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| NPRR Number | [989](http://www.ercot.com/mktrules/issues/nprr989) | NPRR Title | BESTF-1 Energy Storage Resource Technical Requirements |
| Date of Decision | | May 29, 2020 | |
| Action | | Recommended Approval | |
| Timeline | | Urgent | |
| Proposed Effective Date | | Upon system implementation | |
| Priority and Rank Assigned | | Not applicable | |
| Nodal Protocol Sections Requiring Revision | | 2.1, Definitions  3.15, Voltage Support  3.15.1, ERCOT Responsibilities Related to Voltage Support  3.15.3, Generation Resource Requirements Related to Voltage Support  6.5.7.7, Voltage Support Service  8.1.1.2.1.4, Voltage Support Service Qualification  8.5.1.1, Governor in Service  8.5.1.2, Reporting  8.5.2, Primary Frequency Response Measurements  8.5.2.1, ERCOT Required Primary Frequency Response | |
| Related Documents Requiring Revision/Related Revision Requests | | Nodal Operating Guide Revision Request (NOGRR) 204, Related to NPRR989, BESTF-1 Energy Storage Resource Technical Requirements | |
| Revision Description | | This Nodal Protocol Revision Request (NPRR), together with NOGRR204, codifies the concepts described in Battery Energy Storage Task Force (BESTF) Key Topics and Concepts No. 4 (KTC-4), which received consensus support at BESTF and were approved by the Technical Advisory Committee (TAC) at its November 20, 2019, meeting. The NPRR establishes technical requirements for Energy Storage Resources (ESRs) for Voltage Support Service (VSS) (including Reactive Power capability), and Primary Frequency Response, as follows:   * Revisions to Sections 3.15 and 3.15.3 broaden the scope of existing Generation Resource VSS requirements to apply to ESRs and would also require ESRs to have the Reactive Power capability available at all MW levels when charging or discharging; * Revisions to Sections 8.5.1.1, 8.5.2, and 8.5.2.1 broaden the scope of existing Generation Resource Primary Frequency Response requirements to apply to ESRs; and * In various other sections of the Protocols, ESR technical requirements are aligned with those already in place for Generation Resources.   These provisions are applicable during both the current “combo model” era for ESRs (where ESRs are modeled as a combination Generation Resource and Controllable Load Resource) and the future “single model” era which is projected for implementation in 2024.  Any exceptions needed for ESRs connected to the Distribution System are not addressed within NPRR989 and will be addressed in a future NPRR. | |
| Reason for Revision | | Addresses current operational issues.  Meets Strategic goals (tied to the [ERCOT Strategic Plan](http://www.ercot.com/content/wcm/lists/144926/ERCOT_Strategic_Plan_2019-2023.pdf) or directed by the ERCOT Board).  Market efficiencies or enhancements  Administrative  Regulatory requirements  Other: (explain)  *(please select all that apply)* | |
| Business Case | | This NPRR provides needed clarity regarding certain technical requirements for ESR participation in the ERCOT markets. | |
| Credit Work Group Review | | ERCOT Credit Staff and the Credit Work Group (Credit WG) have reviewed NPRR989 and do not believe that it requires changes to credit monitoring activity or the calculation of liability. | |
| PRS Decision | | On 1/16/20, PRS unanimously voted to table NPRR989 and refer the issue to ROS. All Market Segments were present for the vote.  On 4/20/20, PRS unanimously voted via email to recommend approval of NPRR989 as amended by the 2/28/20 ERCOT comments. All Market Segments participated in the email vote.  On 5/15/20, PRS unanimously voted via email to grant NPRR989 Urgent status and to endorse and forward to TAC the 4/20/20 PRS Report as amended by the 5/11/20 ERCOT comments and Impact Analysis for NPRR989. All Market Segments participated in the email vote. | |
| Summary of PRS Discussion | | On 1/16/20, there was no discussion.  On 4/20/20, there was no discussion.  On 5/15/20, there was no discussion. | |
| TAC Decision | | On 5/29/20, TAC voted via email to recommend approval of NPRR989 as recommended by PRS in the 5/15/20 PRS Report. There was one abstention from the Independent Generator (Luminant) Market Segment. All Market Segments participated in the email vote. | |
| Summary of TAC Discussion | | On 5/29/20, there was no discussion. | |
| ERCOT Opinion | | ERCOT supports approval of NPRR989. | |

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| Sponsor | |
| Name | Sandip Sharma |
| E-mail Address | [Sandip.sharma@ercot.com](mailto:Sandip.sharma@ercot.com) |
| Company | ERCOT |
| Phone Number | 512-248-4298 |
| Cell Number |  |
| Market Segment | Not applicable |

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| **Market Rules Staff Contact** | |
| **Name** | Cory Phillips |
| **E-Mail Address** | [cory.phillips@ercot.com](mailto:cory.phillips@ercot.com) |
| **Phone Number** | 512-248-6464 |

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| **Comments Received** | |
| Comment Author | **Comment Summary** |
| ERCOT 012320 | Proposed additional edits to Section 3.15 based on the incorporation of NPRR849, Clarification of the Range of Voltage Set Points at a Generation Resource’s POI |
| ROS 020620 | Requested PRS continue to table NPRR989 for further review by the Operations Working Group (OWG) |
| ERCOT 022820 | Proposed edits to the Revision Description for NPRR989 to clarify that exceptions for distribution-connected ESRs will be addressed in a future NPRR |
| ROS 031020 | Endorsed NPRR989 as amended by the 2/28/20 ERCOT comments |
| ERCOT 051120 | Proposed additional edits to Section 8.5.2.1 based on the incorporation of NPRR963, Base Point Deviation Settlement and Deployment Performance Metrics for Energy Storage Resources (Combo Model) |

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| Market Rules Notes |

Administrative changes to the language were made and authored as “ERCOT Market Rules.”

Please note the baseline Protocol language in the following sections has been updated to reflect the incorporation of the following NPRR(s) into the Protocols:

* NPRR849 (incorporated 1/1/20)
  + Section 3.15
* NPRR863, Creation of ERCOT Contingency Reserve Service and Revisions to Responsive Reserve (Phase 1 unboxed 3/1/20)
  + Section 8.5.2
  + Section 8.5.2.1
* NPRR963, Base Point Deviation Settlement and Deployment Performance Metrics for Energy Storage Resources (Combo Model) (incorporated 3/1/20)
  + Section 8.5.1.2
  + Section 8.5.2
  + Section 8.5.2.1

Please note that the following NPRR(s) also propose revisions to the following section(s):

* NPRR966, Changes to Support Reactive Power Coordination Tool
  + Section 6.5.7.7
* NPRR1001, Clarification of Definitions of Operating Condition Notice, Advisory, Watch, Emergency Notice, and Related Clarifications
  + Section 3.15.3
* NPRR1003, Elimination of References to Resource Asset Registration Form
  + Section 8.1.1.2.1.4
* NPRR1005, Clarify Definition of Point of Interconnection (POI) and Add Definition Point of Interconnection Bus (POIB)
  + Section 3.15
  + Section 3.15.1
  + Section 6.5.7.7
* NPRR1011, RTC – NP 8: Performance Monitoring
  + Section 8.5.1.1
* NPRR1016, Clarify Requirements for Distribution Generation Resources (DGRs) and Distribution Energy Storage Resources (DESRs)
  + Section 3.15
  + Section 6.5.7.7

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| Proposed Protocol Language Revision |

## 2.1 DEFINITIONS

**Automatic Voltage Regulator (AVR)**

A device on a Generation Resource or a control system at the Facility of a Generation Resource or Energy Storage Resource (ESR) used to automatically control the voltage to an established Voltage Set Point.

Primary Frequency Response

The immediate proportional increase or decrease in real power output provided by Settlement Only Transmission Generators (SOTGs), Settlement Only Transmission Self-Generators (SOTSGs), Generation Resources, Energy Storage Resources (ESRs), Controllable Load Resources, and the natural real power dampening response provided by Load in response to system frequency deviations. This response is in the direction that stabilizes frequency.

Resource Entity

An Entity that owns or controls a Generation Resource, an Energy Storage Resource (ESR), a Settlement Only Generator (SOG), or a Load Resource and is registered with ERCOT as a Resource Entity

Voltage Profile

The set of normally desired Voltage Set Points for those Generation Resources or Energy Storage Resources (ESRs) specified in paragraph (2) of Section 3.15, Voltage Support, in the ERCOT System.

**Voltage Set Point**

The voltage that a Generation Resource or Energy Storage Resource (ESR) is required to maintain at its Point of Interconnection (POI) and that is initially communicated via the Voltage Profile but may be modified by a Real-Time instruction from ERCOT, the interconnecting Transmission Service Provider (TSP), or that TSP’s agent.

**3.15 Voltage Support**

(1) ERCOT, in coordination with the Transmission Service Providers (TSPs), shall establish and update, as necessary, the ERCOT System Voltage Profile and shall post it on the Market Information System (MIS) Secure Area. ERCOT, the interconnecting TSP, or that TSP’s agent, may modify the Voltage Set Point described in the Voltage Profile based on current system conditions.

(2) All Generation Resources (including self-serve generating units) and Energy Storage Resources (ESRs) that have a gross unit rating greater than 20 MVA or those units connected at the same Point of Interconnection (POI) that have gross unit ratings aggregating to greater than 20 MVA, that supply power to the ERCOT Transmission Grid, shall provide Voltage Support Service (VSS).

(3) Except as reasonably necessary to ensure reliability or operational efficiency, TSPs should utilize available static reactive devices prior to requesting a Voltage Set Point change from a Generation Resource or ESR.

(4) Each Generation Resource and ESR required to provide VSS shall comply with the following Reactive Power requirements in Real-Time operations when issued a Voltage Set Point by a TSP or ERCOT:

(a) An over-excited (lagging or producing) power factor capability of 0.95 or less determined at the unit's maximum net power to be supplied to the ERCOT Transmission Grid and for any Voltage Set Point from 0.95 per unit to 1.04 per unit, as measured at the POI;

(b) An under-excited (leading or absorbing) power factor capability of 0.95 or less, determined at the unit's maximum net power to be supplied to the ERCOT Transmission Grid and for any Voltage Set Point from 1.0 per unit to 1.05 per unit, as measured at the POI;

(c) For any Voltage Set Point outside of the voltage ranges described in paragraphs (a) and (b) above, the Generation Resource or ESR shall supply or absorb the maximum amount of Reactive Power available within its inherent capability and the capability of any VAr-capable devices as necessary to achieve the Voltage Set Point;

(d) When a Generation Resource or an ESR required to provide VSS is issued a new Voltage Set Point, that Generation Resource or ESR shall make adjustments in response to the new Voltage Set Point, regardless of whether the current voltage is within the tolerances identified in paragraph (4) of Nodal Operating Guide Section 2.7.3.5, Resource Entity Responsibilities and Generation Resource and Energy Storage Resource Requirements;

(e) For Generation Resources, the Reactive Power capability shall be available at all MW output levels and may be met through a combination of the Generation Resource’s Corrected Unit Reactive Limit (CURL), which is the generating unit’s dynamic leading and lagging operating capability, and/or dynamic VAr-capable devices. This Reactive Power profile is depicted graphically as a rectangle. For Intermittent Renewable Resources (IRRs), the Reactive Power requirements shall be available at all MW output levels at or above 10% of the IRR’s nameplate capacity. When an IRR is operating below 10% of its nameplate capacity and is unable to support voltage at the POI, ERCOT, the interconnecting TSP, or that TSP’s agent may require an IRR to disconnect from the ERCOT System for purposes of maintaining reliability. For ESRs, the Reactive Power capability shall be available at all MW levels, when charging or discharging, and may be met through a combination of the ESR’s CURL, and/or dynamic VAr-capable devices.

(5) As part of the technical Resource testing requirements prior to the Resource Commissioning Date, all Generation Resources and ESRs must conduct an engineering study, and demonstrate through performance testing, the ability to comply with the Reactive Power capability requirements in paragraph (4), (7), (8), or (9) of this Section, as applicable. Any study and testing results must be accepted by ERCOT prior to the Resource Commissioning Date.

(6) Except for a Generation Resource or an ESR subject to Planning Guide Section 5.1.1, Applicability, a Generation Resource or an ESR that has already been commissioned is not required to submit a new reactive study or conduct commissioning-related reactive testing, as described in paragraph (5) above.

(7) Wind-powered Generation Resources (WGRs) that commenced operation on or after February 17, 2004, and have a signed Standard Generation Interconnection Agreement (SGIA) on or before December 1, 2009 (“Existing Non-Exempt WGRs”), must be capable of producing a defined quantity of Reactive Power to maintain a set point in the Voltage Profile established by ERCOT in accordance with the Reactive Power requirements established in paragraph (4) above, except in the circumstances described in paragraph (a) below.

(a) Existing Non-Exempt WGRs whose current design does not allow them to meet the Reactive Power requirements established in paragraph (4) above must conduct an engineering study using the Summer/Fall 2010 on-peak/off-peak Voltage Profiles, or conduct performance testing to determine their actual Reactive Power capability. Any study or testing results must be accepted by ERCOT. The Reactive Power requirements applicable to these Existing Non-Exempt WGRs will be the greater of: the leading and lagging Reactive Power capabilities established by the Existing Non-Exempt WGR’s engineering study or testing results; or Reactive Power proportional to the real power output of the Existing Non-Exempt WGR (this Reactive Power profile is depicted graphically as a triangle) sufficient to provide an over-excited (lagging) power factor capability of 0.95 or less and an under-excited (leading) power factor capability of 0.95 or less, both determined at the WGR’s set point in the Voltage Profile established by ERCOT, and both measured at the POI.

(i) Existing Non-Exempt WGRs shall submit the engineering study results or testing results to ERCOT no later than five Business Days after its completion.

(ii) Existing Non-Exempt WGRs shall update any and all Resource Registration data regarding their Reactive Power capability documented by the engineering study results or testing results.

(iii) If the Existing Non-Exempt WGR’s engineering study results or testing results indicate that the WGR is not able to provide Reactive Power capability that meets the triangle profile described in paragraph (a) above, then the Existing Non-Exempt WGR will take steps necessary to meet that Reactive Power requirement depicted graphically as a triangle by a date mutually agreed upon by the Existing Non-Exempt WGR and ERCOT. The Existing Non-Exempt WGR may meet the Reactive Power requirement through a combination of the WGR’s URL and/or automatically switchable static VAr-capable devices and/or dynamic VAr-capable devices. No later than five Business Days after completion of the steps to meet that Reactive Power requirement, the Existing Non-Exempt WGR will update any and all Resource Registration data regarding its Reactive Power and provide written notice to ERCOT that it has completed the steps necessary to meet its Reactive Power requirement.

(iv) For purposes of measuring future compliance with Reactive Power requirements for Existing Non-Exempt WGRs, results from performance testing or the Summer/Fall 2010 on-peak/off-peak Voltage Profiles utilized in the Existing Non-Exempt WGR’s engineering study shall be the basis for measuring compliance, even if the Voltage Profiles provided to the Existing Non-Exempt WGR are revised for other purposes.

(b) Existing Non-Exempt WGRs whose current design allows them to meet the Reactive Power requirements established in paragraph (4) above (depicted graphically as a rectangle) shall continue to comply with that requirement. ERCOT, with cause, may request that these Existing Non-Exempt WGRs provide further evidence, including an engineering study, or performance testing, to confirm accuracy of Resource Registration data supporting their Reactive Power capability.

(8) Qualified Renewable Generation Resources (as described in Section 14, State of Texas Renewable Energy Credit Trading Program) in operation before February 17, 2004, required to provide VSS and all other Generation Resources required to provide VSS that were in operation prior to September 1, 1999, whose current design does not allow them to meet the Reactive Power requirements established in paragraph (4) above, will be required to maintain a Reactive Power requirement as defined by the Generation Resource’s URL that was submitted to ERCOT and established per the criteria in the ERCOT Operating Guides.

(9) New generating units connected before May 17, 2005, whose owners demonstrate to ERCOT’s satisfaction that design and/or equipment procurement decisions were made prior to February 17, 2004, based upon previous standards, whose design does not allow them to meet the Reactive Power requirements established in paragraph (4) above, will be required to maintain a Reactive Power requirement as defined by the Generation Resource’s URL that was submitted to ERCOT and established per the criteria in the Operating Guides.

(10) For purposes of meeting the Reactive Power requirements in paragraphs (4) through (9) above, multiple units including IRRs shall, at a Resource Entity’s option, be treated as a single Resource if the units are connected to the same transmission bus.

(11) Resource Entities may submit to ERCOT specific proposals to meet the Reactive Power requirements established in paragraph (4) above by employing a combination of the CURL and added VAr capability, provided that the added VAr capability shall be automatically switchable static and/or dynamic VAr devices. A Resource Entity and TSP may enter into an agreement in which the proposed static VAr devices can be switchable using Supervisory Control and Data Acquisition (SCADA). ERCOT may, at its sole discretion, either approve or deny a specific proposal, provided that in either case, ERCOT shall provide the submitter an explanation of its decision.

(12) A Resource Entity and TSP may enter into an agreement in which the Generation Resource or ESR compensates the TSP to provide VSS to meet the Reactive Power requirements of paragraph (4) above in part or in whole. The TSP shall certify to ERCOT that the agreement complies with the Reactive Power requirements of paragraph (4).

(13) Unless specifically approved by ERCOT, no unit equipment replacement or modification at a Generation Resource or ESR shall reduce the capability of the unit below the Reactive Power requirements that applied prior to the replacement or modification.

(14) Generation Resources or ESRs shall not reduce high reactive loading on individual units during abnormal conditions without the consent of ERCOT unless equipment damage is imminent.

(15) All WGRs must provide a Real-Time SCADA point that communicates to ERCOT the number of wind turbines that are available for real power and Reactive Power injection into the ERCOT Transmission Grid. WGRs must also provide two other Real-Time SCADA points that communicate to ERCOT the following:

(a) The number of wind turbines that are not able to communicate and whose status is unknown; and

(b) The number of wind turbines out of service and not available for operation.

(16) All PhotoVoltaic Generation Resources (PVGRs) must provide a Real-Time SCADA point that communicates to ERCOT the capacity of PhotoVoltaic (PV) equipment that is available for real power and Reactive Power injection into the ERCOT Transmission Grid. PVGRs must also provide two other Real-Time SCADA points that communicate to ERCOT the following:

(a) The capacity of PV equipment that is not able to communicate and whose status is unknown; and

(b) The capacity of PV equipment that is out of service and not available for operation.

(17) For the purpose of complying with the Reactive Power requirements under this Section 3.15, Reactive Power losses that occur on privately-owned transmission lines behind the POI may be compensated by automatically switchable static VAr-capable devices.

***3.15.1 ERCOT Responsibilities Related to Voltage Support***

(1) ERCOT, in coordination with the TSPs, shall establish, and update as necessary, Voltage Profiles at POI of Generation Resources and ESRs required to provide VSS to maintain system voltages within established limits.

(2) ERCOT shall communicate to the Qualified Scheduling Entity (QSE) and TSPs the desired voltage at the POI by providing Voltage Profiles.

(3) ERCOT, in coordination with TSPs, shall deploy static Reactive Power Resources as required to continuously maintain dynamic reactive reserves from QSEs, both leading and lagging, adequate to meet ERCOT System requirements.

(4) For any Market Participant’s failure to meet the Reactive Power voltage control requirements of these Protocols, ERCOT shall notify the Market Participant in writing of such failure and, upon a request from the Market Participant, explain whether and why the failure must be corrected.

(5) ERCOT shall notify all affected TSPs of any alternative requirements it approves.

(6) Annually, ERCOT shall review Distribution Service Provider (DSP) power factors using the actual summer Load and power factor information included in the annual Load data request to assess whether DSPs comply with the requirements of this subsection. At times selected by ERCOT, ERCOT shall require manual power factor measurement at substations and POIs that do not have power factor metering. ERCOT shall try to provide DSPs sufficient notice to perform the manual measurements. ERCOT may not request more than four measurements per calendar year for each DSP substation or POI where power factor measurements are not available.

(7) If actual conditions indicate probable non-compliance of TSPs and DSPs with the requirements to provide voltage support, ERCOT shall require power factor measurements at the time of its choice while providing sufficient notice to perform the measurements.

(8) ERCOT shall investigate claims of TSP and DSP alleged non-compliance with Voltage Support requirements. The ERCOT investigator shall advise ERCOT and TSP planning and operating staffs of the results of such investigations.

***3.15.3 Generation Resource and Energy Storage Resource Requirements Related to Voltage Support***

(1) Generation Resources and ESRs required to provide VSS shall have and maintain Reactive Power capability at least equal to the Reactive Power capability requirements specified in these Protocols and the ERCOT Operating Guides.

(2) Generation Resources and ESRs providing VSS shall be compliant with the ERCOT Operating Guides for response to transient voltage disturbance.

(3) Generation Resources and ESRs providing VSS must meet technical requirements specified in Section 8.1.1.1, Ancillary Service Qualification and Testing, and the performance standards specified in Section 8.1.1, QSE Ancillary Service Performance Standards.

(4) Each Generation Resource and ESR providing VSS shall operate with the unit’s Automatic Voltage Regulator (AVR) in the automatic voltage control mode unless specifically directed to operate in manual mode by ERCOT, or when the unit is telemetering its Resource Status as STARTUP, SHUTDOWN, or ONTEST, or the QSE determines a need to operate in manual mode in the event of an Emergency Condition at the generating plant.

(5) Each Generation Resource and ESR providing VSS shall maintain the Voltage Set Point established by ERCOT, the interconnecting TSP, or the TSP’s agent, subject to the Generation Resource’s or ESR’s operating characteristic limits, voltage limits, and within tolerances identified in paragraph (4) of Operating Guide Section 2.7.3.5, Resource Entity Responsibilities and Generation Resource Requirements.

(6) The reactive capability required must be maintained at all times that the Generation Resource or ESR is On-Line.

(7) Each QSE shall send to ERCOT, via telemetry, the AVR and Power System Stabilizer (PSS) status for each of its Generation Resources providing VSS. Each QSE shall send to ERCOT via telemetry the AVR status for each of its ESRs providing VSS. For AVRs, an “On” status will indicate the AVR is on and set to regulate the Resource’s terminal voltage in the voltage control mode, and an “Off” status will indicate the AVR is off or in a manual mode. For PSS, an “On” status will indicate the service is enabled and ready for service, and an “Off” status will indicate it is off or out of service. Each QSE shall monitor the status of its Generation Resources’ and ESRs’ regulators and stabilizers, and shall report status changes to ERCOT.

(8) Each Resource Entity shall provide information related to the tuning parameters, local or inter-area, of any PSS installed at a Generation Resource.

**6.5.7.7 Voltage Support Service**

(1) ERCOT shall coordinate with TSPs the creation and maintenance of Voltage Profiles as described in Section 3.15, Voltage Support.

(2) ERCOT shall instruct the interconnecting TSP, or the TSP’s agent, to make Voltage Set Point adjustments, as necessary, within the Generation Resource’s or Energy Storage Resource’s (ESR’s) Corrected Unit Reactive Limit (CURL) provided to ERCOT. The interconnecting TSP, or the TSP’s agent, shall instruct any QSE or Resource Entity representing a Generation Resource or ESR to make the Voltage Set Point adjustments instructed by ERCOT, or as the TSP determines to be necessary. If ERCOT determines that a Generation Resource or ESR should be instructed to provide additional MVAr beyond its URL or that a Generation Resource’s or ESR’s real power output should be decreased to allow the Generation Resource or ESR to provide additional Reactive Power beyond the URL, ERCOT shall issue a Resource-specific Dispatch Instruction requiring any change in Reactive Power and/or real power output, except that ERCOT may not require a Generation Resource or ESR to exceed its operational limits.

(3) ERCOT and TSPs shall develop procedures for the operation of transmission-controlled reactive equipment in order to minimize the dependence on Reactive Power supplied by Generation Resources and ESRs. For Generation Resources and ESRs required to provide Voltage Support Service (VSS), GSU transformer tap settings must be managed to maximize the use of the ERCOT System for all Market Participants while maintaining adequate reliability.

(4) Each TSP, under ERCOT’s direction, is responsible for monitoring and ensuring that all Generation Resources and ESRs required to provide VSS have their dynamic reactive capability deployed in approximate proportion to their respective capability requirements.

(5) Each Generation Resource and ESR required to provide VSS shall follow its Voltage Set Point as directed by ERCOT, the interconnecting TSP, or the TSP’s agent, within the operating Reactive Power capability of the Generation Resource or ESR.

(6) Each interconnecting TSP, or the TSP’s agent, shall telemeter via ICCP the Real-Time Voltage Set Point to ERCOT at the Point of Interconnection (POI) for each Generation Resource and ESRs interconnected to the TSP’s system. Each interconnecting TSP, or the TSP’s agent shall modify the telemetered Voltage Set Point to match any verbal Voltage Set Point instructions as soon as practicable. ERCOT shall telemeter the Real-Time desired Voltage Set Point and the TSP-designated POI kV measurement via ICCP to each QSE representing a Generation Resource or an ESR. Each QSE representing a Generation Resource or an ESR shall provide in Real-Time the desired Voltage Set Point and the associated POI kV measurement provided by ERCOT to the Resource Entity for that Generation Resource or ESR.

**8.1.1.2.1.4 Voltage Support Service Qualification**

(1) The Resource Entity must verify and maintain its stated Reactive Power capability for each of its Generation Resources and Energy Storage Resources (ESRs) providing Voltage Support Service (VSS), as required by the Operating Guides. Generation Resources and ESRs providing VSS reactive capability limits shall be specified as follows: lagging reactive capability should be specified using the Summer/Fall voltage profile, and leading capability specified using the Winter/Spring voltage profile.

(2) The Resource Entity shall conduct reactive capacity qualification tests to verify the maximum leading and lagging reactive capability of all Generation Resources and ESRs required to provide VSS. Reactive capability tests are performed during the resource commissioning process and at a minimum of once every five years or within 12 months following the discovery of a change that affects its real power or Reactive Power capability by more than 10% of the last Resource Asset Registration Form submittal and is expected to last more than six months. Mothballed Generation Resources or ESRs that have not been tested within the last five years shall be verified within 12 calendar months upon return to service. ERCOT may require additional testing if it has information indicating that current data is inaccurate. The Resource Entity is not obligated to place Generation Resources or ESRs On-Line solely for the purposes of testing. The reactive capability tests must be conducted at a time agreed to in advance by the Resource Entity, its QSE, the applicable TSP, and ERCOT.

(3) Leading and lagging reactive operating limits must be demonstrated following the reactive power verification test procedure as more fully described in Nodal Operating Guide Section 3.3.2, Unit Reactive Capability Requirements.

(4) The Resource Entity shall perform the Automatic Voltage Regulator (AVR) tests and shall supply AVR data as specified in the Operating Guides. The AVR tests must be performed on initial qualification. The AVR tests must be conducted at a time agreed on in advance by the Resource Entity, its QSE, the applicable TSP, and ERCOT.

8.5.1 Generation Resource, Energy Storage Resource, and QSE Participation

8.5.1.1 Governor in Service

(1) At all times a Generation Resource, Energy Storage Resource (ESR), Settlement Only Transmission Generator (SOTG), or Settlement Only Transmission Self-Generator (SOTSG) is On-Line, its Governor must remain in service and be allowed to respond to all changes in system frequency except during startup, shutdown, or testing. A Resource Entity may not reduce Primary Frequency Response on an individual Generation Resource, ESR, or Settlement Only Generator (SOG) even during abnormal conditions without ERCOT’s consent (conveyed by way of the Resource Entity’s Qualified Scheduling Entity (QSE)) unless equipment damage is imminent. All Generation Resources, ESRs, SOTGs, and SOTSGs that have capacity available to either increase output or decrease output in Real-Time must provide Primary Frequency Response, which may make use of that available capacity. Only Generation Resources or ESRs providing Regulation Up (Reg-Up), Regulation Down (Reg-Down), Responsive Reserve (RRS), or Non-Spinning Reserve (Non-Spin) from On-Line Resources, as specified in Section 8.1.1, QSE Ancillary Service Performance Standards, shall be required to reserve capacity that may also be used to provide Primary Frequency Response.

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| [NPRR863: Replace paragraph (1) above with the following upon system implementation:]  (1) At all times a Generation Resource, Energy Storage Resource (ESR), Settlement Only Transmission Generator (SOTG), or Settlement Only Transmission Self-Generator (SOTSG) is On-Line, its Governor must remain in service and be allowed to respond to all changes in system frequency except during startup, shutdown, or testing. A Resource Entity may not reduce Primary Frequency Response on an individual Generation Resource, ESR, or Settlement Only Generator (SOG) even during abnormal conditions without ERCOT’s consent (conveyed by way of the Resource Entity’s Qualified Scheduling Entity (QSE)) unless equipment damage is imminent. All Generation Resources, ESRs, SOTGs, and SOTSGs that have capacity available to either increase output or decrease output in Real-Time must provide Primary Frequency Response, which may make use of that available capacity. Only Generation Resources or ESRs providing Responsive Reserve (RRS), Regulation Up (Reg-Up), Regulation Down (Reg-Down), ERCOT Contingency Reserve Service (ECRS), or Non-Spinning Reserve (Non-Spin) from On-Line Resources, as specified in Section 8.1.1, QSE Ancillary Service Performance Standards, shall be required to reserve capacity that may also be used to provide Primary Frequency Response. |

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| [NPRR863: Insert paragraph (2) below upon system implementation:]  (2) Generation Resources, ESRs, SOTGs, and SOTSGs that do not have an RRS or Regulation Service Ancillary Service Resource Responsibility shall set their Governor Dead-Band no greater than ±0.036 Hz from nominal frequency of 60 Hz. A Generation Resource, SOTG, or SOTSG that widens its Governor Dead-Band greater than what is prescribed in Nodal Operating Guide Section 2.2.7, Turbine Speed Governors, must update its Resource Registration data with the new dead-band value. |

8.5.1.2 Reporting

(1) Each Resource Entity shall conduct applicable Governor tests on each of its Generation Resources and ESRs as specified in the Operating Guides. The Resource Entity shall provide test results and other relevant information to ERCOT. ERCOT shall make these results available to the Transmission Service Providers (TSPs).

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| [NPRR963: Replace paragraph (1) above with the following upon system implementation:]  (1) Each Resource Entity shall conduct applicable Governor tests on each of its Generation Resources and Energy Storage Resources (ESRs) as specified in the Operating Guides. The Resource Entity shall provide test results and other relevant information to ERCOT. ERCOT shall make these results available to the Transmission Service Providers (TSPs). |

(2) Generation Resource and ESR Governor modeling information required in the ERCOT planning criteria must be determined from actual Generation Resource or ESR testing described in the Operating Guides. Within 30 days of ERCOT’s request, the results of the latest test performed must be supplied to ERCOT and the connected TSP.

(3) Each QSE shall inform ERCOT as soon as practical when notified by its On-Line Generation Resource, ESR, SOTG, or SOTSG of the Governor being out-of-service. The QSE shall supply related logs to ERCOT upon request.

(4) If a Generation Resource or ESR trips Off-Line during a disturbance, as defined by the North American Electric Reliability Corporation (NERC), while providing Primary Frequency Response, the QSE shall report the cause of the failure to ERCOT as soon as the cause has been identified.

8.5.2 Primary Frequency Response Measurements

(1) ERCOT, with the assistance of the appropriate Technical Advisory Committee (TAC) subcommittee, shall analyze the performance of Generation Resources, ESRs, SOTGs, SOTSGs, Resources capable of Fast Frequency Response (FFR), and Controllable Load Resources for all Frequency Measurable Events (FMEs) in accordance with the Operating Guides. In support of this analysis, ERCOT shall post the following:

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| [NPRR963: Replace paragraph (1) above with the following upon system implementation:]  (1) ERCOT, with the assistance of the appropriate Technical Advisory Committee (TAC) subcommittee, shall analyze the performance of Generation Resources, ESRs, SOTGs, SOTSGs, Resources capable of Fast Frequency Response (FFR), and Controllable Load Resources for all Frequency Measurable Events (FMEs) in accordance with the Operating Guides. In support of this analysis, ERCOT shall post the following: |

(a) ERCOT shall post on the Market Information System (MIS) Public Area the occurrence of an FME within 14 calendar days of occurrence.

(b) ERCOT shall post on the MIS Certified Area for Performance, Disturbance, Compliance Working Group (PDCWG) analysis, the Primary Frequency Response Unit Performance for each Generation Resource, ESR, SOTG, SOTSG, and Controllable Load Resource that is measured in the FME.

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| [NPRR963: Replace paragraph (b) above with the following upon system implementation:]  (b) ERCOT shall post on the MIS Certified Area for Performance, Disturbance, Compliance Working Group (PDCWG) analysis, the Primary Frequency Response Unit Performance for each Generation Resource, ESR, SOTG, SOTSG, and Controllable Load Resource that is measured in the FME. |

(c) ERCOT shall post on the MIS Public Area a monthly report that displays the frequency response of the ERCOT System for a rolling average of the last six FMEs.

(d) ERCOT shall post on the MIS Public Area an annual report that displays the minimum frequency response computation methodology of the ERCOT System.

(e) ERCOT shall post on the MIS Certified Area the Primary Frequency Response 12-month rolling average for each Generation Resource, ESR, SOTG, SOTSG, Resource capable of FFR, and Controllable Load Resource.

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| [NPRR963: Replace paragraph (e) above with the following upon system implementation:]  (e) ERCOT shall post on the MIS Certified Area the Primary Frequency Response 12-month rolling average for each Generation Resource, ESR, SOTG, SOTSG, Resource capable of FFR, and Controllable Load Resource. |

8.5.2.1 ERCOT Required Primary Frequency Response

(1) All Generation Resources, ESRs, SOTGs, SOTSGs, and Controllable Load Resources shall provide Primary Frequency Response in accordance with the requirements established in the Operating Guides.

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| [NPRR963: Replace paragraph (1) above with the following upon system implementation:]  (1) All Generation Resources, ESRs, SOTGs, SOTSGs, and Controllable Load Resources shall provide Primary Frequency Response in accordance with the requirements established in the Operating Guides. |

(2) ERCOT shall evaluate, with the assistance of the appropriate TAC subcommittee, Primary Frequency Response during FMEs. The actual Generation Resource or ESR response must be compiled to determine if adequate Primary Frequency Response was provided.

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| [NPRR963: Replace paragraph (2) above with the following upon system implementation:]  (2) ERCOT shall evaluate, with the assistance of the appropriate TAC subcommittee, Primary Frequency Response during FMEs. The actual Generation Resource or ESR response must be compiled to determine if adequate Primary Frequency Response was provided. |

(3) ERCOT and the appropriate TAC subcommittee shall review each FME, verifying the accuracy of data. Data that is in question may be requested from the QSE for comparison or individual Generation Resource or ESR data may be retrieved from ERCOT’s database.

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| [NPRR963: Replace paragraph (3) above with the following upon system implementation:]  (3) ERCOT and the appropriate TAC subcommittee shall review each FME, verifying the accuracy of data. Data that is in question may be requested from the QSE for comparison or individual Resource data may be retrieved from ERCOT’s database. |