



IBR Modeling Requirements Workshop

BPM-015 Appendix I

March 19th, 2026

Purpose

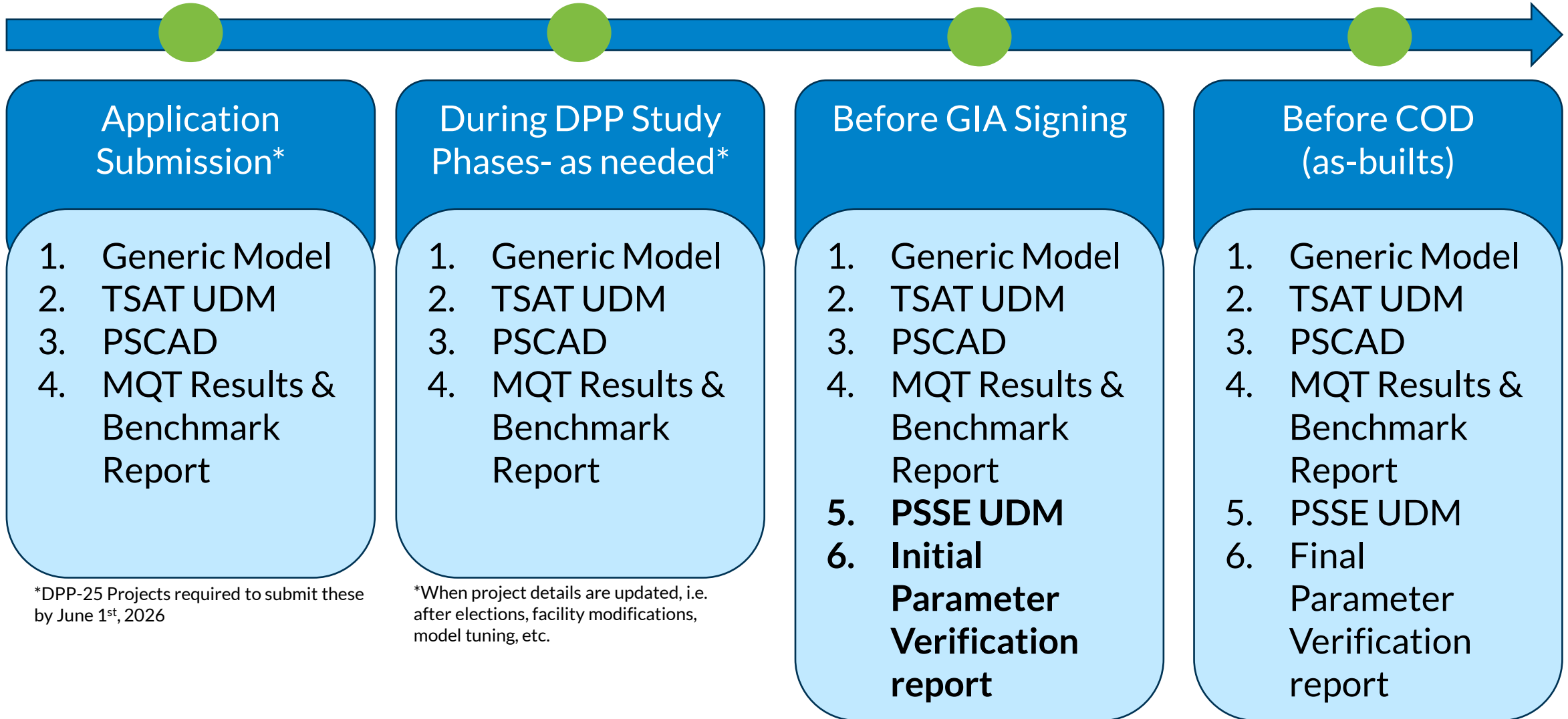
- Provide guidance on meeting new BPM-15 Appendix I: IBR Modeling Requirements for DPP-2025+

Key Takeaways

- MISO solicited stakeholders for questions focused on how to meet the new IBR Modeling Requirements
- The workshop focuses on previously submitted questions- for full compliance with requirements, Interconnection Customers should always reference BPM-15 r32 Appendix I.
- Clarifications and some corrections to the BPM-15 r32 Appendix I are given.

Submission and Process Overview

Dynamic Model Package Requirements



Missing deadline will cause deficiency; 10-day cure

Applicability

- DPP-2025 Projects
 - “Application Submission” packages due June 1st, 2026
- DPP-2026+ Projects
 - If already assigned J#, due before application submission window closes.
 - All other projects, due at application submission to be considered complete.
- Surplus and Replacements
 - Once DPP-2025 Ph3 Models are posted Final for use in Ph3 studies
- Facility Modification Review Requests (aka “Material Modifications”)
 - Any project in DPP-2025 or later
 - For DPP-2025, only needed if request made after June 1st, 2026.

For DPP-2025 Projects, Model Package due on June 1st, 2026*

- Model Package Deliverables:
 - Generic Model (PSSE formatted, v35+)
 - TSAT-Compatible UDM (v25+)
 - PSCAD Model (v 5.0.0+)
 - **Passing Model Quality Test Results**
 - Benchmark Report
 - Documentation indicated in Appendix I, I-4
- Missing deadline will cause deficiency; 10-day cure

Upload here:

Generator Documents

*** Larger files may take longer to upload

Generic Dynamic Generator Model *
Please provide the generic dynamic generator model, formatted for use with PSSE.
File formats accepted: dyr
[Choose File](#)

PSCAD Models *
All inverter based resources where the Transmission Owners Local Planning Criteria calls for an EMT stu
File formats accepted: zip
[Choose File](#)

PSS/E UDM
File formats accepted: zip
[Choose File](#)

TSAT Compatible UDM *
File formats accepted: zip

BPM-015 Generator Interconnection49574_TSATCUDM.zip

IBR MQT and Benchmarking Report *
Model Quality Test and Benchmarking Report, per BPM-015 Appendix I- IBR Modeling Requirements.
File formats accepted: zip
[Choose File](#)

Parameter Verification Report
Parameter Verification, per BPM-015 Appendix I.
File formats accepted: doc, docx, pdf, xls, xlsx
[Choose File](#)

This view is currently under construction and may change slightly once live (~April 1st.)

* As communicated at [IPWG on January 27th, 2026](#).

More Model Package Details

- Review Section I-4 for full details

Selected Highlights

- “11. ... Attestations from the original equipment manufacturers that the models represent the planned or installed equipment...”
- “12. The IBR **unit** models shall be validated... This includes type test, factory acceptance test, or hardware in the loop test results demonstrating a comparison of the IBR unit’s response and the IBR unit’s model response...”
- 13. Requires documentation for each set of models to describe applicability, usage, and capability of the models.

I-4 Model Requirements

I-4.1 General Requirements for All Models

The model requirements listed in this section are applicable to all four model types (i.e., standard library, PSS®E/TSAT™, LIDM, and PSCAD™ models). Model-specific

After Submission

- MISO reviews dynamic model package for completeness
 - 15 days to review and deem valid or identify deficiency
 - Will provide comment/feedback on specific deficiencies, if applicable
- Model packages will be made available to TOs during Stability Model build as a default
 - Aligns with current practice for dynamic model sharing
 - TOs may request this information as early as Ph1 kick-off, however.
 - No allotted TO review period in tariff or BPM, but timely coordination will be valued.
- MISO will indicate which models are used in the Stability Study analysis
 - Based on benchmarked reports and optional TO input. MISO making final determination.
 - May change from phase to phase, based on need.

Model Quality and Performance Tests (MQT)

Model Quality Tests

1. Initialization
2. Balanced Fault Ride-Through
3. Small Voltage Disturbance
4. Small Frequency Disturbance
5. High Voltage Ride-Through
6. Low Voltage Ride-Through
7. High Frequency Ride-Through
8. Low Frequency Ride-Through
9. Protection Verification
10. Short Circuit Ratio (SCR) Tests
11. Phase Angle Tests (PSCAD Only)

- MISO does not provide test “kits” or templates currently.
- Future MQT tool will provide standardized testing/reporting

Test Set Up

- Single-Machine-Infinite-Bus (SMIB)
- Initial Test Assumptions
 - SCR=3*, X/R=5
- GIA/COD Test Assumptions Updates
 - SCR and X/R provided by MISO/TO to reflect site-specific values for these stages
- “Variable” values indicate any value is acceptable
- Test Signal profiles are given, as applicable
- 30 second duration

I-5.1.1 Initialization Tests

Test No.	Disturbance	IBR Plant Initial Condition			Grid Initial Condition		Pass/Fail
		Active Power at the POM	Reactive Power at the POM	Voltage at the POM (pu)	Infinite Bus Voltage	SCR	
0-1	No disturbance	Pmax	Qmax	1.0	Variable	3	
0-2	No disturbance	Pmax	Qmin	1.0	Variable	3	
0-3	No disturbance	Pmin ⁴⁸	Qmax	1.0	Variable	3	
0-4	No disturbance	Pmin ⁴⁸	Qmin	1.0	Variable	3	

*several tests were given SCR assumptions that make meeting initial condition requirement difficult. Exceptions are made for these on slide 12.

IBR Plant Initial Conditions

- **P_{max}**= unit dispatched at value needed to achieve requested service level at POI
 - “P_{max} at POM” is Active P measured at POM when project is dispatched to meet requested service at POI.
 - Hybrid Units should be dispatched following BPM-15 Table 6-1.
- **P_{min}**: if storage is present, when P_{min} is indicated, only storage should be dispatched.
- **Q_{max}/Q_{min}**
 - Appendix I may cause confusion: *“IBR generation plants (i.e., not storage) reactive power **dispatch** assumptions Q_{min} and Q_{max} should be zero and 32.87% of the IBR continuous rating, respectively.”*
 - When Q_{min} is indicated in tests, Q should be **dispatched** at 0 for non-storage
 - **Capability** is expected to have a negative Q_{min}.
 - Capacitor banks may be turned on/off as necessary to achieve initial conditions.

Requested Testing Clarifications

- $SCR = SCR_{POM} = \frac{SCMVA_{Grid @ POM}}{SCMVA_{IBR @ POM}}$, where $SCMVA_{IBR @ POM}$ uses OEM-specified maximum short circuit contribution, aggregating all IBR sources
- Specified SCR in these specific tests may be ignored:
 - I-5.1.3 Small Voltage Disturbance
 - I-5.1.5 High Voltage Ride-Through
 - I-5.1.6 Low Voltage Ride-Through
- Padmount tap ratios should be consistent from test to test

Example: Test I-5.1.3- Small Voltage Disturbance (SVD) Test

- Voltage profile (Figure 7) is intended to be the applied grid source voltage signal
- IBR Plant is expected resist change in magnitude at POM through reactive power response

I-5.1.3 Small Voltage Disturbance (SVD) Tests

Test No.	Disturbance	IBR Plant Initial Condition			Grid Initial Condition		Pass/Fail
		Active Power at the POM	Reactive Power at the POM	Voltage at the POM (pu)	Infinite Bus Voltage	SCR	
0-1	Small voltage disturbance	Pmax	0	Figure 7	N/A	3	

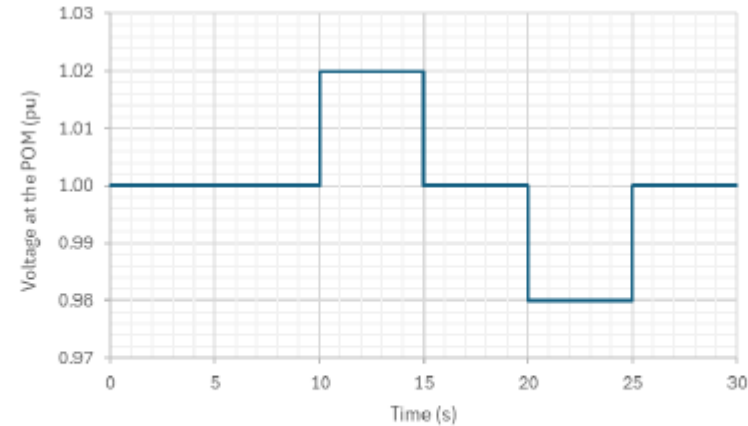


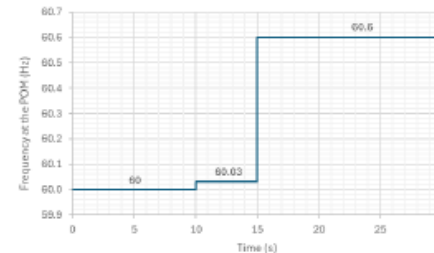
Figure 7: Voltage profile at the POM for the SVD tests.

Test I-5.1.4 Small Frequency Disturbance (SFD) Correction

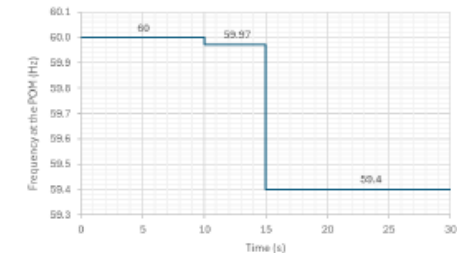
- **Update needed:** Test I-5.1.4 indicates an initial condition of Figure 8 (b)
 - Should indicate 1.0 p.u.
- Both frequency profiles, figure 8(a) and 8(b), need to be applied for each test.

I-5.1.4 Small Frequency Disturbance (SFD) Tests

Test No.	Disturbance	IBR Plant Initial Condition			Grid Initial Condition		Pass/Fail
		Active Power at the POM	Reactive Power at the POM	Voltage at the POM (pu)	Infinite Bus Voltage	SCR	
0-1	Small frequency disturbance	50% Pmax + no headroom ⁴⁹	0	Figure 8 (b)	N/A	N/A	
0-2	Small frequency disturbance	50% Pmax + headroom (50% of Pmax) ⁵⁰	0	Figure 8 (b)	N/A	N/A	



(a) High frequency



(b) Low frequency

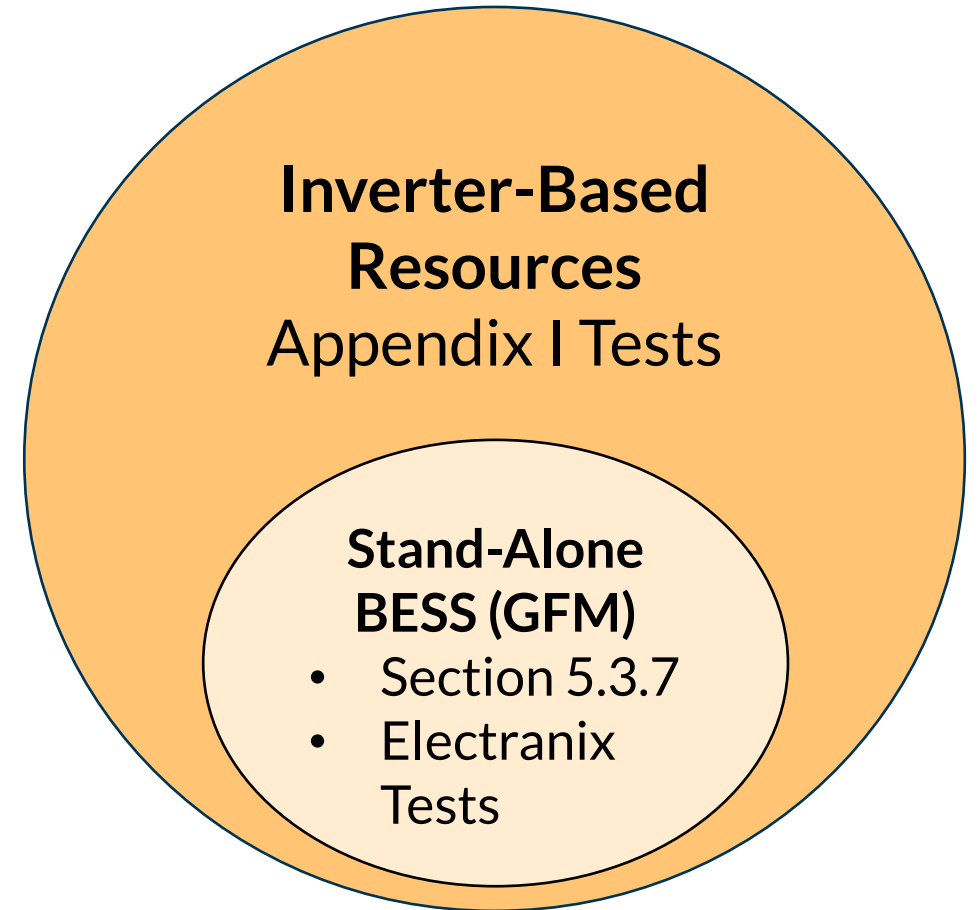
Figure 8: Frequency profile at the POM for the SFD tests.

Grid Initial Condition

Assume an ideal voltage source at the POM to represent the grid and apply the frequency profile shown in Figure 8 (i.e., use the playback model in PSS[®]E/TSAT[™] and controllable voltage source in PSCAD[™] at the POM).

Grid Forming Inverters (GFM): Electranix Tests vs Appendix I

- Stand-Alone BESS need to meet requirements of BPM-15 Section 5.3.7 for GFM controls
 - Electranix Tests for PSCAD Model
- Stand-Alone BESS is an IBR, must also meet Appendix I tests



Test Report and Benchmarking

Test Report

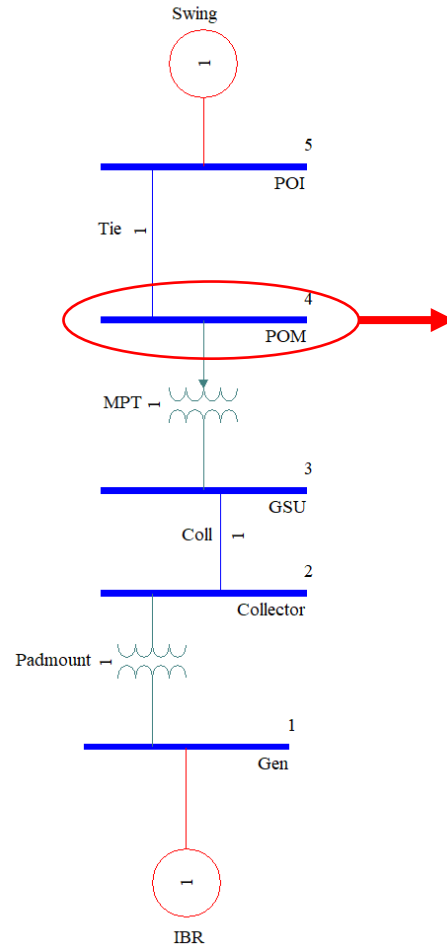
- Provide a table summary of results for each test
- All models should pass all specified tests
- Exact **response** for each test may occasionally differ from model to model

Test #	Description	Generic	TSAT UDM	PSSE UDM	EMT
5.1.1-1	Initialization Tests- No Distrubance Pmax/Qmax	Pass	Pass	N/A	Pass
5.1.1-2	Initialization Tests- No Distrubance Pmax/Qmin	Pass	Pass	N/A	Pass
5.1.1-3	Initialization Tests- No Distrubance Pmin/Qmax	N/A	N/A	N/A	N/A
5.1.1-4	Initialization Tests- No Distrubance Pmin/Qmin	N/A	N/A	N/A	N/A
5.1.2-1	Balanced Fault Ride-Through	Pass	Pass	N/A	Pass
5.1.3-1	SVD Tests	Pass	Pass	N/A	Pass
5.1.4-1	SFD Tests- No Headroom, HiFreq	Pass	Pass	N/A	Pass
5.1.4-1	SFD Tests- No Headroom, LoFreq	Pass	Pass	N/A	Pass
5.1.4-2	SFD Tests- Headroom, HiFreq	Pass	Pass	N/A	Pass
5.1.4-2	SFD Tests- Headroom, LoFreq	Pass	Pass	N/A	Pass
5.1.5-1	HVRT Tests	Pass	Pass	N/A	Pass
5.1.6-1	LVRT Tests	Pass	Pass	N/A	Pass
5.1.7-1	HFRT Tests	Pass	Pass	N/A	Pass
5.1.8-1	LFRT Tests	Pass	Pass	N/A	Pass
5.1.9-1	Protection Verification- High Voltage	Pass	Pass	N/A	Pass
5.1.9-2	Protection Verification- Low Voltage	Pass	Pass	N/A	Pass
5.1.9-3	Protection Verification- High Frequency	Pass	Pass	N/A	Pass
5.1.9-4	Protection Verification- Low Frequency	Pass	Pass	N/A	Pass
5.1.10-1	SCR Tests	Pass	Pass	N/A	Pass
5.2.1-1	Phase Angle Change Tests (EMT Only)	N/A	N/A	N/A	Pass

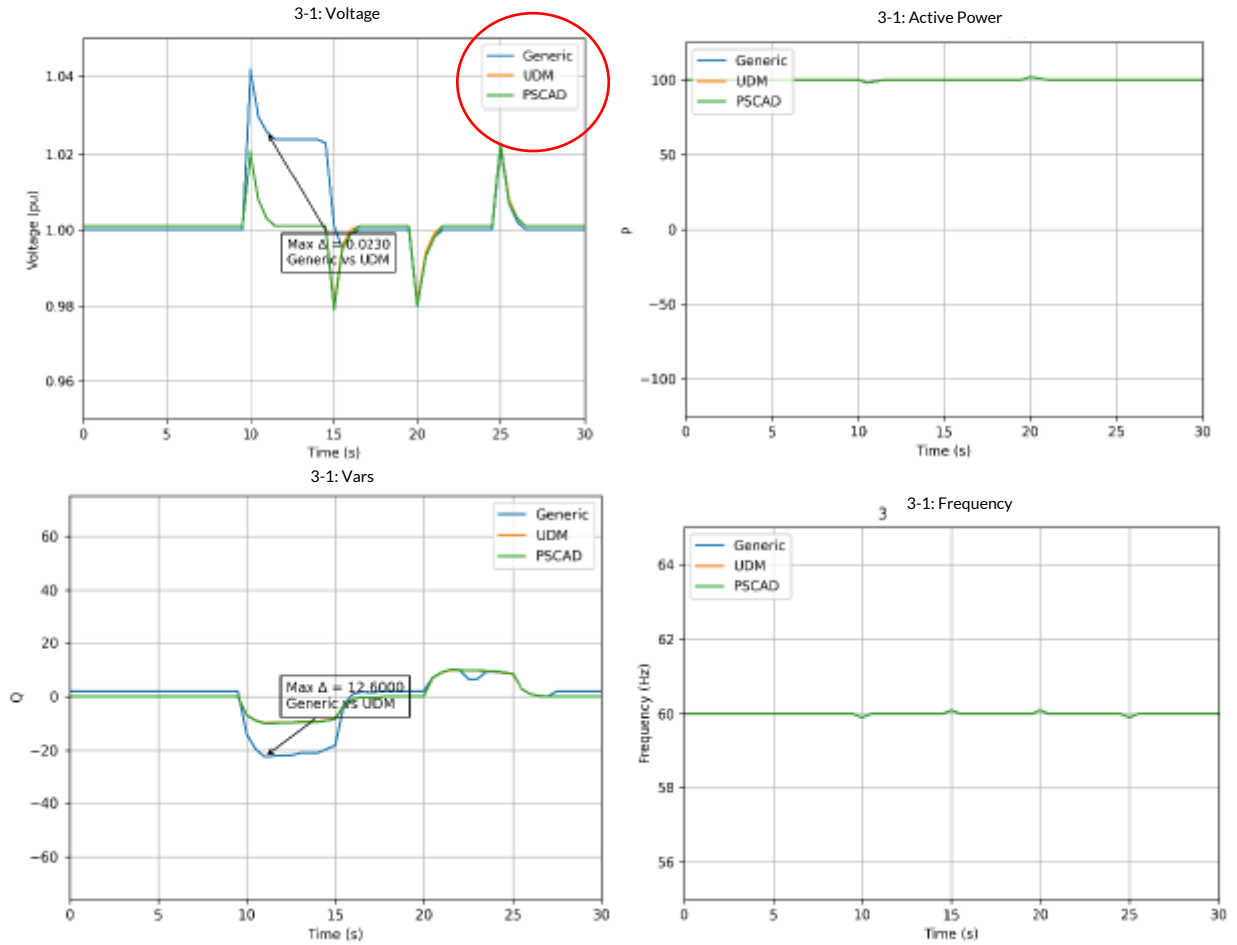
Example of test summary from a project submitting materials at application submission (no PSSE UDM needed yet)

Benchmarking

- Plot voltage, frequency, active power, reactive power at POM
- All models need to be on same plot



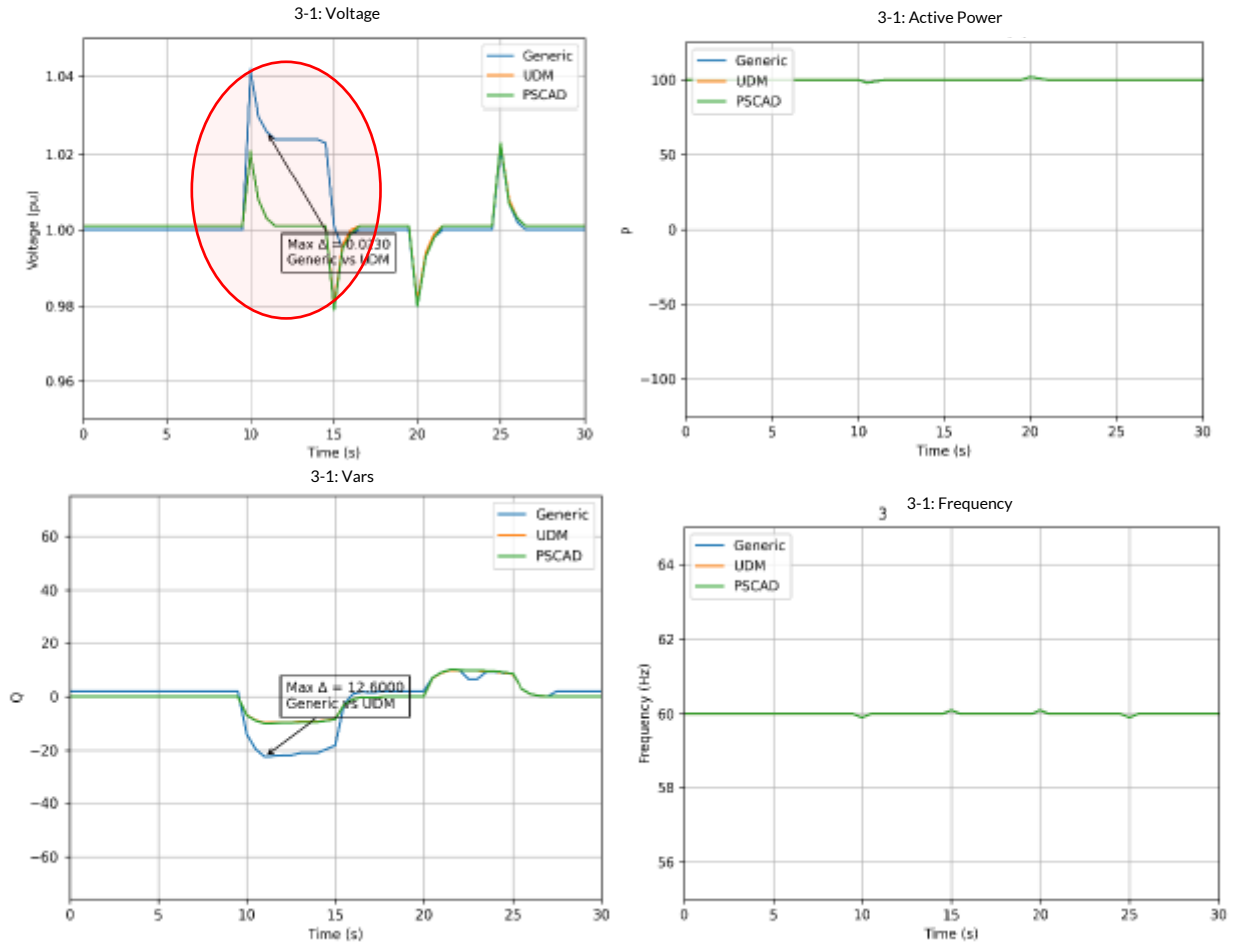
3-1 Small Voltage Disturbance Tests



Benchmarking

- Major discrepancies between results must be explained and justified
- Ex: “xyz control function is unavailable in generic models, resulting in ____ behavior that diverges with UDM and EMT models.”

3-1 Small Voltage Disturbance Tests



Wrap up

Looking forward

- MISO has selected a vendor for the MQT/Benchmarking Tool
 - Will replace need for IC to perform test set up and reporting manually
 - Implementation is expected Fall 2026
 - Likely to require some updates to file formatting/naming submissions
 - Training/guidance will be provided
- Consolidation of GFM Tests with Appendix I

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