

IBR Related Risk

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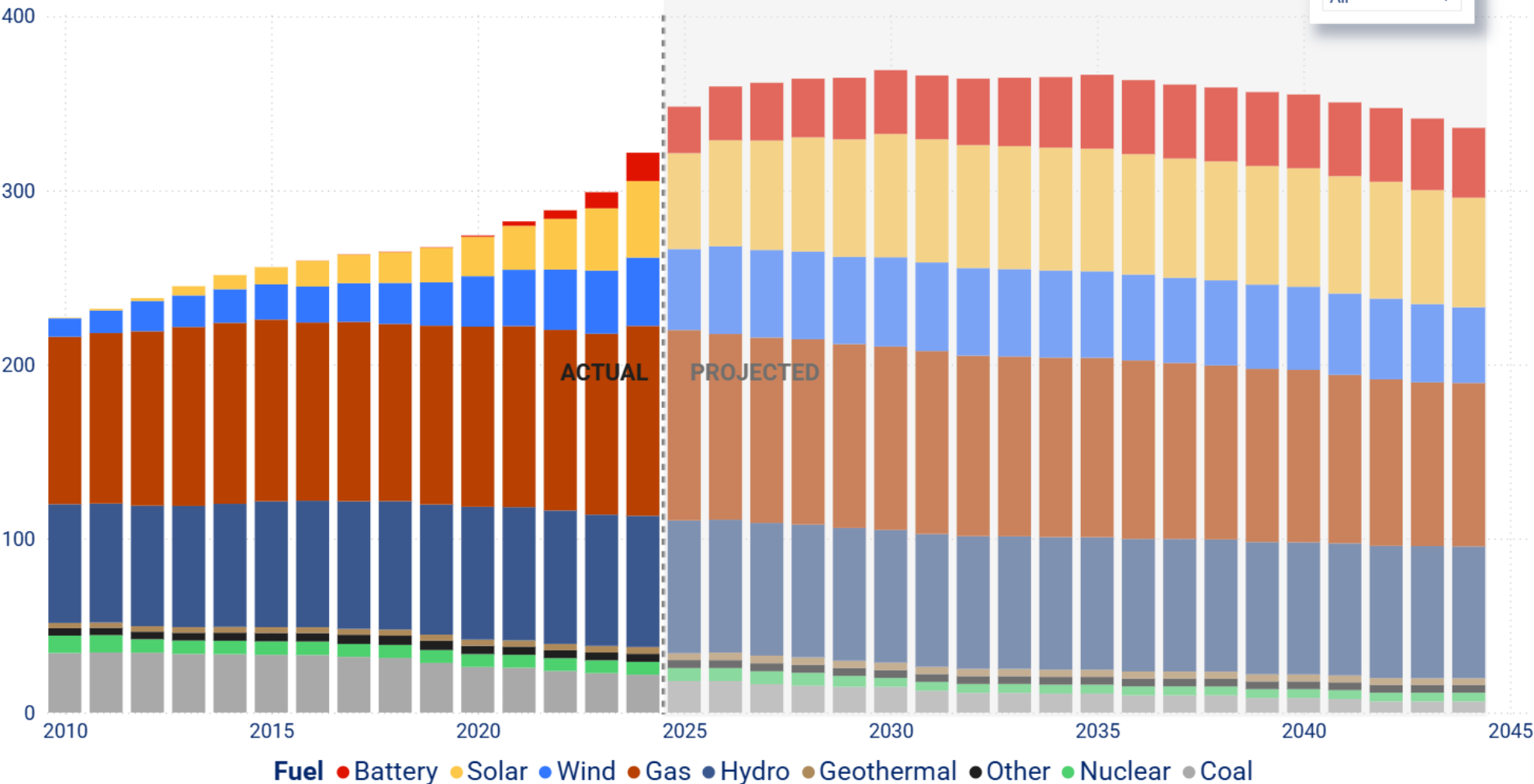
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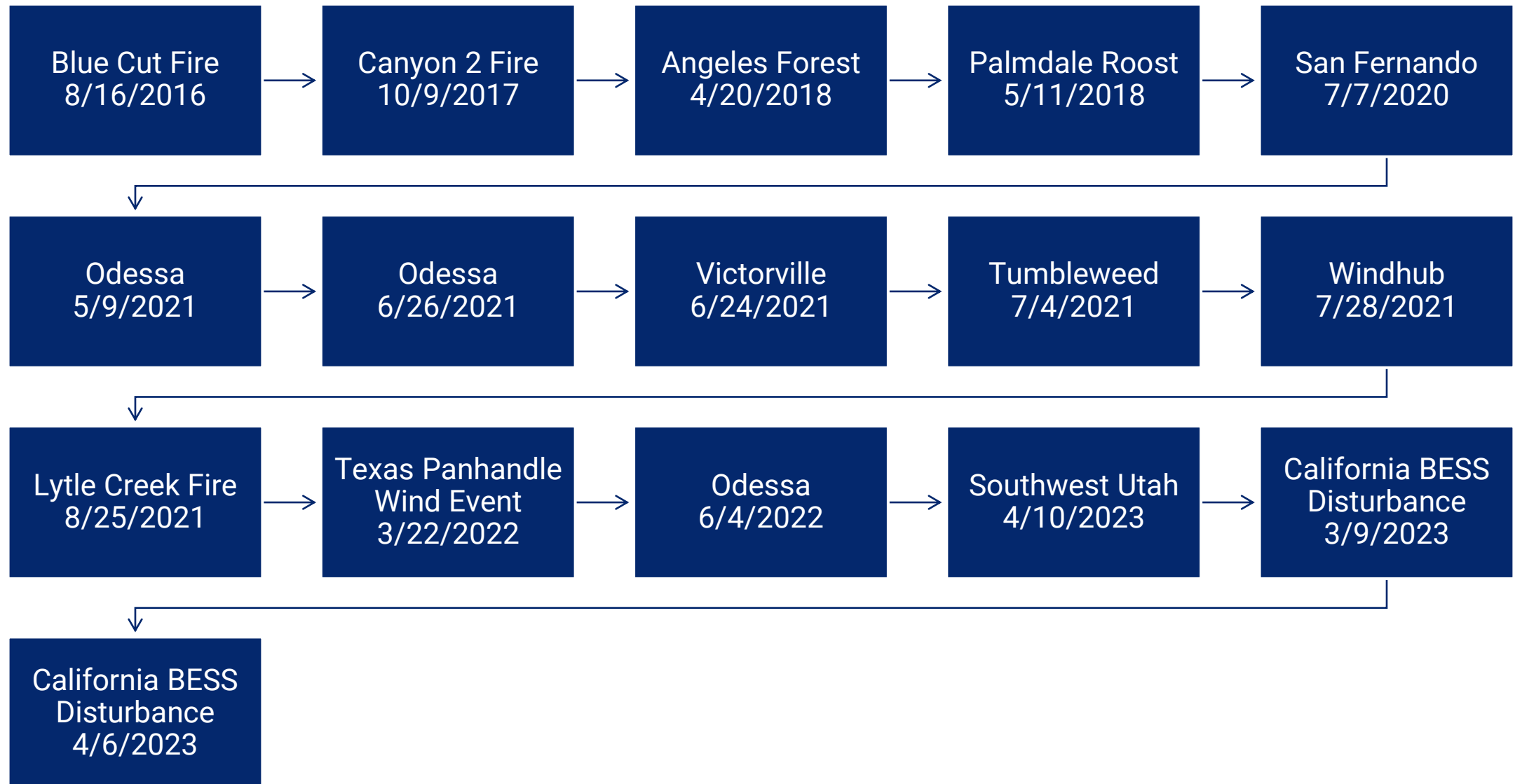
Current and Projected Generation

Actual and Projected Annual Capacity (GW) by Fuel

Source: 2025 WECC Loads and Resources, Existing and Tier 1 Units (9/19/2025)



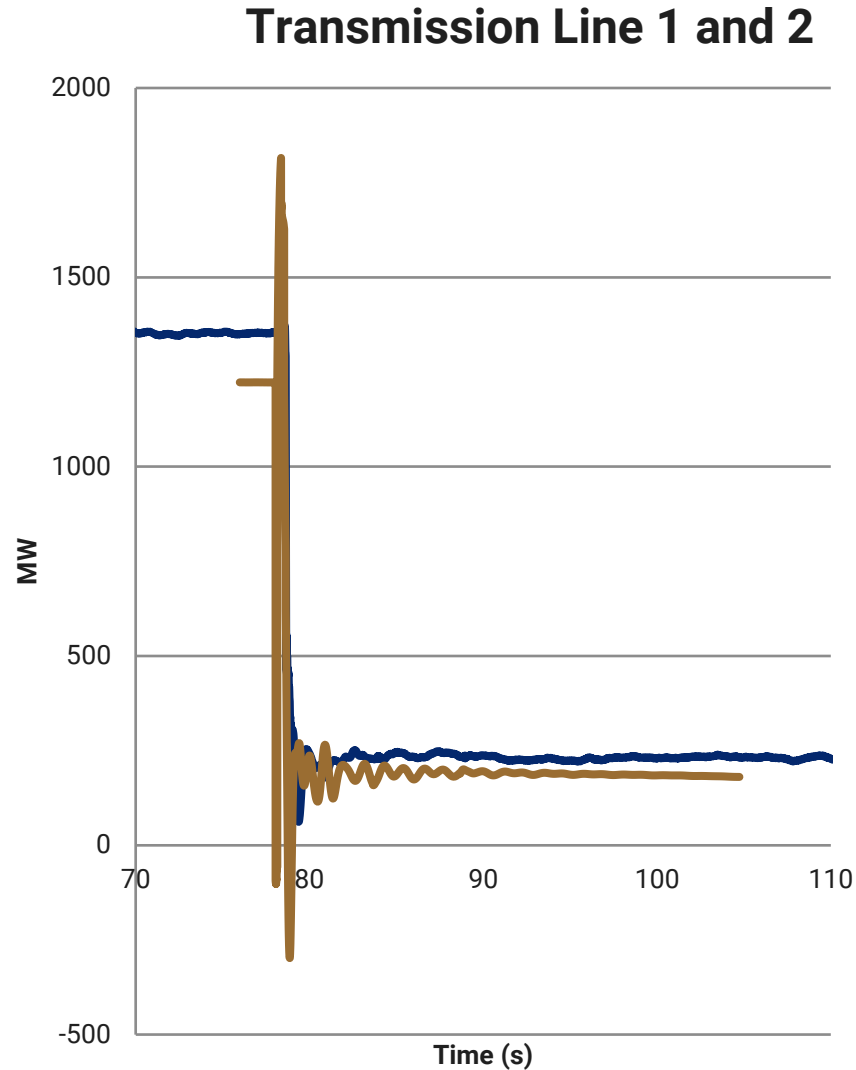
IBR Related Event Reports Over Time



IBR Models

- Types of Models
 - WECC Approved Dynamic Models—Standard Library Models
 - Examples: PSLF, PSS®E, PowerWorld
 - User-defined Model
 - Electromagnetic Transient (EMT) Models
 - Examples: PSCAD EMTP
- Focusing on WECC Approved Dynamic Models
 - Used for interconnection-wide studies
 - Should be validated compared to other types of models
 - Generally, EMT models are treated as best representation

Good Models



- Approaches to make sure it is a good model
 - Comparing simulation results to system measurements
 - Generator testing—staged tests
 - Comparing model results to other model results
 - PSCAD compared to PSLF

Testing Generators

- MOD-25-27 Standards
- WECC Generator Testing Program
 - [Guideline](#)
 - [Requirements](#)
- [Model and Validation Subcommittee](#)—many useful documents

Option 2: Validation using Recordings taken at the Generating Unit

Validation is performed using disturbance and/or test recordings taken at the Generator (see Figure 2). This should be done for every Generator in the Generating Facility.

The dynamic response of the Generator is driven by the stator voltage and frequency (or real and reactive load). The response can be also initiated by the control inputs such as voltage reference and speed reference.

Validation shall be done for the following events:

- a) disturbances or tests that result in generator stator voltage and reactive power changes.
- b) disturbances that result in generator frequency changes or tests that result in generator real power changes.

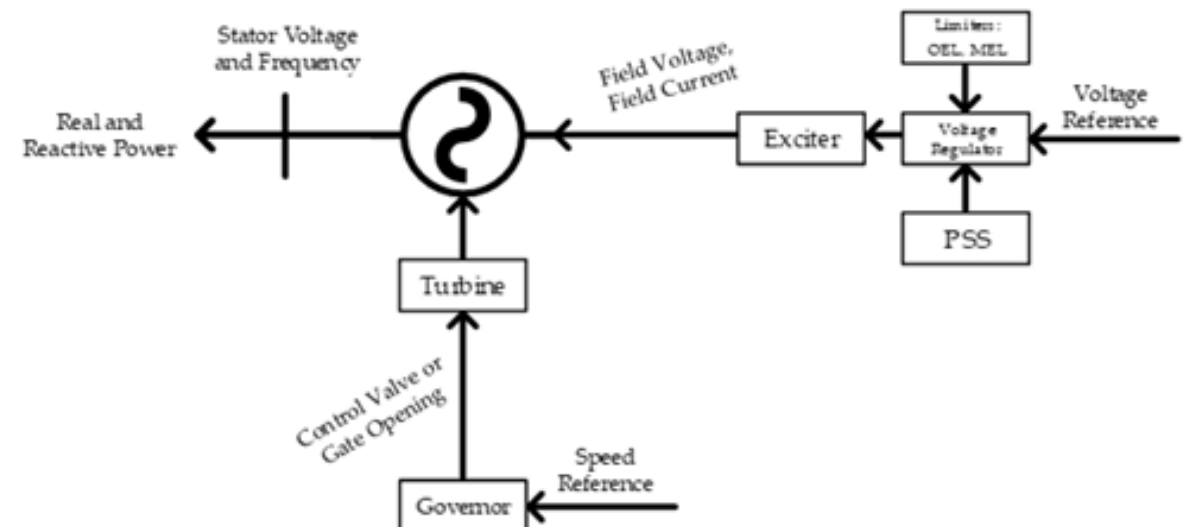


Figure 2: Validation is performed using disturbance and test recordings taken at the Generator

Interconnection Requirements

- NERC Documents
 - [Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources](#)
 - [White Paper: Grid Forming Functional Specifications for BPS-Connected Battery Energy Storage Systems](#)
- Terms you have heard
 - Momentary Cessation
 - Phase Jump
 - IEEE P2800
 - Grid-Forming IBR
 - Fast Frequency Response (AKA synthetic inertia)

Interconnection Requirements Efforts

- Energy Systems Integration Group (ESIG)
 - [System Reliability Resource Library](#)
- Western Interconnection Regional Advisory Body (WIRAB)
 - [Harmonizing IBR Interconnection Requirements in the West](#)
- Observations
 - Size of the plant/unit affects requirements



Inverter-based Resource Analysis

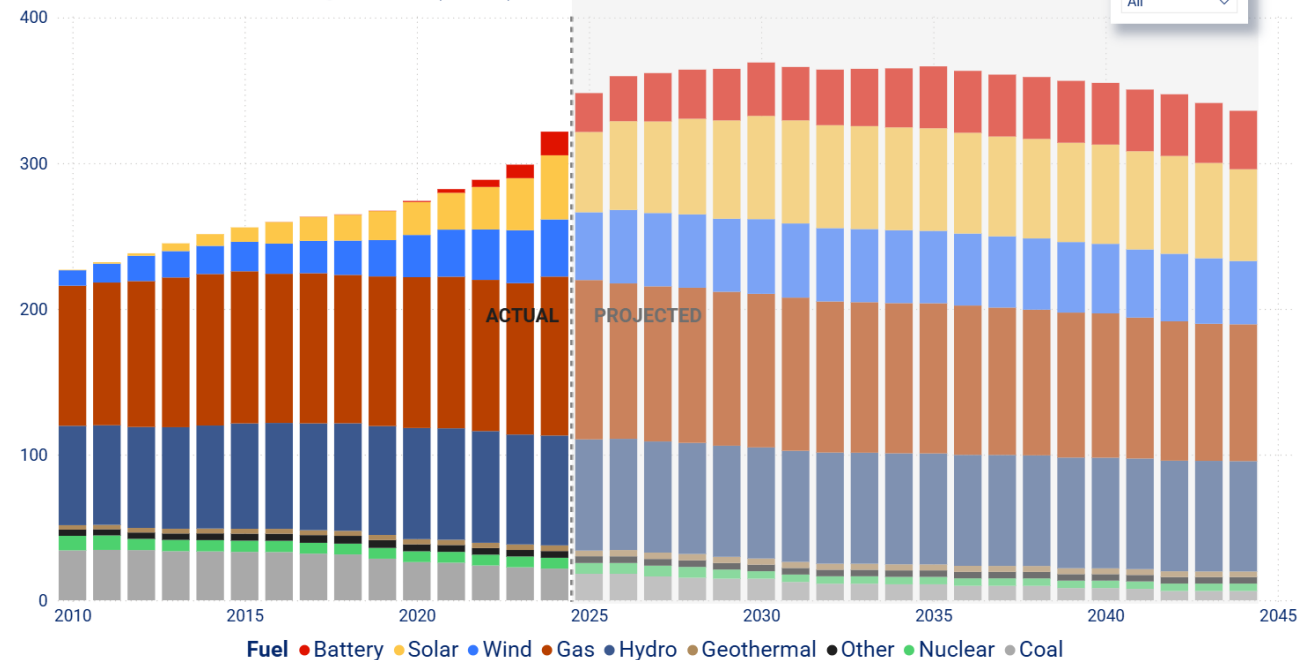
WECC Assessments

- [Impact of High DERs Assessment](#)
- [Changes in System Inertia Assessment](#)
- [Changes in Grid Strength Assessment](#)
- [Grid-Forming Inverter Assessment](#)

System Data Portal

Actual and Projected Annual Capacity (GW) by Fuel

Source: 2025 WECC Loads and Resources, Existing and Tier 1 Units (10/3/2025)



Inverter-based Resource Analysis

- WECC Technical Committee Discussions
 - [Risk Register](#)
 - Includes seven risks directly linked to IBRs
 - Performance and Validation
 - Model Quality Issues
 - Forced Oscillations from Battery Energy Storage Systems
 - Comparison of data submissions
 - Loads and Resources and Base Cases
 - Impact on the [WECC Off-Nominal Frequency Load Shedding Plan](#)
 - How to represent IBRs in Protection Models—[Short-Circuit Modeling Subcommittee](#)

Standards—Clarity

- We operate and work in an industry where words and definitions matter
- Clarity and understanding are musts for EVERYONE
 - Everyone who operates and works with the grid
 - Everyone who regulates the grid

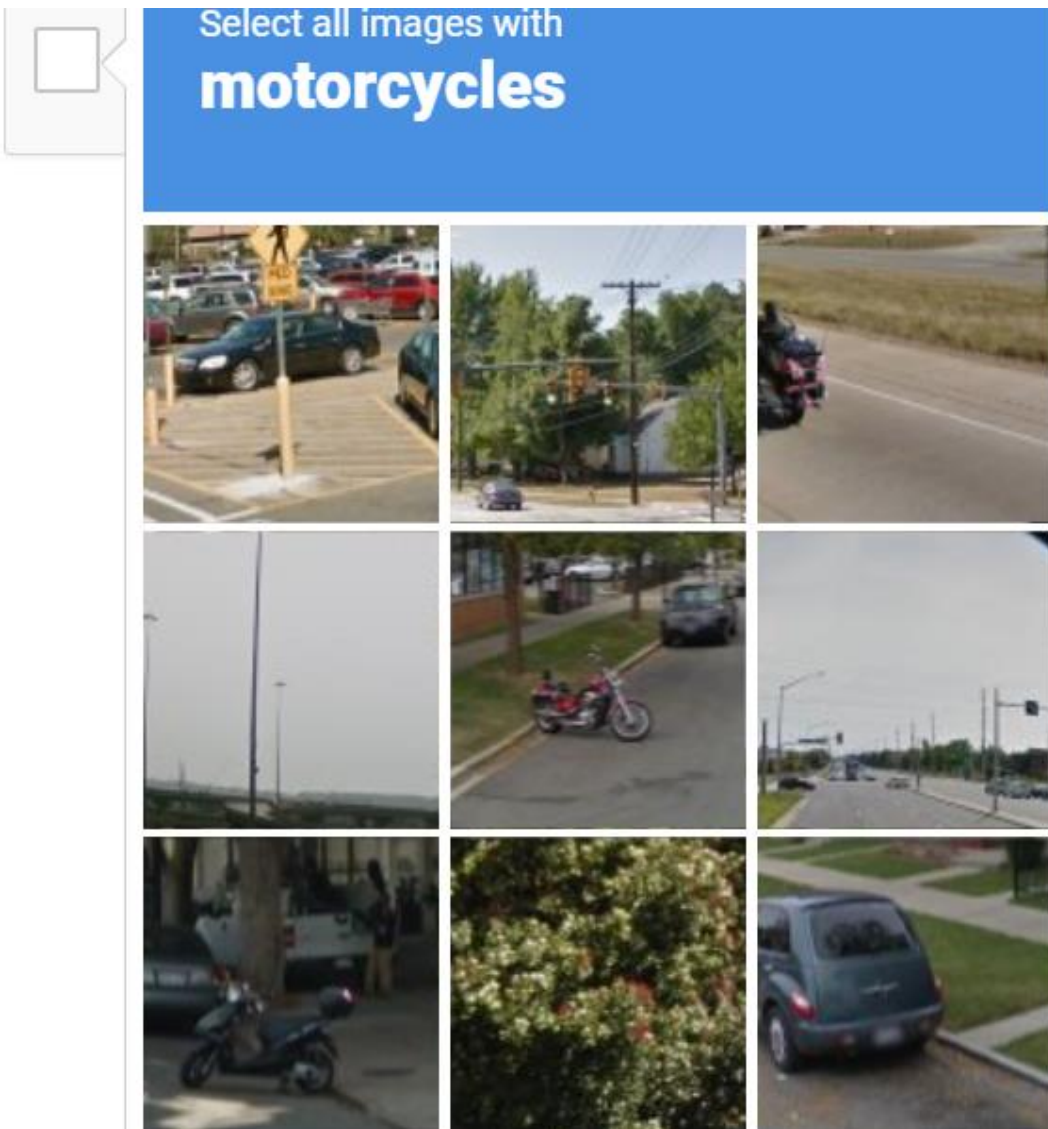
- What is a Motorcycle?



Merriam Webster—an automotive vehicle with two in-line wheels

Also from Merriam Webster as an example used in a sentence: "Evansville is located in Vanderburgh County, which also has a wheel tax of \$20 for motorcycles, passenger vehicles and heavy trucks."

Standards—Clarity



- Do you feel confident choosing the images based only on the previous definition?
- Would that definition bring in:
 - Scooters?
 - E-bikes?
 - Electric motorcycles?
 - This thing?

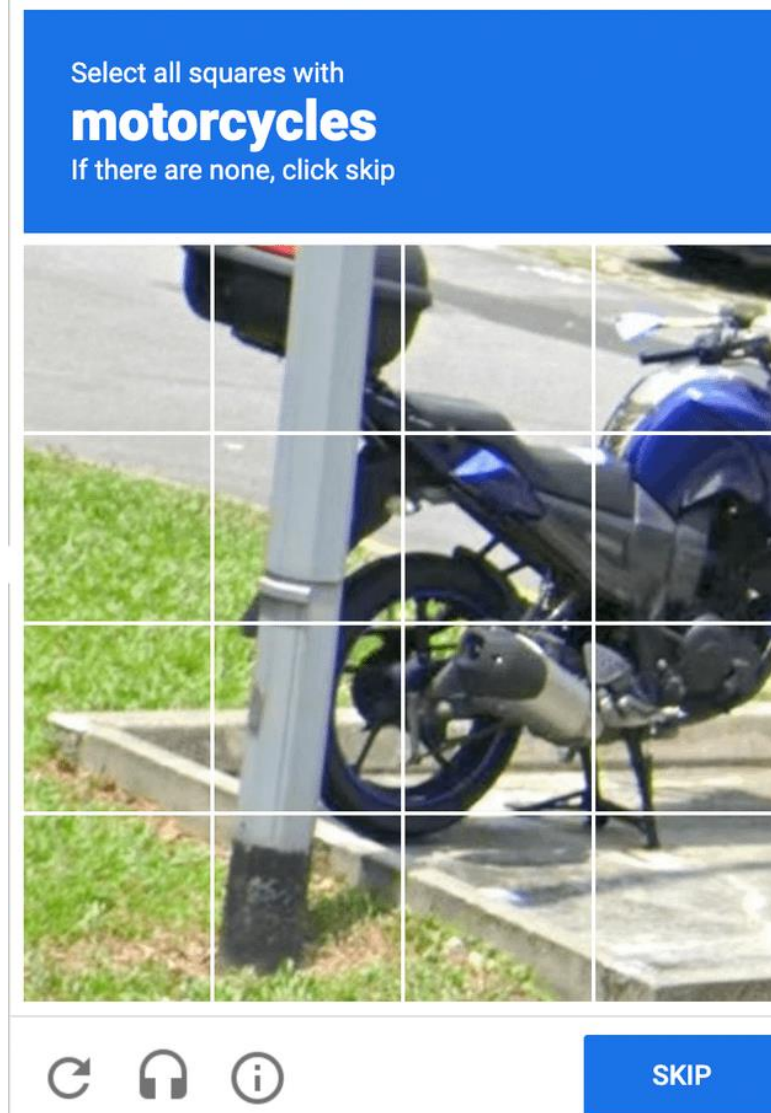


Standards—Consistency

We need to get specific, right?

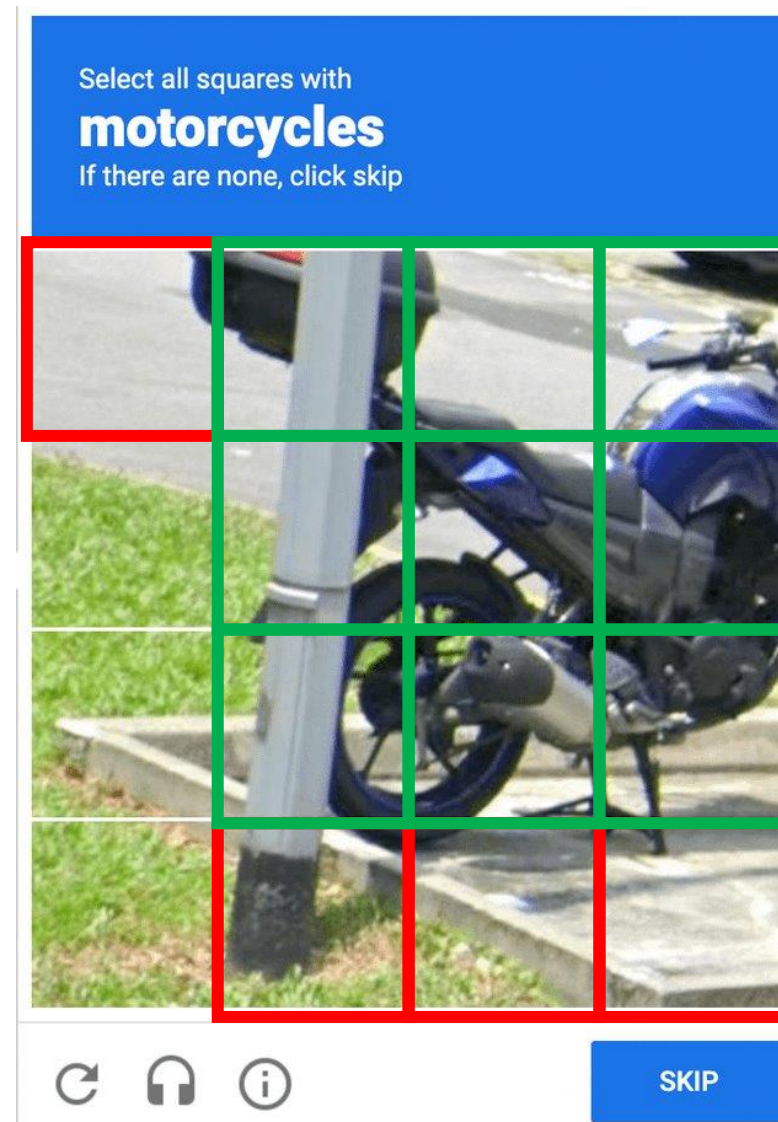
For this next captcha, we will use the definition: *An automotive vehicle with a gasoline-powered engine with only 2 in-line wheels.*

Any questions that this captcha makes you ask?



Standards—Consistency

- Seems a bit easier at first glance
 - Pretty straightforward squares
 - Is the nub of the kickstand what they may be looking for as well?
 - How about that back of the basket?
 - How much of the tire needs to be in the square to count?
- In addition to clear definitions, we need clear and consistent directions
 - Select the squares with any part (no matter how small) of a motorcycle



Standards

- FAC-001
 - Enhanced Facility Interconnection Requirements for IBR
 - Reactive power-voltage control requirements
 - Active power and frequency response requirements
 - Response to transmission system abnormal conditions
 - Protection
 - Modeling data
 - Measurement data for performance monitoring and validation
 - Test and verification requirements



Standards—Upcoming Changes

- FAC-002
 - Modify FAC-002-4, as necessary, to require the Transmission Planner (TP) and Planning Coordinator (PC) to study aggregate distribution-connected generation
 - Additional requirement: TPs and PCs shall develop the process for assessment and assess conformity with applicable interconnection requirements (as per FAC-001-4) for interconnecting IBR facilities and existing IBR facilities seeking to make a qualified change as defined by the Planning Coordinator under requirement R6



Standards—Project 2024-04 Order No. 901 Planning Studies

- Standards Affected

- TPL-001-5.1
- MOD-026
- MOD-032
- MOD-033
- PRC-024
- PRC-028
- PRC-029

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Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the [NERC Help Desk](#). Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information	
SAR Title:	Federal Energy Regulatory Commission (FERC) Order No. 901 – Milestone 4: Planning Studies
Date Submitted:	8/4/2025
SAR Requester	
Name:	Hasala Dharmawardena, JP Skeath, Nadia Smith, Jack Giffried
Organization:	North American Electric Reliability Corporation (NERC)
Telephone:	404-831-6434
Email:	hasala.dharmawardena@nerc.net
SAR Type (Check as many as apply)	
☒ New Standard	☐ Imminent Action/ Confidential Issue (SPM Section 10)
☒ Revision to Existing Standard	☐ Variance development or revision
☐ Add, Modify or Retire a Glossary Term	☐ Other (Please specify)
☐ Withdraw/retire an Existing Standard	
Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)	
☒ Regulatory Initiation	☐ NERC Standing Committee Identified
☐ Emerging Risk (Reliability Issues Steering Committee) Identified	☐ Enhanced Periodic Review Initiated
☐ Reliability Standard Development Plan	☐ Industry Stakeholder Identified
What is the risk to the Bulk Electric System (What Bulk Electric System proposed project provide?):	
This Standard Authorization Request (SAR) is initiated by NERC to a Federal Energy Regulatory Commission (FERC) in Order No. 901, FE 19, 2023, which includes directives on new or modified NERC Reliability Standards related to IBRs. Specifically, FERC directed NERC to address a wide spectrum of reliability risks to the grid from resources (IBRs), including both utility scale and behind-the-meter (DERs).	
Within the Order, there are four milestones that include sets of directives to NERC. In the Order, FERC has directed NERC to propose new or modified standards to mitigate reliability gaps in the current NERC Reliability Standards related to IBRs. Specifically, FERC directed NERC to develop new or modified	

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The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information	
SAR Title:	Federal Energy Regulatory Commission (FERC) Order No. 901 – Milestone 4: Operational Studies
Date Submitted:	8/20/2025
SAR Requester	
Name:	Jack Giffried, JP Skeath, Nadia Smith
Organization:	North American Electric Reliability Corporation (NERC)
Telephone:	470-432-8484 (Jack Giffried)
	404-823-1365 (JP Skeath)
	404-805-4725 (Nadia Smith)
Email:	jack.giffried@nerc.net
	john.skeath@nerc.net
	nadia.smith@nerc.net
SAR Type (Check as many as apply)	
☒ New Standard	☐ Imminent Action/ Confidential Issue (SPM Section 10)
☒ Revision to Existing Standard	☐ Variance development or revision
☐ Add, Modify or Retire a Glossary Term	☐ Other (Please specify)
☐ Withdraw/retire an Existing Standard	
Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)	
☒ Regulatory Initiation	☐ NERC Standing Committee Identified
☒ Emerging Risk (Reliability Issues Steering Committee) Identified	☐ Enhanced Periodic Review Initiated
☒ Reliability Standard Development Plan	☐ Industry Stakeholder Identified
What is the risk to the Bulk Electric System (BES) reliability benefit does the proposed project provide?:	
This Standards Authorization Request (SAR) is initiated by NERC to address directives issued by the Federal Energy Regulatory Commission (FERC) in Order No. 901, FERC issued Order No. 901 on October 19, 2023, which includes directives on new or modified NERC Reliability Standard projects. FERC Order No. 901 addresses a wide spectrum of reliability risks to the grid from the application of inverter-based resources (IBRs), including both utility scale and behind-the-meter or distributed energy resources (DERs).	
Within the Order, there are four milestones that include sets of directives to NERC. In the Order, FERC has directed NERC to propose new or modified standards to mitigate reliability gaps in the current NERC Reliability Standards related to IBRs. Specifically, FERC directed NERC to develop new or modified	

RELIABILITY | RESILIENCE | SECURITY

Standards—Project 2025-03 Order No. 901 Operational Studies

- Standards affected:
 - FAC-011
 - IRO-002
 - IRO-017
 - PRC-012
 - TOP-001
 - TOP-002
- Additional Standards potentially affected:
 - BAL-002
 - FAC-014
 - IRO-008
 - IRO-009
 - IRO-010
 - IRO-014
 - IRO-018
 - TOP-003
 - TOP-010



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