NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

IEEE 2800 OEM Readiness

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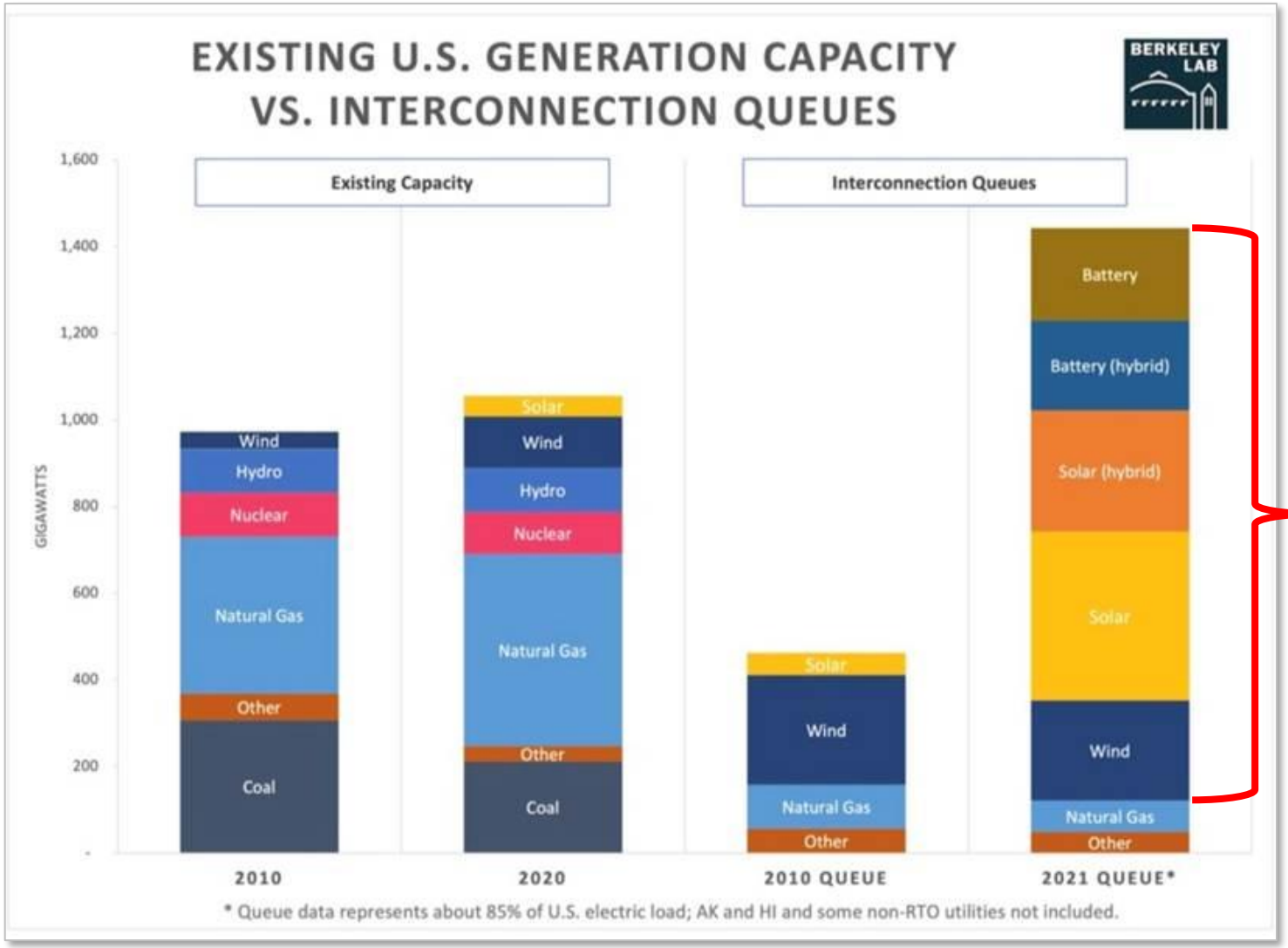
RELIABILITY | RESILIENCE | SECURITY




Interconnection Queues



IBR

Source: LBNL

Overarching Recommendations

1. Industry Adoption of NERC Reliability Guidelines
2. Improvements to FERC GIAs and GIPs
3. Significant Enhancements to NERC Standards

NERC IBR Strategy

Risk Analysis	Interconnection Process Improvements	Best Practices and Education	Regulatory Enhancements
Event Analysis	Improvements to GIAs and GIP	Reliability Guidelines	NERC Standards Projects
Disturbance Reports	Enhanced Interconnection Requirements	Webinars and Workshops	BES Definition Review
Alerts	Modeling and Study Improvements	Outreach and Engagement	Inverter-Specific Requirements and Standards
Lessons Learned	IEEE 2800-2022	Emerging Reliability Risk Issues	Risk-Based Compliance

Current Recommendation

Recommendation:
NERC strongly encourages all Transmission Owners, Transmission Service Providers, ISO/RTOs, Reliability Coordinators, Balancing Authorities, and other relevant transmission entities to consider an appropriate yet comprehensive implementation of IEEE 2800-2022

- Key Points:
  - Leverage local interconnection requirements
  - Begin adoption and implementing IEEE 2800-2022 requirements now
  - Understand equipment capabilities and limitations to meet IEEE 2800
  - Integrate plans for future equipment certification per IEEE P2800.2
  - Develop plans that can adapt with changes coming

Proposed Roadmap

2022	IEEE 2800-2022 approved; IEEE P2800.2 underway. Industry exploring best practices for adopting IEEE 2800 standard.
2023	Industry implementation of IEEE 2800; IEEE P2800.2 drafting. OEM self-certification, industry understanding of IBR performance issues/gaps, where applicable.
2024	Industry maturity with implementation of IEEE 2800 implementation. IEEE P2800.2 drafting and possible balloting/approval. OEM preparedness to meet future .2 conformance testing.
2025	NRTL-certification (?) still in question for IEEE 2800.2. OEMs preparing for conformance testing and validation (.2) to IEEE 2800-2022.
2026 +	Certified equipment conforming to IEEE 2800-2022 Clear and effective industry implementation of IEEE 2800-2022 and .2.

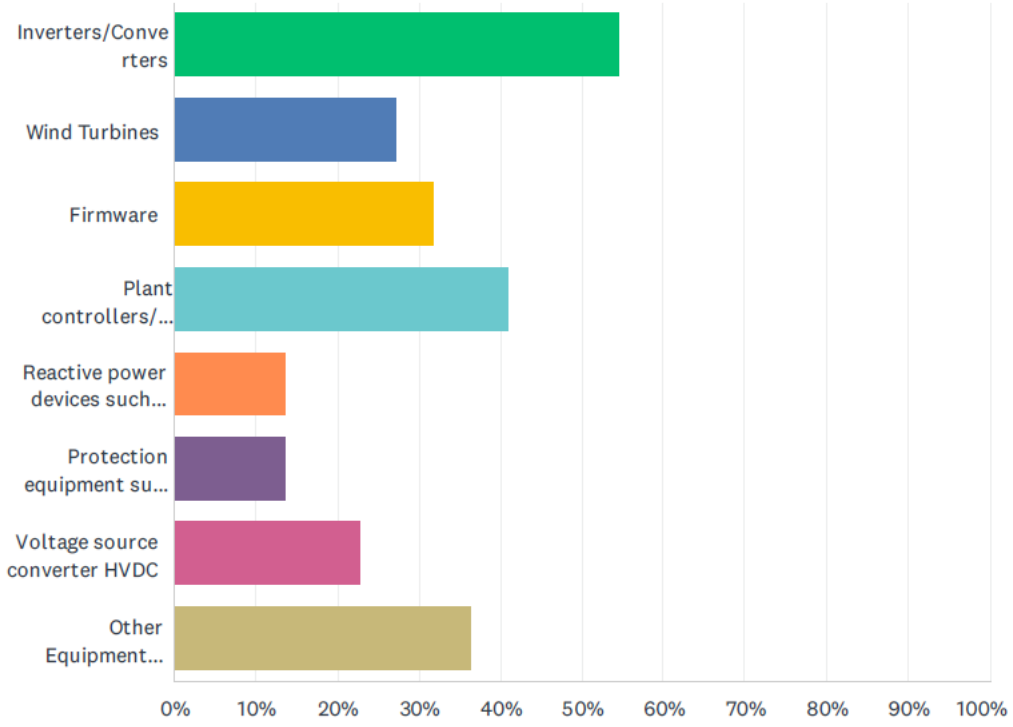
Takeaways:

- Adopt and implement IEEE 2800-2022 now
- Rely on self-certification and engineering judgment
- Enforce interconnection requirements through performance validation
- Adapt process as .2 conformance testing becomes available in future

Survey of Equipment Manufacturers

Q2 Please identify what kind(s) of OEM solutions your organization provides (check all that may apply):

Answered: 22 Skipped: 0



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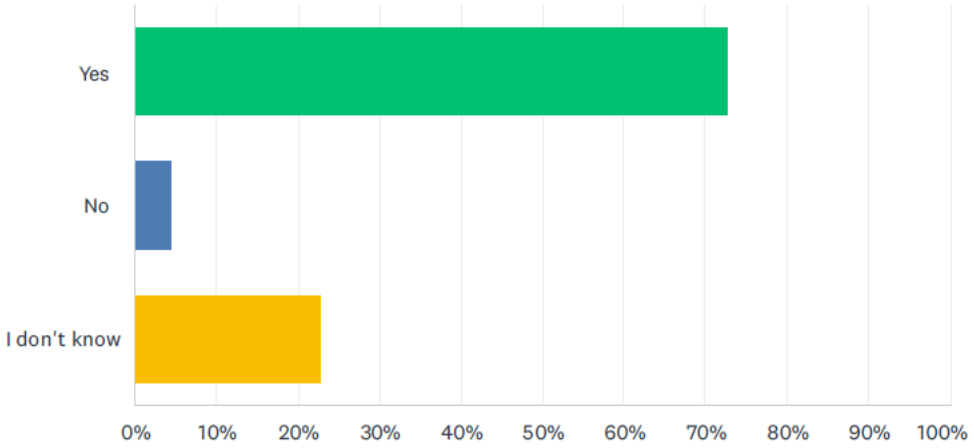
Q3 Does your organization provide (or planning to provide) a product used in transmission- or subtransmission-connected inverter-based resource plants that would be applicable to IEEE 2800-2022?

Answered: 22 Skipped: 0



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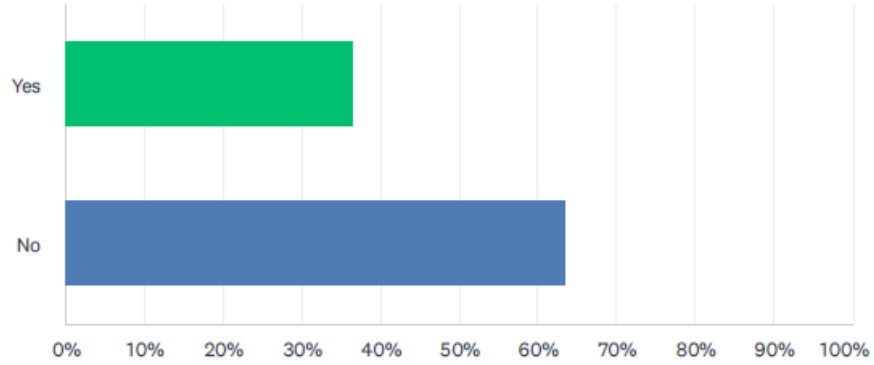
Q7 Are you actively participating in the NERC Inverter-Based Resource Performance Subcommittee (IRPS) and would you be willing to share your experiences described above with industry stakeholders?

Answered: 22 Skipped: 0



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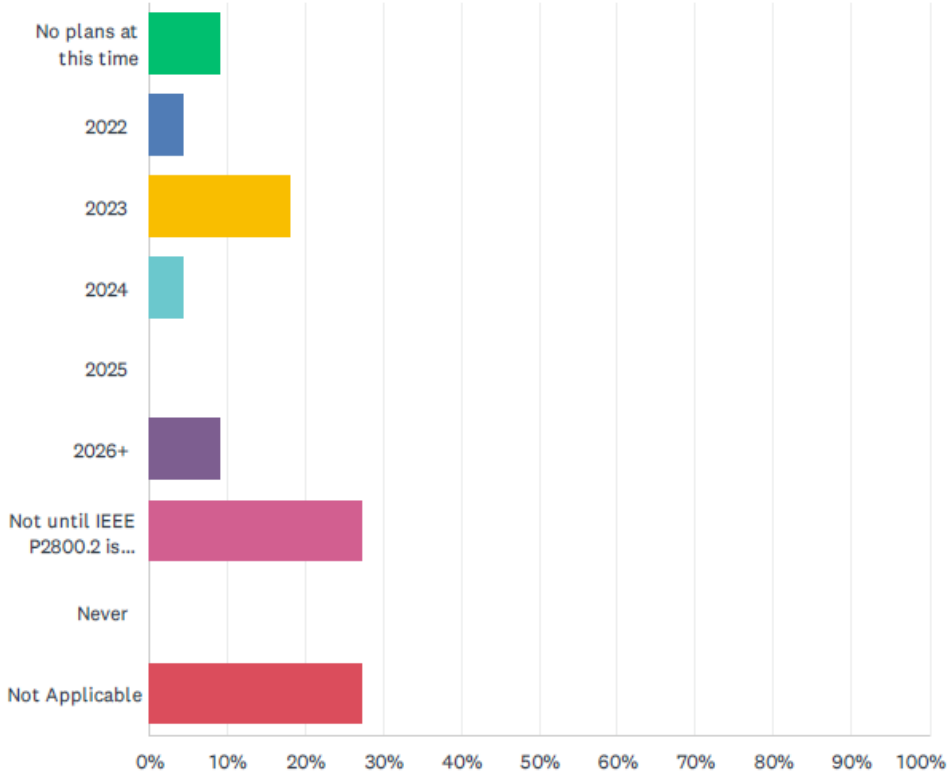
- When does your organization expect to have equipment that could be self-certified to sufficiently support* inverter-based resource plant conformity with the requirements of IEEE 2800-2022?
  - *Note: Most IEEE 2800-2022 requirements apply at the plant level and not at the equipment level; however, IBR units' capabilities and performance are critical success factors for future plant level conformity assessments. Also note that the leadership teams of IEEE 2800 and IEEE P2800.2 do not recommend responsible entities to wait with their adoption of 2800.



Some major OEM Implementation plans:

- *Plans to have solar PV and BESS inverters and plant controllers designed to IEEE 2800-2022 by 2025.*
- *Look into self-certification if IEEE 2800.2 is not published by that time.*

- *plans to have equipment designed to IEEE 2800-2022 by 2026.*
- *Anticipate IEEE 2800.2 would have been published by this time to be used as the basis for demonstrating equipment compliance*

- *No plans to incorporate IEEE 2800 into equipment going into projects that are already sold and are currently in production*

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- What are the primary hurdles or challenges with designing and self-certifying equipment to sufficiently contribute to IBR plant conformity with requirements of IEEE 2800-2022?
  - **Footnotes and Exception Clauses:** very difficult to read and interpret the standard.
  - **Handling Supplemental IBRs:** confusion around plant vs individual supplemental device conformance
  - **Protective Relay Design:** Design and relay settings of IBR Plant.
  - **Testing and Verification:** Prefer to wait till 2800.2 is published, clarified and accepted by industry
    - Not clear what criteria should be used to self-certify equipment. Designs may need to be modified and retesting done once IEEE 2800.2 comes into effect.
    - Risk of having to re-test – both cost (can cost millions for wind turbines) and time (potential longer timeframes to deliver conformity assessment due to multiple iterations required)
    - Testing/certification guidelines & rules add additional levels of clarity in how rules are to be understood and how compliance with them can be proven.
    - Testing at the IBR unit level is one part of the full IBR plant level compliance. Without IEEE P2800.2, it is not clear at this time what IBR unit level data is needed or how it will be used in other parts of the plant level evaluation and modeling process.

Survey of Equipment Manufacturers

- What are the primary hurdles or challenges with designing and self-certifying equipment to sufficiently contribute to IBR plant conformity with requirements of IEEE 2800-2022?
  - **Lack of Interconnection Requirements:** Customers are not asking for it.
    - Lack of evidence this is a “must” requirement
    - No economic incentive to do the design, testing and self-certification of equipment to this standard.
  - **Lack of Knowledge of IEEE 2800 Requirements**
  - **Lack of Clarity in Requirements**
    - No clear requirements for self-certification leads to uncertainty on approval process
    - Not clear on the product performance benchmarking and self-certification under various grid operating conditions, especially during abnormal conditions like system faults
  - **Very open to interpretation:** it can cause unnecessary issues during interconnections as reviewers would have to review and approve each OEM and NRTL's interpretation.
  - **Misalignment with Electrical Equipment Standards:** may expose circuit breakers to overvoltage and abnormal current (frequency) conditions that are beyond the equipment capabilities as specified in the relevant equipment standards.

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- What are the primary hurdles or challenges with designing and self-certifying equipment to sufficiently contribute to IBR plant conformity with requirements of IEEE 2800-2022?
  - **Product Development Cycles: 3-5 years typical**
    - some OEM planning for compliance with new products,
    - Expecting either 1) P2800.2 to be mature by design-complete, less risk of re-tests after 2800.2 release or 2) test against 2800.2 instead of self-certification to unknown criteria
    - For existing platforms, OEM plans to do a gap analysis to understand the design changes and testing required, the associated product cost, program cost and cycles. To make a decision considering *customer demand* and the *maturity* of P2800.2.
  - **Required R&D by OEMs:**
    - Some requirements are hard to fulfill by existing industrial practice.
    - Allocation of R&D time and resources to meeting changing global interconnection requirements
  - **OEM Competitive Environment:**
    - Squeezed time to market due to competitive pricing and other needs.
    - Time/effort required in a hectic commercial marketplace situation to check conformity in all respects
    - Plant level verification is hard to achieve in required time.

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- What are the primary hurdles or challenges with designing and self-certifying equipment to sufficiently contribute to IBR plant conformity with requirements of IEEE 2800-2022?
  - **Additional Requirements Beyond IEEE 2800 or Conflicts with ISO/TO:**
    - Risk that OEM may go through verification/ test process to fulfill the additional requirement by ISO/TO – very expensive and time demanding.
    - Risk of hard argument with ISO/ TO, whether designed capability of IBR unit will be utilized or not at unit level.
  - **Limitation as OEM:**
    - As IEEE 2800 applies mostly at the POM, it is not clear how an OEM, who does not have control of the overall plant design, can self certify that their equipment will allow a plant to meet IEEE 2800-2022.
    - OEMs could identify whether the equipment has the capability to perform the function as stated in IEEE 2800 at the IBR unit level and possibly what method they used to determine this.
  - **OEM + Developer Interactions:** The plant developer is responsible to fulfill the requirement according to IEEE 2800.
    - Uncertainty due to mixture of multiple IBR resources, capability, parameters, and software handling etc.
    - This may lead to needing significant additional support from IBR OEM.

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- Recap
  - Need 2800.2 for
    - Clear criteria and methodology
    - Clarity on unit level tests as well as plant level tests
  - In the meantime, need guidance on self-certification
  - Need adoption in interconnection requirements to drive “demand” and “push” within OEMs’ product teams
  - OEMs need to analyze their inverter capability, address any gaps, possible engineering changes, clarify tech details along the way
  - OEMs preparation for 2800 varies with their product life cycle
  - OEMs want to avoid re-testing when 2800.2 arrives
  - OEMs alone does not solve for all of 2800
    - OEM + Developer

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- Are there any additional capabilities or features that exist in current or planned commercially available products that should be specified in IEEE 2800-2022 or related standardization efforts in the near team?
  - Treatment of supplemental IBRs
  - Voltage harmonic requirements instead of current harmonic values
  - Similarities and differences of testing for IEEE 1547.1 and IEEE P2800.2
  - Grid forming technology
  - Island mode operation
  - The focused should be given in implementation of IEEE 2800 in a best possible way.
  - Minimum overload current capability
  - Improve frequency droop function, remove latch on frequency-watt
  - Uninterruptible BESS
  - No
  - Unknown

Questions and Answers

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