## **Stakeholder Feedback on Response Reserve Service (RRS) Primary Frequency Response (PFR) Limit Study**

Below is the feedback that was received following the discussion on the topic “Update on RRS PFR Limit Study” at the Performance, Disturbance and Compliance Working Group (PDCWG) meeting held on February 16, 2022. Also included are ERCOT’s responses to the specific concerns raised.

ERCOT is currently targeting to provide details of studies conducted, assumptions made, observations and recommendations if any as a part of this effort around May/June 2022 timeframe. ERCOT will coordinate with leadership from PDCWG, Wholesale Market Working Group (WMWG) and Inverter Based Resources Task Force (IBFRTF) to host a joint meeting for the next update on this study.

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*I am a bit surprised, but not disappointed, at what seems to be the broad scope of the GE study. I do want to have a better idea of the intent of the study and the study assumptions. I am also concerned about spending money with GE on issues we don’t need to have covered in ERCOT.*

*My key issue is that it might be useful for stakeholders to opine on the assumptions to be used for the individual study cases. Some concerns that I have:*

1. *ERCOT routinely turns off frequency response (governor action) for all generators not providing RRS in the study; it seems critical, for these studies to properly represent actual operational expectations at all times. IBRs provide excellent PFR at all times within the headroom/footroom available. If we are worried about Instabilities? (E.g. oscillations, load shedding, interactions) then, representing the full control system landscape seems critical.*
2. *Resilient? (e.g., vulnerable to single point of failure) needs to be modelled in some detail. All resources have a breaker and transformer connection to the transmission system; but, behind the breaker things are quite different. It is hard to find any additional failure modes for IBRs that can result in a full loss of capacity; there are many for conventional units.*

*Excerpt:*

*Systemic risks*

1. *Frequency response obligation met*
2. *Instabilities? E.g. oscillations, load shedding, interactions*
3. *Resilient? e.g., vulnerable to single point of failure*

*Other risks*

1. *Modeling risk? e.g. shortcomings w/generic models*
2. *Torsional risks*
3. *Protection risk*

*A problem statement as well as the objective/purpose of the study needs to be stated. In particular:*

1. *ERCOT has had a long standing requirement that ALL resources provide PFR, with some exceptions (nuclear, older wind power, combined cycle augmented capacity, combined cycle steam turbines). Resources in ERCOT are not required to reserve capacity in either direction in order to provide PFR unless paid to do so (AS award). Today all IBRs in ERCOT are required to provide PFR at all times when connected and the resource is capable of producing power or, for batteries, also when capable of charging.*

*Is the study now going to explore weather or not this is a good practice? Are we concerned about Instabilities, interactions, or oscillations (Systemic risks #2)? Have we ever seen any of these problems with current practice?*

*A problem statement and/or objective/purpose of study would help here.*

1. *Does the study include Sub Synchronous Oscillation/Interaction evaluation (Other risks #4)? Do we need more study on this issue?*
2. *What is Protection risk? Have the TSPs not adjusted already to the tens of thousands of MW of IBRs in ERCOT for over two decades?*
3. *(Other risks #4), Is this to reaffirm that ERCOT ALREADY has the right, new modeling requirements? Is this to focus on the need of owners/vendors to submit models in accordance with ERCOT specifications? What is the objective?*

*I guess my basic issue here is that it sounds like we may be studying things that were problems in the infancy of IBR integration; spending more time and money on these should be justified (problem statement and/or objective/purpose of study).*

*Please provide the intended meaning of the following:*

1. *Droop gain (is this ramp rate?)*
2. *New monitoring metrics (e.g. Kt, Rfrac, etc)*
3. *Site specific gain limits*
4. *Transient gains limited*

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## **ERCOT Response**

Following contains responses to the specific concerns that have been raised above.

1. *ERCOT routinely turns off frequency response (governor action) for all generators not providing RRS in the study; it seems critical, for these studies to properly represent actual operational expectations at all times.*

**(ERCOT Response)** Responsive Reserve Service (RRS) studies have been designed to identify minimum requirements that will keep ERCOT compliant with its obligation under NERC’s BAL-003 standard under all possible operating scenarios. The studies conducted as a part of this effort will utilize a setup that best represents the operational setup for the issue being tested. At this point, the project team (combination of staff from GE and ERCOT) expects that a study setup similar to ERCOT’s current RRS studies will be used for most issues.

1. *IBRs provide excellent PFR at all times within the headroom/footroom available. If we are worried about Instabilities? (E.g. oscillations, load shedding, interactions) then, representing the full control system landscape seems critical.*

**(ERCOT Response)** The focus of this study is on RRS that is provided using Primary Frequency Response i.e. RRS-PFR and what risks if any may inhibit compliance with NERC requirements. In this vein, studies will utilize models that best represent the issue being tested. At this point, the team does not anticipate the need to incorporate models for the full control system of Inverter Based Resources (IBRs).

1. *Resilient? (e.g., vulnerable to single point of failure) needs to be modelled in some detail. All resources have a breaker and transformer connection to the transmission system; but, behind the breaker things are quite different. It is hard to find any additional failure modes for IBRs that can result in a full loss of capacity; there are many for conventional units.*

**(ERCOT Response)** Thank you for these insights. Through this, the project team understands that there is at least one mode of failure that may result in loss of the entire resource regardless of type i.e. an IBRs (ex. loss of whole facility due to transmission issue, loss of state-of-charge etc.) or a conventional resource. At this point, the team anticipates using the resource models ERCOT already has along with a version of an N-1 resource contingency to setup scenarios that test this issue.

1. *ERCOT has had a long standing requirement that ALL resources provide PFR, with some exceptions (nuclear, older wind power, combined cycle augmented capacity, combined cycle steam turbines). Resources in ERCOT are not required to reserve capacity in either direction in order to provide PFR unless paid to do so (AS award). Today all IBRs in ERCOT are required to provide PFR at all times when connected and the resource is capable of producing power or, for batteries, also when capable of charging. Is the study now going to explore whether or not this is a good practice? Are we concerned about Instabilities, interactions, or oscillations (Systemic risks #2)? Have we ever seen any of these problems with current practice? A problem statement and/or objective/purpose of study would help here.*

**(ERCOT Response)** The focus of this study is solely to determine what if any reliability reasons exist that may drive the need for a limit on the provision of RRS using Primary Frequency Response (PFR) i.e. RRS-PFR on an individual Resource, a Resource group, technology type or system level. Based on feedback from the PDCWG on this topic, ERCOT had issued a request for proposal (RFP) with following broad scope. This scope was also presented at the [December 2020](https://www.ercot.com/files/docs/2020/12/08/RRS_Limits_RFP_v8.0.pptx) and [January 2021](https://www.ercot.com/files/docs/2021/01/14/update_RRS_limit_2021_0113_v6.2.pptx) PDCWG meeting. It is important to note that based on Stakeholder feedback, this study has been commissioned to take a broad, technology-neutral perspective when determining the need for a limit.



In the presentation that GE made at the [February 2022](https://www.ercot.com/files/docs/2022/02/16/GE-ERCOT%20PFR%20Study%20PDCWG%202-16.pdf) PDCWG meeting, GE shared highlights of the process for this study and the key deliverables along with expected timelines. As a part of its presentation, in keeping with the broad scope of the study, GE also shared its initial hypothesis on some risk areas that may drive the need for PFR limit(s). It is crucial to note that as the work on this study progresses, the project team is actively working on scoping scenarios that will focus on the risk areas that are relevant to and align with current grid operations and practices.

1. *Does the study include Sub Synchronous Oscillation/Interaction evaluation (Other risks #4)? Do we need more study on this issue?*

**(ERCOT Response)** This project will not study whether the PFR response delivered by inverter-based resources can cause some sub-synchronous oscillations for some nearby thermal resources because this is addressed by another system planning study.

1. *What is Protection risk? Have the TSPs not adjusted already to the tens of thousands of MW of IBRs in ERCOT for over two decades?*

**(ERCOT Response)** “Protection risk” is a general category that the project team will keep in mind when evaluating case results, associated with risk of over/underfrequency, over/under voltage tripping or other protection modalities.

1. *(Other risks #4 viz. Modeling risk), Is this to reaffirm that ERCOT ALREADY has the right, new modeling requirements? Is this to focus on the need of owners/vendors to submit models in accordance with ERCOT specifications? What is the objective?*

**(ERCOT Response)** The purpose of calling out this risk is to test whether there is a deficiency in modeling of PFR in the models that are commonly being used by ERCOT resources.

1. *I guess my basic issue here is that it sounds like we may be studying things that were problems in the infancy of IBR integration; spending more time and money on these should be justified (problem statement and/or objective/purpose of study).*

**(ERCOT Response)** The focus of this study is to examine the potential issues that may limit the provision of RRS-PFR. When applicable the latest IBR models will be used in this study. However, the focus of this study is not to examine the validity of these models but to study the impact of the responses delivered from these models.

1. *Please provide the intended meaning of the following:*
2. *Droop gain (is this ramp rate?)*

**(ERCOT Response)** The droop setting of governor response (1% to 5%)

1. *New monitoring metrics (e.g. Kt, Rfrac, etc)*

**(ERCOT Response)** The portion that participates in primary frequency control is the responsive fraction or Rfrac, and the portion that does not participate is the non-responsive fraction or Nfrac. Kt is one of parameters used in the governor model.

1. *Site specific gain limits*

**(ERCOT Response)** The study will look to determine is there is a need to set RRS-PFR response limits (these limits typically drive the droop response settings) to be site specific.

1. *Transient gains limited*

**(ERCOT Response)** Some controllers can dynamically set their gain during the transient. This is out of the scope for this project.