

## Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

### Description of Current Draft

This is the ~~first~~third draft of the proposed standard for a formal 45-day comment period.

Completed Actions	Date
Standards Committee approved Standards Authorization Request (SAR)	September 24, 2020
SAR posted for comment	December 16, 2020 – January 14, 2021
45-day initial formal comment period with ballot	May 20 – July 6, 2022
45-day additional formal comment period with ballot	November 21, 2022 – January 18, 2023

Anticipated Actions	Date
<del>45-day additional formal comment period with ballot</del>	<del>June 7, 2023 – July 21, 2023</del>
10-day final ballot	<del>January</del> <u>August</u> 2023
NERC Board adoption	<del>May</del> <u>December</u> 2023

## **New or Modified Term(s) Used in NERC Reliability Standards**

This section includes all new or modified terms used in the proposed standard that will be included in the *Glossary of Terms Used in NERC Reliability Standards* upon applicable regulatory approval. Terms used in the proposed standard that are already defined and are not being modified can be found in the *Glossary of Terms Used in NERC Reliability Standards*. The new or revised terms listed below will be presented for approval with the proposed standard. Upon Board adoption, this section will be removed.

**Term(s):**

None.

## A. Introduction

1. **Title:** Verification of Dynamic Models and Data for BES Connected Facilities
2. **Number:** MOD-026-2
3. **Purpose:** To verify that the dynamic models and associated parameters used to assess Bulk Electric System (BES) reliability represent the in-service equipment of BES Facilities including generating Facilities, transmission connected dynamic reactive resources, and high-voltage direct current (HVDC) ~~terminal equipments~~systems.
4. **Applicability:**
  - 4.1. **Functional Entities:**
    - 4.1.1. Generator Owner
    - 4.1.2. Transmission Planner
    - 4.1.3. Planning Coordinator
    - 4.1.4. Transmission Owner that owns a Facility listed in Section 4.2.4 or 4.2.5
  - 4.2. **Facilities:** For the purpose of this standard, the term “applicable Facility” or “Facility” shall mean any one of the following:
    - 4.2.1 Individual generating unit meeting the criteria set by Inclusion I2 of the BES definition.
    - 4.2.2 Generating plant/Facility meeting the criteria set by Inclusion I2 of the BES definition.
    - 4.2.3 Generating plant/Facility of dispersed power producing resources meeting the criteria set by Inclusion I4 of the BES definition.
    - 4.2.4 Dynamic reactive resources meeting the criteria set by Inclusion I5 of the BES definition with a gross (individual or aggregate) nameplate rating greater than 20 MVA including, but not limited to:
      - 4.2.4.1 Synchronous condenser; and
      - 4.2.4.2 Flexible alternating current transmission system (FACTS) devices.
    - 4.2.5 ~~HVDC terminal equipment~~High-voltage direct current (HVDC) systems including:
      - 4.2.5.1 Line commutated converter (LCC); and
      - 4.2.5.2 Voltage source converter (VSC).
    - 4.2.6 Facilities meeting an exclusion of the BES definition are exempt as an applicable Facility.
5. **Effective Date:** See Project 2020-06 Verification of ~~Dynamic~~ Models and Data for ~~BES Connected Facilities~~Generators Implementation Plan

## B. Requirements and Measures

- R1.** Each Transmission Planner and its Planning Coordinator, shall jointly develop dynamic model verification<sup>1</sup> requirements and processes. The dynamic model verification requirements and processes shall be made available to the Generator Owner and Transmission Owner by the Transmission Planner, and include at a minimum the following: [*Violation Risk Factor: Lower*] [*Time Horizon: ~~Operations~~Long-term Planning*]
- 1.1.** Acceptable positive sequence dynamic models, format, and level of detail for Facilities specifically identified within Requirement R2–R5;
  - 1.2.** Acceptable electromagnetic transient (EMT) models, format, and level of detail for Facilities specifically identified within Requirement R6;<sup>2</sup>
  - 1.3.** Acceptance criteria used by the Transmission Planner to determine disposition under Requirement R8 including, at a minimum, the following:
    - 1.3.1.** model parameterization checks;
    - 1.3.2.** model usability, initialization, and interoperability; and
    - 1.3.3.** model submittal requirements.<sup>3</sup>
  - 1.4.** Process for Generator Owner or Transmission Owner to provide verified models to the Transmission Planner;
  - 1.5.** Process by which verified model(s) are submitted to the applicable Planning Coordinator, after the model(s) meets acceptance criteria of Part 1.3; and
  - 1.6.** Process for Generator Owner or Transmission Owner to obtain ~~the model(s)~~ contained in data from the Transmission Planner’s database for an existing Facility owned by the Generator Owner or Transmission Owner within 90 calendar days of receiving a written request.
- M1.** Each Transmission Planner and each Planning Coordinator must provide dated evidence such as document(s), webpage(s), or web portal(s) outlining the model requirements and processes that are jointly developed. Each Transmission Planner shall also have evidence showing it made available to the Generator Owner and Transmission Owner the model requirements and processes in accordance with Requirement R1.

### **Synchronous Facility – Excitation Control**

- R2.** For synchronous generation identified in Section 4.2.1 or 4.2.2 or a synchronous condenser identified in Section 4.2.4.1, each asset owner (Generator Owner or Transmission Owner) shall provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service

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<sup>1</sup> For the purposes of this Reliability Standard, the term “verification” refers to the static process of checking documents and files, and comparing them to model parameters, model structure, or equipment settings.

<sup>2</sup> Detailed EMT modeling requirements are developed by the Transmission Planner to ensure consistent EMT models are provided based on the types of studies being performed and the specific EMT simulation tools being used.

<sup>3</sup> Model submittal requirements needed by the Transmission Planner may include, but are not limited to, required data files and inclusions needed in the model report.

equipment of the Facility to its Transmission Planner, ~~in accordance with~~within the timeframe in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*

- 2.1. Manufacturer, model number (if available), and type of generator/synchronous condenser, excitation system hardware, and Protection System(s) specified in Part 2.3;
- 2.2. Model(s) representing the generator/synchronous condenser, ~~and~~ associated excitation system including voltage regulator, impedance compensation, power system stabilizer, and outer-loop controls which impact dynamic volt/volt-ampere reactive (VAR) performance;
- 2.3. Model(s) representing enabled excitation limiters and model(s) representing enabled Protection Systems that ~~directly~~ trip the prime mover or generator/synchronous condenser either directly or via lockout or auxiliary tripping relays. Protection Systems that shall be modeled include phase over-and under-voltage, ~~stator phase overcurrent, voltage restrained time overcurrent, field overcurrent, loss of field,~~ out-of-step, ~~phase distance,~~ and volts per hertz protection; and
- 2.4. Validation<sup>4</sup> of the positive sequence dynamic model(s) of Part 2.2 response using the recorded response ~~for of~~ a dynamic reactive power or voltage event from either a staged test or a measured system disturbance.

- M2.** Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R2 and that it provided the verified model(s) and accompanying information to its Transmission Planner ~~in accordance with the periodicity.~~

**Synchronous Facility – Governor Control**

- R3.** For synchronous generation identified in Section 4.2.1 or 4.2.2, each Generator Owner shall provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, ~~in accordance with~~within the timeframe in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 3.1. Manufacturer, model number (if available), type of prime mover, type of governor, type of control, and Protection System(s) of Part 3.3;
  - 3.2. Model(s) representing the prime mover, governor control system, and any other controls which impact the dynamic active power or frequency performance due

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<sup>4</sup> For the purposes of this Reliability Standard, the term “validation” refers to the dynamic process of testing or monitoring the in-service equipment behavior, and then using the testing or monitoring results and comparing them to the model simulated response.

to a system disturbance (e.g. load controller), but excluding automatic generation control;

- 3.3. Model(s) representing enabled Protection Systems that ~~directly~~ trip the prime mover or generator either directly or via lockout or auxiliary tripping relays. Protection Systems that shall be modeled include over- and under-frequency elements. In addition, model(s) representing enabled prime mover over- and under-speed trip functions that directly trip the prime mover/generator; and
- 3.4. Validation<sup>5</sup> of the positive sequence dynamic model(s) of Part 3.2 response using the recorded response ~~for~~of a dynamic active power or frequency event from either a staged test or a measured system disturbance in which perceived frequency deviates per Attachment 1, Note 1.

M3. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R3 and provided the verified model(s) and accompanying information to its Transmission Planner ~~in accordance with the periodicity~~.

**Inverter Based Resource Facility– Volt/VAR Control**

R4. For inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices identified in Section 4.2.4.2, and VSC HVDC identified in Section 4.2.5.2, each asset owner (Generator Owner or Transmission Owner) shall provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, ~~in accordance with~~within the timeframe in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following:  
*[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*

- 4.1. Manufacturer, model number, and software/firmware version number of the IBR unit(s)<sup>56</sup> and power plant controller;
- 4.2. Model(s) representing the IBR unit(s)~~–~~ and associated reactive power/voltage control system<sup>67</sup> including the IBR unit’s electrical control, the Facility’s power plant controller, auxiliary reactive resources, and other equipment which impacts ~~plant~~Facility voltage and reactive power dynamic response;
- 4.3. Model(s) representing enabled protections<sup>78</sup> and limiting functions,<sup>89</sup> that either directly trip IBR unit(s) or ~~plant~~Facility, or limit active/reactive output of the IBR unit or ~~plant~~Facility; and

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<sup>5</sup> For the purposes of this Reliability Standard, the term “validation” refers to the dynamic process of testing or monitoring the in-service equipment behavior, and then using the testing or monitoring results and comparing them to the model simulated response.

<sup>56</sup> IBR unit includes the inverter, converter, wind turbine generator, or HVDC converter.

<sup>67</sup> Reactive power control system includes voltage reference control, reactive power reference control, and power factor reference control modes.

<sup>78</sup> Protection functions ~~that shall be modeled~~ include at a minimum AC over-over-voltage and under-voltage protection.

<sup>89</sup> Limiting functions include active/reactive power limiting, active/reactive current limiting, or other limiting functions as may be involved in active/reactive power prioritization and disturbance ride-through.

- 4.4. Validation<sup>910</sup> of the positive sequence dynamic model(s) of Part 4.2 response using the recorded response ~~for~~of a dynamic reactive power or voltage event from either a staged test or a measured system disturbance.
- M4. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R4 and provided the verified model(s) and accompanying information to its Transmission Planner ~~in accordance with the periodicity.~~  
Inverter Based Resource – Frequency/Power Control
- R5. For inverter based resources (IBRs) identified in Section 4.2.3, LCC HVDC identified in Section 4.2.5.1, and VSC HVDC identified in Section 4.2.5.2, each asset owner (Generator Owner or Transmission Owner) shall provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, ~~in accordance with~~within the timeframe in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 5.1. Manufacturer, model number, and software/firmware version number of the IBR unit(s), and power plant controller;
- 5.2. Model(s) representing the IBR unit(s), ~~and~~ associated active power/frequency control including the IBR unit's electrical control, the Facility's power plant controller, and other equipment which impacts ~~plant~~Facility active power or grid frequency dynamic response;
- 5.3. Model(s) representing enabled protections<sup>1011</sup> and limiting functions, that either directly trip IBR unit(s) or ~~plant~~Facility, or limit active/reactive output of the IBR unit or ~~plant~~Facility; and
- 5.4. Validation of the positive sequence dynamic model of Part 5.2 response using the recorded response ~~for~~of a dynamic active power or frequency event from either a staged test or a measured system disturbance in which the power plant controller's or some other Facility active power controller's perceived frequency deviates per Attachment 1, Note 1.
- M5. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R5 and provided the verified model(s) and accompanying information to its Transmission Planner ~~in accordance with the periodicity.~~

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<sup>910</sup> For the purposes of this Reliability Standard, the term "validation" refers to the dynamic process of testing or monitoring the in-service equipment behavior, and then using the testing or monitoring results and comparing them to the model simulated response.

<sup>1011</sup> Protection functions ~~that shall be modeled~~ include at a minimum over-over-frequency and under-frequency protection.

**Inverter Based Resource – EMT Model(s)**

R6. For inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices ~~per~~**identified in** Section 4.2.4.2, LCC HVDC identified in Section 4.2.5.1, and VSC HVDC identified in **Section** 4.2.5.2, each **asset owner** (Generator Owner or Transmission Owner) shall provide a verified EMT model(s) with associated parameters and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, ~~in accordance with~~**within the timeframe in** MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*

- 6.1. Attestation from respective original equipment manufacturer(s) (OEM) stating **that** the structure of IBR unit model(s), power plant controller model, and auxiliary control devices model(s) represent the equipment supplied by the OEM. <sup>11</sup> **The attestation shall include the equipment make, model number, software/firmware version number, and confirmation that all inverter control modes, control blocks, and protections are represented in the model.** If an attestation from an OEM is not obtainable, the Generator Owner or Transmission Owner shall document the reason;
- 6.2. Device test<sup>12</sup> results demonstrating a comparison of the IBR unit’s response and the IBR unit’s EMT model response for large signal disturbances.<sup>13</sup> If device test results are not obtainable, the Generator Owner or Transmission Owner shall document the reason;
- 6.3. Facility EMT model with associated parameters representing the IBR unit(s), collector system, auxiliary devices, power plant controller, main transformer(s), and enabled protections and ~~controls that either~~ **limiting functions that act on voltage, frequency, and/or current, or act on quantities derived from voltage, frequency, and/or current, which** directly trip **the** IBR unit(s) or ~~plant~~**Facility**, or limit active/reactive output of the IBR unit or ~~plant~~**Facility**.<sup>13,14</sup>
- 6.4. For inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices identified in Section 4.2.4.2, and VSC HVDC identified in Section 4.2.5.2, validation of the Facility EMT model response using the recorded response of a**

<sup>11</sup> ~~The attestation shall include the equipment make, model number, software/firmware version number, and confirmation that all inverter control modes, control blocks, and protections are represented in the model.~~

<sup>12</sup> A device test that is hardware specific may include a factory type test, hardware in the loop test, or other manufacturer test to ensure the EMT model’s large signal response emulates the supplied equipment to the extent possible.

<sup>13</sup> **In the context of MOD-026-2, a large signal disturbance is typically the result of a fault on the transmission system, a loss of generation, a loss of a large load, or a switching of a heavily loaded transmission line.**

<sup>13</sup> ~~Enabled protections and controls that act on voltage, frequency, and/or current, or act on quantities derived from voltage, frequency, and/or current, which directly trip the IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant.~~<sup>14</sup>

Examples of protections include IBR unit DC reverse current, DC bus over- and under-voltage, DC voltage unbalance, DC overcurrent, AC over- and under-voltage protection (instantaneous and RMS), AC overcurrent, over- and under-frequency protection, feeder (equivalent) AC over- and under-voltage, feeder (equivalent) over- and under-frequency, PLL (or equivalent) loss of synchronism, and phase jump tripping.



dynamic reactive power or voltage event from either a staged test or a measured system disturbance;

- 6.5.** ~~6.4.~~ Validation of the Facility EMT model response using the recorded response ~~for a dynamic reactive power or voltage event,<sup>14</sup> and for of~~ a dynamic active power or frequency event from either a staged test or a measured system disturbance in which the power plant controller's or other Facility active power controller's perceived frequency deviates per Attachment 1, Note 1, ~~resulting from either a staged test or a system disturbance;~~ and
- 6.6.** ~~6.5.~~ Documentation comparing the response of the Facility positive sequence dynamic model(s) of ~~Requirement~~Requirements R4 and R5 to the response of the Facility EMT model of Requirement R6 for large signal disturbances.
- M6.** Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R6 and provided the verified model(s) and accompanying information to its Transmission Planner ~~in accordance with the periodicity.~~

**General Requirements**

- R7.** Each Generator Owner or Transmission Owner ~~shall provide an updated verified model(s), or a plan to verify the model(s), in accordance with one or more of Requirements R2, R3, R4, R5, or R6<sup>15</sup> to its Transmission Planner within 180 calendar days of,~~ upon making a hardware, software, firmware, control mode, or setting change to in-service equipment specified in Part 2.2, 2.3, 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, or 6.3 that alters the equipment's dynamic response characteristic(s), ~~in accordance with<sup>15</sup> shall provide its Transmission Planner one of the following, within the timeframe in~~ MOD-026-2 Attachment 1. [*Violation Risk Factor: Lower*] [*Time Horizon: Operations Planning*]
- An updated verified model(s) in accordance with each Requirement R2, R3, R4, R5, or R6 applicable to the change being made, or
  - A plan to verify the model(s) in accordance with Requirement R2, R3, R4, R5, or R6.
- M7.** Each Generator Owner or Transmission Owner must provide dated evidence such as an updated verified model or a plan to verify the model including transmittal date ~~within 180 calendar days of~~after making ~~changes~~a change to in-service equipment

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<sup>14</sup> LCC HVDC facilities are excluded from the dynamic voltage or VAR event portion of the requirement.

<sup>15</sup> If an updated verification is performed, the 10-year period as outlined in MOD-026 Attachment 1 is reset.

<sup>15</sup> Such changes include: (a) exciter, voltage regulator, plant volt/var, power system stabilizer, or governor control replacement including software alterations; (b) addition or replacement of protection systems that deploy under- and over-voltage and/or under- and over- frequency elements; (c) plant digital control system addition or replacement; (d) plant volt/var function equipment addition or replacement (such as static var systems, capacitor banks, individual unit excitation systems, or other equipment); (e) software, firmware or setting change in the equipment (such as exciter, voltage regulator, power system stabilizer, excitation limiter, governor, plant controller, FACTS devices or IBR unit, or other equipment.) that alters its dynamic response characteristics; (f) a permanent change in the voltage or frequency control mode (such as manually switching the voltage regulator from power factor control to automatic voltage control); or (g) any other equipment change that alters its dynamic response characteristic. Automatic change of control mode or a control setting that is implemented in the plant control systems are excluded.

(e.g., email message, postal receipt, upload via web portal, etc.) in accordance with Requirement R7.

- R8.** Each Transmission Planner shall review ~~material~~the model(s) and accompanying information submitted under Requirement R2–R7 or R9, and provide written response to the submitter ~~within 120 calendar days from~~after receiving each submission, within the timeframe in MOD-026-2 Attachment 1. The written response shall include one of the following: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]
- Notification of acceptance: the model and accompanying information meet the acceptance criteria established in Requirement R1, or
  - Notification of denial: the model and accompanying information does not meet acceptance criteria established in Requirement R1, or information submitted is incomplete. The notification of denial shall include an explanation and supporting evidence.
- M8.** Each Transmission Planner must provide dated evidence such as review date of submitted model and accompanying information, review disposition (notification of acceptance or denial), and dated response to the submitter (e.g., email message, postal receipt, etc.) ~~within 90 calendar days of receipt~~ in accordance with Requirement R8.
- R9.** Each Generator Owner or Transmission Owner shall provide a written response to its Transmission Planner after receiving a notification of denial under Requirement R8 or a request from its Transmission Planner for a model review due to identified model or accompanying information deficiencies ~~shall provide a written response to its Transmission Planner within 90 calendar days of receiving a notification or request, in accordance with the periodicity,~~ within the timeframe in MOD-026-2 Attachment 1. The written response shall contain one of the following: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]
- An updated verified model and accompanying information in accordance with ~~Requirements~~Requirement R2–, R3, R4, R5, or R6,
  - A plan to verify the model in accordance with ~~Requirements~~Requirement R2–, R3, R4, R5, or R6, or
  - ~~Technical justification and supporting evidence for maintaining the current model.~~
  - A resubmission of the current model and accompanying information in accordance with Requirement R2, R3, R4, R5, or R6, with additional technical justification and supporting evidence to address the notification of denial or model review from the Transmission Planner.
- M9.** Each Generator Owner or Transmission Owner must provide dated evidence such as a response (e.g., email message, postal receipt, etc.) ~~containing the information identified in~~ in accordance with Requirement R9 ~~within 90 calendar days following receipt of notification of denial or request for model review.~~

## C. Compliance

### 1. Compliance Monitoring Process

**1.1. Compliance Enforcement Authority:** “Compliance Enforcement Authority” means NERC or the Regional Entity, or any entity as otherwise designated by an Applicable Governmental Authority, in their respective roles of monitoring and/or enforcing compliance with mandatory and enforceable Reliability Standards in their respective jurisdictions.

**1.2. Evidence Retention:** The following evidence retention period(s) identify the period of time an entity is required to retain specific evidence to demonstrate compliance. For instances where the evidence retention period specified below is shorter than the time since the last audit, the Compliance Enforcement Authority may ask an entity to provide other evidence to show that it was compliant for the full-time period since the last audit.

The applicable entity shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.

- Each Transmission Planner and Planning Coordinator shall keep data or evidence of Requirement R1 since the most current revision date for each of the model processes and requirements.
- Each Generator Owner and Transmission Owner shall keep data or evidence of Requirement R2 and R3 since the transmission date of the most current verified model(s) provided to the Transmission Planner.
- Each Generator Owner and Transmission Owner shall keep data or evidence of Requirement R4 and R5 since the transmission date of the most current verified model(s) provided to the Transmission Planner.
- Each Generator Owner and Transmission Owner shall keep data or evidence of Requirement R6 since the transmission date of the most current verified model(s) provided to the Transmission Planner.
- Each Generator Owner and Transmission Owner shall keep data or evidence of Requirement R7 since the transmission date of the most current verified model(s) provided to the Transmission Planner.
- Each Transmission Planner shall keep data or evidence of Requirement R8 for a rolling 36 calendar months.
- Each Generator Owner **and Transmission Owner** shall keep data or evidence of Requirement R9 for a rolling 36 calendar months.

**1.3. Compliance Monitoring and Enforcement Program:** As defined in the NERC Rules of Procedure, “Compliance Monitoring and Enforcement Program” refers to the identification of the processes that will be used to evaluate data or information for the purpose of assessing performance or outcomes with the associated Reliability Standard.

## Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>R1.</b>	The Transmission Planner’s dynamic model verification requirements and processes failed to include one of the items in Requirement 1, Parts 1.1 through 1.6.	The Transmission Planner’s dynamic model verification requirements and processes failed include two of the items in Requirement 1, Parts 1.1 through 1.6.	The Transmission Planner’s dynamic model verification requirements and processes failed to include three of the items in Requirement 1, Parts 1.1 through 1.6.	<p>The Transmission Planner’s dynamic model verification requirements and processes failed to include four or more of the items in Requirement 1, Parts 1.1 through 1.6.</p> <p>OR</p> <p>The Transmission Planner and Planning Coordinator failed to jointly develop dynamic model verification requirements and processes.</p> <p>OR</p> <p>The Transmission Planner failed to make available dynamic model verification requirements and processes to the Generator Owner and Transmission Owner.</p>
<b>R2.</b>	The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner after the date required, but within 90 calendar days after the date required.	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner between 91 and 180 calendar days after the date required.</p> <p>OR</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner between 181 and 270 calendar days after the date required.</p> <p>OR</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner more than 270 calendar days after the date required.</p> <p>OR</p>

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include one of the items in Requirement R2, Parts 2.1 through 2.4.</p>	<p>The applicable entity provided a verified model(s) that failed to include two of the items in Requirement R2, Parts 2.1 through 2.4.</p>	<p>The applicable entity provided a verified model(s) that failed to include three of the items in Requirement R2, Parts 2.1 through 2.4.</p>	<p>The applicable entity provided a verified model(s) that failed to include four of the items in Requirement R2, Parts 2.1 through 2.4.</p> <p>OR</p> <p>The applicable entity failed to provide a verified model.</p>
<b>R3.</b>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner after the date required but within 90 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include one of the items in Requirement R3, Parts 3.1 through 3.4.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner between 91 and 180 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include two of the items in R3, Parts 3.1 through 3.4.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner between 181 and 270 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include three of the items in Requirement R3, Parts 3.1 through 3.4.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner more than 270 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include four of the items in Requirement R3, Parts 3.1 through 3.4.</p> <p>OR</p> <p>The applicable entity failed to provide a verified model.</p>
<b>R4.</b>	<p>The applicable entity provided a verified model(s), with associated parameters, and</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and</p>

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<p>accompanying information to its Transmission Planner after the date required but within 90 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include one of the items in Requirement R4, Parts 4.1 through 4.4.</p>	<p>accompanying information to its Transmission Planner between 91 and 180 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include two of the items in Requirement R4, Parts 4.1 through 4.4.</p>	<p>accompanying information to its Transmission Planner between 181 and 270 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include three of the items in Requirement R4, Parts 4.1 through 4.4.</p>	<p>accompanying information to its Transmission Planner more than 270 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include four of the items in Requirement R4, Parts 4.1 through 4.4.</p> <p>OR</p> <p>The applicable entity failed to provide a verified model.</p>
<b>R5.</b>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner after the date required but within 90 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include one of the items in Requirement R5, Parts 5.1 through 5.4.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner between 91 and 180 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include two of the items in Requirement R5, Parts 5.1 through 5.4.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner between 181 and 270 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include three of the items in Requirement R5, Parts 5.1 through 5.4.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner more than 270 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include four of the items in Requirement R5, Parts 5.1 through 5.4.</p> <p>OR</p>

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
				The applicable entity failed to provide a verified model.
<b>R6.</b>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner after the date required but within 90 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include one of the items in Requirement R6, Parts 6.1 through <del>6.56.6</del>.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner between 91 and 180 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include two of the items in Requirement R6, Parts 6.1 through <del>6.56.6</del>.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner between 181 and 270 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include three of the items in Requirement R6, Parts 6.1 through <del>6.56.6</del>.</p>	<p>The applicable entity provided a verified model(s), with associated parameters, and accompanying information to its Transmission Planner more than 270 calendar days after the date required.</p> <p>OR</p> <p>The applicable entity provided a verified model(s) that failed to include four or more of the items in Requirement R6, Parts 6.1 through <del>6.56.6</del>.</p> <p>OR</p> <p>The applicable entity failed to provide a verified model.</p>
<b>R7.</b>	<p>The applicable entity provided an updated verified model(s) or a plan to verify the model(s) in accordance with one or more of Requirements R2, R3, R4, R5, or R6 to its Transmission Planner between 181 and 210 calendar days from making a change to in-</p>	<p>The applicable entity provided an updated verified model(s) or a plan to verify the model(s) in accordance with one or more of Requirements R2, R3, R4, R5, or R6 to its Transmission Planner between 211 and 240 calendar days of making a change to in-service</p>	<p>The applicable entity provided an updated verified model(s) or a plan to verify the model(s) in accordance with one or more of Requirements R2, R3, R4, R5, or R6 to its Transmission Planner between 241 and 270 calendar days of making a change to in-service</p>	<p>The applicable entity failed to provide an updated verified model(s) or a plan to verify the model(s) in accordance with one or more of Requirements R2, R3, R4, R5, or R6 to its Transmission Planner within 270 calendar days of making a change to in-service</p>

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
	service equipment that altered the equipment response.	equipment that altered the equipment response.	equipment that altered the equipment response.	equipment that altered the equipment response.
R8.	The Transmission Planner reviewed <del>material</del> <u>the model(s) and accompanying information</u> submitted under Requirement R2-R7 or R9, but provided written response to the submitter, between 121 to 150 calendar days after receiving each submission.	The Transmission Planner reviewed <del>material</del> <u>the model(s) and accompanying information</u> submitted under Requirement R2-R7 or R9, but provided written response to the submitter, between 151 to 180 calendar days after receiving each submission.	The Transmission Planner reviewed <del>material</del> <u>the model(s) and accompanying information</u> submitted under Requirement R2-R7 or R9, but provided written response to the submitter, between 181 to 210 calendar days after receiving each submission.	The Transmission Planner reviewed <del>material</del> <u>the model(s) and accompanying information</u> submitted under Requirement R2-R7 or R9, but provided written response to the submitter greater than 210 calendar days after receiving each submission.  OR  The Transmission Planner reviewed <del>material</del> <u>the model(s) and accompanying information</u> submitted under Requirement R2-R7 or R9, and provided written response with notification of denial, indicating that the model was unacceptable, but did not include an explanation and supporting evidence.  OR  The Transmission Planner failed to review <del>material</del> <u>the model(s) and accompanying information</u> submitted under Requirement R2-R7 or R9, and



R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
				failed to provide written response to the submitter for each submission.
R9.	The applicable entity provided a written response to the Transmission Planner between <del>91 to 120</del> <b>121 to 150</b> calendar days after receiving a notification of denial or request to perform model review.	The applicable entity provided a written response to the Transmission Planner between <del>121 to 150</del> <b>151 to 180</b> calendar days after receiving a notification of denial or request to perform model review.	The applicable entity provided a written response to the Transmission Planner between <del>151 to 180</del> <b>181 to 210</b> calendar days after receiving a notification of denial or request to perform model review.	The applicable entity failed to provide a written response to the Transmission Planner within <del>180</del> <b>210</b> calendar days after receiving a notification of denial or request to perform model review.  OR The applicable entity’s written response failed to contain one of <del>the</del> <b>three optional options for</b> responses described in Requirement R9.

### D. Regional Variances

None.

### E. Associated Documents

Project 2020-06 Verification of Models ~~for BES Connected Facilities~~ **and Data for Generators** Implementation Plan

Project 2020-06 MOD-026-2 Technical Rationale

Project 2020-06 Mapping Document

## Version History

Version	Date	Action	Change Tracking
1	February 7, 2013	Adopted by NERC Board of Trustees	New
1	March 20, 2014	FERC Order issued approving MOD-026-1. (Order becomes effective for R1, R3, R4, R5, and R6 on 7/1/14. R2 becomes effective on 7/1/18.)	
1	May 7, 2014	NERC Board of Trustees adopted revisions to VSLs in Requirement R6.	Revisions
1	November 26, 2014	FERC issued a letter order approved revisions to VSLs in Requirement R6.	
2	TBD	Adopted by NERC Board of Trustees	

MOD-026-2 Attachment 1 Model Verification Periodicity		
Row Number	Verification Condition	Required Action
1	Establishing the initial verification date for an applicable Facility. (Applies to Requirements R2, R3, R4, R5, and R6)	Transmit the verified model and accompanying information to the Transmission Planner in accordance with the Implementation Plan.
2	Initial verification for a newly commissioned Facility. (Applies to Requirements R2, R3, R4, R5, and R6)	Transmit the verified model and accompanying information to the Transmission Planner within 365 calendar days after the commissioning date.
3	Subsequent verification for an applicable Facility. (Applies to Requirements R2, R3, R4, R5, and R6)	Transmit the verified model and accompanying information to the Transmission Planner <del>on or before the</del> <u>within</u> 10-year anniversary calendar years of the most recent transmittal date.
4	Applicable Facility with installed and operating recording equipment does not experience a frequency excursion as applicable per Note 1 by the date otherwise required to meet the dates per Rows 1, 2, 3, 5, or 6. (Applies to Requirements R3 and R5)	Requirement R3 or R5 is met with a written statement transmitted to the Transmission Planner. Transmit the verified model and accompanying information to the Transmission Planner on or before 365 calendar days after a frequency excursion per Note 1 occurs and the recording equipment captures the applicable Facility’s real power response as expected.

MOD-026-2 Attachment 1 Model Verification Periodicity		
Row Number	Verification Condition	Required Action
5	For an existing applicable Facility with a change to in-service equipment as described under Requirement R7.  (Applies to Requirement R7)	Transmit the verified model and accompanying information or a plan to verify the model to the Transmission Planner within 180 calendar days after making the change to in-service equipment. If a plan to verify the model is provided to the Transmission Planner, then Row 6 also applies.  <u>In order for the transmittal to reset the 10-year anniversary transmittal date for Requirement R2-R6 as described in Row 3, all model(s) and model parameters must be verified according to the applicable requirement(s) and included in the transmittal.</u>
6	The Generator Owner or Transmission Owner has provided a plan to verify the model.  (Applies to Requirements R7 and R9)	Transmit the updated verified model and accompanying information to the Transmission Planner within 365 calendar days after the submittal of the plan to verify the model.
<u>7</u>	<u>The Transmission Planner has received model(s) and accompanying information submitted under Requirement R2-R7 or R9.</u>  <u>(Applies to Requirement R8)</u>	<u>Transmission Planner provides written response to the submitter within 120 calendar days from receiving each submission, per Requirement R8.</u>
<u>8</u>	<u>The Generator Owner or Transmission Owner receives a notification of denial under Requirement R8 or a request for model review from its Transmission Planner.</u>  <u>(Applies to Requirement R9)</u>	<u>Provide a written response to its Transmission Planner within 120 calendar days of receiving a notification of denial or request for model review, per Requirement R9.</u>

MOD-026-2 Attachment 1 Model Verification Periodicity		
Row Number	Verification Condition	Required Action
<del>79</del>	<p>Existing, <b>new, or upgraded</b> generating unit or synchronous condenser that is equivalent to another unit(s) at the same physical location.</p> <p>AND</p> <p>Each unit has the same MVA nameplate rating.</p> <p>AND</p> <p>The nameplate rating is ≤ 350 MVA.</p> <p>AND</p> <p>Each unit has the same components and settings.</p> <p>AND</p> <p>The model for one of these equivalent units has been verified.</p> <p>(<del>Applies to Requirements</del><b>Requirement</b> R2, R3, R4, R5, <del>and/or</del> R6 <b>exemption</b>)</p>	<p>Document circumstance with a written statement and include with the verified model, documentation, and data provided to the Transmission Planner for the verified equivalent unit.</p> <p>Verify the model(s) of a different equivalent unit during each 10-year verification period.</p>
<del>810</del>	<p>New or existing applicable unit or Facility does not include an active closed loop voltage or reactive power control function.</p> <p>(Requirement R2 or R4 exemption)</p>	<p>Requirement R2 or R4 is met with a written statement to that effect transmitted to the Transmission Planner.</p>

MOD-026-2 Attachment 1 Model Verification Periodicity		
Row Number	Verification Condition	Required Action
911	<p>Applicable Facility is not responsive to frequency excursion events during normal operation. (The applicable Facility does not operate in a frequency control mode, except during normal start up and shut down, that would result in a prime mover/governor and load control or active power/frequency control mode response.)</p> <p>OR</p> <p>New or existing applicable Facility does not have an installed frequency control system or has a disabled frequency control system.</p> <p>(Requirement R3 or R5 exemption)</p> <p>If the applicable Facility is operating in a frequency control mode that is responsive to a frequency excursion event in only one direction (over- or under-frequency), then R3 and R5 are still applicable.</p>	<p>Requirement R3 or R5 is met with a written statement to that effect transmitted to the Transmission Planner.</p> <p>Perform verification per the periodicity specified in Row 2 for a “Newly commissioned Facility” (or new equipment) <del>only if responsive control mode operation for connected operations is established</del> <b><u>if the exemption Verification Condition no longer applies.</u></b></p>

MOD-026-2 Attachment 1 Model Verification Periodicity		
Row Number	Verification Condition	Required Action
<del>10</del> 12	Existing applicable Facility has a current average net capacity factor over the most recent three calendar years, beginning on January 1 and ending on December 31, of 5% or less.  (Requirement R2, R3, R4, R5, or R6 periodicity exemption of Row 1 or Row 3; does not exempt obligation under Requirement R7 or R9.)	Requirement R2, R3, R4, R5, or R6 are met with a written statement to that effect transmitted to the Transmission Planner annually.  If the current average net capacity factor over the most recent three calendar years exceeds 5%, then within 365 calendar days model verification must be performed to meet the required action of Row 1 or Row 3.  For the definition of net capacity factor, refer to Appendix F of the GADS Data Reporting Instructions on the NERC website.
<del>11</del> 13	Commissioning date of the applicable Facility is before January 1, <del>2020</del> 2023; OR  OEM is no longer doing business in North America; OR  OEM no longer supports model(s) for in-service equipment at the Facility.  (Requirement R6 exemption)	Requirement R6 is met with a written statement to that effect transmitted to the Transmission Planner.  If the OEM that commissioned the Facility was acquired, merged, or operating under a different name, the new company would be considered the OEM.

MOD-026-2 Attachment 1 Model Verification Periodicity		
Row Number	Verification Condition	Required Action
<b>NOTE 1:</b> Unit model verification frequency excursion criteria: <ul style="list-style-type: none"><li>• <math>\geq 0.05</math> hertz deviation (nadir point) from scheduled frequency for the Eastern Interconnection with the applicable Facility operating in a frequency responsive mode</li><li>• <math>\geq 0.10</math> hertz deviation (nadir point) from scheduled frequency for the ERCOT and Western Interconnections with the applicable Facility operating in a frequency responsive mode</li><li>• <math>\geq 0.15</math> hertz deviation (nadir point) from scheduled frequency for the Quebec Interconnection with the applicable Facility operating in a frequency responsive mode</li></ul>		