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| NPRR Number | [1255](https://www.ercot.com/mktrules/issues/NPRR1255) | NPRR Title | ****Introduction of Mitigation of ESRs**** |
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| Date | | April 2, 2025 | |
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| Submitter’s Information | | | |
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| Cell Number | |  | |
| Market Segment | | Not Applicable | |

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| Comments |

ERCOT offers the following comments to the proposed mitigation framework for Energy Storage Resources (ESRs). This Nodal Protocol Revision Request (NPRR) introduces a dynamic, “just-in-time” mitigation framework that determines constraint contributions as a function of the maximum Shadow Price and the Shift Factor of the ESR in intervals when an ESR has been flagged for mitigation through the Security-Constrained Economic Dispatch (SCED) Constraint Competitiveness Test (CCT) process.

As part of the analysis to assess the impact of a “just-in-time” mitigation proposal, ERCOT ran a [[backcast](https://www.ercot.com/files/docs/2024/03/18/2024-03-esr-mitigation-proposal-impacts_cmwg.pptx)](https://www.ercot.com/files/docs/2024/03/18/2024-03-esr-mitigation-proposal-impacts_cmwg.pptx) using 2023 data. Mitigation would have impacted ~0.34% of intervals in that year and the vast majority (~95%) of those impacted intervals were for one hour or less.

ERCOT, in consultation with stakeholders, is proposing an additional refinement to this design to account for circumstances where the available stored energy of a resource for the next hour is less than 25%. In this case, the Mitigated Offer Cap (MOC) would revert to the System-Wide Offer Cap (SWCAP). The addition of an available energy ‘filter’ balances the need for an enduring ESR mitigation framework in the ERCOT market while making appropriate account for circumstances where the application of mitigation would be of limited operational benefit to resolving congestion because of the limited remaining energy.

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| Revised Cover Page Language |

None

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| Revised Proposed Protocol Language |

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| **Market Rules Notes** |

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

* NPRR1177, Enhance Exceptional Fuel Cost Process (unboxed 1/1/25)
  + Section 4.4.9.4.1
* NPRR1245, Additional Clarifying Revisions to Real-Time Co-Optimization (incorporated 2/1/25)
  + Section 4.4.9.4.1
* NPRR1246, Energy Storage Resource Terminology Alignment for the Single-Model Era (incorporated 4/1/25)
  + Section 3.8.5

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| **Proposed Protocol Language Revision** |

***3.8.5 Energy Storage Resources***

(1) For the purposes of all ERCOT Protocols and Other Binding Documents, all requirements that apply to Generation Resources and Controllable Load Resources shall be understood to apply to ESRs to the same extent, except where the Protocols explicitly provide otherwise.

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| ***[NPRR1246: Delete paragraph (1) above upon system implementation of the Real-Time Co-Optimization (RTC) project and renumber accordingly.]*** |

(2) A QSE representing an ESR may update the telemetered HSL and/or Maximum Power Consumption (MPC) for the ESR in Real-Time to ensure the ability to meet the ESR’s full Ancillary Service Resource Responsibility for the current Operating Hour. ERCOT shall adjust the ESR’s MOC curve as described in paragraph (1)(b) of Section 4.4.9.4.1, Mitigated Offer Cap.

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| ***[NPRR1075: Replace paragraph (2) above upon system implementation of the Real-Time Co-Optimization (RTC) project.]***  (2) ERCOT shall adjust the ESR’s MOC curve as described in paragraph (1)(b) of Section 4.4.9.4.1, Mitigated Offer Cap. |

(3) A QSE representing an ESR may update the telemetered HSL and/or MPC for the ESR in Real-Time to reflect state of charge limitations.

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| ***[NPRR1075: Replace paragraph (3) above with the following upon system implementation of NPRR1014:]***  (3) A QSE representing an ESR may update the telemetered HSL and/or LSL for the ESR in Real-Time to reflect state of charge limitations. |

(4) A QSE representing an ESR co-located with a Generation Resource may reduce the telemetered MPC of the Controllable Load Resource modeled to represent the charging side of the ESR when self-charging using output from the Generation Resource. Such reduction in MPC shall be equal to the MW level of self-charge.

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| ***[NPRR1075: Replace paragraph (4) above with the following upon system implementation of NPRR1014:]***  (4) A QSE representing an ESR co-located with a Generation Resource may update the telemetered LSL of the ESR when self-charging (using output from the Generation Resource). The updated LSL shall be equal to the MW level of self-charge. |

***4.4.9.4.1 Mitigated Offer Cap***

(1) Energy Offer Curves may be subject to mitigation in Real-Time operations under Section 6.5.7.3, Security Constrained Economic Dispatch, using a Mitigated Offer Cap (MOC). ERCOT shall construct an incremental MOC curve in accordance with Section 6.5.7.3 such that each point on the MOC curve is calculated as follows:

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| ***[NPRR1014: Replace paragraph (1) above with the following upon system implementation:]***  (1) Energy Offer Curves and Energy Bid/Offer Curves may be subject to mitigation in Real-Time operations under Section 6.5.7.3, Security Constrained Economic Dispatch, using a Mitigated Offer Cap (MOC). For Generation Resources, ERCOT shall construct an incremental MOC curve in accordance with Section 6.5.7.3 such that each point on the MOC curve is calculated as follows: |

MOC *q, r, h* = Max [GIHR *q, r* \* Max(FIP, WAFP *q, r, h*), (IHR *q, r* \* FPRC *q, r* + OM *q, r*)]

Where,

If a QSE has submitted an Energy Offer Curve on behalf of a Generation Resource and the Generation Resource has approved verifiable costs, then

FPRC *q, r* = Max(WAFP *q, r, h*, FIP + FA *q, r*) \* RTPERFIP *q, r* / 100 + FOP \* RTPERFOP *q, r* / 100

If a QSE has not submitted an Energy Offer Curve on behalf of a Generation Resource and the Generation Resource has approved verifiable costs, then

FPRC *q, r* = Max(WAFP *q, r, h*, FIP + FA *q, r*) \* GASPEROL *q, r* / 100 + FOP \* OILPEROL *q, r* / 100 + (SFP + FA *q, r*) \* SFPEROL *q, r* / 100

The above variables are defined as follows:

| **Variable** | **Unit** | **Definition** |
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| MOC *q, r, h* | $/MWh | *Mitigated Offer Cap per Resource*—The MOC for Resource *r*, for the hour. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| GIHR *q, r* | MMBtu/MWh | *Generic Incremental Heat Rate*—The generic, single-value, incremental heat rate. For Generation Resources with a Commercial Operations Date on or before January 1, 2004, the generic incremental heat rate shall be set to 10.5. For Generation Resources that have a Commercial Operations Date after January 1, 2004, this value shall be set to 14.5. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| IHR *q, r* | MMBtu/MWh | *Verifiable Incremental Heat Rate per Resource*—The verifiable incremental heat rate curve for Resource *r,* as approved in the verifiable cost process. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| FIP | $/MMBtu | *Fuel Index Price*—The natural gas index price as defined in Section 2.1, Definitions. |
| RTPERFIP *q, r* | none | *Fuel Index Price Percentage*—The percentage of natural gas used by Resource *r* to operate above LSL, as submitted with the energy offer curve. |
| FOP | $/MMBtu | *Fuel Oil Price*—The fuel oil index price as defined in Section 2.1. |
| RTPERFOP *q, r* | none | *Fuel Oil Price Percentage*—The percentage of fuel oil used by Resource *r* to operate above LSL, as submitted with the energy offer curve. |
| SFP | $/MMBtu | *Solid Fuel Price—*The solid fuel index price is $1.50. |
| FPRC *q, r* | $/MMBtu | *Fuel Price Calculated per Resource*—The calculated index price for fuel for the Resource based on the Resources fuel mix. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| GASPEROL *q, r* | none | *Percent of Natural Gas to Operate Above LSL*—The percentage of natural gas used by Resource *r* to operate above LSL, as approved in the verifiable cost process. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| OILPEROL *q, r* | none | *Percent of Oil to Operate Above LSL*—The percentage of fuel oil used by Resource *r* to operate above LSL, as approved in the verifiable cost process. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| SFPEROL *q, r* | none | *Percent of Solid Fuel to Operate Above LSL*—The percentage of solid fuel used by Resource *r* to operate above LSL, as approved in the verifiable cost process. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| FA *q, r* | $/MMBtu | *Fuel Adder*—The fuel adder is the average cost above the index price Resource *r* has paid to obtain fuel. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. See the Verifiable Cost Manual for additional information. |
| OM *q, r* | $/MWh | *Variable Operations and Maintenance Cost above LSL*—The O&M cost for Resource *r* to operate above LSL, including an adjustment for emissions costs, as approved in the verifiable cost process. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. See the Verifiable Cost Manual for additional information. |
| WAFP *q, r, h* | $/MMBtu | *Weighted Average Fuel Price*—The volume-weighted average intraday, same-day and spot price of fuel submitted to ERCOT during the Adjustment Period for a specific Resource and specific hour within the Operating Day, as described in paragraph (1)(d) below. |
| *q* | none | A QSE. |
| *r* | none | A Generation Resource. |
| *h* | none | The Operating Hour. |

(a) For a Resource contracted by ERCOT under paragraph (4) of Section 6.5.1.1, ERCOT Control Area Authority, ERCOT shall increase the O&M cost such that every point on the MOC curve is greater than the SWCAP in $/MWh.

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| ***[NPRR1008 and NPRR1014: Replace applicable portions of paragraph (a) above with the following upon system implementation of the Real-Time Co-Optimization (RTC) project for NPRR1008; or upon system implementation for NPRR1014:]***  (a) For a Resource contracted by ERCOT under paragraph (4) of Section 6.5.1.1, ERCOT Control Area Authority, ERCOT shall increase the O&M cost such that every point on the MOC curve is greater than the effective Value of Lost Load (VOLL) in $/MWh. |

(b) Notwithstanding the MOC calculation described in paragraph (1) above, the MOC for ESRs is calculated as follows:

(i) The ESR mitigation process considers all Non-Competitive Constraints as described in Section 3.19, Constraint Competitiveness Tests.  For each ESR that has been flagged for mitigation as part of the SCED Constraint Competitiveness Test (CCT) process, each Non-Competitive Constraint with a negative Shift Factor with a magnitude greater than 0.2 shall be considered.

(ii) If no such constraint exists or the ESR has not been flagged for mitigation, the MOC for the ESR shall be set at the SWCAP.

(iii) If an ESR is flagged for consideration but the available stored energy over the next hour, as defined below, is less than 25%, the MOC for the ESR shall be set at the SWCAP. Available stored energy for the next hour is determined using telemetered State of Charge (SOC) and High Sustained Limit (HSL) information and is calculated as:

Available stored energy = ((current SOC - MinSOC) / (HSL \* 1 hour)) \* 100

(iv) Otherwise, for each ESR flagged for consideration that does not meet the criterion above, the constraint contribution shall be calculated by multiplying the maximum Shadow Price by the Shift Factor of the ESR for each constraint defined in paragraph (i) above. The MOC for the ESR shall be set at the lowest absolute value of these constraint contributions plus the System Lambda of the first step in the two-step SCED process described in paragraph (10)(a) of Section 6.5.7.3 minus $0.01/MWh.

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| ***[NPRR1008 and NPRR1014: Replace applicable portions of paragraph (b) above with the following upon the system implementation of the Real-Time Co-Optimization (RTC) project for NPRR1008; or upon system implementation for NPRR1014:]***  (b) Notwithstanding the MOC calculation described in paragraph (1) above, the MOC for ESRs is calculated as follows:  (i) The ESR mitigation process considers all Non-Competitive Constraints as described in Section 3.19, Constraint Competitiveness Tests.  For each ESR that has been flagged for mitigation as part of the SCED Constraint Competitiveness Test (CCT) process, each Non-Competitive Constraint with a negative Shift Factor with a magnitude greater than 0.2 shall be considered.  (ii) If no such constraint exists or the ESR has not been flagged for mitigation, the MOC for the ESR shall be set at the RTSWCAP.  (iii) If an ESR is flagged for consideration but the available stored energy over the next hour, as defined below, is less than 25%, the MOC for the ESR shall be set at the SWCAP. Available stored energy for the next hour is determined using telemetered State of Charge (SOC) and High Sustained Limit (HSL) information and is calculated as:  Available stored energy = ((current SOC - MinSOC) / (HSL \* 1 hour)) \* 100  (iv) Otherwise, for each ESR flagged for consideration that does not meet the criterion above, the constraint contribution shall be calculated by multiplying the maximum Shadow Price by the Shift Factor of the ESR for each constraint defined in paragraph (i) above. The MOC for the ESR shall be set at the lowest absolute value of these constraint contributions plus the System Lambda of the first step in the two-step SCED process described in paragraph (10)(a) of Section 6.5.7.3 minus $0.01/MWh. |

(c) For Quick Start Generation Resources (QSGRs) the MOC shall be adjusted in accordance with Verifiable Cost Manual Appendix 7, Calculation of the Variable O&M Value and Incremental Heat Rate used in Real Time Mitigation for Quick Start Generation Resources (QSGRs).

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| ***[NPRR1008, NPRR1014, and NPRR1245: Insert applicable portions of paragraph (d) below upon system implementation of the Real-Time Co-Optimization (RTC) project for NPRR1008 and NPRR1245; or upon system implementation for NPRR1014; and renumber accordingly:]***  (d) For hydro Generation Resources, the MOC shall be adjusted in accordance with   Verifiable Cost Manual, Appendix 10, Setting the variables used in Mitigated   Offer Cap for Hydro Generating Resources. |

(d) During the Adjustment Period, a QSE representing a Resource may submit Exceptional Fuel Cost as a volume-weighted average fuel price for use in the MOC calculation for that Resource. To qualify as Exceptional Fuel Cost, the submission must meet the following conditions:

(i) For all Resources, the weighted average fuel price must exceed FIP for the applicable Operating Day, plus a threshold parameter value of $1/MMBtu, plus the applicable fuel adder. For Resources without approved verifiable costs, the fuel adder will be set to the default value assigned to Resources with approved verifiable costs, as defined in the Verifiable Cost Manual. The threshold parameter value in this paragraph shall be recommended by the Wholesale Market Subcommittee (WMS) and approved by the TAC. ERCOT shall update the threshold value on the first day of the month following TAC approval unless otherwise directed by the TAC. ERCOT shall provide a Market Notice prior to implementation of a revised parameter value.

(ii) Fixed cost (fees, penalties and similar non-gas costs) may not be included in the calculation of the weighted average fuel price.

(iii) All intra-day, same day, and spot fuel purchases must be included in the calculation of the weighted average fuel price in paragraph (1) above. These must account for at least 10% of the total fuel volume burned by the applicable Resource for the hour for which the weighted average fuel price is computed. As noted in paragraph (j) below, the methodology used in the allocation of the cost and volume of purchased fuel to the Resource for the hour is subject to validation by ERCOT.

(iv) Weighted average fuel prices must be submitted individually for each Operating Hour for which they are applicable. Values submitted outside of the Adjustment Period will be rejected and not used in the calculation of the MOC for the designated Operating Hour.

(e) ERCOT may notify the Independent Market Monitor (IMM) if a QSE submits an Exceptional Fuel Cost.

(f) The day following an Operating Day for which an Exceptional Fuel Cost is submitted, ERCOT shall post a report on the ERCOT website indicating the affected Operating Hours and the number of Resources for which a QSE submitted Exceptional Fuel Cost for a particular Operating Day.

(g) No later than 1700 Central Prevailing Time (CPT) on the 15th day following an Exceptional Fuel Cost submission, the submitting QSE shall provide ERCOT with the calculation of the weighted average fuel price, intraday or same-day fuel purchases, if applicable, and any available supporting documentation. Such information may include, but is not limited to, documents of the following nature: relevant contracts between the QSE or Resource Entity and fuel supplier, trade logs, transportation, storage, balancing and distribution agreements, calculation of the weighted average fuel price, or any other documentation necessary to support the Exceptional Fuel Cost price and volume for the applicable period(s).

(h) No later than 1700 Central Prevailing Time (CPT) on the 60th day following an Exceptional Fuel Cost submission, the submitting QSE shall provide ERCOT with all supporting documentation not previously provided to ERCOT. No supporting documentation will be accepted after the 60th day.

(i) The accuracy of submitted Exceptional Fuel Cost and the need for purchasing intraday or same-day gas must be attested to by a duly authorized officer or agent of the QSE representing the Resource. The attestation must be provided in a standardized format acceptable to ERCOT and submitted with the other documentation described in paragraph (g) above.

(j) ERCOT will use the supporting documentation to validate the Exceptional Fuel Cost for the applicable period. Validation will include, but not be limited to, the cost and the quantity of purchased fuel, Resource-specific heat rates, and the methodology used in the allocation of the cost and volume of purchased fuel, if applicable, to the Resource for the applicable hour used in the weighted average fuel price calculation. In connection with the validation process ERCOT may request additional documentation or clarification of previously submitted documentation. Such requests must be honored within ten Business Days.

(k) At ERCOT’s sole discretion, submission and follow-up information deadlines may be extended on a case-by-case basis.