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| NPRR Number | DRAFT | NPRR Title | Introduce Mitigation of Energy Storage Resources |
| Date Posted | May TBD, 2024 |
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| Requested Resolution  | Normal |
| Nodal Protocol Sections Requiring Revision  | 3.8.5, Energy Storage Resources4.4.9.4.1, Mitigated Offer Cap |
| Related Documents Requiring Revision/Related Revision Requests | None |
| Revision Description | Energy Storage Resources (ESRs) currently have a Mitigated Offer Cap (MOC) curve equal to the System-Wide Offer Cap (SWCAP). While the mitigation process is still applied, the value is set such that mitigation of ESRs never occurs in practice. This NPRR introduces a dynamic ‘just-in-time’ mitigation framework that determines the MOC 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. |
| Reason for Revision |  [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 1 – Be an industry leader for grid reliability and resilience [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 2 - Enhance the ERCOT region’s economic competitiveness with respect to trends in wholesale power rates and retail electricity prices to consumers [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 3 - Advance ERCOT, Inc. as an independent leading industry expert and an employer of choice by fostering innovation, investing in our people, and emphasizing the importance of our mission General system and/or process improvements Regulatory requirements ERCOT Board/PUCT Directive*(please select ONLY ONE – if more than one apply, please select the ONE that is most relevant)* |
| Justification of Reason for Revision and Market Impacts | This NPRR introduces MOC curves below the SWCAP for ESRs when the Resource, through its Qualified Scheduling Entity (QSE), has the potential to exploit market power, as evaluated in the SCED CCT process. A constraint contribution is calculated for each Non-Competitive constraint an ESR could help resolve. The constraint contribution is the product of the maximum Shadow Price and the Shift Factor of the ESR. When offers are priced below the constraint contribution, there is a trade-off between economics and transmission limitations in the SCED optimization. This trade-off disappears when resources offer in above this value. Consequently, the MOC curve for ESRs is set one cent under the maximum constraint contribution, if one exists. This mitigation strategy is intended to maximize autonomy while ensuring competitive behavior. |

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| Market Segment | Not Applicable |

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| Proposed Protocol Language Revision |

3.8.5 Energy Storage Resources

(1) The Resource Entity and QSE representing an Energy Storage Resource (ESR) which is jointly registered with ERCOT as a Generation Resource and a Controllable Load Resource, pursuant to paragraph (6) of Section 16.5, Registration of a Resource Entity, are responsible for following all requirements in these Protocols associated with Generation Resources and Controllable Load Resources.

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| ***[NPRR1002: Replace paragraph (1) above with the following upon system implementation:]***(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 Energy Storage Resources (ESRs) to the same extent, except where the Protocols explicitly provide otherwise. |

(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.

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(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*) \* CFMLT *q, r*]

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| ***[NPRR1058 and NPRR1172: Replace the formula “MOC q, r, h” above with the following upon system implementation:]***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. |
| CFMLT *q, r* | none | *Capacity Factor Multiplier*—A multiplier based on the corresponding monthly capacity factor as described in paragraph (1)(d) below.  |
| ***[NPRR1058 and NPRR1172: Delete the variable “CFMLT q, r” above upon system implementation.]*** |
| WAFP *q, r, h* | $/MMBtu | *Weighted Average Fuel Price*—The volume-weighted average intraday, same-day and spot fuel price, the projected incremental fuel consistent with a fuel supply contract(s), or a combination of these two prices, submitted to ERCOT during the Adjustment Period for a specific Resource and specific hour within the Operating Day, as described in paragraph (1)(f) below.

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| ***[NPRR1177: Replace the definition above with the following on January 1, 2025:]****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)(f) below. |

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| *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 Competitive Tests (CCT).  For each ESR that has been flagged for mitigation as part of the SCED CCT process, each Non-Competitive Constraint with a helping 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) Otherwise, 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 highest absolute value of these constraint contributions less $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 Competitive Tests (CCT).  For each ESR that has been flagged for mitigation as part of the SCED CCT process, each Non-Competitive Constraint with a helping 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) Otherwise, 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 highest absolute value of these constraint  contributions less $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 and NPRR1014: Insert applicable portions of paragraph (d) below upon system implementation of the Real-Time Co-Optimization (RTC) project for NPRR1008; or upon system implementation for NPRR1014; and renumber accordingly:]***(d) For On-line hydro Generation Resources not operating in Synchronous Condenser Fast-Response mode, the MOC shall be adjusted in accordance with Verifiable Cost Manual, Appendix 12, Calculation of the Variable O&M Value and Incremental Heat Rate used in Real Time Mitigation for On-Line Hydro Generation Resources not operating in Synchronous Condenser Fast-Response mode. |

(d) The multipliers for the MOC calculation above are as follows:

(i) 1.10 for Resources running at a ≥ 50% capacity factor for the previous 12 months;

(ii) 1.15 for Resources running at a ≥ 30 and < 50% capacity factor for the previous 12 months;

(iii) 1.20 for Resources running at a ≥ 20 and < 30% capacity factor for the previous 12 months;

(iv) 1.25 for Resources running at a ≥ 10 and < 20% capacity factor for the previous 12 months;

(v) 1.30 for Resources running at a ≥ 5 and < 10% capacity factor for the previous 12 months;

(vi) 1.40 for Resources running at a ≥ 1 and < 5% capacity factor for the previous 12 months; and

(vii) 1.50 for Resources running at a less than 1% capacity factor for the previous 12 months.

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| ***[NPRR1058 and NPRR1172: Delete paragraph (d) above upon system implementation and renumber accordingly.]*** |

(e) The previous 12 months’ capacity factor must be updated by ERCOT by the 20th day of each month using the most recent data for use in the next month. ERCOT shall post to the MIS Secure Area the capacity factor for each Resource before the start of the effective month.

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| ***[NPRR1058 and NPRR1172: Delete paragraph (e) above upon system implementation and renumber accordingly.]*** |

(f) 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 Technical Advisory Committee (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) The weighted average fuel price in paragraph (1) above must be a single value and based on the following fuel price options:

(A) A volume-weighted price considering all intra-day, same day, and spot fuel purchases for the Resource; or

(B) A projected fuel price for a Resource with a fuel supply contract(s) that also has submitted an Energy Offer Curve for the Operating Hour where the Energy Offer Curve is calculated as the incremental heat rate times the incremental fuel price plus Operations and Maintenance (O&M) cost; or

(C) A combination of the above two options.

 A weighted average fuel price based on actual 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. A projected incremental fuel price must be consistent with the terms of the fuel supply contract(s). A weighted average fuel price based on a combination of these options must meet the requirements described for each of the options. As noted in paragraph (l) below, the methodology used in the allocation of the cost and volume of fuel to the Resource for the hour is subject to validation by ERCOT.

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| ***[NPRR1177: Replace paragraph (iii) above with the following on January 1, 2025:]***(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 (l) 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.

(v) A projected volume-weighted average fuel price must be consistent with the Energy Offer Curve for each Operating Hour for which they are applicable, and consistent with the signed and executed fuel supply contract(s) for each Resource.

(vi) An Exceptional Fuel Cost submitted based on projected fuel prices may not match with the actual volume-weighted average fuel price due to prospective costs and/or contractual costs.

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| ***[NPRR1177: Delete paragraphs (v) and (vi) above on January 1, 2025.]*** |

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

(h) No later than five Business Days after an Operating Day for which an Exceptional Fuel Cost is submitted, ERCOT shall issue a Market Notice indicating the affected Operating Hours and the number of Resources for which a QSE submitted Exceptional Fuel Cost for a particular Operating Day.

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| ***[NPRR1121: Replace paragraph (h) above with the following upon system implementation:]***(h) 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. |

(i) 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).

(j) 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.

(k) 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 (i) above. An attestation for Exceptional Fuel Costs must state that the costs are accurate and variable, based on the dispatch of the Resource.

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| ***[NPRR1177: Replace paragraph (k) above with the following on January 1, 2025:]***(k) 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 (i) above. |

(l) 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.

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

(n) The documentation described in paragraphs (i) through (l) above is only required for the hours for which Exceptional Fuel Costs were submitted and the Resource was subject to mitigation.

(o) For Resources submitting Exceptional Fuel Costs based on projected incremental fuel prices based on a contract(s) the QSE must submit to ERCOT all applicable fuel supply contracts at least ten Business Days in advance of submitting Exceptional Fuel Costs. ERCOT may, at any time, notify the QSE of any cost identified in the contract that is ineligible for inclusion in any Exceptional Fuel Cost submission. Upon receiving such notification, the QSE shall ensure that such cost is not included in any Exceptional Fuel Cost submission or in any Energy Offer Curve submission for any hours for which Exceptional Fuel Costs are submitted. The absence of any such notification shall not imply that such cost is eligible for inclusion in any Exceptional Fuel Cost submission or in any Energy Offer Curve submission.

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| ***[NPRR1177: Delete paragraphs (n) and (o) above on January 1, 2025.]*** |