Review of Dynamic Model Requirements

John Schmall
ERCOT Transmission Planning

Resource Integration Working Group Meeting
August 24, 2021

Overview

- This presentation provides an overview of dynamic model requirements, including the approved PGRR075 (effective 5/1/2020) and PGRR085 (effective 3/1/2021)
  - PGRR075 introduced dynamic model quality test (MQT) requirements
  - PGRR085 introduced dynamic unit model validation (UMV), parameter verification and additional PSCAD model quality test requirements

- For IBRs (including wind, solar, and battery):
  - PSCAD models must be provided with a **model quality test report**
    - Applicable whenever a PSCAD model is provided or updated
  - PSCAD models must be provided with a unit model validation **hardware benchmark**
    - Applicable to make/model of inverter/turbine rather than site specific

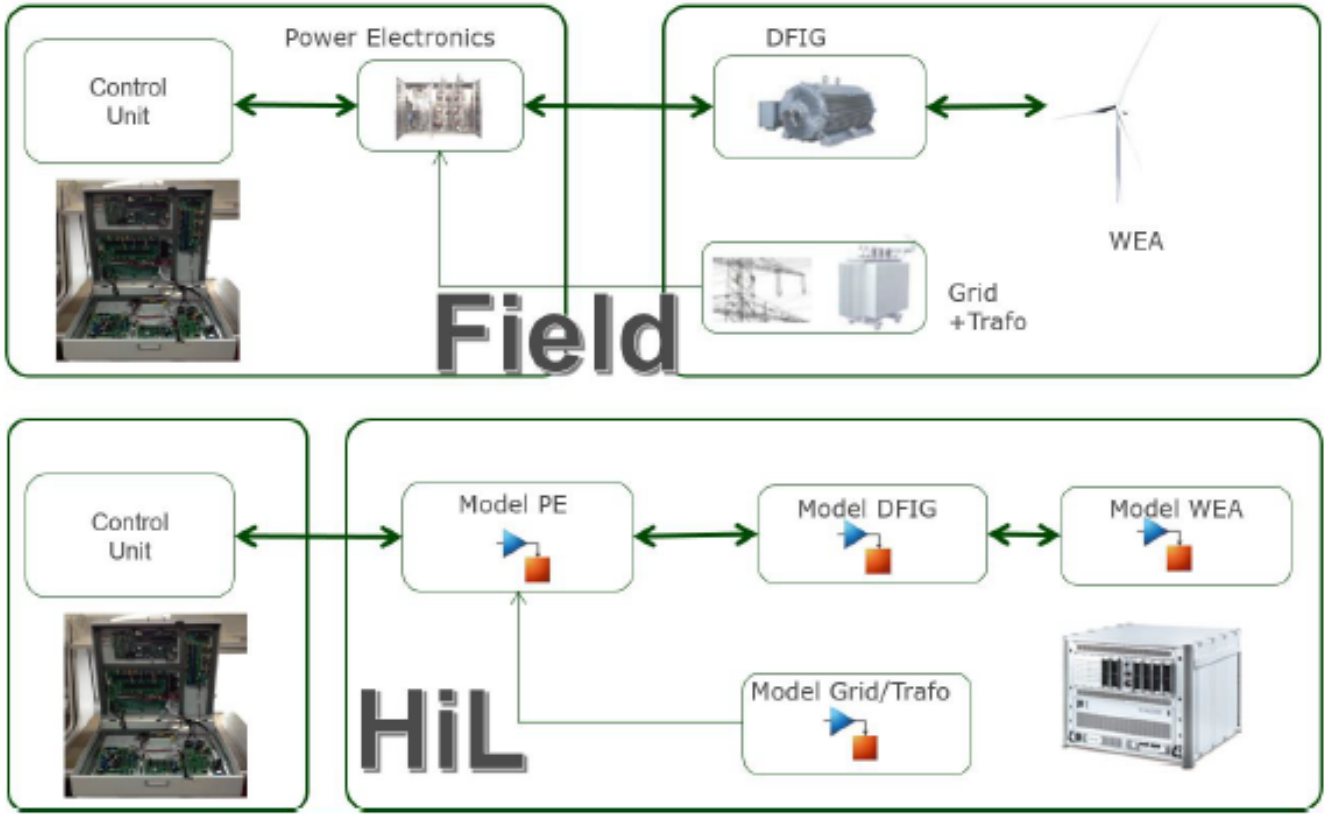
- For all resources:
  - Tunable parameters in the model must be periodically verified:
    - Within 30 days of Part III approval (≈ Commercial Operations Date) or any change in settings
    - Within 12 – 24 months of Part III approval (for new resources)
    - Within 12 – 24 months of 3/1/21 (for existing resources)
    - A minimum of every 10 years
  - Different models should yield a consistent response (PSS/E, PSCAD, TSAT)

Background

- IEs reported challenges in obtaining acceptable UMV reports from manufacturers ahead of May 1, 2021 QSA deadline
  - Projects allowed into the May 1 QSA with the understanding that UMV (and PSCAD MQT) would be completed by August 1, 2021
  - Projects unable to meet August 1 deadline
  - Projects also allowed into the August 1 QSA with an incomplete UMV
    - ERCOT has been providing feedback on preliminary submissions.
  - Some projects are also lacking and acceptable PSCAD MQT
  - UMV tests would seem to be more challenging for IEs than PSCAD MQT, but note that there can be some MQT challenges if there are inconsistencies between PSCAD and PSS/E MQT results

UMV Acceptance Flexibility

- ERCOT considers hardware-in-the-loop (HiL) and other alternative test approaches acceptable with sufficient justification



Acceptance of UMV Reports

- Include all test components as specified in Planning Guide
  - Section 6.2 (5) (d)
- Demonstrate appropriate model performance relative to test results
- Provide explanations/justifications for the test set-up as needed
- Not include disclaimers that render validation results meaningless:

Disclaimer

The modeling data presented herein are intended to produce simulation results that closely approximate the response of the inverter to these disturbances, and do not in any way represent the physical implementation of the specific inverter and its control algorithms.

Firm Deadline for UMV & MQT Submissions

- Projects will not be allowed to qualify for November 1, 2021 QSA unless acceptable UMV and MQT reports are submitted
- Projects that were allowed into the May 1 and August 1 QSA will not be allowed to synchronize unless acceptable UMV and MQT reports are submitted
  - Exception for projects that submitted their current PSCAD model prior to 3/1/21 (PGRR-085 was not intended to apply retroactively), however:
    - Parameter verification report is required upon completion of commissioning
    - MQT reports are required to accompany any “as-built” model updates
  - Potential non-compliance consequences for failure to provide required modeling data per NERC Reliability Standard MOD-032-1
- Submit UMV/MQT reports with sufficient lead time to allow an adequate review period

Summary of Dynamic Model Requirements

Requirement	Applicable Equipment	Required Tests[1]	When to Update	Responsible Entity	Language
Model Quality Test for PSS/E Model	All Resources and Dynamic Transmission Elements (system strength test is only required for inverter-based devices)	Flat start, small and large voltage disturbance, small frequency disturbance, and system strength tests	A new or updated model	Equipment owner (RE, IE or TSP)	PG 6.2(5)(c)
Model Quality Test for PSCAD Model	Inverter-based Resources (IBRs) and Dynamic Transmission Elements	All above tests plus phase angle jump test	A new or updated model	Equipment owner (RE, IE or TSP)	PG 6.2(5)(c)
Unit Model Validation for PSCAD Model[2]	Inverter-based Resources (IBRs)	Step change in voltage, large voltage disturbance, system strength, phase angle jump, and subsynchronous tests	A new PSCAD model provided after 3/1/21. (Validation tests should not need updating for model parameter updates on an existing model.)	Resource owner (RE or IE)	PG 6.2(5)(d)
Model Parameter Verification ("Verification Report")	All Resources and Dynamic Transmission Elements	Provide evidence that tunable model parameters match what is implemented in the field. Evidence can take the form of screenshots, nameplate photographs, signed manufacturer commissioning reports, etc.	1. Required within 30 days of COD (i.e., Part 3 approval), 2. 12 to 24 months after COD or 12-24 months after March 1, 2021 for existing resources, 3. A minimum of every ten yrs. 4. Within 30 days of a change at the plant	Equipment owner (RE, IE or TSP)	PG 5.7.1, PG 6.2(5)(b)

(1) Detailed test information is available in the DWG Procedural Manual 3.1.5.

(2) Benchmark the PSCAD model against actual hardware measurements. This is not a site-specific test; the same report can be submitted for different projects whenever that the same inverter is used.

References

- Planning Guide Revision Request PGRR-085 (approved & effective)
- Planning Guide 5.7.1 (in particular, paragraph (4)(e) & (4)(f))
- Planning Guide 6.2 (in particular, paragraph (5))
- Dynamics Working Group DWG Procedure Manual section 3.1
- Model Quality Guide, published on the RE webpage at ercot.com
- Dynamic Model Templates, published on the RE webpage at ercot.com

Miscellaneous Reminders:

- PSS/E Dynamic models must be submitted using a Template
  - The Template serves as the vehicle for both the PSS/E and the TSAT model submission
  - If submitting a model that is a User-Defined Model (UDM) then additional UDM files are required for TSAT
  - If submitting a model that is a generic or standard library model available in PSS/E and TSAT, then no additional files are required for TSAT
- The TSAT model and PSS/E model should be the same type of model with the same parameter settings and format. This permits interoperability and allows the same Template to be used for both
- Performing a NERC MOD 26, 27 study? Running your model quality tests at the same time is an efficient means to meet both NERC and ERCOT requirements. (Refer to the Model Quality Guide.)
- Converting from UDM to Generic? Suggest to have the vendor/manufacture to verify the conversion and provide their attestation. Details are available in this presentation

Questions or Comments

Contact:
John Schmall, John.Schmall@ercot.com
Jonathan Rose, Jonathan.Rose@ercot.com