WECC generic model clarification

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*"Pursuant to section 215(d)(5) of the FPA, we adopt the NOPR proposal and direct NERC to develop new or modified Reliability Standards that require the use of approved industry **generic library IBR models** that accurately reflect the behavior of IBRs during steady state, short-circuit, and dynamic conditions when developing **planning, operations, and interconnection-wide models**."*

*"This approved component model list includes **WECC's IBR models**."*

- FERC Order No. 901, issued October 19, 2023

Outline

- The value of the WECC Generic Models
- The limitation of the generic model
- The value of the User-Defined Models
- The limitation of the user-defined model
- Cases to Use WECC Generic Models/User-Defined Models
- MVS document development Plan

Technical Specifications for the WECC Generic Models

- The models must be non-proprietary and accessible to transmission planners and grid operators and for inclusion and distribution in WECC dynamic models without the need for non-disclosure agreements
- The models need to provide a reasonably good representation of dynamic electrical performance
- Simulations performed using these models typically cover a 20-30 seconds time frame, with ¼ cycle integration time step
- The generic models are functional models suitable for the analysis and simulation of large-scale power systems
- etc…

WECC Wind Plant Dynamic Modeling Guide.pdf – November 19, 2010

The value of the WECC Generic Models

- Public accessibility, documentation, and openness (White box)
- Software portability across platforms
- Future system simulation
- Simplified Model Management
- Facilitates Coordination
- Adaptability to Emerging Technologies
  - Generic models are more adaptable to new or emerging technologies because they can be easily updated or adjusted as new equipment classes are introduced into the grid. This flexibility is key in an evolving power system landscape with increasing penetration of renewable resources and new inverter-based technologies

The limitation of the generic model

- Not for detailed studies
- Lack of Specificity
  - Generic models may not accurately represent the exact behavior of a specific device, especially if the equipment has unique characteristics or advanced controls
- Limited Customization
  - Generic models may not capture every detail of control technologies, leading to inaccuracies in specialized studies
- Conservative Assumptions
  - To ensure robustness, generic models often make conservative assumptions about equipment behavior, which can sometimes lead to less optimal performance predictions in studies

The value of the User-Defined Models

- Accurate Representation
  - Highly detailed and accurate representations of specific equipment, including unique control schemes, performance characteristics, and manufacturer-specific designs
- Customization
  - The manufacturer generally provides these models with unique configurations or specific operational requirements
- Better Performance in Specialized Studies
  - For studies involving complex or high-risk scenarios, user-defined models can provide more precise insights and lead to more informed decision-making

The limitation of the user-defined model

- Limited Sharing and Collaboration (Black Box)
- Complexity and Maintenance
  - User-defined models require significant effort to maintain
  - Keeping these models updated can be time-consuming and costly, particularly for equipment that evolves over time
- Compatibility Issues
  - User-defined models may not be supported across all simulation platforms or tools, leading to potential incompatibilities that require additional effort to resolve
- Lack of Standardization

Summary

- **WECC Generic Models** offer standardization, ease of use, and better coordination across regions but sacrifice some specificity and flexibility in modeling
- **User-defined models** provide a more accurate and customizable representation of equipment, making them ideal for specialized studies, but they require more resources to maintain and validate, and can limit collaboration due to their proprietary nature

Cases to Use WECC Generic Models

- System-Wide Planning Studies
  - Transmission planning, resource adequacy analysis, expansion planning
- Interconnection-Wide Reliability Studies
  - Ensures consistency across participants
- Long-Term or Seasonal Studies
  - Seasonal forecasts, 1-0-year reliability studies, etc.
- Routine Operational Studies
  - Day-to-day operational assessments or typical grid studies
- Model Validation for New or Emerging Technologies
- When Proprietary or Detailed Information is Unavailable

Cases to Use User-Defined Models

- Detailed Equipment Behavior Analysis
- Grid Integration of New or Complex Technologies
- Stability and Dynamic Studies for Critical Projects
- Grid Code Compliance Testing
- Protection System and Control Design Studies
- High-Fidelity Studies of New Generation Plants
- When Generic Model Don’t Capture Unique Characteristics

Summary of Use Case

Use Generic Model When:	Use User-Defined Model When:
Broad, system-wide, or long-term planning studies	Detail analysis of specific equipment behavior
Consistency across regions and stakeholders is needed	Equipment has unique or advanced controls
Proprietary data is not available or needed	High-fidelity dynamic or stability studies are required
Large-scale, operational, or routine grid studies	Grid integration of new, complex, or emerging technologies
Coordinating between multiple utilities or RTOs	Testing for grid code compliance or protection design
Studies of future scenarios	custom control design work

Future Plan

- WECC document development plan
- Specification of user-defined model requirement
  - A UDM should come from an entity that profoundly understands the equipment and thus be a vendor-specific model based on the actual vendor design and equipment and its control strategy
  - The model should be demonstrated to accurately represent the equipment (e.g., for IBR units through type testing of the equipment as described in IEEE Std 2800™-2022)
  - The model should be usable and able to pass some basic model quality tests (e.g., initialization, responding properly to voltage and frequency step tests)
  - The parameters and control modes should be well documented and easily changeable by the user to e.g., allow adjustment by the user to match the field tuning and control modes can be selected to match the field setting