# Model Quality Tests (MQT) and Voltage Ride-Through (VRT) Tests

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Resource Integration Working Group Meeting
June 28, 2022

# MQT Should Be Performed With PSS/e

- Planning Guide Section 6.2(5)(c) [highlight added]:

> Results of model quality tests and associated simulation files that demonstrate acceptable performance of the models in the planning model software as described in the Dynamics Working Group Procedure Manual. These shall be provided whenever a new or updated dynamic model is provided to ERCOT representing a Generation Resource, ESR, or Transmission Element. The purpose of these tests is to ensure the quality of the provided dynamic data and models for use in numerous system studies and ensure consistency across planning software platforms. Therefore, the Facility owner shall also assess sufficient sensitivities, including but not limited to Voltage Set Point at the Point of Interconnection (POI), real power output, and Reactive Power output to ensure acceptable model performance over the entire range of operating conditions. An explanation shall be provided for review if model responses do not match.

- Dynamics Working Group Procedure Manual Section 3.1.1:

> The current planning model software is PSS/E version 33 and PSCAD version 4.5 or higher. A planning model software transition from PSS/E version 33 to version 35 is in progress. Models compatible with version 35 are required to be provided by July 1, 2022. During years where a PSS/E version change is being conducted, the previous PSS/E version user defined models shall also be provided until a full transition is completed. The current operations model software Powertech DSATools™ Transient Security Assessment Tool (TSAT) version 21.

# Model Submission Best Practices

- Submit as a “package” including PSS/e and PSCAD models and all supporting documents:
  - Model data using dynamic model templates
  - MQT reports (demonstrate consistency between PSS/e and PSCAD)
  - Unit Model Validation (UMV) report
  - Model parameter verification report

- Review model performance prior to submitting to ERCOT
  - Focus on satisfying the “should” rather than the “may”

- Considerations to facilitate model performance consistency review
  - PSS/e and PSCAD results comparison on same plot
  - PSS/e and PSCAD comparison on same report page using same plot scales (side-by-side)

# Relationship between VRT and MQT for GINR

- TSPs perform VRT test as part of FIS
  - Confirms acceptable model performance
  - ERCOT will review VRT results that are submitted by TSP prior to starting stability simulations (recommended practice)
  - ERCOT will review IE MQT in conjunction with TSP VRT result

- IEs perform MQT – should be included with every model submission
  - ERCOT is not typically reviewing MQT until TSP VRT test is reviewed
  - ERCOT will review PSCAD MQT prior to SSR study if requested by TSP
  - ERCOT still conducting MQT review prior to QSA
    - Minor model adjustments after FIS
    - Consistency between PSS/e and PSCAD MQT

# Questions

# References

- Model Quality Guide, published on the RE webpage at ercot.com
- Dynamic Model Templates, published on the RE webpage at ercot.com
- Planning Guide section 5.5 (in particular, paragraph (2) and (3))
- Planning Guide section 6.2 (in particular, paragraph (5))
- DWG Procedure Manual section 3.1

Miscellaneous Reminders:

- PSS/E Dynamic models must be submitted using a Dynamic Model Template
  - The template serves as the vehicle for both the PSS/E and the TSAT model submission and is available from the RE webpage at ercot.com
  - 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? Developing your model quality test report and parameter verification report at the same time is an efficient means to meet both NERC and ERCOT requirements. (Refer to the Model Quality Guide.)

# 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),<br>2. 12 to 24 months after COD or 12-24 months after March 1, 2021 for existing resources,<br>3. A minimum of every 10 years.<br>4. Within 30 days of a change at the plant | Equipment owner (RE, IE or TSP) | PG 5.5, 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.