

## 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 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
Anticipated Actions	Date
45-day initial formal comment period with ballot	May 20 – July <del>5</del> <u>6</u> , 2022
45-day additional formal comment period with ballot	<del>October – November</del> <u>21, 2022 – January 18, 2023</u>

Anticipated Actions	Date
10-day final ballot	<del>December 2022</del> <u>January 2023</u>
NERC Board adoption	<del>February</del> <u>May</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 equipment.
4. **Applicability:**
  - 4.1. **Functional Entities:**
    - 4.1.1. Generator Owner
    - 4.1.2. Transmission Planner
    - 4.1.3. Planning ~~Authority~~ 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 ~~units~~ Facility” or “Facility” shall mean any one of the following:
    - 4.2.1 Individual generating ~~resource identified through unit meeting the criteria set by~~ Inclusion I2 of the BES definition.
    - 4.2.2 Generating plant/Facility ~~identified through meeting the criteria set by~~ Inclusion I2 of the BES definition.
    - 4.2.3 Generating plant/Facility of dispersed power producing resources ~~identified through meeting the criteria set by~~ Inclusion I4 of the BES definition.
    - 4.2.4 Dynamic reactive resources ~~identified through 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 including:
      - 4.2.5.1 Line commutated converter (LCC); and
      - 4.2.5.2 Voltage source converter (VSC).
5. **Effective Date:** See Project 2020-06 Verification of Dynamic Models and Data for BES Connected Facilities Implementation Plan

**6.—Standard-Only Definitions:**

~~6.1.—Verification refers to the static process of checking documents and files, and comparing them to model parameters, model structure, or equipment settings.~~

~~6.2.—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.~~

## **B. Requirements and Measures**

- R1.** Each Transmission Planner and its Planning Authority 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 Planning*]
- 1.1.** Acceptable positive sequence dynamic models, format, and level of detail;
  - 1.2.** Acceptable electromagnetic transient (EMT) models, format, and level of detail<sup>1;2</sup>
  - 1.3.** Acceptance criteria used by the Transmission Planner to determine disposition in 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>23</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 Authority 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 the Transmission Planner’s database for an existing Facility owned by the Generator Owner or Transmission Owner within 90 days of receiving a written request.
- M1.** Each Transmission Planner and each Planning Authority Coordinator must provide dated evidence such as document(s), webpage(s), or web portal(s) outlining the model

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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>1</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>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>23</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.

requirements and processes that are jointly developed. Each Transmission Planner shall also have evidence showing it made available to the Generator Owner ~~or and~~ Transmission Owner the model requirements and processes in accordance with Requirement R1.

### **Synchronous Facility**

- 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 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 ~~the periodicity 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) ~~of 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, ~~excitation limiters~~, and outer-loop controls which impact dynamic volt/volt-ampere reactive (VAR) performance;
  - 2.3.** Model(s) representing enabled excitation limiters and enabled Protection Systems that directly trip the prime mover or generator/synchronous condenser. Protection Systems that shall be modeled include phase over- and under-voltage, stator-and-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 a dynamic volt or VAR 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 unit-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.
- 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 ~~the periodicity in~~ MOD-026-2 Attachment 1. The verified ~~model(s)~~model(s) and accompanying information

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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.

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 ~~turbine~~prime mover, type of governor, ~~mode of operation~~type of control, and Protection System(s) of Part 3.3;
  - 3.2. Model(s) representing the ~~turbine~~prime mover, governor control system, ~~load controller, and other outer loop controls that override the governor response or modes of operation that limit frequency response and any other controls which impact the dynamic active power or frequency performance due 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 ~~turbine-prime mover or~~ generator. Protection Systems that shall be modeled include over- and ~~under-speed, and 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 of the positive sequence dynamic model(s) of Part 3.2 response using the recorded response for 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 ~~unit~~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**

- 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~~Section 4.2.5.2, each Generator Owner or Transmission Owner shall provide a verified positive sequence dynamic model(s); ~~with~~with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with ~~the periodicity in~~ MOD-026-2 Attachment 1. The verified ~~model(s)~~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>35</sup> and power plant controller;
  - 4.2. Model(s) representing the IBR unit(s), and associated reactive power control system<sup>46</sup> including the IBR unit's electrical control, power plant controller, auxiliary reactive resources, and other equipment which impacts plant voltage and reactive power dynamic response;

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<sup>35</sup> IBR unit includes the inverter, converter, wind turbine generator, or HVDC converter.

<sup>46</sup> Reactive power control system includes voltage reference control, reactive power reference control, and power factor control modes.

- 4.3. Model(s) representing enabled protections<sup>57</sup> and limiting functions,<sup>68</sup> that either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant; and
- 4.4. Validation<sup>9</sup> of the positive sequence dynamic model(s) of Part 4.2 response using the recorded response for a dynamic ~~volt or VAR~~ reactive power or voltage event from either a staged test or a system disturbance.
- M4. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable ~~unit~~ 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.
- 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 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 ~~the~~ periodicity in MOD-026-2 Attachment 1. The verified ~~model(s)~~ model(s) 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), 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, power plant controller, and other equipment which impacts plant active power or grid frequency dynamic response;
- 5.3. Model(s) representing enabled protections<sup>710</sup> and limiting functions, that either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant; and
- 5.4. Validation of the positive sequence dynamic model of Part 5.2 response using the recorded response for 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.
- M5. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable ~~unit~~ 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>57</sup> Protection functions that shall be modeled include at a minimum ~~ac~~ AC over- and under-voltage protection.

<sup>68</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.

<sup>9</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>710</sup> Protection functions that shall be modeled include at a minimum over- and under-frequency protection.

- R6. For ~~applicable units of~~ inverter based resources (IBRs) ~~per-identified in~~ Section 4.2.3, FACTS devices per Section 4.2.4.2, LCC HVDC ~~per-identified in~~ Section 4.2.5.1, and VSC HVDC ~~per-identified in~~ 4.2.5.2, each 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 ~~the periodicity in~~ MOD-026-2 Attachment 1. The verified ~~model(s)~~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 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>811</sup> If an attestation from an OEM is not obtainable, the Generator Owner or Transmission Owner shall document the reason;
  - 6.2. Device test<sup>912</sup> results demonstrating a comparison of the IBR unit's response and the IBR unit's EMT model response for large signal disturbances. If device test results are not obtainable, the Generator Owner or Transmission Owner shall document the reason;
  - 6.3. Facility EMT model and 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 directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant;<sup>+013</sup>
  - 6.4. Validation of the Facility EMT model response using the recorded response for a dynamic ~~volt or VAR~~reactive power or voltage event,<sup>+14</sup> and for a dynamic active power or frequency event 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
  - 6.5. Documentation comparing the response of positive sequence dynamic model(s) of Requirement R4 and R5 to the response of Facility EMT model of Requirement R6 for large signal disturbances.
- M6. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable unit-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.

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<sup>811</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>912</sup> A device test that is hardware specific may include a factory type test, hardware in the loop test, or other manufacture manufacturer test to ensure the EMT model's large signal response emulates the supplied equipment to the extent possible.

<sup>+013</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. 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.

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



**General Requirements**

- R7.** Each Generator Owner or Transmission Owner shall provide an updated verified model(s) ~~or a mutually agreed upon plan with its Transmission Planner~~ to verify the model ~~(s)~~, in accordance with one or more of Requirements ~~R2–R6~~ R2, R3, R4, R5, or R6<sup>1215</sup> to its Transmission Planner within 180 calendar days of 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 response characteristic, in accordance with MOD-026-2 Attachment 1.<sup>13</sup> [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]
- M7.** Each Generator Owner or Transmission Owner must provide dated evidence such as an updated model or a mutually agreed upon plan with its Transmission Planner to verify the model including transmittal date within 180 calendar days of making changes to in-service equipment (e.g., email message, postal receipt, upload via web portal, etc.) in accordance with Requirement R7.
- R8.** Each Transmission Planner shall review ~~the verified model and accompanying information, an updated verified model provided materials submitted~~ under Requirement ~~R7, or a written response provided under Requirement R9, provided by a Generator Owner or Transmission Owner~~ R2-R7 or R9, and provide a written response to the submitter within 90-120 calendar days from receiving ~~the verified model information~~ each submission. 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 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 in MOD-026-2 Attachment

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<sup>1215</sup> If an updated verification is performed, the 10 year period as outlined in MOD-026 Attachment 1 is reset.

<sup>13</sup> ~~This includes a hardware, software, firmware, control mode, or setting change to in-service equipment that alters the equipment response characteristics.~~

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 R2–R6,
- A ~~mutually agreed upon~~ plan ~~with its Transmission Planner~~ to verify the model in accordance with Requirements R2–R6, or
- Technical justification and supporting evidence for maintaining the current model.

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

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<p>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 R2, Parts 2.1 through 2.4.</p>	<p>OR</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>OR</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>OR</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)-, <u>with associated parameters</u>, 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)-, <u>with associated parameters</u>, 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)-, <u>with associated parameters</u>, 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)-, <u>with associated parameters</u>, 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)-, <u>with</u></p>	<p>The applicable entity provided a verified model(s)-, <u>with</u></p>	<p>The applicable entity provided a verified model(s)-, <u>with</u></p>	<p>The applicable entity provided a verified model(s)-, <u>with</u></p>

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<p><u>associated parameters</u>, 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 R4, Parts 4.1 through 4.4.</p>	<p><u>associated parameters</u>, 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 R4, Parts 4.1 through 4.4.</p>	<p><u>associated parameters</u>, 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 R4, Parts 4.1 through 4.4.</p>	<p><u>associated parameters</u>, 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 R4, Parts 4.1 through 4.4.</p> <p>OR</p> <p>The applicable entity failed to provide a verified model.</p>
R5.	<p>The applicable entity provided a verified model(s)-, <u>with associated parameters</u>, 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)-, <u>with associated parameters</u>, 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)-, <u>with associated parameters</u>, 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)-, <u>with associated parameters</u>, 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>

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
				OR The applicable entity failed to provide a verified model.
<b>R6.</b>	<p>The applicable entity provided a verified model(s)-, <u>with associated parameters</u>, 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 6.5.</p>	<p>The applicable entity provided a verified model(s)-, <u>with associated parameters</u>, 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 6.5.</p>	<p>The applicable entity provided a verified model(s)-, <u>with associated parameters</u>, 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 6.5.</p>	<p>The applicable entity provided a verified model(s)-, <u>with associated parameters</u>, 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 6.5.</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 <u>mutually-agreed-upon plan to verify the model-(s) in accordance with one or more of Requirements R2, R3, R4, R5, or R6 to its Transmission Planner</u> between 181 and 210 calendar days from making a</p>	<p>The applicable entity provided an updated verified model-(s) or a <u>mutually-agreed-upon plan to verify the model-(s) in accordance with one or more of Requirements R2, R3, R4, R5, or R6 to its Transmission Planner</u> between 211 and 240 calendar days of making a</p>	<p>The applicable entity provided an updated verified model-(s) or a <u>mutually-agreed-upon plan to verify the model-(s) in accordance with one or more of Requirements R2, R3, R4, R5, or R6 to its Transmission Planner</u> between 241 and 270 calendar days of making a</p>	<p>The applicable entity failed to provide an updated verified model-(s) or a <u>mutually-agreed-upon plan to verify the model (s) in accordance with one or more of Requirements R2, R3, R4, R5, or R6 to its Transmission Planner</u> within 270 calendar days of making a</p>

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
	change <u>to in-service equipment</u> that altered the equipment response.	change <u>to in-service equipment</u> that altered the equipment response.	change <u>to in-service equipment</u> that altered the equipment response.	change <u>to in-service equipment</u> that altered the equipment response.
R8.	The Transmission Planner <u>reviewed materials submitted under Requirement R2-R7 or R9, but</u> provided a written response to the submitter, between <u>91 to 120 121 to 150</u> calendar days after receiving <u>the verified model information each submission.</u>	The Transmission Planner <u>reviewed materials submitted under Requirement R2-R7 or R9, but</u> provided a written response to the submitter, between <u>121 to 150 151 to 180</u> calendar days after receiving <u>the verified model information each submission.</u>	The Transmission Planner <u>reviewed materials submitted under Requirement R2-R7 or R9, but</u> provided a written response to the submitter, between <u>151 to 180 181 to 210</u> calendar days after receiving <u>the verified model information each submission.</u>	The Transmission Planner <del>failed to provide a reviewed materials submitted under Requirement R2-R7 or R9, but</del> <u>provided</u> written response to the submitter, <del>within 180</del> <u>greater than 210</u> calendar days after receiving <u>the verified model information each submission.</u>  OR  The Transmission Planner <u>reviewed materials submitted under Requirement R2-R7 or R9, and</u> provided a written response with notification of denial, indicating that the model was unacceptable, but did not include an explanation and supporting evidence.  <u>OR</u>  <u>The Transmission Planner failed to review materials submitted under Requirement R2-R7 or R9, and failed to provide written response to</u>



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

### D. Regional Variances

None.

### E. Associated Documents

~~Link to for~~ Project 2020-06 Verification of Models for BES Connected Facilities 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 <del>unit</del> 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.  <del>Row 7 (equivalent unit verification condition) applies when calculating generation fleet compliance during the implementation period.</del>
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 <del>unit</del> Facility. (Applies to Requirements R2, R3, R4, R5, and R6)	Transmit the verified model and accompanying information to the Transmission Planner on or before the 10-year anniversary of the most recent transmittal date.
4	Applicable <del>unit</del> -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 <del>unit's</del> 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 <del>unit</del> <u>Facility</u> with a change to in-service equipment as described under Requirement <del>R8</del> <u>R7</u> .  (Applies to Requirement <del>R8</del> <u>R7</u> )	Transmit the verified model and accompanying information or a <del>mutually-agreed-upon</del> <u>plan to verify the model</u> to the Transmission Planner within 180 calendar days after making the change to in-service equipment. If <del>mutually-agreed-upon</del> <u>a plan to verify the model</u> is provided to the Transmission Planner, then Row 6 <u>also</u> applies.
6	The Generator Owner or Transmission Owner has provided a <del>mutually-agreed-upon</del> <u>plan with its Transmission Planner</u> to verify the model.  (Applies to Requirements R7 and R9)	Transmit the <u>updated</u> verified model and accompanying information to the Transmission Planner within <del>180</del> <u>365</u> <u>calendar</u> days after the <del>verification date specified in the mutually-agreed-upon plan</del> <u>submittal of the plan to verify the model</u> .

MOD-026-2 Attachment 1 Model Verification Periodicity		
Row Number	Verification Condition	Required Action
7	<p>Existing <del>applicable-generating</del> unit <u>or synchronous condenser</u> that is equivalent to another unit(s) at the same physical location.</p> <p>AND</p> <p>Each <del>applicable</del>-unit has the same MVA nameplate rating.</p> <p>AND</p> <p>The nameplate rating is <math>\leq</math> 350 MVA.</p> <p>AND</p> <p>Each <del>applicable</del>-unit has the same components and settings.</p> <p>AND</p> <p>The model for one of these equivalent <del>applicable</del>-units has been verified.</p> <p>(Applies to Requirements R2, R3, R4, R5, and R6)</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> <p><del>Applies to Row 1 when calculating generation fleet compliance during the implementation period.</del></p>
8	<p>New or existing applicable unit <u>or Facility</u> 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
9	<p>Applicable <u>unit Facility</u> is not responsive to <del>both over- and under-</del> frequency excursion events during normal operation. <u>(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.)</u></p> <p>OR</p> <p>New or existing applicable <u>unit Facility</u> does not have an installed frequency control system or has a disabled frequency control system.</p> <p>(Requirement R3 or R5 exemption)</p> <p><u>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.</u></p>	<p>Requirement R3 or R5 is met with a written statement to that effect transmitted to the Transmission Planner.</p> <p><u>Perform verification per the periodicity specified in Row 2 for a “Newly commissioned Facility” (or new equipment) only if responsive control mode operation for connected operations is established.</u></p>

MOD-026-2 Attachment 1 Model Verification Periodicity		
Row Number	Verification Condition	Required Action
10	<p>Existing applicable <del>unit</del>-<u>Facility</u> 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.</p> <p>(Requirement R2, R3, R4, R5, or R6 periodicity exemption of Row 1 or Row 3; does not exempt obligation under Requirement R7 or R9.)</p>	<p>Requirement R2, R3, R4, R5, or R6 are met with a written statement to that effect transmitted to the Transmission Planner annually.</p> <p>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.</p> <p>For the definition of net capacity factor, refer to Appendix F of the GADS Data Reporting Instructions on the NERC website.</p>
11	<p>Commissioning date of the <u>applicable</u> Facility is before January 1, <del>2015</del><u>2020</u>; OR</p> <p>OEM is no longer <del>in-doing</del> business <u>in North America</u>; OR</p> <p>OEM no longer supports model(s) for in-service equipment at the Facility.</p> <p>(Requirement R6 exemption)</p>	<p>Requirement R6 is met with a written statement to that effect transmitted to the Transmission Planner.</p> <p><u>If the OEM that commissioned the Facility was acquired, merged, or operating under a different name, the new company would be considered the OEM.</u></p>

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 <del>unit</del> <u>Facility</u> 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 <del>unit</del> <u>Facility</u> 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 <del>unit</del> <u>Facility</u> operating in a frequency responsive mode</li></ul>		