Date:	January 28, 2025
To:	Board of Directors
From:	Julie England, Reliability and Markets (R&M) Committee Chair
Subject:	Recommendation regarding 2025 ERCOT Methodologies for Determining Minimum Ancillary Service Requirements

Issue for the ERCOT Board of Directors

ERCOT Board of Directors Meeting Date: February 4, 2024
Item No.: 9.3.5

Issue: Whether the Board of Directors (Board) of Electric Reliability Council of Texas, Inc. (ERCOT) should endorse the proposed update to the 2025 ERCOT Methodologies for Determining Minimum Ancillary Service Requirements (Updated 2025 AS Methodology) as presented in ***Attachment A***, to be effective upon implementation of NPRR 1257, Limit on Amount of RRS a Resource can Provide Using Primary Frequency Response (NPRR1257).

Background/History:
NPRR1257 updates paragraph (3) of Section 3.16, Standards for Determining Ancillary Service Quantities. Specifically, NPRR1257 requires ERCOT to determine via studies the maximum amount of Responsive Reserve Service (RRS) that an individual Resource can provide using Primary Frequency Response (PFR) (RRS-PFR-limit). Further, paragraph (3) requires the ERCOT Board to review and recommend approval of ERCOT's methodology for determining the minimum Ancillary Service requirements.

ERCOT staff previously presented the 2025 ERCOT Methodologies for Determining Minimum Ancillary Service Requirements (2025 AS Methodology) to the Board on October 10, 2024, for which the Board unanimously recommended approval with an effective date of January 1, 2025, as requested. The PUCT approved the 2025 AS Methodology unanimously at its November 21, 2024, open meeting.

The primary changes in the Updated 2025 AS Methodology in comparison to 2025 AS Methodology are related to the amount of RRS a Resource can provide using PFR. As shown in ***Attachment A***, ERCOT proposes to document in the Updated 2025 AS Methodology a limit of 157 megawatts (MW) on the amount of RRS that a Resource can provide using PFR. No change has been proposed to the requirements determination methodologies used to compute RRS, or to compute Regulation Service, ERCOT Contingency Reserve Service (ECRS), or Non-Spinning Reserve (Non-Spin) Service.

On January 22, 2025, the Technical Advisory Committee (TAC) unanimously endorsed the proposed Updated 2025 AS Methodology. The Reliability and Markets (R&M) Committee is expected to review the Updated 2025 AS Methodology at its meeting on

February 3, 2025, and is expected to recommend the Board to endorse the proposed Updated 2025 AS Methodology to be effective upon implementation of NPRR1257.
Key Factors Influencing Issue: RRS is procured to ensure sufficient response is available to meet ERCOT's frequency response requirements under North American Electric Reliability Corporation's (NERC) Reliability Standard BAL-003, specifically, to ensure that enough capacity is available such that Under-Frequency Load Shed (UFLS) is not triggered in the event of the loss of the two largest Resources in the ERCOT Region, totaling 2,805 MW. Failure of a Resource that is carrying an RRS obligation to respond during a frequency event will degrade system frequency response and could increase the risk of triggering UFLS that might not otherwise occur. To minimize reliability impact resulting from failure to perform, NPRR1257 proposes that ERCOT establish a maximum limit on the amount of RRS-PFR that any individual Resource can provide and reevaluate annually. ERCOT has performed studies at various inertia levels to determine the frequency response degradation due to the failure of any single Resource providing RRS-PFR at various MW levels. Based on these studies, ERCOT is proposing to set 157 MW as the maximum limit on the amount of RRS-PFR that any individual Resource can provide. With this limit, in case of an event where 2,805 MW of supply trip, failure to perform from a single RRS-PFR Resource is not expected to trigger UFLS under a variety of historic inertia conditions while providing sufficient margin in the procured frequency reserves to react to other balancing issues that can also occur simultaneously. On January 22, 2025, TAC unanimously recommended for approval NPRR1257 and related Nodal Operating Guide Revision Request 271 (NOGRR271) and unanimously endorsed the proposed Updated 2025 AS Methodology.
Conclusion/Recommendation: ERCOT staff recommends, and the R&M Committee is expected to recommend, that the Board endorse the proposed updated 2025 ERCOT Methodologies for Determining Minimum Ancillary Service Requirements, attached as ***Attachment A***, as endorsed by TAC, to be effective on the first day of the month after PUCT's approval of NPRR1257.

ELECTRIC RELIABILITY COUNCIL OF TEXAS, INC.
BOARD OF DIRECTORS RESOLUTION

WHEREAS, Protocol Section 3.16 requires that the Board of Directors (Board) of Electric Reliability Council of Texas, Inc. (ERCOT), review and recommend approval of the ERCOT methodology for determining the minimum Ancillary Service requirements;

WHEREAS, Protocol Section 3.16 requires, prior to implementation, approval by the Public Utility Commission of Texas (PUCT) of any Board recommendation for determining the minimum Ancillary Service requirements;

WHEREAS, the Reliability and Markets (R&M) Committee has reviewed and recommends the Updated 2025 ERCOT Methodologies for Determining Minimum Ancillary Service Requirements (Updated 2025 AS Methodology) recommended by ERCOT staff and as endorsed by the Technical Advisory Committee (TAC), as set forth in ***Attachment A***, to be effective upon implementation of NPRR 1257, Limit on Amount of RRS a Resource can Provide Using Primary Frequency Response; and

WHEREAS, after due consideration of the alternatives, the Board deems it desirable and in the best interest of ERCOT to recommend approval of the Updated 2025 AS Methodology;

THEREFORE, BE IT RESOLVED, that the ERCOT Board hereby recommends the PUCT authorize and approve ERCOT to implement the Updated 2025 AS Methodology, as set forth in ***Attachment A***, as endorsed by TAC, to be effective upon implementation of NPRR 1257, Limit on Amount of RRS a Resource can Provide Using Primary Frequency Response.

CORPORATE SECRETARY'S CERTIFICATE

I, Chad V. Seely, Corporate Secretary of ERCOT, do hereby certify that, at its February 4, 2025 meeting, the Board passed a motion approving the above Resolution by ______.

IN WITNESS WHEREOF, I have hereunto set my hand this ___ day of ______________, 2025.

____
Chad V. Seely
Corporate Secretary

ERCOT Methodologies for Determining Minimum Ancillary Service Requirements

ERCOT Board Recommended approval on ~~10/10/2024~~TBD

PUC Approved on TBD~~11/21/2024~~

Effective Date of TBD~~1/1/2025~~

TABLE OF CONTENTS

Introduction

Paragraph (2) of Protocol Section 3.16, Standards for Determining Ancillary Service Quantities, requires that methodologies for determining the amounts of Ancillary Services to be required by ERCOT must be developed at least annually. Paragraph (3) of Protocol Section 3.16 requires review of this methodology by the ERCOT Board of Directors and approval by the Public Utility Commission of Texas (PUCT).

This document discusses the various Ancillary Services for which requirements are to be developed. Further, detailed methodologies for determining those requirements are included as part of this document.

Specifically, methodologies are required for the determination of the quantities of Regulation Service, ERCOT Contingency Reserve Service (ECRS), Non-Spinning Reserve (Non-Spin) and Responsive Reserve (RRS) that are required to maintain system reliability. Those procedures are discussed below.

These procedures are intended for determining each of the Ancillary Service requirements for all months of the upcoming year. This procedure will be performed annually. The Ancillary Service requirements are determined annually and will be posted to the Market Information System (MIS) by December 20th for the upcoming year. If necessary, any additional incremental adjustment to the posted Ancillary Service requirements for a particular month will be made using this procedure and will be posted to the MIS prior to the 20th of each month for the upcoming month. If the Ancillary Service requirements identified through this process for a particular operating day are found to be insufficient based on the expected operating conditions for that day, ERCOT may make an updated Ancillary Service requirements posting for that day if the need for incremental adjustments is identified day-ahead and may use the Supplemental Ancillary Service Market (SASM) process for similar adjustments made closer to Real-Time. For any additional months for which ERCOT is required to provide an Ancillary Service requirement forecast, the forecasted requirement will be set to the historical requirement for the same month of the previous year.

Regulation Service Requirement Details

Introduction

Regulation Service consists of resources that can be deployed by ERCOT in response to changes in ERCOT System frequency to maintain the target ERCOT System frequency within predetermined limits according to the Operating Guides. ERCOT is required to evaluate normal requirements for Reg-Up Service and Reg-Down Service on an annual basis. It is ERCOT's practice to use historical rates of Regulation Service usage to perform evaluation and determine the required quantities for this service. Regulation Service is deployed in order to correct actual frequency to scheduled frequency and to ensure North American Electric Reliability Corporation (NERC) requirements are met.

Summary

The Regulation Service requirements are calculated with the expectation that sufficient Regulation Service will be available to cover the 95th percentile of deployed regulation or net load variability. An adjustment may also be made based on historic CPS1 performance.

Procedure

To evaluate Regulation Service requirements, ERCOT will collect historical Resource Registration information, CPS1 data, Regulation Service deployment data, and ERCOT system load data. For determining the base Reg-Up requirements for a particular hour, ERCOT will calculate the 95th percentile of the positive net load (load – wind – solar) forecast error for the same month of the previous two years. For determining the base Reg-Down requirements, ERCOT will calculate the 95th percentile of the negative net load (load – wind – solar) forecast error for the same month of the previous two years. To better reflect balancing needs within the hours, the net load variability may be updated to account for accumulated Area Control Error (ACE).

In order to consider the increased amount of wind and solar penetration, ERCOT will calculate the increase in installed wind and solar generation capacity, respectively. Then, depending on the month of the year and the hour of the day, ERCOT will add incremental MWs that are derived using the wind and solar forecast error adjustment tables and associated increase in wind and solar generation capacity, to the values determined above. The wind and solar forecast error adjustment tables for incremental MWs for Reg-Up and Reg-Down come from the study ERCOT performs annually, using similar techniques as the 2008 GE wind study, but using actual wind and solar data respectively. The increase in wind (or solar) generation capacity will be calculated by taking the total nameplate capacity of wind (or solar) resources in the ERCOT network model at the time of the procurement study and subtracting out the total nameplate capacity of wind (or solar) resources in the ERCOT model at the end of the month being studied from the previous year.

ERCOT will post these monthly amounts for Regulation Service requirements for the upcoming year on the MIS.

If any incremental changes to the annually posted amounts are needed then the revised amounts for the following month will be posted to the MIS prior to the 20th of the current month. ERCOT may include adjustments for hours in a month considering monthly average for CPS1 and 12-month rolling average CPS1 scores. If it is determined that during the course of the year that the ERCOT monthly average for CPS1 score was less than 140% for a specific month, ERCOT will apply an extra 10% of both Reg-Up and Reg-Down for hours in which the CPS1 score was less than 140%. Additionally, if the ERCOT 12-month rolling average CPS1 score is less than 140%, for the next month ERCOT will procure an extra 10% of both Reg-Up and Reg-Down for hours in which the hourly CPS1 score was less than 140%. This value will increase to 20% if the CPS1 score falls below 100%.

Non-Spinning Reserve (Non-Spin) Requirement Details

Introduction

Non-Spinning Reserve (Non-Spin) consists of Generation Resources capable of being ramped to a specified output level within 30 minutes or Controllable Load Resources that are capable of being interrupted within 30 minutes and that are capable of running (or being interrupted) at a specified output level for at least four consecutive hours. Non-Spin may also be provided by Load Resources that are not Controllable Load Resources and are capable of reducing consumption based on an ERCOT Extensible Markup Language (XML) instruction within 30 minutes and maintaining that deployment until recalled. Non-Spin may be deployed to replace loss of generating capacity, to compensate for Load forecast and/or forecast uncertainty on days in which large amounts of reserve are not available online, to address the risk of net load ramp, or when there is a limited amount of capacity available for Security-Constrained Economic Dispatch (SCED).

The periods when load is increasing and wind and/or solar are decreasing requires other generation resources to increase output or come online quickly to compensate for the sudden net load increases. As a result, net load ramp risk should be accounted for in the determination of Non-Spin requirements. While net load forecast analysis may cover reserves required for forecast uncertainty, it may not necessarily cover exposure to the loss of generation and net load ramp risk. Due to this risk, it may be necessary for ERCOT to have additional reserves available to protect against forecast uncertainty and Forced Outages of thermal Resources within an Operating Day.

Summary

Analysis for Non-Spin requirements are conducted using data from the same month of previous three years. For the purpose of determining the amount of Non-Spin to purchase for each hour of the day, hours will be placed into 4-hour blocks. The net load uncertainty for the analyzed days for all hours which are considered to be part of a 4-hour block will be calculated and a percentile will be assigned to this block of hours based on the risk of net load ramp. The same calculation will be done separately for each block. The Non-Spin requirement for the month for each block is calculated using the assigned percentile (based on risk of net load ramp) for the block minus the average Reg-Up requirement during the same block of hours ("Non-Spin block"). The Non-Spin requirement for each hour in the month is calculated by adding an adjustment that accounts for intra-day Forced Outage of thermal Resources to the previously calculated "Non-Spin block" quantity that the hour falls in.

ERCOT will post the monthly amounts for Non-Spin requirements for the upcoming year on the MIS. Following this posting, ERCOT will monitor the weather and net load forecast (i.e. load, wind and solar forecasts) near Real-Time and may procure up to an additional 1,000 MW of Non-Spin for Operating Hours that are (a) identified as having an increased potential of high forecast variability, (b) there is a risk that the actual net load during these Operating Hours could be higher than forecast (after making appropriate forecast model selection) and (c) the expected available capacity and expected reserves including the posted minimum Non-Spin requirements during these Operating Hours is not sufficient to cover the projected net load forecast uncertainty risk.

The minimum amount of Non-Spin procured from SCED dispatchable Resources in any hour shall not be less than ERCOT's Most Severe Single Contingency (MSSC) value.

Procedure

ERCOT will determine the Non-Spin requirement using the 75th to 95th percentile of hourly net load uncertainty from the same month of the previous three years. Net load is defined as the ERCOT load minus the estimated un-curtailed total output from Intermittent Renewable Resource (IRR), which includes both Wind-powered Generation Resources (WGRs) and Photo-Voltaic Generation Resources (PVGR) at a point in time. The forecast of net load is computed by subtracting the aggregate IRR High Sustained Limits (HSLs) in the Current Operating Plans (COPs) from the Mid-Term Load Forecast (MTLF). The COPs and MTLF used for HE23, HE24, HE01 and HE02 are the updated values as of four hours prior to each Operating Hour. For remaining hours, the COPs and MTLF used are the updated values as of six hours prior to each Operating Hour. The net load uncertainty is then defined as the difference between the average 5-minute net load within the hour and the forecasted net load.

The risk of net load ramp is determined based on the change in net load over an hour divided by highest observed net load for the season. A fixed value of 68th percentile will be assigned to HE23, HE24, HE01 and HE02 to the net load forecast uncertainty calculated previously. Additionally, in all seasons excluding Winter, in hours HE03, HE04, HE05, HE06 a fixed value of 68th percentile will be assigned for the net load forecast uncertainty calculated previously. For the remaining hours, a fixed value of percentile ranging between 75th percentile and 95th percentile will be assigned to the net load forecast uncertainty calculated previously. Periods where the risk of net load ramp is highest will use 95th percentile and 75th percentile for periods with lowest risks.

ERCOT has seen significant growth in installed wind and solar capacity from one year to the next; an increase in wind and solar capacity also tends to increase the MW quantity of error in their respective forecasts. Hence, ERCOT's reliance on historical wind and solar forecast errors alone creates a possibility of under-estimation of the Non-Spin requirement.

To address this, ERCOT will include the impact of increase in over-forecast error from the expected growth in wind and solar generation installed capacity into the future Non-Spin requirement. The net wind impact is calculated by a multiplication of the projected wind capacity growth between the same month of current year and the next year, and incremental MW adjustment to Non-Spin value per 1000 MW of incremental wind generation capacity. The incremental MW wind adjustment to the Non-Spin value per 1000 MW increase in wind installed capacity is calculated as the change in 50th percentile of the historical wind over-forecast error for 4-hour blocks of each month in the past 5 years, which is then normalized to per 1000 MW of installed wind capacity. The net solar impact is calculated by a multiplication of the projected solar capacity growth between the same month of current year and the next year, and incremental MW adjustment to Non-Spin value per 1000 MW of incremental solar generation capacity. The incremental MW solar adjustment to the Non-Spin value per 1000 MW increase in solar installed capacity is calculated as the change in 50th percentile of the historical solar over-forecast error for 4-hour blocks of each month in the past 3 years, which is then normalized to per 1000 MW of installed solar capacity.

To account for increased capacity needs due to unplanned generation Outages that occur during an Operating Day, ERCOT will include an incremental adjustment in the Non-Spin requirements that accounts for intra-day Forced Outages of thermal Resources. This Forced Outage adjustment is calculated as the 75th percentile of the historical intra-day Forced Outages (accumulated since midnight) for six-hour blocks of each month in the past three years. ERCOT will purchase Non-Spin such that the combination of Non-Spin and Reg-Up Services cover the uncertainties of net load forecast errors depending on the net load ramp risk and intra-day Forced Outages.

Responsive Reserve (RRS) Requirement Details

Nodal Operating Guide Section 2.3.1.1, Obligation, sets the minimum RRS requirement for all hours under normal conditions. ERCOT will procure amounts of RRS that vary by hour of the day and by month. These RRS amounts will be published by month in six separate blocks covering four-hour intervals. These amounts will be based on expected diurnal load, solar, and wind patterns for the month, will cover 70% of historic system inertia conditions for each block of hours for the month, and will use the equivalency ratio for RRS between Load Resources and Generation Resources to establish the conditions for each block of hours. The equivalency ratio will be used to establish the total reserves assuming the Day-Ahead Market (DAM) will use a one to one equivalency ratio. The minimum level of RRS procured from Resources providing RRS using Primary Frequency Response shall be determined for each month by ERCOT through the use of studies and shall not be less than 1,365 MWs. The maximum amount of RRS using Primary Frequency Response that a single Resource can provide is limited to 157 MW. The remaining capacity required for RRS will be procured from all Resources qualified to provide RRS including Load Resources. The maximum amount of RRS that can be provided by Resources providing Fast Frequency Response (FFR) is limited to 450 MW. DAM will limit the combined RRS procured from Load Resources controlled by high set under frequency relay and Resources providing FFR to 60% of the total RRS requirement. ERCOT may increase the minimum capacity required from Resources providing RRS using Primary Frequency Response if it believes that the current posted quantity will have a negative impact on reliability or if it would require additional Regulation Service to be deployed. ERCOT will procure additional 200 MW of RRS for each percent of Reserve Discount Factor (RDF) when ERCOT estimates RDF to be less than 1. This adjustment will only apply for those 4-hour blocks where the 85th percentile of weighted average temperate is greater than 95°F. RDFs are reviewed and adjusted based on the generators performance during an unannounced test. RRS amount will be published as a monthly requirement along with the equivalency ratio for each 4-hour block. Additionally, ERCOT will make incremental adjustments to account for Resources operating in synchronous condenser fast response mode providing RRS. This adjustment will only apply to those 4-hour blocks when system inertia is typically expected to be less than 250 GW*s. ERCOT will post these monthly amounts for the upcoming year on the MIS. These annually published amounts are the minimum quantity that will be procured in the DAM for each hour of the year.

Self-arranged RRS used to fulfill a Qualified Scheduling Entity’s (QSE’s) RRS requirement will be limited to 60% from Resources providing FFR and Load Resources excluding Controllable

Load Resources.

If the percentage level for Resources providing FFR and Load Resources, excluding Controllable Load Resources, specified in the Protocols is changed, that change will be reflected in these requirements.

ERCOT Contingency Reserve Service (ECRS) Details

Introduction

ECRS is a service that is provided using capacity that is capable of being ramped to a specified output level within 10 minutes. ECRS may be provided by unloaded, On-Line Generation Resource capacity; Quick Start Generation Resources (QSGRs); Load Resources that may or may not be controlled by high-set, underfrequency relays; Controllable Load Resources; and Generation Resources operating in synchronous condenser fast-response mode as defined in the Operating Guides. ECRS may be deployed to restore frequency within 10 minutes of a significant frequency deviation to recover deployed Regulation Service, to compensate for intra-hour net load forecast uncertainty and variability on days in which large amounts of online thermal ramping capability is not available, or when there is a limited amount of capacity available for Security-Constrained Economic Dispatch (SCED).

Procedure

ERCOT will procure amounts of ECRS that vary by hour of the day and by month. ERCOT will determine the ECRS requirement as the maximum of capacity needed to recover frequency following a large unit trip and capacity needed to cover for intra-hour net load forecast errors.

The frequency recovery related capacity for ECRS is computed for each hour in every month as capacity needed following a supply-side trip to recover frequency; will be based on expected diurnal load, solar, and wind patterns; will cover 70% of historic system inertia conditions for each hour for the month and will include an adjustment to account for Regulation Up requirement in the hour.

Intra-hour net load forecast is utilized in establishing Base Points for SCED dispatchable Resources. ERCOT has observed larger intra-hour net load forecast errors during times when there are sudden net load ramps. Through including intra-hour net load forecast errors in calculating ECRS quantities, uncertainty in forecasting intra-hour net load (and hence intra-hour net load ramps) will be accounted for. Specifically, the intra-hour net load forecast error related capacity for ECRS is computed using the 85^{th} to 95^{th} percentile of intra-hour net load uncertainty from the same hour and same month in the previous two years. Net load is defined as the ERCOT load minus the estimated un-curtailed total output from Intermittent Renewable Resource (IRR), which includes both Wind-powered Generation Resources (WGRs) and Photo-Voltaic Generation Resources (PVGR). The forecast of net load is computed by subtracting the Intra-Hour Wind Power Forecast (IHWPF) and Intra-Hour Photo Voltaic Power Forecast (IHPPF) from the Intra-Hour Load Forecast (IHLF). The IHWPF, IHPPF and IHLF used are the updated values as of thirty minutes prior to each Security Constrained Economic Dispatch (SCED) interval. The net load uncertainty is then defined as the difference between the average net load within the SCED interval and the forecasted net load.

The risk of net load ramp is determined based on the change in net load over an hour divided by highest observed net load for the season. The fixed value of percentile ranging between 85th percentile and 95th percentile will be assigned to the net load forecast uncertainty calculated previously. Periods where the risk of net load ramp is highest will use 95th percentile and 85th percentile for periods with lowest risks.

ERCOT has seen significant growth in installed solar capacity from one year to the next; an increase in solar capacity also tends to increase the MW quantity of error in their respective forecasts. Hence, ERCOT's reliance on historical solar forecast errors alone creates a possibility of under-estimation of the ECRS requirement. To address this, ERCOT will include the estimated impact of increase in over-forecast error from the expected growth in solar generation installed capacity into the future ECRS requirement. The net solar impact is calculated by a multiplication of the projected solar capacity growth between the same month of current year and the next year, and incremental MW adjustment to ECRS value per 1000 MW of incremental solar generation capacity. The incremental MW solar adjustment to the ECRS value per 1000 MW increase in solar installed capacity is calculated as the change in 50th percentile of the historical solar over-forecast error for 4-hour blocks of each month in the past 2 years, which is then normalized to per 1000 MW of installed solar capacity.