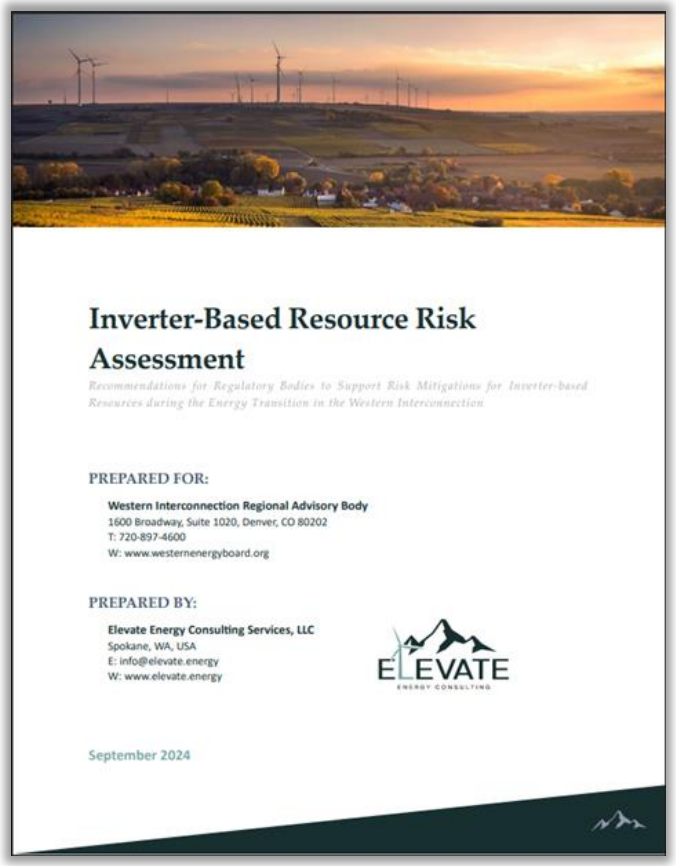
## Grid Enhancing Technologies for Reliability

**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

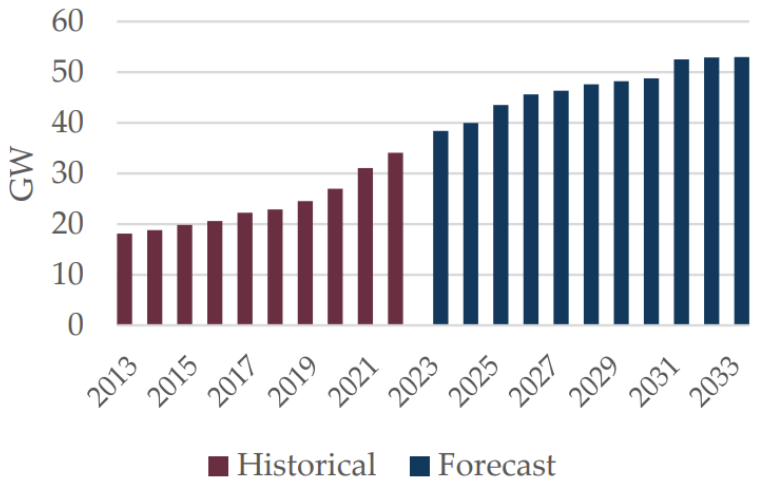
Western Interconnection Regional Advisory Body

- **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.

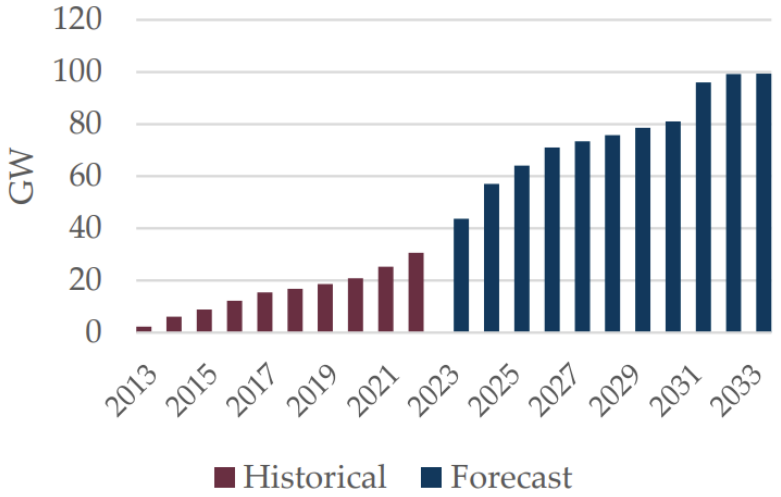


# Wind, Solar, and Storage in the West

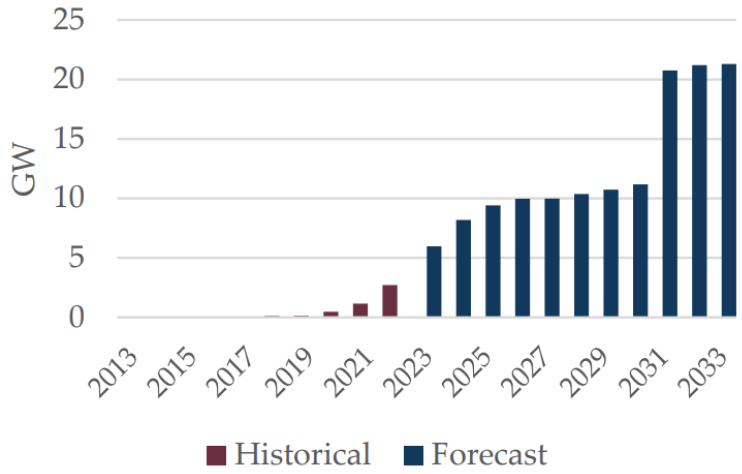
## Wind




## Solar and Hybrid Solar



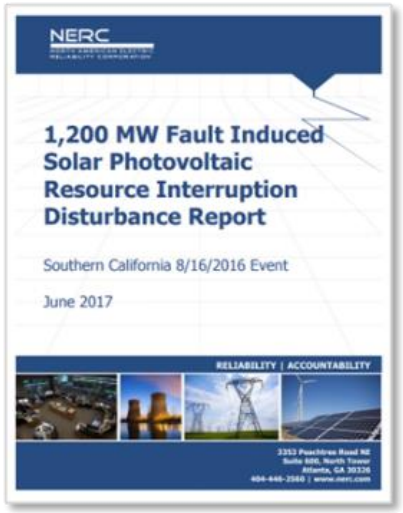

## Energy Storage

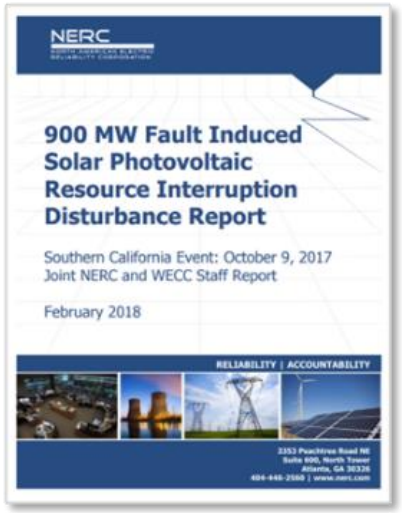


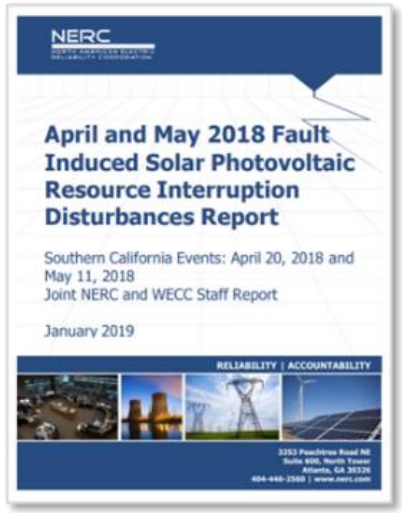

*95 GW of resource addition in next 10 years*
*80% are solar, energy storage, and wind*

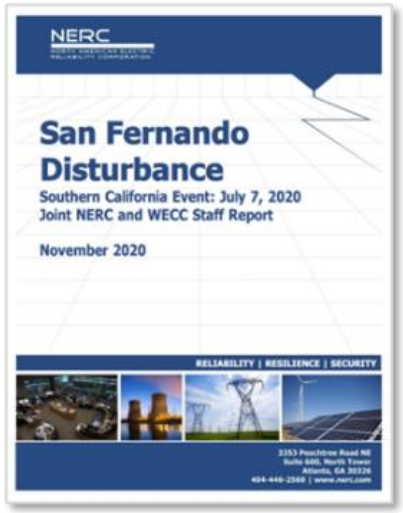
2023 Western Assessment of Resource Adequacy (WECC)

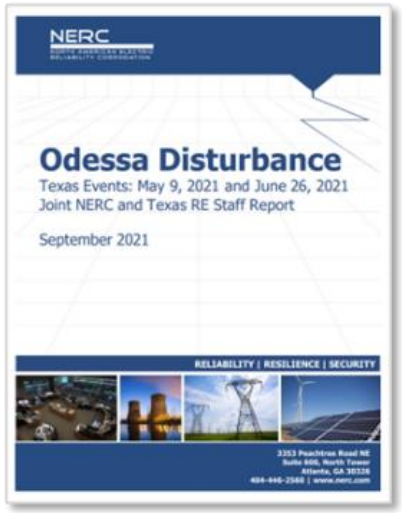
# The Infamous Disturbance Reports

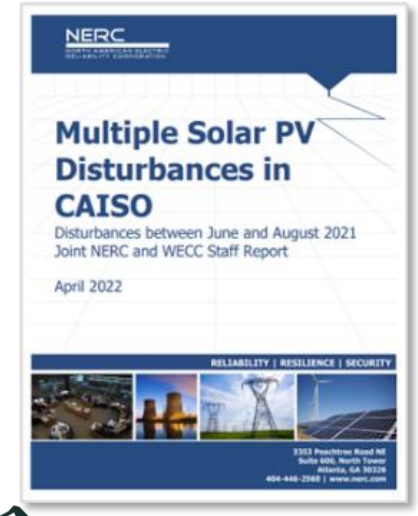


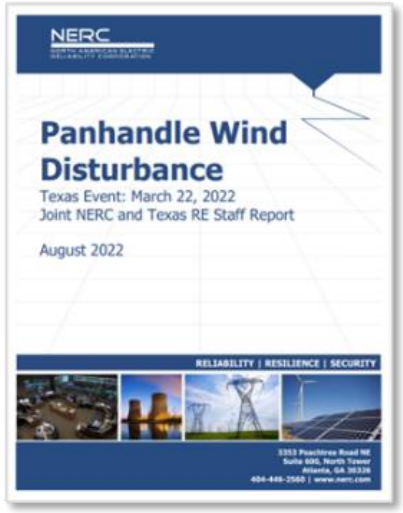



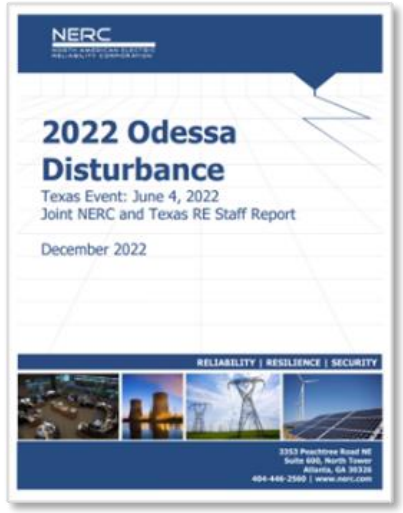



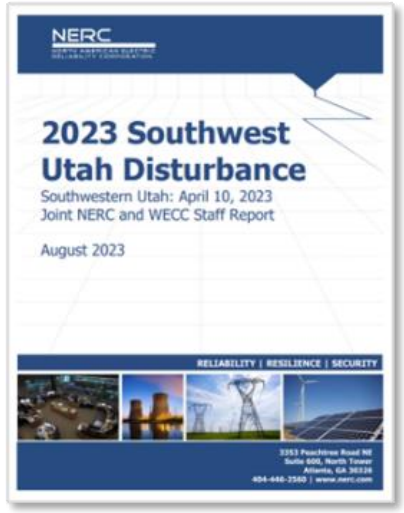



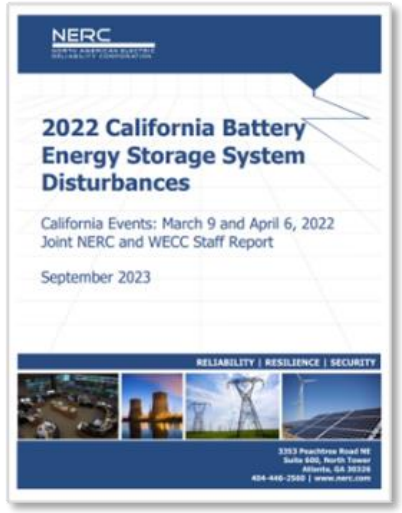



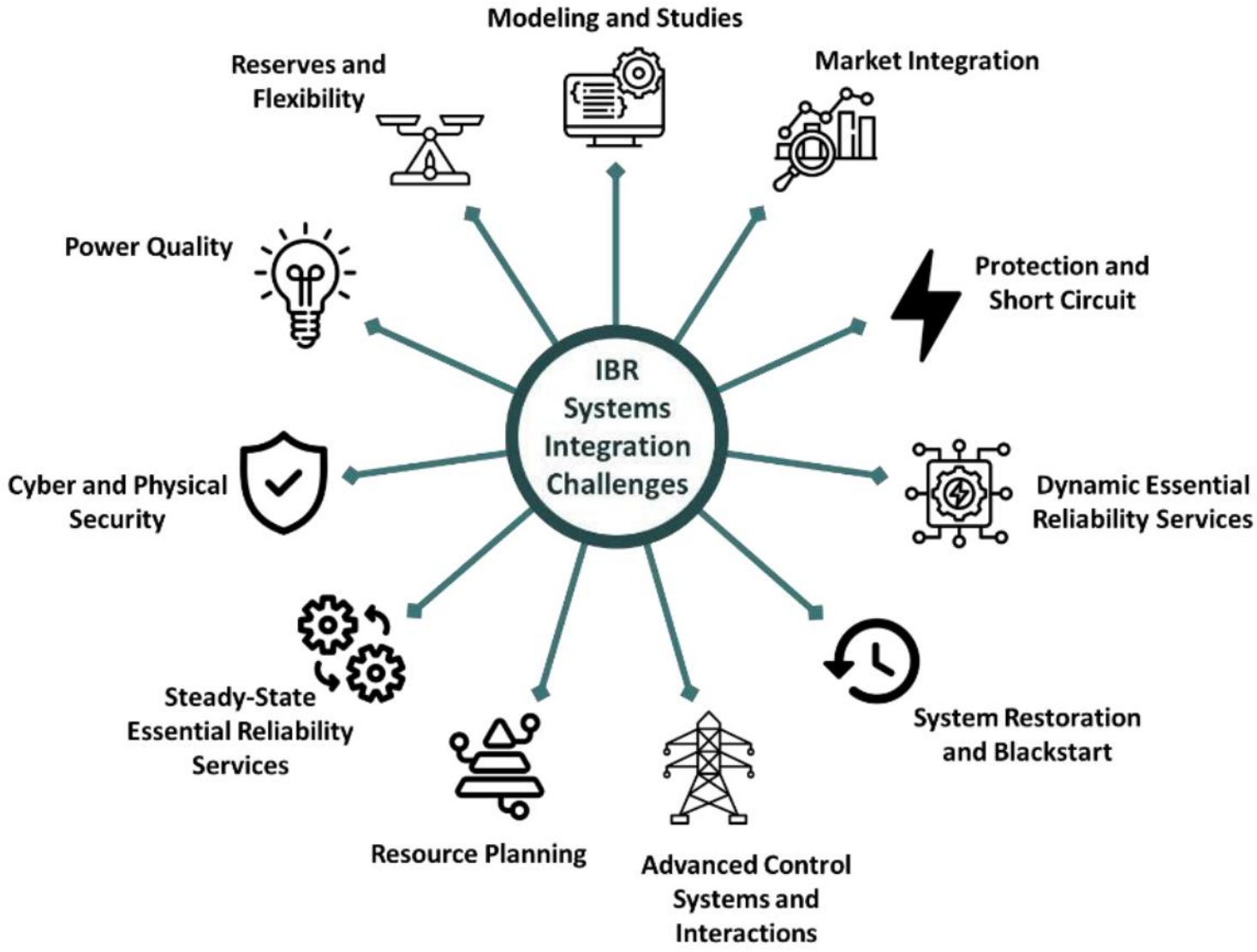



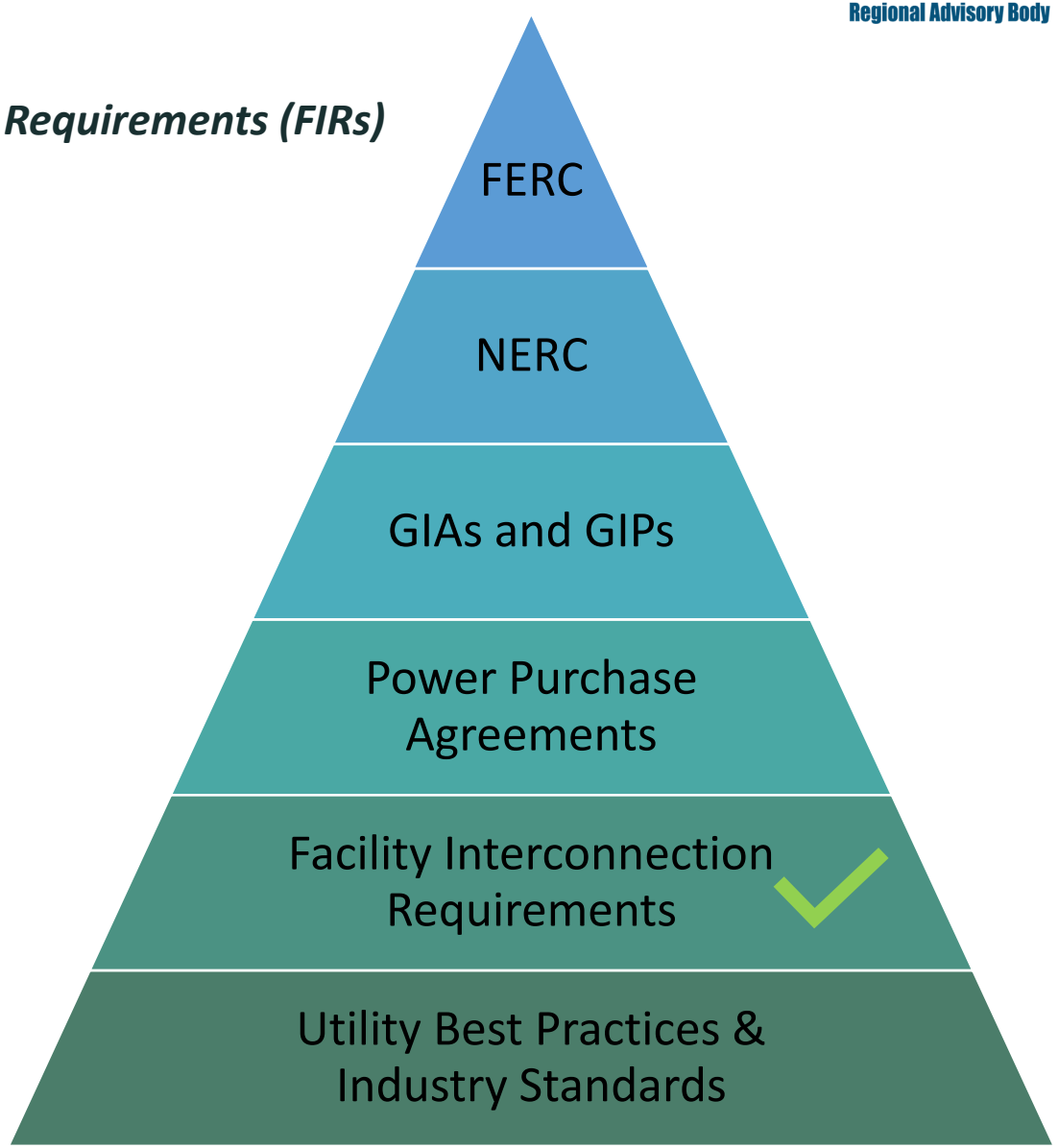



# IBR Risks and Challenges

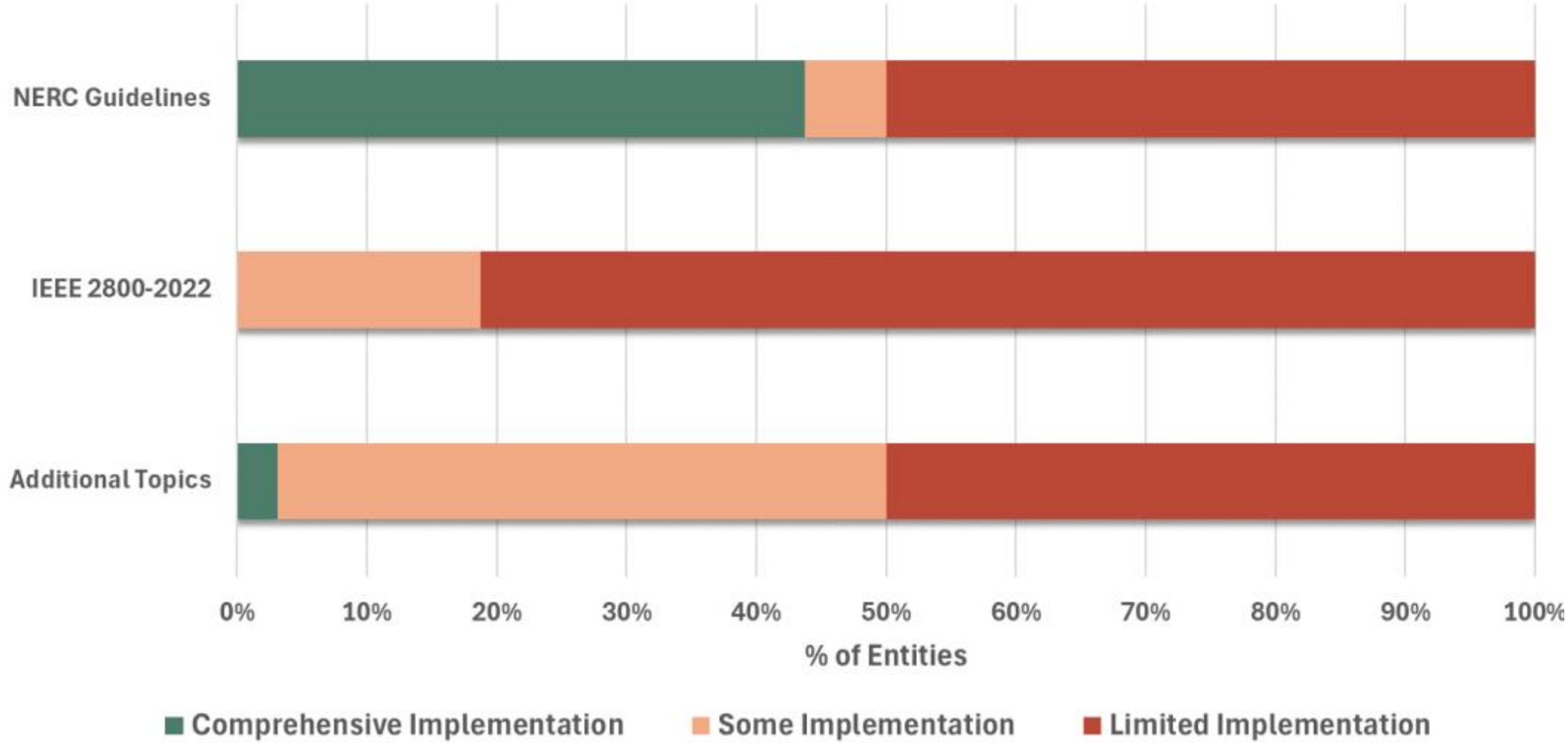


# Is Industry Adopting Recommendations?

- Reviewed ***32 Western Interconnection Facility Interconnection Requirements (FIRs)***
- In each FIR, searched for IBR risk mitigations:
  - Inclusion of NERC Reliability Guideline recommendations
  - Adoption of the IEEE 2800-2022 standard
  - Enhanced IBR-Applicable and IBR-Specific Requirements
    - Ride-Through Capability and Performance
    - Oscillations and Instability
    - Modeling and Model Validation
    - Electromagnetic Transient (EMT) Modeling
    - Inertia and System Strength
    - Event Analysis and Performance Validation
    - Disturbance Monitoring (PMU and DFR)
    - Power Quality
    - Grid Forming
    - Testing and Commissioning



# Is Industry Adopting Recommendations?



# 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

# DOE i2X FIRST Initiative

ESIG | DOE i2X Forum for the Implementation of Reliability Standards for Transmission

RETURN TO I2X SEASON 2 PAGE

ESIG with support from Elevate Energy Consulting, and in collaboration with Berkeley Lab and EPRI, is supporting the U.S. Department of Energy (DOE) initiative to facilitate the Forum for the Implementation of Reliability Standards for Transmission (FIRST) as part of the DOE's Interconnection Innovation e-Xchange (i2X).

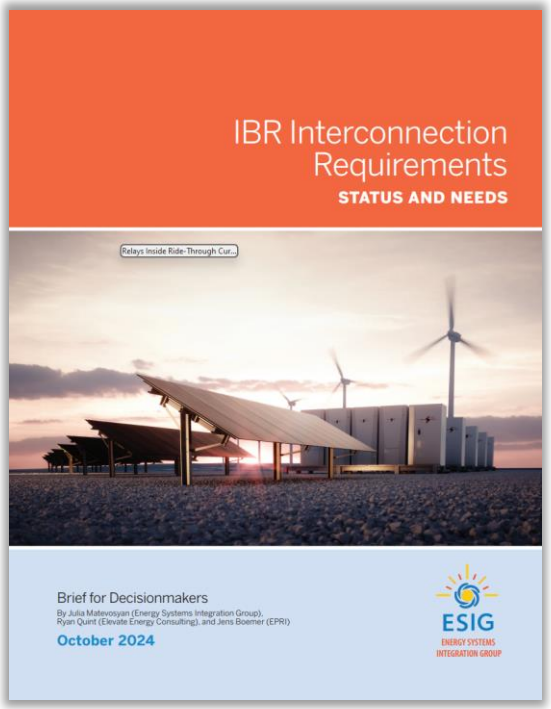
To ensure the reliable and secure operation of clean energy resources connected to the electric grid, interconnection standards need to address inverter-based generator capabilities, expected performance, cybersecurity requirements, and other relevant issues. Some of these standards, such as Institute of Electrical and Electronics Engineers (IEEE)-2800, have been developed, but still need to be widely adopted and implemented. Other standards, as well as procedures for assessing and verifying plant conformity with them, have yet to be developed.

The U.S. Department of Energy (DOE) Interconnection Innovation e-Xchange (i2X) Forum for the Implementation of Reliability Standards for Transmission (FIRST) facilitates the adoption of new and recently updated standards relevant for interconnected clean energy resources like solar and wind energy. The Forum convenes industry stakeholders to enable easier and more harmonized implementation of these interconnection standards.

i2X FIRST addresses the solutions related to interconnection standards (4.2 to 4.9) identified in the *DOE Transmission Interconnection Roadmap*. i2X FIRST covers practices outlined in the draft of IEEE P2800.2 and best practices from early adopters of the IEEE 2800 standard. Additionally, ongoing North American Electric Reliability Corporation (NERC) standard revision efforts related to Federal Energy Regulatory Commission (FERC) Order 901 are discussed to ensure alignment with IEEE 2800 adoption. Feedback gained through i2X FIRST will help shape new standards development processes.

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

# ESIG IBR Requirements Brief




[ESIG Brief: IBR Interconnection Requirements]

## IEEE 2800-2022 Adoption Strategies

| General Reference<br>*Cite IEEE 2800 in Full* | Detailed Reference<br>*Cite IEEE 2800 Clauses* | Hybrid Integration<br>*Organic Integration* | Detailed Spec<br>*Recreate Specs of IEEE 2800* |
|---|---|---|---|
| "Point to standard in existing requirements" | "Point to specific clauses in existing requirements" | "Point to specific clauses and add clarifying language in existing requirements" | "Recreate requirements language entirely" |
| ✓Minimal effort to adopt<br>× **Limited system-specific details***<br>× Lacks clarity and specificity<br>× **Leaves gaps in implementation and understanding** | ✓Targeted enhancements<br>✓Allows phased approach<br>× **Limited system-specific details*** | ✓Targeted enhancements<br>✓Allows phased approach<br>✓Allows adaptation and additional requirements<br>✓**System-specific and clear**<br>✓Enables conformity language additions | ✓Targeted enhancements<br>✓Allows phased approach<br>✓Allows adaptation and tailored solution for specific rules framework<br>✓Enables conformity language<br>× **Significant work and duplication for AGIR**<br>× Copyright concerns |

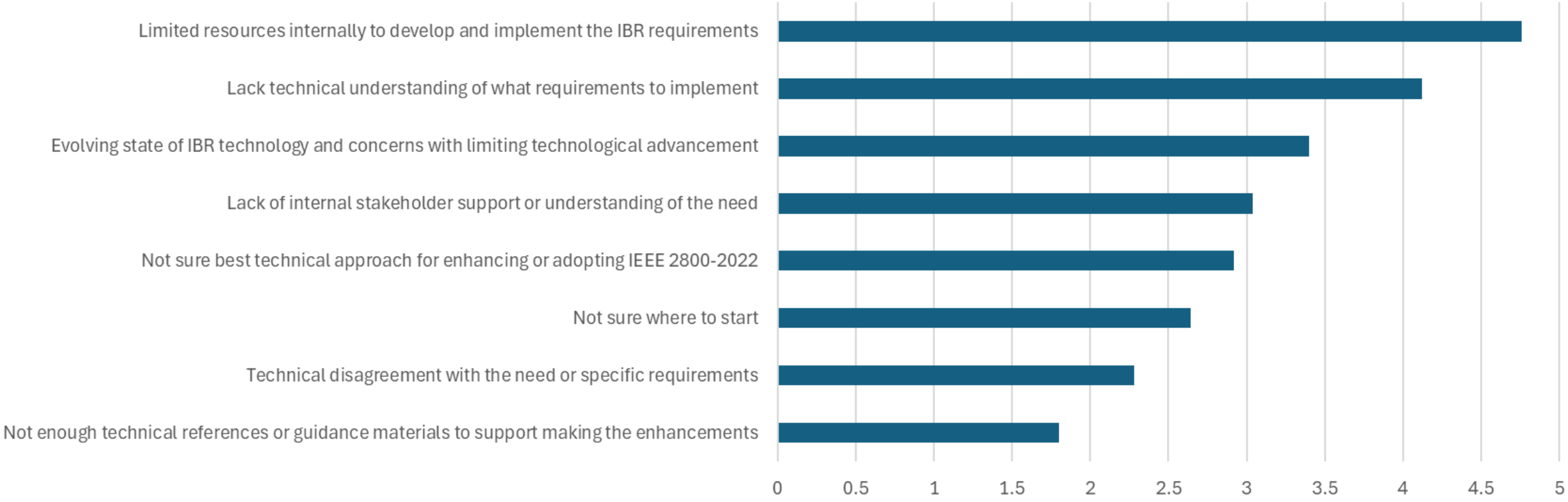
*** Industry practice has tended not to provide the necessary AGIR-specific details (i.e., functional settings) needed for complete adoption of IEEE 2800-2022.**

Notes: Green text indicates advantages of the adoption method, yellow text indicates limitations, and red text indicates gaps. More important advantages, limitations, and gaps are in bold. AGIR = Authority Governing Interconnection Requirements.

Source: Elevate Energy Consulting.

ELEVATE ENERGY CONSULTING

# Q1: What have been the main challenges and/or barriers for enhancing IBR interconnection requirements?



# Q2: 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

# This Industry Advisory Group Initiative

- Create forum to share lessons learned, questions, findings, etc.
- Foster harmonization of interconnection requirements across the West, with adequate room for system-specific needs
- Support smaller entities or entities maybe further behind
- Improve adoption of industry-recommended standards like IEEE 2800-2022
- ***Goals:***
  - Develop and publish “template” Facility Interconnection Requirements (FIRs) that entities can adopt and adapt as needed
  - Open, engaging, informal, collaborative, and respectful environment – share and learn
- Learn more here!

# Meeting Series

| Date | Topics |
|---|---|
| May 19, 2025 from 3:00 – 4:00 p.m. MT | Introduction, Background, Goals, Timeline |
| June 26, 2025 from 1:00 – 2:00 p.m. MT | Overview of IEEE 2800 and IBR Requirements Plan |
| July 17, 2025 from 9:30 – 10:30 a.m. MT | IBR Requirements Enhancements – Industry Experience |
| August 28, 2025 from 1:00 – 2:00 p.m. MT | Draft Template Review: General Interconnection Requirements |
| September 25, 2025 from 1:00 – 2:00 p.m. MT | Draft Template Review: Technical Performance Requirements |
| October 23, 2025 from 1:00 – 2:00 p.m. MT | Draft Template Review: Model & Study Requirements |
| November 13, 2025 from 1:00 – 2:00 p.m. MT | Draft Template Review: SCADA, Monitoring, Compliance |
| December 17, 2025 from 1:00 – 2:00 p.m. MT | Final Review & Closeout |

***Register for the entire series!***

https://us06web.zoom.us/meeting/register/FUwPrsIOS9q1gCpnkuZCPA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