

Progress Update on

**NERC Project 2020-06
Verification of Dynamic Models and Data
for Generators**

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Agenda

- **Project Background**
- **Project Progress**
- **Project Timeline**
- **Needs of Development**
- **Questions & Answers**



Project Background

- **Current NERC Standards**

- MOD-026-1: Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions
- MOD-027-1: Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Freq Control Functions

- **Increased penetration of IBRs**

- Issues identified in IRPTF Review of NERC Reliability Standards White Paper March 2020
- Odessa Disturbance Report recommended EMT models quality and fidelity checks
- Multiple Solar PV Disturbances in CAISO reinforced the NERC reliability standards improvement needs

- **Transmission-connected dynamic reactive resources**

- Coordination with NERC Project 2020-02



Project Progress

- Overview of MOD-026-2 (Draft)

MOD-026-2	Functional Entities	General Requirements
R1	TP&PC	Develop requirements and processes
R2 to R6	GO/TO	Provide verified models
R7	GO/TO	Update verified models after change
R8	TP	Review submittals and written response
R9	GO/TO	Written response to R8



Project Progress

- **Highlight Changes regarding Model Validation (Draft)**
 - MOD-026 and MOD-027 are merged
 - The facility includes BES generating resources and dynamic reactive resources per BES Inclusion I2, I4, I5 and HVDC terminal equipment (LCC, VSC). (R1)
 - Positive Sequence limiter and protection model validation and verification are required (R2 to R5)
 - Synchronous generator, condenser
 - IBRs, FACTs, HVDC facilities
 - EMT model validation and verification are required (R6)
 - IBRs, FACTs, HVDC facilities



Project Progress

- **Standard-Only Definitions (Draft)**
 - **Verification** refers to the static process of checking documents and files, and comparing them to model parameters, model structure, or equipment settings.
 - **Validation** refers to the dynamic process of testing or monitoring the in-service equipment behavior, and then using the testing or monitoring result and comparing them to the model simulated response.



Project Progress

- **Model Verification and Validation Requirement Mapping**

MOD-026-1 (R2) and MOD-027-1 (R2)	MOD-026-2
MOD-026-1 R2 (synchronous) generator excitation	R2
MOD-027-1 R2 (synchronous) turbine/governor and load control	R3
MOD-026-1 R2 (IBR) volt/var control	R4
MOD-027-1 R2 (IBR) active power/frequency control	R5
EMT model (new requirement)	R6



Project Progress

- **Model Verification and Validation Related Changes and Updates**
 - Synchronous Generator or Condenser Positive Sequence Dynamic Model
 - Excitation limiters and Protection Systems (R2)
 - excitation limiters
 - outer-loop controls
 - Protection Systems including over- and under-voltage, stator and field overcurrent, loss of field, out-of-step, and volts-per-hertz protection
 - Turbine Protection System (R3)
 - Protection Systems including over- and under-speed/frequency



Project Progress

- **Model Verification and Validation Related Changes and Updates**
 - IBR, FACTS, VSC HVDC Positive Sequence Dynamic Model
 - Unit, reactive power control system and protection/limiting functions (R4)
 - Active power/frequency control system and protection/limiting functions (R5)

Either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant



Project Progress

- **Model Verification and Validation Related Changes and Updates**
 - IBR, FACTS, LCC HVDC, VSC HVDC EMT Model Requirements (R6)
 - Attestation from respective original equipment manufacturer(s) (OEM)
 - Device test for large signal disturbances
 - Model of the unit, collector system, auxiliary devices, power plant controller, main transformer(s), and enabled limiters and protections



Project Progress

- **Model Verification and Validation Related Changes and Updates**
 - IBR, FACTS, LCC HVDC, VSC HVDC EMT Model Requirements (R6)
 - Validation using recorded response
 - Comparison between EMT and positive sequence model response for large signal disturbances

R6 exemptions: (i) Commissioning date of the Facility is before January 1, 2015; OR (ii) OEM is no longer in business; OR (iii) OEM no longer supports model(s) for in-service equipment at the Facility.



Project Progress

- **Implementation Plan**

Milestone	Time Gap	Date
FERC approval date (example only)		12/31/2023
Effective Date of R1, R7, R8, R9	+ 1 year	01/01/2025
Compliance Date R2 to R6	+ 2 year	01/01/2027



Project Progress

- **Implementation Plan**

Year of Latest Verified Model	Periodicity	Compliance with R2 (MOD-026-1/027-1)	Compliance with R2 to R6 (MOD-026-2)
2015	10	2025	2027
2016		2026	2027
2017		2027	2027
2018		2028	2028
2019		2029	2029
...	
2025		2035	2035



Project Timeline

- **May 20 – July 5, 2022**
 - 45-day initial formal comment period with ballot
- **October – November 2022**
 - 45-day additional formal comment period with ballot
- **December 2022**
 - 10-day final ballot
- **February 2023**
 - NERC board adoption



References and Resources

- [NERC Project 2020-06](#)

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Slides and Recording Posted

Project 2020-06 Verifications of Models
and Data for Generators Industry
Webinar

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Webinar Date: April 20, 2022



Needs of Development

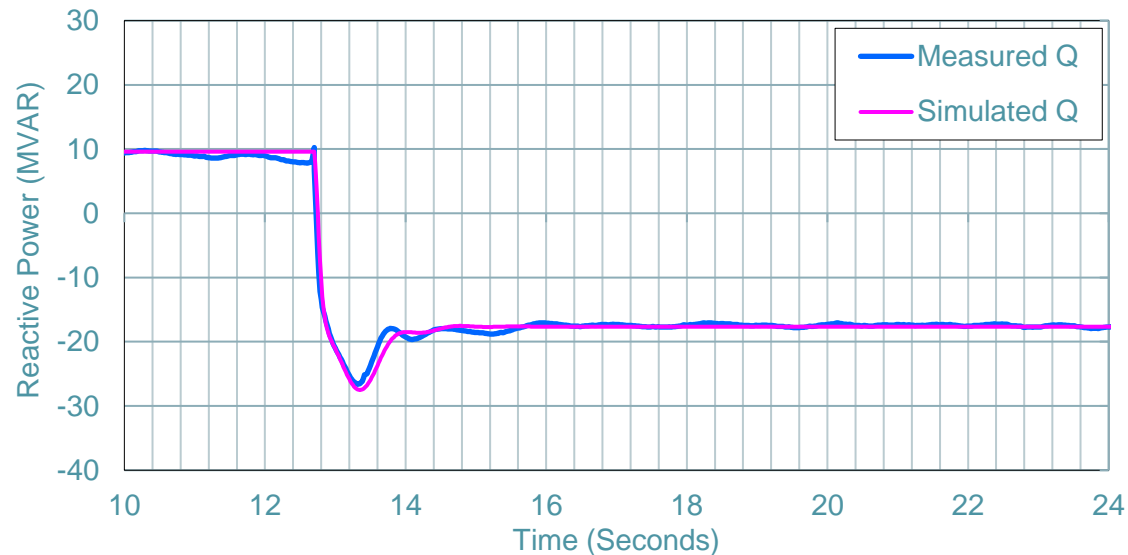
- **Positive Sequence Dynamic Model Development and Validation**
 - WECC approved limiter models
 - oel2c, oel3c, oel4c, oel5c
 - uel1, uel2, uel2c
 - scl1c, scl2c
 - WECC approved protection models
 - gp1, gp2, gp3
 - lhfrt, lhvrt
 - ...
 - New model development needs

(Does Implementation Plan look reasonable for model development?)



Needs of Development

- **Positive Sequence Dynamic Model Development and Validation**
 - UEL Model Validation Example
 - 400 MVA synchronous generator
 - Summing-point UEL with terminal voltage dependency
 - UEL2 model



Questions and Answers

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