Standard Development Roadmap

This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.

Development Steps -Completed:

1. SAR posted for comment (April 20–May 21, 2007).
2. Revised SAR and response to comments posted.
3. Revised SAR and response to comments approved by SC (June 14, 2007).
4. SDT appointed on (August 18, 2007).
5. Posted first draft of standard for a 30 day comment period June 15 –July 15, 2011

Proposed Action Plan and Description of Current Draft:

This is the ~~first~~second draft of the ~~this~~proposed standard including Time Horizons, Data Retention, Violation Risk Factors, and Violation Severity Levels~~. This first posting~~; and is being submitted for a ~~30~~45-day concurrent formal comment period~~.~~ and initial ballot.

Future Development Plan:

Anticipated Actions	Anticipated Date
1. ~~Post first~~Develop responses to comments and develop second version draft ~~revision of~~ standard.	~~April-May~~July 2011 – February 2012
2. Post response to comments and ~~second version draft revision of~~conduct a formal 45 day comment period with concurrent initial ballot for the revised standard.	~~July – August 2011~~March - April 2012
3. ~~Post response to comments and request authorization~~Develop responses to ballot ~~the revised standard~~comments.	~~September - October 2011~~April - June 2012
4. ~~Conduct initial~~Post response to comments and conduct successive ballot.	~~November 2011~~June - July 2012
5. ~~Post response~~Develop responses to ballot comments.	~~December 2011~~August - September 2012
6. ~~Conduct~~Post responses to comments and conduct recirculation ballot.	~~January~~October 2012
7. BOT adoption.	~~February~~November 2012

8. File with regulatory authorities.	~~March~~December 2012

A. Introduction

1. Title: Verification of Models and Data for Turbine/Governor and Load Control ~~or~~and Active Power/Frequency Control ~~-~~Functions

2. Number: MOD-027-1

3. Purpose: To verify that the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] model and the model parameters, used in dynamic ~~simulations~~simulations that assess Bulk Electric System (BES) reliability, that accurately represent generator unit real power response to system frequency variations.

4. Applicability:

4.1. Functional entities

4.1.1 Generator Owner

4.1.2 Transmission Planner

4.2. Facilities

For the purpose of this standard, the ~~following Facilities are~~term "applicable Facility" is considered, "applicable units[2]." Units or plants with an average capacity[3] factor greater than 5~~%~~ percent over the last three calendar years, beginning on January 1 and ending on December 31, that meet the following:

4.2.1 Generating units connected to the Eastern or Quebec Interconnections with the following characteristics:

- ~~Each~~Individual generating unit ~~with a~~ greater than 100 MVA (gross nameplate rating ~~greater than 100 MVA,~~) directly connected ~~at~~to the ~~point of interconnection~~[4] ~~at greater than 100 kV~~bulk power system.
- For each generating plant or generating Facility consisting of one or more units that are connected to the bulk power system at a common bus with ~~a~~ total generation greater than 100 MVA (gross aggregate ~~nameplate~~ rating ~~greater than 100 MVA, connected at the same point of interconnection at greater than 100 kV:~~):

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[1] Turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control:

a. Turbine/governor and ~~Load~~load control applies to conventional synchronous generation.

b. Active power/frequency control applies to variable energy plants.

2 Applicable generating units do not include startup or standby units not normally connected to the grid.

[3] 3 Once a capacity factor exemption is declared by notifying the Transmission Planner, verification is not required for 10 calendar years from the date eligibility occurs. At the end of this 10 calendar year timeframe, the current average 3 year capacity factor (for years 8, 9, and 10) is examined to determine if the capacity factor exemption can be declared for the next 10 calendar year period. If not eligible for the capacity factor exemption, then model verification must be completed within one year of the date the capacity factor exemption expired with the 10 calendar year periodicity requirement reset based on the verification date. For the definition of capacity factor, refer to Appendix F of the GADS Data Reporting Instructions on the NERC website.

[4] ~~The common transmission bus voltage level at which the generator step-up transformer is connected.~~

- Each individual generating unit ~~with a~~ greater than 20 MVA (gross nameplate rating ~~greater than 20 MVA;~~); and
- ~~The remainder of the plant as an aggregate.~~
- Each generating plant or generating Facility consisting of individual generating units less than 20 MVA (gross nameplate ratings)

4.2.2 Generating units connected to the Western Interconnection with the following characteristics:

- ~~Each~~Individual generating unit ~~with a~~ greater than 75 MVA (gross nameplate rating ~~greater than 75 MVA,~~) directly connected ~~at~~to the ~~point of interconnection[3] at greater than 100 kV~~bulk power system.
- For each generating plant or generating Facility consisting of one or more units that are connected to the bulk power system at a common bus with ~~a~~ total generation greater than 75 MVA (gross aggregate ~~nameplate~~ rating ~~greater than 75 MVA, connected at the same point of interconnection t greater than 100 kV:~~):
  - ~~-~~Each individual generating unit ~~with a gross nameplate~~ greater than 20 MVA~~;~~ (gross nameplate rating); and
  - ~~The remainder of the plant as an aggregate.~~
  - Each generating plant or generating Facility comprised consisting of individual generating units less than 20 MVA (gross nameplate ratings)

4.2.3 Generating units connected to the ERCOT Interconnection with the following characteristics:

- ~~Each~~Individual generating unit ~~with a~~ greater than 50 MVA (gross nameplate rating ~~of greater than 50 MVA,~~) directly connected ~~at~~to the ~~point of interconnection[3] with rating greater than 100 kV~~bulk power system.
- For each generating plant or generating Facility consisting of one or more units that are connected to the bulk power system at a common bus with ~~a~~ total generation greater than 75 MVA (gross aggregate ~~nameplate~~ rating ~~of greater than 75 MVA, connected at the same point of interconnection at greater than 100 kV:~~):
  - Each individual generating unit ~~with a gross nameplate~~ greater than 20 MVA~~;~~ (gross nameplate rating); and
  - ~~The remainder of the plant as an aggregate.~~
  - Each generating plant or generating Facility comprised of individual generating units less than 20 MVA (gross nameplate ratings)

5. Effective Date:

5.1. In those jurisdictions where regulatory approval is required:

5.1.1 ~~By~~Each responsible entity shall ensure compliance with Requirements R1, and R3 through R5 by the first day of the first calendar quarter, three years following applicable regulatory approval~~:~~.

- **5.1.2** ~~At~~Each Generator Owner shall ensure at least 25~~%~~ percent of ~~each Generator Owner's~~its applicable units per Interconnection on an MVA basis are compliant with Requirement R2 by the first day of the first calendar quarter, three years following applicable regulatory approval.

  - ~~100% compliant with Requirements R1, and R3 through R5.~~

~~5.1.2~~**5.1.3** ~~By~~Each Generator Owner shall ensure at least 50 percent of its applicable units per Interconnection on an MVA basis are compliant with Requirement R2 by the first day of the first calendar quarter, five years following applicable regulatory approval~~:~~.

  - ~~At least 50% of each~~Each Generator ~~Owner's~~Owner shall ensure at least 75 percent of its applicable units per Interconnection on an MVA basis are compliant with Requirement R2~~.~~

~~5.1.3~~**5.1.4** ~~By~~ by the first day of the first calendar quarter, seven years following applicable regulatory approval~~:~~.

  - ~~At least 75% of each~~Each Generator ~~Owner's~~Owner shall ensure at least 100 percent of its applicable units per Interconnection on an MVA basis are compliant with Requirement R2~~.~~

~~5.1.4 By~~ by the first day of the first calendar quarter, nine years following applicable regulatory approval~~:~~

- **5.1.5** ~~100% of each Generator Owner's applicable units compliant with Requirement R2~~.

5.2. In those jurisdictions where no regulatory approval is required:

5.2.1 ~~By~~Each responsible entity shall ensure compliance with Requirements R1, and R3 through R5 by the first day of the first calendar quarter, three years following Board of Trustees adoption~~:~~.

- **5.2.2** ~~At~~Each Generator Owner shall ensure at least 25~~%~~ percent of ~~each Generator Owner's~~its applicable units per Interconnection on an MVA basis are compliant with Requirement R2 by the first day of the first calendar quarter, three years following Board of Trustees adoption.

  - ~~100% compliant with Requirements R1, and R3 through R5.~~

~~5.2.2~~**5.2.3** ~~By~~Each Generator Owner shall ensure at least 50 percent of its applicable units per Interconnection on an MVA basis are compliant with Requirement R2 by the first day of the first calendar quarter, five years following Board of Trustees adoption~~:~~.

- ~~At least 50% of each~~Each Generator ~~Owner's~~Owner shall ensure at least 75 percent of its applicable units per Interconnection on an MVA basis are compliant with Requirement R2~~.~~

~~5.2.3~~5.2.4 ~~By~~ by the first day of the first calendar quarter, seven years following Board of Trustees adoption~~:~~.

- ~~At least 75% of each~~Each Generator ~~Owner's~~Owner shall ensure at least 100 percent of its applicable units per Interconnection on an MVA basis are compliant with Requirement R2~~.~~

~~5.2.4~~5.2.5 ~~By~~ by the first day of the first calendar quarter, nine years following Board of Trustees adoption~~:~~.

- ~~100% of each Generator Owner's applicable units compliant with Requirement R2.~~

B. Requirements

R1. Each Transmission Planner shall provide ~~its Generator Owner with~~ the following instructions and model data to its requesting Generator Owner within ~~30~~90 calendar days of receiving a request ~~from its Generator Owner~~ for those instructions ~~and~~or model data: *[Violation Risk Factor: Lower] [Time Horizon: ~~Long-term~~Operations Planning]*

- Instructions on how to obtain the list of acceptable turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system models for use in dynamic simulation.
- Instructions on how to obtain the Transmission Planner's software manufacturer's dynamic turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system model library block diagrams and/or data sheets.
- ~~Any~~Model data for any of the Generator Owner's existing unit or plant specific turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system ~~data~~ contained in the Transmission Planner's dynamic database from the current (in-use) model(s).

R2. Each Generator Owner shall provide, for each of its applicable units, a verified turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] model ~~(for each of its applicable Facilities)~~including documentation and data as specified in Parts 2.1 and 2.2, to its Transmission Planner (within 365 calendar days from the date that the response was recorded) in accordance with the periodicity specified in MOD-027 Attachment 1, to ensure modeling data is accurate for use in simulation software ~~subject to the following:~~. *[Violation Risk Factor: ~~Lower~~Medium] [Time Horizon: Long-term Planning]*

2.1. ~~Each Generator Owner shall perform its verifications with~~ Perform verification using one or more models acceptable to ~~its~~the Transmission Planner that ~~collectively~~ include(s) the following information:

2.1.1. Documentation ~~from the turbine/governor and Load control or active power/frequency control~~[1] comparing the applicable unit's model ~~verification activities including the on-line~~ response ~~compared~~ to the recorded response for either a frequency excursion from a system disturbance~~, or~~ that meets Attachment 1 Criteria 1 with the unit on-line, a ~~frequency~~ speed governor reference change~~.~~ with the unit on-line, or from a partial load rejection test[5].

2.1.2. Type of governor and ~~Load~~load control ~~or~~and active power control/frequency control equipment.

2.1.3. A description of the turbine (e.g. for Hydro turbine - Kaplan, Francis, or Pelton; for steam turbine - boiler type, normal fuel type, and turbine type; for gas turbine - the type and manufacturer; for variable energy plant - type and manufacturer).

2.1.4. ~~Turbine~~Model structure and data for turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] ~~model structure and data~~.

2.1.5. Representation of the real power response effects of outer loop controls (such as operator set point controls, ~~Load~~and load control~~, etc.~~ but excluding AGC control) ~~which~~that would override the governor response (including blocked or nonfunctioning governors or modes of operation that limit Frequency Response), if applicable.

2.2. For plants that are comprised of units that have a gross nameplate rating of less than 20 MVA, perform verification using plant aggregate model(s) that include the information required by Requirement sub-parts 2.1.1 through 2.1.5

R3. Each Generator Owner shall provide a written response ~~that contains~~to its Transmission Planner within 90 calendar days of receiving one of the following items for an applicable unit. The written response shall contain either the technical basis for maintaining the current model, ~~a list of future~~or the model changes, or a plan to perform model verification[6] ~~to its Transmission Planner within 90 calendar days of receiving written notice of one of the following:~~(in accordance with Requirement R2): *[Violation Risk Factor: Lower] [Time Horizon: ~~Long-term~~Operations Planning]*

- Written notification, ~~including a technical description~~ from its Transmission Planner ~~of why~~(in accordance with Requirement R5) that the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] model is not "usable~~" as identified in Requirement R5, Parts 5.1 through 5.3 criteria,~~", or

[5] Differences between the control mode tested and the final simulation model must be identified, particularly when analyzing load rejection data. Most controls change gains or have a set point runback which takes effect when the breaker opens. Load or set point controls will also not be in effect once the breaker opens. Some method of accounting for these differences must be presented if the final model is not validated from on load data under the normal operating conditions under which the model is expected to apply

[6] If verification is performed, the 10 year period as outlined in Attachment 1 is reset.

- Written comments from its Transmission Planner identifying technical concerns with the verification documentation related to the turbine/governor and load control and active power/frequency control model, or
- Written comments and supporting evidence from its Transmission Planner indicating that the predicted turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] response did not ~~match~~approximate the recorded response for three or more transmission system events.

R4. Each Generator Owner shall provide revised model data or plans to perform model verification[6] (in accordance with Requirement R2) for an applicable unit to its Transmission Planner within 180 calendar days of making changes to the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system that alter the equipment response [7] characteristic[8]. *[Violation Risk Factor: Lower] [Time Horizon: ~~Long-term~~Operations Planning]*

R5. Each Transmission Planner shall ~~determine if the model meets the criteria identified in Requirement R5, Parts 5.1 through 5.3 and provide a written response to~~notify the Generator Owner ~~indicating whether the model is useable or not useable; including a technical description if the model is not useable. This written response shall be submitted~~ within 90 calendar days of receiving the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system verified model information~~.~~ whether the model is useable (meets the criteria specified in Parts 5.1 through 5.3) or is not usable; and shall include a technical description if the model is not useable. *[Violation Risk Factor: ~~Lower~~Medium] [Time Horizon: ~~Long-term~~Operations Planning]*

5.1. The turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] function model ~~can initialize~~initializes to compute modeling data without error.

5.2. A no-disturbance simulation results in negligible transients.

5.3. For an otherwise stable simulation, a disturbance simulation results in the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] model exhibiting positive damping.

C. Measures

~~**M1.** The Transmission Planner shall have~~ Evidence for Requirement R1 must include the transmitted instructions or data and dated evidence ~~to show that it provided~~ of transmission of requested instructions and data ~~(such as dated electronic mail messages or mail receipts) within 30 calendar days of receiving a request as specified in Requirement R1.~~

~~[7] Control replacement or alteration including software alterations or plant digital control system addition or replacement, plant digital control system software alterations that alter droop, and/or dead band, and/or frequency response and/or a change in the frequency control mode (such as going from droop control to constant MW control, etc).~~

[8] Control replacement or alteration including software alterations or plant digital control system addition or replacement, plant digital control system software alterations that alter droop, and/or dead band, and/or frequency response and/or a change in the frequency control mode (such as going from droop control to constant MW control, etc).

M1. ~~Each Generator Owner shall have evidence (~~, such as dated electronic mail messages~~ or mail receipts) including~~, dated postal receipts, dated confirmation of facsimile transmission.

M2. Evidence for Requirement R2 must include, for each of the Generator Owner's applicable Facilities, the verification report ~~to show~~showing that ~~it provided~~ the ~~verified~~ turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] ~~model as specified~~ model was verified and dated evidence of transmission, ,such as a dated electronic mail messages, dated postal receipts, or dated confirmation of facsimile transmission as specified in Requirement R2.

~~**M2.**~~ Evidence for Requirement R3 must include the Generator Owner's dated written response containing the information identified in Requirement ~~R2.~~

M3. ~~Each Generator Owner shall have~~R3 and dated evidence ~~to show that it provided a written response (~~of transmittal, such as a dated ~~copy of the response, dated~~ electronic mail messages~~ or mail~~, dated postal receipts~~) containing identified information and submitted within 90 calendar days of receiving any written notification as specified in Requirement R3~~, or dated confirmation of facsimile transmission.

M4. ~~Each~~Evidence for Requirement R4 must include, for each of the Generator ~~Owner shall have~~Owner's Facilities for which system changes specified in Requirement R4 were made, dated revised model data or dated plans to perform a model verification and dated evidence ~~to show that it provided a written response (~~of transmittal, such as dated electronic mail messages~~ or mail~~, dated postal receipts~~) submitted within 180 calendar days of making system changes specified in Requirement R4~~, or dated confirmation of facsimile transmittal.

M5. ~~Each Transmission Planner shall have~~Evidence of Requirement R5 must include, for each model received, the dated response containing the information required in Parts 5.1 through 5.3 and dated evidence ~~to show that it provided a written response (~~of transmittal, such as dated electronic mail messages~~ or mail~~, dated postal receipts~~)~~ ~~within 90 calendar days of receiving the model as specified in Requirement R5~~, or dated confirmation of facsimile transmittal.

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

Regional Entity

1.2. Data Retention

The following evidence retention periods 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 Generator Owner and Transmission Planner shall each 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:

- The Transmission Planner shall retain the information/data request and provided response evidence of Requirements R1 and R5, Measures M1 and M5 for 3 calendar years from the date the document was provided.
- The Generator Owner shall retain the latest and previous turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system model verification evidence of Requirement R2, Measure M2.
- The Generator Owner shall retain the information/data request and provided response evidence of Requirements R3, and R4 Measures M3 and M4 for 3 calendar years from the date the document was provided.

If a Generator Owner or Transmission Planner is found non-compliant, it shall keep information related to the non-compliance until ~~found compliant~~mitigation is complete and approved or for the time specified above, whichever is longer.

The Compliance Enforcement Authority shall keep the last audit records and all requested and submitted subsequent audit records.

1.3. Compliance Monitoring and Assessment Processes

Compliance ~~Audits~~Audit

Self-~~Certifications~~Certification

Spot Checking

Compliance ~~Violation Investigations~~Investigation

Self-Reporting

~~Complaints~~

Complaint

1.4. Additional Compliance Information

None

2. Violation Severity Levels

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	The Transmission Planner provided the instructions and data to the Generator Owner more than 90 calendar days but less than or equal to 120 calendar days of receiving a request.	The Transmission Planner provided the instructions and data to the Generator Owner more than 120 calendar days but less than or equal to 150 calendar days of receiving a request.	The Transmission Planner provided the instructions and data to the Generator Owner more than 150 calendar days but less than or equal to 180 calendar days of receiving a request.	The Transmission Planner failed to provide the instructions and data to the Generator Owner within 181 calendar days of receiving a request.
R2	The Generator Owner provided its verified model(s) to its Transmission Planner after the periodicity timeframe specified in MOD-027 Attachment 1 but less than or equal to 30 calendar days late; OR The Generator Owner provided the Transmission Planner a verified model that omitted one of the five Parts identified in Requirement R2, ~~Parts~~Subparts 2.1.1, through 2.1.5.	The Generator Owner provided its verified model(s) to its Transmission Planner more than 30 calendar days but less than or equal to 60 calendar days late as specified by the periodicity timeframe in MOD-027 Attachment 1. OR The Generator Owner provided the Transmission Planner a verified model that omitted two of the five Parts identified in Requirement R2, ~~Parts~~Subparts 2.1.1, through 2.1.5.	The Generator Owner provided its verified model(s) to its Transmission Planner more than 60 calendar days but less than or equal to 90 calendar days late as specified by the periodicity timeframe in MOD-027 Attachment 1. OR The Generator Owner provided the Transmission Planner verified models that omitted three of the five Parts identified in Requirement R2, ~~Parts~~Subparts 2.1.1, through 2.1.5.	The Generator Owner ~~failed to provide~~provided its verified turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] model(s) more than 90 calendar days late or failed to provide the verified model(s) ~~no more than 90 calendar days late~~ to its Transmission Planner in accordance with the periodicity specified in MOD-027 Attachment 1. OR The Generator Owner failed to use model(s) acceptable to the Transmission Planner as specified in Requirement R2, ~~Part~~Subpart 2.1. OR The Generator Owner provided the Transmission Planner verified model(s) that omitted four or more of the five Parts

				identified in Requirement R2, ~~Parts~~Subparts 2.1.1, through 2.1.5.
R3	The Generator Owner provided a written response more than 90 calendar days but less than or equal to 120 calendar days of receiving written notice. (R3)	The Generator Owner provided a written response more than 120 calendar days but less than or equal to 150 calendar days of receiving written notice. (R3)	The Generator Owner provided a written response more than 150 calendar days but less than or equal to 180 calendar days of receiving written notice. (R3)	The Generator Owner failed to provide a written response within 181 calendar days of receiving notice as specified in Requirement R3. OR The Generator Owner's written response was provided within 181 calendar days of receiving written notice ~~however~~. However the Generator Owner's written response failed to contain either the technical basis for maintaining the current model, or a list of future model changes, or a plan to perform another model verification.
R4	The Generator Owner provided revised model data or plans to perform model verification more than 180 calendar days but less than or equal to 210 calendar days of making changes to the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system that alter the equipment response characteristic. (R4)	The Generator Owner provided revised model data or plans to perform model verification more than 210 calendar days but less than or equal to 240 calendar days of making changes to the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system that alter the equipment response characteristic. (R4)	The Generator Owner provided revised model data or plans to perform model verification more than 240 calendar days but less than or equal to 270 calendar days of making changes to the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system that alter the equipment response characteristic. (R4)	The Generator Owner failed to provide revised model data or failed to provide plans to perform model verification within 271 calendar days of making changes to the turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system that ~~alter~~altered the equipment response ~~-~~characteristic as specified in Requirement R3.
R5	The Transmission Planner provided a written response to the Generator Owner indicating whether the model is useable or not useable~~;~~ (including a technical description if the model is not useable~~,~~) more than 90 calendar days but less than 120 calendar	The Transmission Planner provided a written response to the Generator Owner indicating whether the model is useable or not useable~~;~~ (including a technical description if the model is not useable~~,~~), more than 120 calendar days but less than 150 calendar days of receiving the verified model	The Transmission Planner provided a written response to the Generator Owner indicating whether the model is useable or not useable~~;~~ (including a technical description if the model is not useable~~,~~) more than 150 calendar days but less than 180 calendar days of receiving the verified model	The Transmission Planner failed to provide a written response to the Generator Owner within 181 calendar days of receiving the verified model information as specified in Requirement R5. OR

		days of receiving verified model information. (R5)	information. (R5) OR The Transmission Planner provided a written response within 181 calendar days to the Generator Owner however the written response omitted confirmation for one of the specified model criteria listed in Requirement R5, Parts 5.1 through 5.3.	information. (R5) OR The Transmission Planner provided a written response within 181 calendar days to the Generator Owner however the written response omitted confirmation for two of the specified model criteria listed in Requirement R5, Parts 5.1 through 5.3.	The Transmission Planner provided a written response ~~within 181 calendar days to the Generator Owner however the written response omitted~~without including confirmation ~~for~~of all specified model criteria listed in Requirement R5, Parts 5.1 through 5.3~~.~~

E. Regional Variances

None.

F. Associated Documents

Version History

Version	Date	Action	Change Tracking

G. References

The following documents contain technical information beyond the scope of this Standard on turbine/governor and ~~Load~~load control ~~or~~and active power/frequency control[1] system functionality, modeling, and testing.

1) IEEE Task Force on Generator Model Validation Testing of the Power System Stability Subcommittee, “Guidelines for Generator Stability Model Validation Testing,” IEEE PES General Meeting 2007, paper 07GM1307
2) L. Pereira "New Thermal Governor Model Development: Its Impact on Operation and Planning Studies on the Western Interconnection" IEEE POWER AND ENERGY MAGAZINE, MAY/JUNE 2005
3) D.M. Cabbell, S. Rueckert, B.A. Tuck, and M.C. Willis, "The New Thermal Governor Model Used in Operating and Planning Studies in WECC," in Proc. IEEE PES General Meeting, Denver, CO, 2004
4) S. Patterson, "Importance of Hydro Generation Response Resulting from the New Thermal Modeling-and Required Hydro Modeling Improvements," in Proc. IEEE PES General Meeting, Denver, CO, 2004
5) L. Pereira, D. Kosterev, D. Davies, and S. Patterson, "New Thermal Governor Model Selection and Validation in the WECC," IEEE Trans. Power Syst., vol. 19, no. 1, pp. 517-523, February 2004
6) L. Pereira, J. Undrill, D. Kosterev, D. Davies, and S. Patterson, "A New Thermal Governor Modeling Approach in the WECC," IEEE Trans. Power Syst., vol. 18, no. 2, pp. 819-829, May 2003

7) P. Pourbeik, C. Pink and R. Bisbee, “Power Plant Model Validation for Achieving Reliability Standard Requirements Based on Recorded On-Line Disturbance Data”, Proceedings of the IEEE PSCE, March, 2011

MOD-027 Attachment 1

Turbine/Governor and Load Control ~~or~~and Active Power/Frequency Control Model Periodicity

~~Note that local grid codes may specify shorter time frames.~~

~~Facility~~	~~Condition~~ Periodicity Determination Supporting Criteria	~~Periodicity~~

	Criteria 1: Unit Model Verification Frequency Excursion ~~Threshold~~Criteria: • ≥ 0.05 hertz deviation from scheduled frequency for the Eastern Interconnection~~, or~~ with the applicable unit operating in a frequency responsive mode • ≥ 0.10 hertz deviation from scheduled frequency for the ERCOT and Western Interconnections~~, or~~ with the applicable unit operating in a frequency responsive mode • ≥ 0.15 hertz deviation from scheduled frequency for the Quebec Interconnection with the applicable unit operating in a frequency responsive mode ~~from scheduled frequency.~~ **Criteria 2: Establishing the ~~Recurring~~Initial Ten Year Unit Verification Period Start Date:** For each applicable unit, the initial start date is set to either of the 25~~%.~~ percent, 50~~%,~~ percent, 75~~%,~~ percent, or 100~~%~~ percent Standard ~~implementation~~Implementation Effective Dates established ~~as required~~ for compliance in accordance with the nine calendar year transition period. ~~or~~ **Criteria 3: Establishing the Recurring Ten Year Unit Verification Period Start Date:** The start date is ~~set to~~ the actual data collection date for the most recently performed applicable unit verification. **Criteria 4: For the purpose of calculating the initial ten year unit verification period 25 percent, 50 percent, 75 percent or 100 percent threshold for generation fleet compliance, equivalent unit MVA is ~~performed~~included (reference 4th row in the following table).** **Consideration for Early Compliance** **Existing turbine/governor and load control and active power/frequency control model verification is sufficient for demonstrating compliance for a ten year period from the actual verification date if either of the following applies:** • **The Generator Owner has a verified model that is compliant with the applicable regional policies, guidelines or criteria existing at the time of model verification.** • **The Generator Owner has an existing verified model that is compliant with the requirements of this standard.**	

~~Existing Generating Unit~~	~~During each ten year unit verification period as established by Criteria 2 above.~~ ~~**AND**~~ ~~**No exceptions** apply.~~ ~~**AND**~~ ~~While the unit is operating in a control mode with MW output that would result in a turbine/governor and load control or active power/frequency control mode response (or the unit is subjected to a staged frequency reference change test if possible) and is subjected to at least one BES frequency excursion as specified in Criteria 1 above.~~	~~A recorded unit Real Power response for a frequency excursion shall be collected during a ten calendar year (January – December) period with the verified model and documentation transmitted to the Transmission Planner no more than 730 days from the date that the recorded response was collected.~~
~~Existing Generating Unit~~	~~During each ten year unit verification period as established by Criteria 2 above.~~ ~~**AND**~~ ~~**The following unit exception** applies:~~ ~~1) Multiple units have the same MVA nameplate rating that are ≤ 350 MVA **AND**~~ ~~2) The same multiple units have identical applicable components and settings **AND**~~ ~~3) The same multiple units are sited at the same physical location **AND**~~ ~~4) The model for one of these equivalent units has been verified.~~	~~Not Required (however, perform verification on a different unit each ten calendar year cycle).~~
~~Existing Generating Unit~~	~~An acceptable frequency excursion at the generator from scheduled frequency **does not** occur during the ten calendar year (January – December) period and a staged frequency reference test is not performed~~ ~~**AND**~~ ~~The first time after the ten calendar year period while the unit is operating in a control mode with MW output that would result in a turbine/governor and load control or active~~	~~The recorded unit Real Power response for the frequency excursion shall be collected with the verified model and documentation transmitted to the Transmission Planner no more than 730 days from the date that the recorded response was collected.~~

	power/frequency control mode response and is subjected to a BES frequency excursion as specified in Criteria 1 above.	
Existing Generating Unit	Installation of new excitation control system equipment. **AND** The first time the unit is operating in a control mode with MW output that would result in a turbine/governor and load control or active power/frequency control mode response (or the unit is subjected to a staged frequency reference change test if possible) and is subjected to a BES frequency excursion as specified in Criteria 1 above.	The recorded unit Real Power response for the frequency excursion shall be collected with the verified model and documentation transmitted to the Transmission Planner no more than 730 days from the date that the recorded response was collected
Existing Generating Unit	Subjected to an activity resulting in an alteration of the response of the turbine/governor and Load control or active power/frequency control model. **OR** Receive written comments including dated electronic or hard copy evidence indicating that the recorded turbine/governor and Load control or active power/frequency control response for three or more Transmission System event did not match the predicted control system model response.. **OR** Receive written comments detailing technical concerns with the Generator Owner's turbine/governor and Load control or active power/frequency control model verification documentation. **AND** The Generator Owner has submitted a verification plan. **AND** The first time the unit is operating in a control mode with MW output that would result in a turbine/governor and load control or active power/frequency control mode response (or the unit is subjected to a staged frequency reference change test if possible) and is subjected to a BES frequency excursion as	The recorded unit Real Power response for the frequency excursion shall be collected with the verified model and documentation transmitted to the Transmission Planner no more than 730 days from the date that the recorded response was collected

	~~specified in Criteria 1 above.~~	
~~New or Existing Generator Unit~~	~~Excitation control system model identified as unusable by the Transmission Planner.~~ ~~**AND**~~ ~~The Generator Owner has submitted a verification plan.~~ ~~**AND**~~ ~~The first time the unit is operating in a control mode with MW output that would result in a turbine/governor and load control or active power/frequency control mode response (or the unit is subjected to a staged frequency reference change test if possible) and is subjected to a BES frequency excursion as specified in Criteria 1 above.~~	~~The recorded unit Real Power response for the frequency excursion shall be collected with the verified model and documentation transmitted to the Transmission Planner no more than 730 days from the date that the recorded response was collected~~
~~New Generating Unit~~	~~The first time the unit is operating in a control mode with MW output that would result in a turbine/governor and load control or active power/frequency control mode response (or the unit is subjected to a staged frequency reference change test if possible) and is subjected to aBES frequency excursion as specified in Criteria 1 above.~~	~~The recorded unit Real Power response for the frequency excursion shall be collected with the verified model and documentation transmitted to the Transmission Planner no more than 730 days from the date that the recorded response was collected~~

Event Triggering Verification	Verification Periodicity	Comments
Establishing the initial verification period (Criteria 2) for an applicable unit (Requirement R2)	Record unit Real Power response to the first frequency excursion event that meets Criteria 1 on or after the Standard Implementation Effective Date. OR Record unit Real Power response for an on-line speed governor reference change test or a partial load rejection test before or on the Standard Implementation Effective Date	Transmit the verified model and documentation and data to the Transmission Planner no more than 365 calendar days from the date that the response was recorded. Criteria 4 applies when calculating generation fleet compliance during the 9-year transition period

Event Triggering Verification	Verification Periodicity	Comments
Subsequent verification for an existing applicable unit	Record unit Real Power response for a frequency excursion event that meets Criteria 1 within one year of the applicable unit's ten year anniversary date of the collection of the recorded unit Real Power response used for the current validation. OR Record unit Real Power response for an on-line speed governor reference change test or a partial load rejection test on or before the applicable unit's ten year anniversary date of the collection of the recorded unit Real Power response used for the current validation.	Transmit the verified model and documentation and data to the Transmission Planner no more than 365 calendar days from the date that the response was recorded.
Initial verification for a new applicable unit or for an existing applicable unit with new turbine/governor and load control or active power/frequency control equipment installed with settings final (Requirement R2)	Record unit Real Power response to the first frequency excursion event that meets Criteria 1 OR Record unit Real Power response for an on-line speed governor reference change test or a partial load rejection test no more than 365 calendar days from the commissioning date	Transmit the verified model and documentation and data to the Transmission Planner no more than 365 calendar days from the date that the response was recorded.
Existing applicable unit that is equivalent to another operating unit(s) at the same physical location AND Each equivalent applicable unit has the same MVA nameplate rating. AND	Verify a different equivalent unit during each ten year verification period.	Document circumstance with a written statement and include with the verified model and documentation and data provided to the Transmission Provider for the verified equivalent unit.

Event Triggering Verification	Verification Periodicity	Comments
The nameplate rating is ≤ 350 MVA. AND Each equivalent applicable unit has identical applicable components and settings. AND The model for one of these equivalent applicable units has been verified. (Requirement R2)		Criteria 4 applies when calculating generation fleet compliance during the 9-year transition period.
Existing applicable unit does not experience an acceptable frequency excursion event during the ten year unit verification period AND Neither an on-line speed governor reference test nor a partial load rejection test was performed. (Requirement R2)	Record unit Real Power response to the first frequency excursion event that meets Criteria 1after the ten year verification period	Document circumstance with a written statement. Transmit the verified model and documentation and data to the Transmission Planner no more than 365 calendar days from the date that the response was recorded.
Existing applicable unit control system response is altered resulting in an alteration of the response of the turbine/governor and load control or active power/frequency control model AND The Generator Owner has submitted a verification plan. (Requirement R4)	Record unit Real Power response to the first frequency excursion event that meets Criteria 1. OR Record unit Real Power response for an on-line speed governor reference change test or a partial load rejection test no more than 365 calendar days from the date of the submitted verification plan.	Transmit the verified model and documentation and data to the Transmission Planner no more than 365 calendar days from the date that the response was recorded.
The Generator Owner receives written comments including dated electronic or hard copy evidence indicating that the recorded turbine/governor and load control or active power/frequency control response for three or more transmission system events did not match the predicted control system model	Record unit Real Power response to the first frequency excursion event that meets Criteria 1. OR	Transmit the verified model and documentation and data to the Transmission Planner no more than 365 calendar days from the date that the unit Real Power response was

Event Triggering Verification	Verification Periodicity	Comments
response. AND The Generator Owner has submitted a verification plan. (Requirement R3)	Record unit Real Power response for an on-line speed governor reference change test or a partial load rejection test no more than 365 calendar days from the date of the submitted verification plan	provided as part of the dated evidence.
The Generator Owner receives written comments detailing technical concerns with the Generator Owner's turbine/governor and load control and active power/frequency control model verification documentation. AND The Generator Owner has submitted a verification plan (Requirement R3)	Record unit Real Power response to the first frequency excursion event that meets Criteria 1. OR Record unit Real Power response for an on-line speed governor reference change test or a partial load rejection test no more than 365 calendar days from the date of the submitted verification plan	Transmit the verified model and documentation and data to the Transmission Planner no more than 365 calendar days from the date that the response was recorded.
The Turbine/governor and load control and active power/frequency control model identified as unusable by the Transmission Planner. AND The Generator Owner has submitted a verification plan. (Requirement R3)	Record unit Real Power response to the first frequency excursion event that meets Criteria 1. OR Record unit Real Power response for an on-line speed governor reference change test or a partial load rejection test no more than 365 calendar days from the date that of the submitted verification plan	Transmit the verified model and documentation and data to the Transmission Planner no more than 365 calendar days from the date that the response was recorded.

Event Triggering Verification	Verification Periodicity	Comments
New or existing applicable unit is not responsive to a frequency excursion event (The unit does not operate in a control mode, except during normal start up and shut down, that would result in a turbine/governor and load control or active power/frequency control mode response.) OR New or existing applicable unit has a disabled control system	Not required until responsive control mode operation for connected operations is established.	Document circumstance with a written statement. Perform verification per the periodicity specified in Row 3 for a "New Generating Unit" (or new equipment) once responsive control mode operation for connected operations is established.
New or existing applicable unit does not have an installed control system	Not required until unit has an installed control system	Document circumstance with a written statement. Perform verification per the periodicity specified in Row 3 for a "New Generating Unit" (or new equipment) once responsive control mode operation for connected operations is established.