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| **NPRR Number** | [**986**](http://www.ercot.com/mktrules/issues/NPRR986) | **NPRR Title** | **BESTF-2 Energy Storage Resource Energy Offer Curves, Pricing, Dispatch, and Mitigation** |
| **Date of Decision** | | January 29, 2020 | |
| **Action** | | Recommended Approval | |
| **Timeline** | | Urgent | |
| **Proposed Effective Date** | | Upon system implementation | |
| **Priority and Rank Assigned** | | Priority – 2020; Rank – 2765 | |
| **Nodal Protocol Sections Requiring Revision** | | 2.1, Definitions  2.2, Acronyms and Abbreviations  3.6.1, Load Resource Participation  3.8, Special Considerations for Split Generation Meters, Combined Cycle Generation Resources, Quick Start Generation Resources, Hydro Generation Resources, Limited Duration Resources, and Energy Storage Resources  3.8.5, Limited Duration Resources (delete)  4.4.9.2.3, Startup Offer and Minimum-Energy Offer Generic Caps  4.4.9.3, Energy Offer Curve  4.4.9.4.1, Mitigated Offer Cap  5.6.1 Verifiable Costs  6.4.3.1, Real-Time Market Energy Bids  6.5.7.3, Security Constrained Economic Dispatch  6.6.3.1, Real-Time Energy Imbalance Payment or Charge at a Resource Node  6.6.3.2, Real-Time Energy Imbalance Payment or Charge at a Load Zone | |
| **Related Documents Requiring Revision/Related Revision Requests** | | Verifiable Cost Manual Revision Request (VCMRR) 027, Related to NPRR986, BESTF-2 Energy Storage Resource Energy Offer Curves, Pricing, Dispatch, and Mitigation | |
| **Revision Description** | | This Nodal Protocol Revision Request (NPRR) codifies concepts described in two Battery Energy Storage Task Force (BESTF) Key Topics and Concepts (KTCs), which received consensus support at BESTF and were approved by the Technical Advisory Committee (TAC) at its November 20, 2019, meeting. Each NPRR provision listed below is identified with its specific KTC.  This NPRR sets forth the following provisions for Energy Storage Resource (ESR) participation in the ERCOT markets:   * Revisions to Section 3.6.1 provide for ESR charging to be settled at the ESR’s Resource Node, thus providing for symmetrical Dispatch and Settlement of ESRs for both charging and discharging; *(KTC-3, Item 1)* * Revisions to paragraph (1)(b) of Section 4.4.9.4.1 set the Mitigated Offer Cap (MOC) for ESRs at the System-Wide Offer Cap (SWCAP), and require ERCOT and stakeholders to recommend a longer-term approach to the TAC by Dec. 31, 2023. ERCOT notes that this provision is intended for batteries and may not be appropriate for other ESR types. MOCs for other, future ESR types will need to be addressed separately; *(KTC-3, Items 2 and 3)* * Revisions to Section 4.4.9.2.3 align the Protocols with the changes made in VCMRR027. The Startup Offer and Minimum-Energy Offer for an ESR will be set to $0 per start and $0/MWh, respectively; *(KTC-3, Item 2)* * Revisions to paragraph (7) of Section 4.4.9.3 and paragraph (1) of Section 6.4.3.1 propose flexibility for ESRs in updating Energy Offer Curves and Real-Time Market (RTM) Energy Bids. These revisions would allow ESRs to update their Energy Offer Curves and RTM Energy Bids in Real Time. Under this framework, Security-Constrained Economic Dispatch (SCED) would use the most recent valid Energy Offer Curve and RTM Energy Bid from the ESR; *(KTC-6, Item 1)* * Revisions to Section 5.6.1 clarify that verifiable costs cannot be submitted by ESRs; * Revisions to Section 6.5.7.3 enable SCED Dispatch using the appropriate Shift Factor for ESRs. New paragraph (16) in that same section allows ESRs to charge only when Dispatched by SCED; *(KTC-3 Item 1)* * Revisions to Section 6.6.3.1 establish Settlement equations that implement nodal pricing for ESRs when charging. ESRs that receive Wholesale Storage Load (WSL) treatment are already charged the nodal price; this provision enables nodal pricing for an ESR that does not qualify for WSL treatment under applicable Public Utility Commission of Texas (PUCT) rules and Protocols. In addition, these changes clarify that the Real-Time price at the bus is calculated using weighted base points instead of telemetry; and *(KTC-3 Item 1 and KTC-7 Item 6)* * Revisions to Section 6.6.3.2 remove the Controllable Load Resource side of an ESR Load that is not WSL from the Real-Time Adjusted Metered Load (RTAML) since these Loads will now be charged at a nodal price. *(KTC-3 Item 1 and KTC-7 Item 6)*   The provisions in this NPRR are applicable to the to the current “combo model” era, in which ESRs are modeled as combination of a Generation Resource and a Controllable Load Resource. As a general rule, the underlying concepts from the combo-only era will carry over to the single-model era, although the Protocol language may need to be further modified in some cases. | |
| **Reason for Revision** | | Addresses current operational issues.  Meets Strategic goals (tied to the [ERCOT Strategic Plan](http://www.ercot.com/content/news/presentations/2013/ERCOT%20Strat%20Plan%20FINAL%20112213.pdf) or directed by the ERCOT Board).  Market efficiencies or enhancements  Administrative  Regulatory requirements  Other: (explain)  *(please select all that apply)* | |
| **Business Case** | | Due to current system limitations, ESRs today must participate in the ERCOT markets as a Generation Resource and a Controllable Load Resource. ERCOT has informed stakeholders that this “combo model” must remain in place until a single-model ESR type can be incorporated into the ERCOT core systems, which is projected to be implemented concurrently with Real-Time Co-optimization (RTC) of energy and Ancillary Services in 2024.  This NPRR is one of several that ERCOT plans to submit to support participation by ESRs under the combination model during the interim period. The concepts incorporated here, which are consistent with nodal market design, will be carried over to the single-model era.  Under current rules, Resources’ Energy Offer Curves are frozen at the end of the Adjustment Period – a full hour prior to the start of an Operating Hour. The proposed modifications to Section 4.4.9.3 would enable expanded flexibility for fast-acting ESRs. | |
| **Credit Work Group Review** | | ERCOT Credit Staff and the Credit Work Group (Credit WG) have reviewed NPRR986 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 grant NPRR986 Urgent status. PRS then unanimously voted to recommend approval of NPRR986 as amended by the 1/9/20 WMS comments as revised by PRS; and to forward NPRR986 and the Impact Analysis to TAC with a recommended priority of 2020 and rank of 2765. All Market Segments were present for both votes. | |
| **Summary of PRS Discussion** | | On 1/16/20, participants reviewed the 1/9/20 WMS comments; discussed a potential subsequent NPRR to expand the intra-hour updates of Energy Offer Curves to all Resource types; reviewed the possible timelines for the NPRR986 project with and without Urgent status; requested ERCOT file additional comments to avoid conflicts between NPRR986 revisions and existing language for Limited Duration Resources (LDRs) utilizing the OUTL Resource Status; and proposed additional edits to clarify ESRs “withdraw” energy rather than “consume” energy. | |
| **TAC Decision** | | On 1/29/20, TAC unanimously voted to recommend approval of NPRR986 as recommended by PRS in the 1/16/20 PRS Report as amended by the 1/22/20 ERCOT comments. All Market Segments were present for the vote. | |
| **Summary of TAC Discussion** | | On 1/29/20, participants reviewed the 1/22/20 ERCOT comments and the Business Case for NPRR986. | |
| **ERCOT Opinion** | | ERCOT supports approval of NPRR986. | |

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| **Market Segment** | Not applicable |

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| **Comments Received** | |
| **Comment Author** | **Comment Summary** |
| ERCOT 010620 | Proposed additional revisions to clarify Qualified Scheduling Entities (QSEs) representing ESRs will be able to submit intra-hour updates to their Energy Offer Curves and RTM Energy Bids at any time prior to execution of SCED, which will use the most recent valid Energy Offer Curve and RTM Energy Bid |
| Luminant 010920 | Requested PRS grant NPRR986 Urgent status |
| WMS 010920 | Proposed additional revisions to the 1/6/20 ERCOT comments |
| ERCOT 012220 | Removed the term “Limited Duration Resource (LDR)” from the Protocols to avoid conflict with proposed language for ESRs |

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| **Market Rules Notes** |

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

* NPRR826, Mitigated Offer Caps for RMR Resources
  + Section 4.4.9.4.1
  + Section 5.6.1
* NPRR838, Updated O&M Cost for RMR Resources
  + Section 5.6.1
* NPRR967, Remove the 10 MW Limit from the Definition of Limited Duration Resource (LDR)
  + Section 4.4.9.3

Please note that the following NPRR(s) also propose revisions to the definition of “Resource Attribute”:

* NPRR963, Base Point Deviation Settlement and Deployment Performance Metrics for Energy Storage Resources (Combo Model)
* NPRR967, Remove the 10 MW Limit from the Definition of Limited Duration Resource (LDR)
* NPRR973, Add Definitions for Generator Step-Up and Main Power Transformer
* NPRR990, Relocation of Combined Cycle Train to Resource Attribute

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| **Proposed Protocol Language Revision** |

## 2.1 DEFINITIONS

**Resource Attribute**

Specific qualities associated with various Resources (i.e., specific aspects of a Resource or the services the Resource is qualified to provide).

***Aggregate Generation Resource (AGR)***

A Generation Resource that is an aggregation of generators, with the exception of Intermittent Renewable Resources (IRRs) pursuant to paragraph (12) of Section 3.10.7.2, Modeling of Resources and Transmission Loads, each of which is less than 20 MW in output, which share identical operational characteristics and are interconnected at the same Point of Interconnection (POI) and located behind the same Generator Step-Up (GSU) transformer (with a high-side voltage greater than 60 kV).

***Black Start Resource***

A Generation Resource under contract with ERCOT to provide Black Start Service (BSS).

***Decommissioned Generation Resource***

A Generation Resource for which a Resource Entity has submitted a Notification of Suspension of Operations or a Notification of Change of Generation Resource Designation, for which ERCOT has declined to execute a Reliability Must-Run (RMR) Agreement, and which has been decommissioned and permanently retired.

***Dynamically Scheduled Resource (DSR)***

A Resource that has been designated by the Qualified Scheduling Entity (QSE), and approved by ERCOT, as a DSR status-type and that follows a DSR Load.

***Intermittent Renewable Resource (IRR)***

A Generation Resource that can only produce energy from variable, uncontrollable Resources, such as wind, solar, or run-of-the-river hydroelectricity.

***Intermittent Renewable Resource (IRR) Group***

A group of two or more IRRs whose performance in responding to Security-Constrained Economic Dispatch (SCED) Dispatch Instructions will be assessed as an aggregate for Generation Resource Energy Deployment Performance (GREDP) and Base Point Deviation. An IRR Group cannot contain any IRRs that are Split Generation Resources. Additionally, only IRRs that have the same Resource Node can be mapped to an IRR Group. Resource Entities can choose to group IRRs and shall provide the grouping information in a timely manner for ERCOT review prior to the scheduled database loads.

***Mothballed Generation Resource***

A Generation Resource for which a Resource Entity has submitted a Notification of Suspension of Operations, for which ERCOT has declined to execute a Reliability Must-Run (RMR) Agreement, and which has not been decommissioned and retired.

***Quick Start Generation Resource (QSGR)***

A Generation Resource that in its cold-temperature state can come On-Line within ten minutes of receiving ERCOT notice and has passed an ERCOT QSGR test that establishes an amount of capacity that can be deployed within a ten-minute period.

***Split Generation Resource***

Where a Generation Resource has been split to function as two or more independent Generation Resources in accordance with Section 10.3.2.1, Generation Resource Meter Splitting, and Section 3.10.7.2, Modeling of Resources and Transmission Loads, each such functionality independent Generation Resource is a Split Generation Resource.

***Switchable Generation Resource (SWGR)***

A Generation Resource that can be connected to either the ERCOT Transmission Grid or a non-ERCOT Control Area.

## 2.2 ACRONYMS AND ABBREVIATIONS

***3.6.1 Load Resource Participation***

(1) A Load Resource may participate by providing:

(a) Ancillary Service:

(i) Regulation Up (Reg-Up) Service as a Controllable Load Resource capable of providing Primary Frequency Response;

(ii) Regulation Down (Reg-Down) Service as a Controllable Load Resource capable of providing Primary Frequency Response;

(iii) Responsive Reserve (RRS) as a Controllable Load Resource qualified for Security-Constrained Economic Dispatch (SCED) Dispatch and capable of providing Primary Frequency Response, or as a Load Resource controlled by high-set under-frequency relay; and

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| ***[NPRR863: Insert paragraph (iv) below upon system implementation and renumber accordingly:]***  (iv) ERCOT Contingency Reserve Service (ECRS) as a Controllable Load Resource qualified for SCED Dispatch and capable of providing Primary Frequency Response, or as a Load Resource that may or may not be controlled by high-set under-frequency relay; and |

(iv) Non-Spinning Reserve (Non-Spin) Service as a Controllable Load Resource qualified for SCED Dispatch;

(b) Energy in the form of Demand response from a Controllable Load Resource in Real-Time via SCED;

(c) Emergency Response Service (ERS) for hours in which the Load Resource does not have an Ancillary Service Resource Responsibility; and

(d) Voluntary Load response in Real-Time.

(2) Except for voluntary Load response and ERS, loads participating in any ERCOT market must be registered as a Load Resource and are subject to qualification testing administered by ERCOT.

(3) All ERCOT Settlements resulting from Load Resource participation are made only with the Qualified Scheduling Entity (QSE) representing the Load Resource.

(4) A QSE representing a Load Resource and submitting a bid to buy for participation in SCED, as described in Section 6.4.3.1, RTM Energy Bids, must represent the Load Serving Entity (LSE) serving the Load of the Load Resource. If the Load Resource is an Aggregate Load Resource (ALR), the QSE must represent the LSE serving the Load of all sites within the ALR.

(5) The Settlement Point for a Controllable Load Resource is its Load Zone Settlement Point. For an Energy Storage Resource (ESR), the Settlement Point for the modeled Controllable Load Resource associated with the ESR is the Resource Node of the modeled Generation Resource associated with the ESR.

(6) QSEs shall not submit offers for Load Resources containing sites associated with a Dynamically Scheduled Resource (DSR).

**3.8 Special Considerations for Split Generation Meters, Combined Cycle Generation Resources, Quick Start Generation Resources, Hydro Generation Resources, and Energy Storage Resources**

***4.4.9.2.3 Startup Offer and Minimum-Energy Offer Generic Caps***

(1) The Resource Category Startup Offer Generic Cap, by applicable Resource category, is determined by the following Operations and Maintenance (O&M) costs by Resource category:

| **Resource Category** | **O&M Costs ($)** |
| --- | --- |
| Nuclear, coal, lignite and hydro | 7,200 |
| Combined Cycle Generation Resource with a combustion turbine ≥ 90 MW, as determined by the largest combustion turbine in the Combined Cycle Generation Resource and for each combustion turbine in the Combined Cycle Generation Resource | 6,810 |
| Combined Cycle Generation Resource with a combustion turbine < 90 MW, as determined by the largest combustion turbine in the Combined Cycle Generation Resource and for each combustion turbine in the Combined Cycle Generation Resource | 6,810 |
| Gas steam supercritical boiler | 4,800 |
| Gas steam reheat boiler | 3,000 |
| Gas steam non-reheat or boiler w/o air-preheater | 2,310 |
| Simple cycle greater than 90 MW | 5,000 |
| Simple cycle less than or equal to 90 MW | 2,300 |
| Reciprocating Engines | $58 /MW \* the average of the seasonal net max sustainable ratings |
| RMR Resource | Not Applicable |
| Wind generation Resources | 0 |
| PhotoVoltaic Generation Resources (PVGRs) | 0 |
| Any Resources not defined above | 0 |

(2) The Resource Category Minimum-Energy Generic Cap is the cost per MWh of energy for a Resource to produce energy at the Resource’s LSL and is as follows:

(a) Hydro = $10.00/MWh;

(b) Coal and lignite = $18.00/MWh;

(c) Combined-cycle greater than 90 MW = 8 MMBtu/MWh \* ((Percentage of FIP \* FIP) + (Percentage of FOP \* FOP))/100, as specified in Minimum-Energy Offer;

(d) Combined-cycle less than or equal to 90 MW = 9 MMBtu/MWh \* ((Percentage of FIP \* FIP) + (Percentage of FOP \* FOP))/100, as specified in Minimum-Energy Offer;

(e) Gas steam supercritical boiler = 14 MMBtu/MWh \* ((Percentage of FIP \* FIP) + (Percentage of FOP \* FOP))/100, as specified in Minimum-Energy Offer;

(f) Gas steam reheat boiler = 14.5 MMBtu/MWh \* ((Percentage of FIP \* FIP) + (Percentage of FOP \* FOP))/100, as specified in Minimum-Energy Offer;

(g) Gas steam non-reheat or boiler without air-preheater = 16.0 MMBtu/MWh \* ((Percentage of FIP \* FIP) + (Percentage of FOP \* FOP))/100, as specified in Minimum-Energy Offer;

(h) Simple-cycle greater than 90 MW = 15.0 MMBtu/MWh \* ((Percentage of FIP \* FIP) + (Percentage of FOP \* FOP))/100, as specified in Minimum-Energy Offer;

(i) Simple-cycle less than or equal to 90 MW = 14.0 MMBtu/MWh \* ((Percentage of FIP \* FIP) + (Percentage of FOP \* FOP))/100, as specified in Minimum-Energy Offer;

(j) Reciprocating engines = 16.0 MMBtu/MWh \* ((Percentage of FIP \* FIP) + (Percentage of FOP \* FOP))/100, as specified in the Minimum-Energy Offer;

(k) RMR Resource = RMR contract estimated fuel cost using its contract I/O curve at its LSL times FIP;

(l) Nuclear = Not Applicable;

(m) Wind generation Resources = $0;

(n) PVGRs = $0; and

(o) Other Resources not defined above = $0.

(3) The FIP and FOP used to calculate the Resource Category Minimum-Energy Generic Cap shall be the FIP or FOP for the Operating Day. In the event the Resource Category Minimum-Energy Generic Cap must be calculated before the FIP or FOP is available for the particular Operating Day, the FIP and FOP for the most recent preceding Operating Day shall be used. Once the FIP and FOP are available for a particular Operating Day, those values shall be used in the calculations. If the percentage fuel mix is not specified for Resource categories having the option to specify the fuel mix, then the minimum of FIP or FOP shall be used.

(4) Items (2)(c) and (2)(d) above are determined by capacity of largest simple-cycle combustion turbine in the train.

4.4.9.3 Energy Offer Curve

(1) The Energy Offer Curve represents the QSE’s willingness to sell energy at or above a certain price and at a certain quantity in the DAM or its willingness to be dispatched by SCED in Real-Time Operations.

(2) A QSE may submit Resource-specific Energy Offer Curves to ERCOT. Such Energy Offer Curves will be bounded in the DAM for each Operating Hour by the LSL and HSL of the Generation Resource specified in the COP, and bounded in SCED by the LSL and HSL of the Generation Resource as shown by telemetry.

(3) Energy Offer Curves remain active for the offered period until either:

(a) Selected by ERCOT; or

(b) Automatically inactivated by the software at the offer expiration time selected by the QSE.

(4) For any Operating Hour, the QSE for a Resource may submit or change Energy Offer Curves in the Adjustment Period and a QSE may withdraw an Energy Offer Curve if:

(a) An Output Schedule is submitted for all intervals for which an Energy Offer Curve is withdrawn; or

(b) The Resource is forced Off-Line and notifies ERCOT of the Forced Outage by changing the Resource Status appropriately and updating its COP.

(5) For any Operating Hour that is a RUC-Committed Interval or a DAM-Committed Interval for a Resource, a QSE for that Resource may not change a Startup Offer or Minimum-Energy Offer.

(6) If a valid Energy Offer Curve or an Output Schedule does not exist for a Resource that has a status of On-Line at the end of the Adjustment Period, then ERCOT shall notify the QSE and set the Output Schedule equal to the then current telemetered output of the Resource until an Output Schedule or Energy Offer Curve is submitted in a subsequent Adjustment Period.

(7) Notwithstanding any other provision in this subsection, a QSE representing an Energy Storage Resource (ESR) may submit or update its Energy Offer Curve for that ESR at any time prior to SCED execution, and SCED will use the latest updated Energy Offer Curve available in the system. If a new Energy Offer Curve is not deemed to be valid, then the most recent valid Energy Offer Curve available in the system at the time of SCED execution will be used and ERCOT will notify the QSE that the invalid Energy Offer Curve was rejected. Once an Operating Hour ends, an Energy Offer Curve for that hour cannot be submitted, updated, or canceled.

***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:

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*]

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** |
| --- | --- | --- |
| 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. |
| 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)(f) below. |
| *q* | none | A QSE. |
| *r* | none | A Generation Resource. |
| *h* | none | The Operating Hour. |

(a) For a Resource contracted by ERCOT under paragraph (2) 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.

(b) Notwithstanding the MOC calculation described in paragraph (1) above, the MOC for Energy Storage Resources (ESRs) shall be set at the SWCAP. No later than December 31, 2023, ERCOT and stakeholders shall submit a report to TAC that includes a recommendation to continue the existing approach or a proposal to implement an alternative approach to determine the MOC for Energy Storage Resources.

(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).

(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.

(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.

(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) 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.

(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.

(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, and any available supporting documentation. Such information may include, but is not be 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.

(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 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.

5.6.1 Verifiable Costs

(1) The Qualified Scheduling Entity (QSE) is responsible for submitting verifiable costs unless both the QSE and Resource Entity agree that the Resource Entity will have this responsibility, in which case both the QSE and Resource Entity shall submit an affidavit to ERCOT stating this arrangement. Notwithstanding the foregoing, QSEs that submit Power Purchase or Tolling Agreements (PPAs) do not have the option of allowing Resource Entities to file verifiable costs.

(2) Make-Whole Payments for a Resource are based on the Startup Offers and Minimum-Energy Offers for the Resource, limited by caps. Until ERCOT approves verifiable unit-specific costs for that Resource, the caps are the Resource Category Startup Generic Cap and the Resource Category Minimum-Energy Generic Cap. When ERCOT approves verifiable unit-specific costs for that Resource the caps are those verifiable unit-specific costs. A QSE or Resource Entity may file verifiable unit-specific costs for a Resource at any time, but it must file those costs no later than 30 days after five Reliability Unit Commitment (RUC) events for that Resource in a calendar year. A RUC event begins when a Resource receives a RUC instruction to come or stay On-Line and ends the later of when the Resource shuts down or the end of the Operating Day. The most recent ERCOT-approved verifiable costs must be used going forward.

(3) These unit-specific verifiable costs may include and are limited to the following average incremental costs:

(a) Allocation of maintenance requirements based on number of starts between maintenance events using, at the option of the QSE or Resource Entity, either:

(i) Manufacturer-recommended maintenance schedule;

(ii) Historical data for the unit and actual maintenance practices; or

(iii) Another method approved in advance by ERCOT in writing;

(b) Startup fuel calculations based on recorded actual measured flows when the data is available or based on averages of historical flows for similar starts (for example, hot, cold, intermediate) when actual data is not available. Startup fuel will include filing separately the startup fuel required to reach breaker close and fuel after breaker close to Low Sustained Limit (LSL). Any fuel required to shutdown a Resource will be submitted as the fuel from breaker open to shutdown;

(c) Operation costs;

(d) Chemical costs;

(e) Water costs; and

(f) Emission credits.

(4) Standard Operations and Maintenance (O&M) costs pursuant to paragraph (6) below may be used in lieu of the incremental O&M costs set forth in items (3)(a), (c), (d) and (e) above.

(5) These unit-specific verifiable costs may not include:

(a) Fixed costs, which are any cost that is incurred regardless of whether the unit is deployed or not; and

(b) Costs for which the QSE or Resource Entity cannot provide sufficient documentation for ERCOT to verify the costs.

(6) At their election, QSEs or Resource Entities may receive standard O&M costs for both startup and minimum energy. This election may be made by submitting an election form to ERCOT. If a QSE or Resource has received final approval for actual verifiable O&M costs under the verifiable cost process, it may not elect to receive standard O&M costs.

(a) Until December 31, 2011, standard O&M costs are defined as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Resource Category**  **Start Year = 2009** | **Cold Startup ($/start)** | **Intermediate Startup ($/start)** | **Hot Startup ($/start)** | **Variable O&M ($/MWh)** |
| Aeroderivative simple cycle commissioned after 1996 | 1,000.00 | 1,000.00 | 1,000.00 | 3.94 |
| Reciprocating Engine | $58/MW \* the average of the Seasonal net max sustainable ratings | $58/MW \* the average of the Seasonal net max sustainable ratings | $58/MW \* the average of the Seasonal net max sustainable ratings | 5.09 |
| Simple cycle ≤ 90 MW | 2,300.00 | 2,300.00 | 2,300.00 | 3.94 |
| Simple cycle ≥ 90 MW | 5,000.00 | 5,000.00 | 5,000.00 | 3.94 |
| Combined cycle: for each Combined-Cycle Configuration, the Startup Cost for that configuration is the sum of the Startup Costs for each unit within that configuration as follows: |  |  |  | 3.19 |
| Combustion turbine < 90 MW | 2,300.00 | 2,300.00 | 2,300.00 |  |
| Combustion turbine ≥ 90 MW | 5,000.00 | 5,000.00 | 5,000.00 |  |
| Steam turbine | 3,000.00 | 2,250.00 | 1,250.00 |  |
| Gas-steam non-reheat boiler | 2,310.00 | 1,732.50 | 866.25 | 7.08 |
| Gas-steam reheat boiler | 3,000.00 | 2,250.00 | 1,125.00 | 7.08 |
| Gas-steam supercritical boiler | 4,800.00 | 3,600.00 | 1,800.00 | 7.08 |
| Nuclear, coal, lignite and hydro | 7,200.00 | 5,400.00 | 2,700.00 | 5.02 |
| Renewable | Not Applicable | Not Applicable | Not Applicable | 5.50 |

(b) For the period beginning January 1, 2012 and ending December 31, 2012, standard O&M costs shall be reduced by 10% from the levels specified in the table in paragraph (a) above as follows:

| **Resource Category** | **Cold Startup ($/start)** | **Intermediate Startup ($/start)** | **Hot Startup ($/start)** | **Variable O&M ($/MWh)** |
| --- | --- | --- | --- | --- |
| **Start Year = 2009** |
| Aeroderivative simple cycle commissioned after 1996 | 900.00 | 900.00 | 900.00 | 3.55 |
| Reciprocating Engine | $52.20/MW \* the average of the Seasonal net max sustainable ratings | $52.20/MW \* the average of the Seasonal net max sustainable ratings | $52.20/MW \* the average of the Seasonal net max sustainable ratings | 4.58 |
| Simple cycle ≤ 90 MW | 2,070.00 | 2,070.00 | 2,070.00 | 3.55 |
| Simple cycle ≥ 90 MW | 4,500.00 | 4,500.00 | 4,500.00 | 3.55 |
| Combined cycle: for each Combined-Cycle Configuration, the Startup Cost for that configuration is the sum of the Startup Costs for each unit within that configuration as follows: |  |  |  | 2.87 |
| Combustion turbine < 90 MW | 2,070.00 | 2,070.00 | 2,070.00 |  |
| Combustion turbine ≥ 90 MW | 4,500.00 | 4,500.00 | 4,500.00 |  |
| Steam turbine | 2,700.00 | 2,025.00 | 1,125.00 |  |
| Gas-steam non-reheat boiler | 2,079.00 | 1,559.25 | 779.63 | 6.37 |
| Gas-steam reheat boiler | 2,700.00 | 2,025.00 | 1,012.50 | 6.37 |
| Gas-steam supercritical boiler | 4,320.00 | 3,240.00 | 1,620.00 | 6.37 |
| Nuclear, coal, lignite and hydro | 6,480.00 | 4,860.00 | 2,430.00 | 4.52 |
| Renewable | Not Applicable | Not Applicable | Not Applicable | 4.95 |

(c) Beginning January 1, 2013 and going forward, standard O&M costs shall be reduced by 20% from the levels specified in the table in paragraph (a) above as follows:

| **Resource Category** | **Cold Startup ($/start)** | **Intermediate Startup ($/start)** | **Hot Startup ($/start)** | **Variable O&M ($/MWh)** |
| --- | --- | --- | --- | --- |
| **Start Year = 2009** |
| Aeroderivative simple cycle commissioned after 1996 | 800.00 | 800.00 | 800.00 | 3.15 |
| Reciprocating Engine | $46.40/MW \* the average of the Seasonal net max sustainable ratings | $46.40 /MW \* the average of the Seasonal net max sustainable ratings | $46.40 /MW \* the average of the Seasonal net max sustainable ratings | 4.07 |
| Simple cycle ≤ 90 MW | 1,840.00 | 1,840.00 | 1,840.00 | 3.15 |
| Simple cycle ≥ 90 MW | 4,000.00 | 4,000.00 | 4,000.00 | 3.15 |
| Combined cycle: for each Combined-Cycle Configuration, the Startup Cost for that configuration is the sum of the Startup Costs for each unit within that configuration as follows: |  |  |  | 2.55 |
| Combustion turbine < 90 MW | 1,840.00 | 1,840.00 | 1,840.00 |  |
| Combustion turbine ≥ 90 MW | 4,000.00 | 4,000.00 | 4,000.00 |  |
| Steam turbine | 2,400.00 | 1,800.00 | 1,000.00 |  |
| Gas-steam non-reheat boiler | 1,848.00 | 1,386.00 | 693.00 | 5.66 |
| Gas-steam reheat boiler | 2,400.00 | 1,800.00 | 900.00 | 5.66 |
| Gas-steam supercritical boiler | 3,840.00 | 2,880.00 | 1,440.00 | 5.66 |
| Nuclear, coal, lignite and hydro | 5,760.00 | 4,320.00 | 2,160.00 | 4.02 |
| Renewable | Not Applicable | Not Applicable | Not Applicable | 4.40 |

(d) If the QSE or Resource Entity chooses to utilize the standard O&M costs for O&M, standard O&M costs will be used by ERCOT going forward until either:

(i) Verifiable variable O&M costs are filed; or

(ii) ERCOT notifies the QSE or Resource Entity to update its verifiable costs as set forth in either paragraph (9) or (10) below. If a Resource is receiving standard O&M costs, it may reelect standard O&M costs when resubmitting verifiable costs.

(7) When submitting verifiable costs for combined cycle Resources, the QSE or Resource Entity must elect standard O&M costs for all Combined-Cycle Configurations or verifiable costs for all Combined-Cycle Configurations within the combined cycle train.

(8) QSEs submitting PPAs as Resource-specific verifiable costs documentation are subject to the guidelines detailed below and in the Verifiable Cost Manual.

(a) Only QSEs offering Three-Part Supply Offers for a specific Resource may submit a PPA as verifiable costs documentation.

(b) A QSE submitting a PPA as verifiable costs documentation must represent 100% of the Resource’s capacity.

(c) Only PPAs:

(i) Signed prior to July 16, 2008; and

(ii) Not between Affiliates, subsidiaries or partners will be accepted as verifiable cost documentation.

(d) Verifiable costs for PPAs shall be capped at the level of the highest comparable Resource (referred to as the reference Resource) specific verifiable costs approved by ERCOT without a PPA. The ERCOT approved verifiable costs for a PPA shall be equal to the lesser of:

(i) The cap as described in paragraph (d) above; and

(ii) The costs from the PPA.

(e) ERCOT shall use the Resource actual fuel costs submitted by the QSE for startup and operation at minimum-energy level (LSL), and shall use the Resource Category Startup Offer Generic Costs as the cap for the O&M portion of the Startup Costs until ERCOT receives and approves comparable Resource specific verifiable costs.

(f) PPAs will no longer be accepted as verifiable cost documentation after the primary term of the contract expires.

(g) ERCOT shall produce a report each April that provides the percentage of RUC Make-Whole Payments for Resources with PPAs during the 12 months of the previous calendar year. If there are no Make-Whole Payments for Resources with PPAs, ERCOT shall not produce the annual report. The report shall be based on the final Settlements and include the total number of Resources that used a PPA for their most recent verifiable cost submission that was approved by ERCOT. ERCOT shall present the results of this study to the appropriate Technical Advisory Committee (TAC) subcommittee.

(h) Notwithstanding anything to the contrary in this Section 5.6.1, QSEs representing PPAs may, at any time, submit data from a Resource as verifiable costs documentation and such documentation will be accepted for consideration by ERCOT. A QSE submitting verifiable costs documentation pursuant to this paragraph shall not be required to submit a PPA to ERCOT for consideration for verifiable cost recovery.

(9) ERCOT shall notify a QSE to update verifiable cost data of a Resource when the Resource has received more than 50 RUC instructions meeting the criteria in Section 5.6.2, RUC Startup Cost Eligibility, in a year, but ERCOT may not request an update more frequently than annually.

(10) ERCOT shall notify a QSE to update verifiable cost data of a Resource if at least five years have passed since ERCOT previously approved verifiable cost data for that Resource.

(11) Within 30 days after receiving an update Notice from ERCOT under either paragraph (9) or (10) above, a QSE or Resource Entity must submit verifiable cost data for the Resource. Despite the provisions in paragraph (2) above, if the QSE or Resource Entity does not submit verifiable cost data within 30 days after receiving an update Notice, then ERCOT shall determine payment using the Resource Category Startup Offer Generic Cap, Resource Category Minimum-Energy Offer Generic Cap, and a zeroed value for variable O&M Cost as described in Section 4.4.9.4.1, Mitigated Offer Cap, in accordance with the schedule established in this section until updated verifiable costs are approved. If the 30-day deadline has been reached before the start of the tenth day before the end of the month, the Resource’s verifiable costs will revert back to generic costs beginning on the first day of the following month. If the 30-day deadline falls within the last ten days of the month, the Resource’s verifiable costs will revert back to generic costs on the first day of the second month following the deadline month.

(12) Resource Entities that represent Reliability Must-Run (RMR) Resources shall submit to ERCOT, Startup and variable O&M Cost estimates to be used by ERCOT as proxies for verifiable Startup Cost and minimum-energy verifiable cost and for Settlement. The ERCOT-approved verifiable Startup Cost estimate will equal the startup fuel estimate times the sum of the appropriate Fuel Index Price (FIP) or Fuel Oil Price (FOP) and the fuel adder, plus the startup O&M. The ERCOT-approved minimum-energy verifiable cost estimate will equal the heat rate from the RMR Agreement contract times the sum of the appropriate FIP or FOP and the fuel adder, plus the variable O&M. The O&M cost estimates shall be revised monthly to be consistent with the latest actual costs for the RMR Unit submitted in accordance with Section 3.14.1.14, Reporting Actual RMR Eligible Costs. The O&M values will be effective until updated costs have been submitted to ERCOT.

(13) Notwithstanding the foregoing, QSEs and Resource Entities shall not submit verifiable costs for Energy Storage Resources (ESRs).

**6.4.3.1 RTM Energy Bids**

(1) A QSE may submit Controllable Load Resource-specific Real-Time Market (RTM) Energy Bids by the end of the Adjustment Period on behalf of a Load Serving Entity (LSE) representing a Controllable Load Resource.

(2) An RTM Energy Bid represents the willingness to buy energy at or below a certain price, not to exceed the System-Wide Offer Cap (SWCAP), for the Demand response capability of a Controllable Load Resource in the RTM.

(3) RTM Energy Bids remain active for the offered period until either:

(a) Selected by ERCOT; or

(b) Automatically inactivated at the offer expiration time specified in the RTM Energy Bid.

(4) For any Operating Hour, the QSE may submit or change an RTM Energy Bid in the Adjustment Period. If, by the end of the Adjustment Period, the QSE has not submitted a valid RTM Energy Bid, ERCOT shall create a proxy RTM Energy Bid for the entire Demand response capability of that Load Resource with a not-to-exceed price at the SWCAP.

(5) The QSE may remove the Controllable Load Resource from SCED Dispatch by changing the Load Resource’s telemetered Resource Status or ramp rates appropriately. The QSE will update the COP Resource Status accordingly as soon as practicable.

(6) Notwithstanding any other provisions in this subsection, a QSE representing an Energy Storage Resource (ESR) may submit or update its RTM Energy Bid for that ESR at any time prior to SCED execution, and SCED will use the latest updated RTM Energy Bid available in the system. If a new RTM Energy Bid is not deemed to be valid, then the most recent valid RTM Energy Bid available in the system at the time of SCED execution will be used and ERCOT will notify the QSE that the invalid RTM Energy Bid was rejected. Once an Operating Hour ends, an RTM Energy Bid for that hour cannot be submitted, updated, or canceled.

**6.5.7.3 Security Constrained Economic Dispatch**

(1) The SCED process is designed to simultaneously manage energy, the system power balance and network congestion through Resource Base Points and calculation of LMPs every five minutes. The SCED process uses a two-step methodology that applies mitigation prospectively to resolve Non-Competitive Constraints for the current Operating Hour. The SCED process evaluates Energy Offer Curves, Output Schedules and Real-Time Market (RTM) Energy Bids to determine Resource Dispatch Instructions by maximizing bid-based revenues minus offer-based costs, subject to power balance and network constraints. The SCED process uses the Resource Status provided by SCADA telemetry under Section 6.5.5.2, Operational Data Requirements, and validated by the Real-Time Sequence, instead of the Resource Status provided by the COP.

(2) The SCED solution must monitor cumulative deployment of Regulation Services and ensure that Regulation Services deployment is minimized over time.

(3) In the Generation To Be Dispatched (GTBD) determined by LFC, ERCOT shall subtract the sum of the telemetered net real power consumption from all Controllable Load Resources available to SCED.

(4) For use as SCED inputs, ERCOT shall use the available capacity of all committed Generation Resources by creating proxy Energy Offer Curves for certain Resources as follows:

(a) Non-IRRs and Dynamically Scheduled Resources (DSRs) without Energy Offer Curves

(i) ERCOT shall create a monotonically increasing proxy Energy Offer Curve as described below for:

(A) Each non-IRR for which its QSE has submitted an Output Schedule instead of an Energy Offer Curve; and

(B) Each DSR that has not submitted incremental and decremental Energy Offer Curves.

|  |  |
| --- | --- |
| **MW** | **Price (per MWh)** |
| HSL | SWCAP |
| Output Schedule MW plus 1 MW | SWCAP minus $0.01 |
| Output Schedule MW | -$249.99 |
| LSL | -$250.00 |

(b) DSRs with Energy Offer Curves

(i) For each DSR that has submitted incremental and decremental Energy Offer Curves, ERCOT shall create a monotonically increasing proxy Energy Offer Curve. That curve must consist of the incremental Energy Offer Curve that reflects the available capacity above the Resource’s Output Schedule to its HSL and the decremental Energy Offer Curve that reflects the available capacity below the Resource’s Output Schedule to the LSL. The curve must be created as described below:

|  |  |
| --- | --- |
| **MW** | **Price (per MWh)** |
| Output Schedule MW plus 1 MW to HSL | Incremental Energy Offer Curve |
| LSL to Output Schedule MW | Decremental Energy Offer Curve |

(c) Non-IRRs without full-range Energy Offer Curves

(i) For each non-IRR for which its QSE has submitted an Energy Offer Curve that does not cover the full range of the Resource’s available capacity, ERCOT shall create a proxy Energy Offer Curve that extends the submitted Energy Offer Curve to use the entire available capacity of the Resource above the highest point on the Energy Offer Curve to the Resource’s HSL and the offer floor from the lowest point on the Energy Offer Curve to its LSL, using these points:

|  |  |
| --- | --- |
| **MW** | **Price (per MWh)** |
| HSL (if more than highest MW in submitted Energy Offer Curve) | Price associated with highest MW in submitted Energy Offer Curve |
| Energy Offer Curve | Energy Offer Curve |
| 1 MW below lowest MW in Energy Offer Curve (if more than LSL) | -$249.99 |
| LSL (if less than lowest MW in Energy Offer Curve) | -$250.00 |

(d) IRRs

(i) For each IRR that has not submitted an Energy Offer Curve, ERCOT shall create a monotonically increasing proxy Energy Offer Curve as described below:

|  |  |
| --- | --- |
| **MW** | **Price (per MWh)** |
| HSL | $1,500 |
| HSL minus 1 MW | -$249.99 |
| LSL | -$250.00 |

(ii) For each IRR for which its QSE has submitted an Energy Offer Curve that does not cover the full range of the IRR’s available capacity, ERCOT shall create a monotonically increasing proxy Energy Offer Curve as described below:

|  |  |
| --- | --- |
| **MW** | **Price (per MWh)** |
| HSL (if more than highest MW in submitted Energy Offer Curve) | Price associated with the highest MW in submitted Energy Offer Curve |
| Energy Offer Curve | Energy Offer Curve |
| 1 MW below lowest MW in Energy Offer Curve (if more than LSL) | -$249.99 |
| LSL (if less than lowest MW in Energy Offer Curve) | -$250.00 |

(e) RUC-committed Resources

(i) For each RUC-committed Resource that has not submitted an Energy Offer Curve, ERCOT shall create a proxy Energy Offer Curve as described below:

|  |  |
| --- | --- |
| **MW** | **Price (per MWh)** |
| HSL | $1,500 |
| Zero | $1,500 |

(ii) For each RUC-committed Resource that has submitted an Energy Offer Curve, ERCOT shall create a monotonically increasing proxy Energy Offer Curve as described below:

|  |  |
| --- | --- |
| **MW** | **Price (per MWh)** |
| HSL (if more than highest MW in Energy Offer Curve) | Greater of $1,500 or price associated with the highest MW in QSE submitted Energy Offer Curve |
| Energy Offer Curve | Greater of $1,500 or the QSE submitted Energy Offer Curve |
| Zero | Greater of $1,500 or the first price point of the QSE submitted Energy Offer Curve |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***[NPRR930: Insert paragraph (iii) below upon system implementation:]***  (iii) For each RUC-committed Resource during the time period stated in the Advance Action Notice (AAN) if any Resource received an Outage Schedule Adjustment, ERCOT shall create a proxy Energy Offer Curve as described below:   |  |  | | --- | --- | | **MW** | **Price (per MWh)** | | HSL | $4,500 | | Zero | $4,500 | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***[NPRR884: Insert paragraphs (iv) and (v) below upon system implementation:]***  (iv) For each Combined Cycle Generation Resource that was RUC-committed from one On-Line configuration in order to transition to a different configuration with additional capacity, as instructed by ERCOT, that has not submitted an Energy Offer Curve for the RUC-committed configuration, ERCOT shall create a proxy Energy Offer Curve as described below:   |  |  | | --- | --- | | **MW** | **Price (per MWh)** | | HSL of RUC-committed configuration | $1,500 | | Zero | $1,500 |   (v) For each Combined Cycle Generation Resource that was RUC-committed from one On-Line configuration in order to transition to a different configuration with additional capacity, as instructed by ERCOT, that has submitted an Energy Offer Curve for the RUC-committed configuration, ERCOT shall create a monotonically increasing proxy Energy Offer Curve as described below:   |  |  | | --- | --- | | **MW** | **Price (per MWh)** | | HSL of RUC-committed configuration (if more than highest MW in Energy Offer Curve) | Greater of $1,500 or price associated with the highest MW in QSE submitted Energy Offer Curve | | Energy Offer Curve for MW at and above HSL of QSE-committed configuration | Greater of $1,500 or the QSE submitted Energy Offer Curve | | HSL of QSE-committed configuration (if more than highest MW in Energy Offer Curve) | Greater of $1,500 or price associated with the highest MW in QSE submitted Energy Offer Curve | | Energy Offer Curve for MW at and below HSL of QSE-committed configuration | The QSE submitted Energy Offer Curve | | 1 MW below lowest MW in Energy Offer Curve (if more than LSL) | -$249.99 | | LSL (if less than lowest MW in Energy Offer Curve) | -$250.00 | |

(5) The Entity with decision making authority, as more fully described in Section 3.19.1, Constraint Competitiveness Test Definitions, over how a Resource or Split Generation Resource is offered or scheduled, shall be responsible for all offers associated with each Resource, including offers represented by a proxy Energy Offer Curve.

(6) For a Controllable Load Resource whose QSE has submitted an RTM Energy Bid that does not cover the full range of the Resource’s available Demand response capability, consistent with the Controllable Load Resource’s telemetered quantities, ERCOT shall create a proxy energy bid as described below:

|  |  |
| --- | --- |
| **MW** | **Price (per MWh)** |
| LPC to MPC minus maximum MW of RTM Energy Bid | Price associated with the lowest MW in submitted RTM Energy Bid curve |
| MPC minus maximum MW of RTM Energy Bid to MPC | RTM Energy Bid curve |
| MPC | Right-most point (lowest price) on RTM Energy Bid curve |

(7) ERCOT shall ensure that any RTM Energy Bid is monotonically non-increasing. The QSE representing the Controllable Load Resource shall be responsible for all RTM Energy Bids, including bids updated by ERCOT as described above.

(8) If a Controllable Load Resource telemeters a status of OUTL, it is not considered as dispatchable capacity by SCED. A QSE may use this function to inform ERCOT of instances when the Controllable Load Resource is unable to follow SCED Dispatch Instructions. Under all telemetered statuses including OUTL, the remaining telemetry quantities submitted by the QSE shall represent the operating conditions of the Controllable Load Resource that can be verified by ERCOT. A QSE representing a Controllable Load Resource with a telemetered status of OUTL is still obligated to provide any applicable Ancillary Service Resource Responsibilities previously awarded to that Controllable Load Resource. This paragraph does not apply to Energy Storage Resources (ESRs).

(9) Energy Offer Curves that were constructed in whole or in part with proxy Energy Offer Curves shall be so marked in all ERCOT postings or references to the energy offer.

(10) The two-step SCED methodology referenced in paragraph (1) above is:

(a) The first step is to execute the SCED process to determine Reference LMPs. In this step, ERCOT executes SCED using the full Network Operations Model while only observing limits of Competitive Constraints. Energy Offer Curves for all On-Line Generation Resources and RTM Energy Bids from available Controllable Load Resources, whether submitted by QSEs or created by ERCOT under this Section, are used in the SCED to determine “Reference LMPs.”

(b) The second step is to execute the SCED process to produce Base Points, Shadow Prices, and LMPs, subject to security constraints (including Competitive and Non-Competitive Constraints) and other Resource constraints. The second step must:

(i) Use Energy Offer Curves for all On-Line Generation Resources, whether submitted by QSEs or created by ERCOT. Each Energy Offer Curve must be bounded at the lesser of the Reference LMP (from Step 1) or the appropriate Mitigated Offer Floor. In addition, each Energy Offer Curve subject to mitigation under the criteria described in Section 3.19.4, Security-Constrained Economic Dispatch Constraint Competitiveness Test, must be capped at the greater of the Reference LMP (from Step 1) at the Resource Node plus a variable not to exceed 0.01 multiplied by the value of the Resource’s Mitigated Offer Cap (MOC) curve at the LSL or the appropriate MOC;

(ii) Use RTM Energy Bid curves for all available Controllable Load Resources, whether submitted by QSEs or created by ERCOT. There is no mitigation of RTM Energy Bids. An RTM Energy Bid from a Controllable Load Resource represents the bid for energy distributed across all nodes in the Load Zone in which the Controllable Load Resource is located. For an ESR, an RTM Energy Bid represents a bid for energy at the ESR’s Resource Node; and

(iii) Observe all Competitive and Non-Competitive Constraints.

(c) ERCOT shall archive information and provide monthly summaries of security violations and any binding transmission constraints identified in Step 2 of the SCED process. The summary must describe the limiting element (or identified operator-entered constraint with operator’s comments describing the reason and the Resource-specific impacts for any manual overrides). ERCOT shall provide the summary to Market Participants on the MIS Secure Area and to the Independent Market Monitor (IMM).

(11) For each SCED process, in addition to the binding Base Points and LMPs, ERCOT shall calculate a non-binding projection of the Base Points and Resource Node LMPs, Real-Time Reliability Deployment Price Adders, Real-Time On-Line Reserve Price Adders, Real-Time Off-Line Reserve Price Adders, Hub LMPs and Load Zone LMPs at a frequency of every five minutes for at least 15 minutes into the future based on the same inputs to the SCED process as described in this Section, except that the Resource’s HDL and LDL and the total generation requirement will be as estimated at future intervals. The Resource’s HDL and LDL will be calculated for each interval of the projection based on the ramp rate capability over the study period. ERCOT shall estimate the projected total generation requirement by calculating a Load forecast for the study period. In lieu of the steps described in Section 6.5.7.3.1, Determination of Real-Time On-Line Reliability Deployment Price Adder, the non-binding projection of Real-Time Reliability Deployment Price Adders shall be estimated based on GTBD, reliability deployments MWs, and aggregated offers. The Energy Offer Curve from SCED Step 2, the virtual offers for Load Resources deployed and the power balance penalty curve will be compared against the updated GTBD to get an estimate of the System Lambda from paragraph (2)(l) of Section 6.5.7.3.1. ERCOT shall post the projected non-binding Base Points for each Resource for each interval study period on the MIS Certified Area and the projected non-binding LMPs for Resource Nodes, Real-Time Reliability Deployment Price Adders, Real-Time On-Line Reserve Price Adders, Real-Time Off-Line Reserve Price Adders, Hub LMPs and Load Zone LMPs on the MIS Public Area pursuant to Section 6.3.2, Activities for Real-Time Operations.

(12) For each SCED process, ERCOT shall calculate a Real-Time On-Line Reserve Price Adder and a Real-Time Off-Line Reserve Price Adder based on the On-Line and Off-Line available reserves in the ERCOT System and the Operating Reserve Demand Curve (ORDC). The Real-Time Off-Line available reserves shall be administratively set to zero when the SCED snapshot of the Physical Responsive Capability (PRC) is equal to or below the PRC MW at which Energy Emergency Alert (EEA) Level 1 is initiated. In addition, for each SCED process, ERCOT shall calculate a Real-Time On-Line Reliability Deployment Price Adder. The sum of the Real-Time Reliability Deployment Price Adder and the Real-Time On-Line Reserve Price Adder shall be averaged over the 15-minute Settlement Interval and added to the Real-Time LMPs to determine the Real-Time Settlement Point Prices. The price after the addition of the sum of the Real-Time On-Line Reliability Deployment Price Adder and the Real-Time On-Line Reserve Price Adder to LMPs approximates the pricing outcome of the impact to energy prices from reliability deployments and the Real-Time energy and Ancillary Service co-optimization since the Real-Time On-Line Reserve Price Adder captures the value of the opportunity cost of reserves based on the defined ORDC. An Ancillary Service imbalance Settlement shall be performed pursuant to Section 6.7.5, Real-Time Ancillary Service Imbalance Payment or Charge, to make Resources indifferent to the utilization of their capacity for energy or Ancillary Service reserves.

(13) ERCOT shall determine the methodology for implementing the ORDC to calculate the Real-Time On-Line Reserve Price Adder and Real-Time Off-Line Reserve Price Adder. Following review by TAC, the ERCOT Board shall review the recommendation and approve a final methodology. Within two Business Days following approval by the ERCOT Board, ERCOT shall post the methodology on the MIS Public Area.

(14) At the end of each season, ERCOT shall determine the ORDC for the same season in the upcoming year, based on historic data using the ERCOT Board-approved methodology for implementing the ORDC. Annually, ERCOT shall verify that the ORDC is adequately representative of the loss of Load probability for varying levels of reserves. Twenty days after the end of the Season, ERCOT shall post the ORDC for the same season of the upcoming year on the MIS Public Area.

(15) ERCOT may override one or more of a Controllable Load Resource’s parameters in SCED if ERCOT determines that the Controllable Load Resource’s participation is having an adverse impact on the reliability of the ERCOT System.

(16) The QSE representing an ESR, in order to charge the ESR, must submit RTM Energy Bids, and the ESR may withdraw energy from the ERCOT System only when dispatched by SCED to do so. An ESR may telemeter a status of OUTL only if the ESR is in Outage status.

6.6.3.1 Real-Time Energy Imbalance Payment or Charge at a Resource Node

(1) The payment or charge to each QSE for Energy Imbalance Service is calculated based on the Real-Time Settlement Point Price for the following amounts at a particular Resource Node Settlement Point:

(a) The energy produced by all its Generation Resources or withdrawn by all its Energy Storage Resources (ESRs) at the Settlement Point; plus

(b) The amount of its Self-Schedules with sink specified at the Settlement Point; plus

(c) The amount of its Day-Ahead Market (DAM) Energy Bids cleared in the DAM at the Settlement Point; plus

(d) The amount of its Energy Trades at the Settlement Point where the QSE is the buyer; minus

(e) The amount of its Self-Schedules with source specified at the Settlement Point; minus

(f) The amount of its energy offers cleared in the DAM at the Settlement Point; minus

(g) The amount of its Energy Trades at the Settlement Point where the QSE is the seller.

(2) The payment or charge to each QSE for Energy Imbalance Service at a Resource Node Settlement Point for a given 15-minute Settlement Interval is calculated as follows:

RTEIAMT *q, p* = (-1) \* {((RESREV *q, r, gsc, p*)) + (WSLAMTTOT *q, r, p*) + (ESRNWSLAMTTOT *q, r, p*) + RTSPP *p* \* [(SSSK *q, p* \* ¼) + (DAEP *q, p* \* ¼) + (RTQQEP *q, p* \* ¼) – (SSSR *q, p* \* ¼) – (DAES *q, p* \* ¼) – (RTQQES *q, p* \* ¼)]}

Where:

RESREV *q, r, gsc, p* = GSPLITPER *q, r, gsc, p* \* NMSAMTTOT *gsc*

RESMEB q, r, gsc, p = GSPLITPER q, r, gsc, p \* NMRTETOT gsc

WSLTOT *q, p* =  ( MEBL *q,r,b*)

ESRNWSLTOT *q, p* =  ( MEBR *q, r, b*)

RNIMBAL *q, p =* (RESMEB *q, r, gsc, p*) + WSLTOT *q, p* + ESRNWSLTOT *q, p* + (SSSK *q, p* \* ¼) + (DAEP *q, p* \* ¼) + (RTQQEP *q, p* \* ¼) – (SSSR *q, p* \* ¼) – (DAES *q, p* \* ¼) – (RTQQES *q, p* \* ¼)

The above variables are defined as follows:

| Variable | Unit | Description |
| --- | --- | --- |
| RTEIAMT *q, p* | $ | *Real-Time Energy Imbalance Amount per QSE per Settlement Point*—The payment or charge to QSE *q* for Real-Time Energy Imbalance Service at Settlement Point *p*, for the 15-minute Settlement Interval. |
| RNIMBAL *q, p* | MWh | *Resource Node Energy Imbalance per QSE per Settlement Point*—The Resource Node volumetric imbalance for QSE *q* for Real-Time Energy Imbalance Service at Settlement Point *p*, for the 15-minute Settlement Interval. |
| RTSPP *p* | $/MWh | *Real-Time Settlement Point Price per Settlement Point*—The Real-Time Settlement Point Price at Settlement Point *p*, for the 15-minute Settlement Interval. |
| SSSK *q, p* | MW | *Self-Schedule with Sink at Settlement Point per QSE per Settlement Point*—The QSE *q*’s Self-Schedule with sink at Settlement Point *p*, for the 15-minute Settlement Interval. |
| DAEP *q, p* | MW | *Day-Ahead Energy Purchase per QSE per Settlement Point*—The QSE *q*’s DAM Energy Bids at Settlement Point *p* cleared in the DAM, for the hour that includes the 15-minute Settlement Interval. |
| RTQQEP *q, p* | MW | *Real-Time QSE-to-QSE Energy Purchase per QSE per Settlement Point*⎯The amount of MW bought by QSE *q* through Energy Trades at Settlement Point *p*, for the 15-minute Settlement Interval. |
| SSSR *q, p* | MW | *Self-Schedule with Source at Settlement Point per QSE per Settlement Point*—The QSE *q*’s Self-Schedule with source at Settlement Point *p*, for the 15-minute Settlement Interval. |
| DAES *q, p* | MW | *Day-Ahead Energy Sale per QSE per Settlement Point*—The QSE *q*’s energy offers at Settlement Point *p* cleared in the DAM, for the hour that includes the 15-minute Settlement Interval. |
| RTQQES *q, p* | MW | *Real-Time QSE-to-QSE Energy Sale per QSE per Settlement Point*⎯The amount of MW sold by QSE *q* through Energy Trades at Settlement Point *p*, for the 15-minute Settlement Interval. |
| RESREV *q, r, gsc, p* | $ | *Resource Share Revenue Settlement Payment*—The Resource share of the total payment to the entire Facility with a net metering arrangement attributed to Resource *r* that is part of a generation site code *gsc* for the QSE *q* at Settlement Point *p*. |
| RESMEB *q, r, gsc, p* | MWh | *Resource Share Net Meter Real-Time Energy Total*—The Resource share of the net sum for all Settlement Meters attributed to Resource *r* that is part of a generation site code *gsc* for the QSE *q* at Settlement Point *p*. |
| WSLTOT *q, p* | MWh | *WSL Total*—The total WSL energy metered by the Settlement Meters which measure WSL for the QSE *q* at Settlement Point *p*. |
| ESRNWSLTOT *q, p* | MWh | *ESR Non-WSL Total*—The total energy metered by the Settlement Meters which measures ESR load that is not WSL for the QSE *q* at Settlement Point *p.* |
| MEBL *q,r,b* | MWh | *Metered Energy for Wholesale Storage Load at bus*⎯The WSL energy metered by the Settlement Meter which measures WSL for the 15-minute Settlement Interval represented as a negative value, for the QSE *q*, Resource *r*, at bus *b*. |
| MEBR *q, r, b* | MWh | *Metered Energy for Energy Storage Resource load at Bus* - The energy metered by the Settlement Meter which measures ESR load that is not WSL for the 15-minute Settlement Interval represented as a negative value, for the QSE *q*, Resource *r*, at bus *b*. |
| NMSAMTTOT *gsc* | $ | *Net Metering Settlement*—The total payment or charge to a generation site with a net metering arrangement. |
| WSLAMTTOT*q, r, p* | $ | *Wholesale Storage Load Settlement*—The total payment or charge to QSE *q*, Resource *r*, at Settlement Point *p*, for WSL for each 15-minute Settlement Interval. |
| ESRNWSLAMTTOT*q, r, p* | $ | *Energy Storage Resource Non-WSL Settlement*—The total payment or charge to QSE *q*, Resource *r*, at Settlement Point *p*, for ESR load that is not WSL for each 15-minute Settlement Interval. |
| NMRTETOT *gsc* | MWh | *Net Meter Real-Time Energy Total*—The net sum for all Settlement Meters included in generation site code *gsc*. A positive value indicates an injection of power to the ERCOT System. |
| GSPLITPER *q, r, gsc, p* | none | *Generation Resource SCADA Splitting Percentage*—The generation allocation percentage for Resource *r* that is part of a net metering arrangement. GSPLITPER is calculated by taking the Supervisory Control and Data Acquisition (SCADA) values (GSSPLITSCA) for a particular Generation Resource *r* that is part of a net metering configuration and dividing by the sum of all SCADA values for all Resources that are included in the net metering configuration for each interval. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| *q* | none | A QSE. |
| *p* | none | A Resource Node Settlement Point. |
| *r* | none | A Generation Resource or a Controllable Load Resource that is part of an ESR that is located at the Facility with net metering. |
| *gsc* | none | A generation site code. |
| *b* | none | An Electrical Bus. |

(3) For a facility with Settlement Meters that measure ESR Load, the total payment or charge for ESR Load is calculated for a QSE, ESR, and Settlement Point for each 15-minute Settlement Interval.

The WSL is settled as follows:

**WSLAMTTOT *q, r, p* =**  **(RTRMPRESR *b* \* MEBL** ***q, r, b*)**

The ESR load that is not WSL is settled as follows:

**ESRNWSLAMTTOT *q, r, p* =**  **(RTRMPRESR *b* \* MEBR** ***q, r, b*)**

Where the price for Settlement Meter is determined as follows:

**RTRMPRESR *b* = Max [-$251, (image010(RNWFL *b, y* \* RTLMP *b, y*) + RTRSVPOR + RTRDP)]**

Where the weighting factor for the Electrical Bus associated with the meter is:

**RNWFL *b, y* = [Max (0.001,** image001**BP *r, y*) \* TLMP *y*] /**

**[image010Max (0.001,** image001 **BP *r, y*) \* TLMP *y*]**

Where:

RTRSVPOR = image010(RNWF  *y* \* RTORPA *y*)

RTRDP = (RNWF  *y* \* RTORDPA *y*)

RNWF *y* = TLMP *y* / TLMP *y*

The summation is over all ESR Load *r* associated to the individual meter. The determination of which Resources are associated to an individual meter is static and based on the normal system configuration of the generation site code, *gsc*.

The above variables are defined as follows:

| Variable | Unit | Description |
| --- | --- | --- |
| RTLMP *b, y* | $/MWh | *Real-Time Locational Marginal Price at bus per interval*⎯The Real-Time LMP for the meter at Electrical Bus *b*, for the SCED interval *y*. |
| TLMP *y* | second | *Duration of SCED interval per interval*⎯The duration of the SCED interval *y*. |
| RTRSVPOR | $/MWh | *Real-Time Reserve Price for On-Line Reserves*⎯The Real-Time Reserve Price for On-Line Reserves for the 15-minute Settlement Interval. |
| RTORPA*y* | $/MWh | *Real-Time On-Line Reserve Price Adder per interval*⎯The Real-Time On-Line Reserve Price Adder for the SCED interval *y*. |
| RTRDP | $/MWh | *Real-Time On-Line Reliability Deployment Price* ⎯The Real-Time price for the 15-minute Settlement Interval, reflecting the impact of reliability deployments on energy prices that is calculated from the Real-time On-Line Reliability Deployment Price Adder. |
| RTORDPA*y* | $/MWh | *Real-Time On-Line Reliability Deployment Price Adder* ⎯The Real-Time Price Adder that captures the impact of reliability deployments on energy prices for the SCED interval *y*. |
| RNWF *y* | none | *Resource Node Weighting Factor per interval*⎯The weight used in the Resource Node Settlement Point Price calculation for the portion of the SCED interval *y* within the Settlement Interval. |
| MEBL*q,r,b* | MWh | *Metered Energy for Wholesale Storage Load at bus*⎯The WSL energy metered by the Settlement Meter which measures WSL for the 15-minute Settlement Interval represented as a negative value, for the QSE *q*, Resource *r*, at bus *b*. |
| MEBR *q, r, b* | MWh | *Metered Energy for Energy Storage Resource Load at Bus* - The energy metered by the Settlement Meter which measures ESR Load that is not WSL for the 15-minute Settlement Interval represented as a negative value, for the QSE *q*, Resource *r*, at bus *b*. |
| WSLAMTTOT*q, r, p* | $ | *Wholesale Storage Load Settlement*—The total payment or charge to QSE *q*, Resource *r*, at Settlement Point *p*, for WSL for each 15-minute Settlement Interval. |
| ESRNWSLAMTTOT*q, r, p* | $ | *Energy Storage Resource Non-WSL Settlement*—The total payment or charge to QSE *q*, Resource *r*, at Settlement Point *p*, for ESR Load that is not WSL for each 15-minute Settlement Interval. |
| RNWFL*b, y* | none | *Net meter Weighting Factor per interval for the Energy Metered as Energy Storage Resource Load*The weight factor used in net meter price calculation for meters in Electrical Bus *b*, for the SCED interval *y*, for the ESR Load associated with an ESR. The weighting factor used in the net meter price calculation shall not be recalculated after the fact due to revisions in the association of Resources to Settlement Meters. |
| RTRMPRESR*b* | $/MWh | *Real-Time Price for the Energy Metered as Energy Storage Resource Load at bus*⎯The Real-Time price for the Settlement Meter which measures ESR load at Electrical Bus *b*, for the 15-minute Settlement Interval. |
| BP *r, y* | MW | *Base Point per Resource per interval* - The Base Point of Resource *r*, for the SCED interval *y*. |
| *q* | none | A QSE. |
| *gsc* | none | A generation site code. |
| *r* | none | The Controllable Load Resource that is part of an ESR. |
| *p* | none | A Resource Node Settlement Point. |
| *y* | none | A SCED interval in the 15-minute Settlement Interval. The summation is over the total number of SCED runs that cover the 15-minute Settlement Interval. |
| *b* | none | An Electrical Bus. |

(4) The total payment or charge to a Facility with a net metering arrangement for each 15-minute Settlement Interval shall be calculated as follows:

**NMRTETOT *gsc* = Max (0, ( (MEB *gsc, b +* MEBC *gsc, b*)))**

If NMRTETOT *gsc* = 0 for a 15-minute Settlement Interval, then

The Load that is not WSL is included in the Real-Time AML per QSE.

Otherwise, when NMRTETOT *gsc* **>** 0 for a 15-minute Settlement Interval, then

NMSAMTTOT *gsc* =  [(RTRMPR *b* \* MEB *gsc, b*) + (RTRMPR *b* \* MEBC *gsc, b*)]

Where the price for Settlement Meter is determined as follows:

RTRMPR *b* = Max [-$251, (image010(RNWF *b, y* \* RTLMP *b, y*) + RTRSVPOR + RTRDP)]

Where the weighting factor for the Electrical Bus associated with the meter is:

**RNWF *b, y* = [Max (0.001,** **BP *r, y*) \* TLMP *y*] /**

**[image010Max (0.001,** **BP *r, y*) \* TLMP *y*]**

Where:

RTRSVPOR = image010(RNWF  *y* \* RTORPA *y*)

RTRDP = (RNWF  *y* \* RTORDPA *y*)

RNWF *y* = TLMP *y* / TLMP *y*

The summation is over all Resources *r* associated to the individual meter. The determination of which Resources are associated to an individual meter is static and based on the normal system configuration of the generation site code, *gsc*.

The above variables are defined as follows:

| Variable | Unit | Description |
| --- | --- | --- |
| NMRTETOT *gsc* | MWh | *Net Meter Real-Time Energy Total*—The net sum for all Settlement Meters included in generation site code *gsc*. A positive value indicates an injection of power to the ERCOT System. |
| NMSAMTTOT*gsc* | $ | *Net Metering Settlement*—The total payment or charge to a generation site with a net metering arrangement. |
| RTRMPR *b* | $/MWh | *Real-Time Price for the Energy Metered for each Resource meter at bus*⎯The Real-Time price for the Settlement Meter at Electrical Bus *b*, for the 15-minute Settlement Interval. |
| MEB *gsc, b* | MWh | *Metered Energy at bus*⎯The metered energy by the Settlement Meter which is not upstream from another Settlement Meter which measures ESR Load for the 15-minute Settlement Interval. A positive value represents energy produced, and a negative value represents energy withdrawn. |
| RTRSVPOR | $/MWh | *Real-Time Reserve Price for On-Line Reserves*⎯The Real-Time Reserve Price for On-Line Reserves for the 15-minute Settlement Interval. |
| RTORPA*y* | $/MWh | *Real-Time On-Line Reserve Price Adder per interval*⎯The Real-Time On-Line Reserve Price Adder for the SCED interval *y*. |
| RTRDP | $/MWh | *Real-Time On-Line Reliability Deployment Price* ⎯The Real-Time price for the 15-minute Settlement Interval, reflecting the impact of reliability deployments on energy prices that is calculated from the Real-time On-Line Reliability Deployment Price Adder. |
| RTORDPA*y* | $/MWh | *Real-Time On-Line Reliability Deployment Price Adder* ⎯The Real-Time Price Adder that captures the impact of reliability deployments on energy prices for the SCED interval *y*. |
| RNWF *y* | none | *Resource Node Weighting Factor per interval*⎯The weight used in the Resource Node Settlement Point Price calculation for the portion of the SCED interval *y* within the Settlement Interval. |
| RTLMP *b, y* | $/MWh | *Real-Time Locational Marginal Price at bus per interval*⎯The Real-Time LMP for the meter at Electrical Bus *b*, for the SCED interval *y*. |
| TLMP *y* | second | *Duration of SCED interval per interval*⎯The duration of the SCED interval *y*. |
| RNWF *b, y* | none | *Net meter Weighting Factor per interval*The weight factor used in net meter price calculation for meters in Electrical Bus *b*, for the SCED interval *y*. The weighting factor used in the net meter price calculation shall not be recalculated after the fact due to revisions in the association of Resources to Settlement Meters. |
| BP *r, y* | MW | *Base Point per Resource per interval*The Base Point of Resource *r,* for the SCED interval *y*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| MEBC*gsc, b* | MWh | *Metered Energy at bus (Calculated)*⎯The calculated energy for the 15-minute Settlement Interval for a Settlement Meter which is upstream from another Settlement Meter which measures ESR Load. A positive value represents energy produced, and a negative value represents energy withdrawn. |
| *gsc* | none | A generation site code. |
| *r* | none | A Generation Resource that is located at the Facility with net metering. |
| *y* | none | A SCED interval in the 15-minute Settlement Interval. The summation is over the total number of SCED runs that cover the 15-minute Settlement Interval. |
| *b* | none | An Electrical Bus. |

(5) The Generation Resource SCADA Splitting Percentage for each Resource within a net metering arrangement for the 15-minute Settlement Interval is calculated as follows:

**GSPLITPER *q, r, gsc, p* = GSSPLITSCA *r* /** **GSSPLITSCA *r***

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| GSPLITPER *q, r, gsc, p* | none | *Generation Resource SCADA Splitting Percentage*—The generation allocation percentage for Resource *r* that is part of a generation site code *gsc* for the QSE *q* at Settlement Point *p*. GSPLITPER is calculated by taking the SCADA values (GSSPLITSCA) for a particular Generation Resource *r* that is part of a net metering configuration and dividing by the sum of all SCADA values for all Resources that are included in the net metering configuration for each interval. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| GSSPLITSCA *r* | MWh | *Generation Resource SCADA Net Real Power provided via Telemetry*—The net real power provided via telemetry per Resource within the net metering arrangement, integrated for the 15-minute Settlement Interval. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| *gsc* | none | A generation site code. |
| *r* | none | A Generation Resource that is located at the Facility with net metering. |
| *q* | none | A QSE. |
| *p* | none | A Resource Node Settlement Point. |

(6) The total net payments and charges to each QSE for Energy Imbalance Service at all Resource Node Settlement Points for the 15-minute Settlement Interval is calculated as follows:

RTEIAMTQSETOT *q* =  RTEIAMT *q, p*

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RTEIAMTQSETOT *q* | $ | *Real-Time Energy Imbalance Amount QSE Total per QSE*⎯The total net payments and charges to QSE *q* for Real-Time Energy Imbalance Service at all Resource Node Settlement Points for the 15-minute Settlement Interval. |
| RTEIAMT *q, p* | $ | *Real-Time Energy Imbalance Amount per QSE per Settlement Point*—The payment or charge to QSE *q* for Real-Time Energy Imbalance Service at Settlement Point *p*, for the 15-minute Settlement Interval. |
| *q* | none | A QSE. |
| *p* | none | A Resource Node Settlement Point. |

6.6.3.2 Real-Time Energy Imbalance Payment or Charge at a Load Zone

(1) The payment or charge to each QSE for Energy Imbalance Service is calculated based on the Real-Time Settlement Point Price for the following amounts at a particular Load Zone Settlement Point:

(a) The amount of its Self-Schedules with sink specified at the Settlement Point; plus

(b) The amount of its DAM Energy Bids cleared in the DAM at the Settlement Point; plus

(c) The amount of its Energy Trades at the Settlement Point where the QSE is the buyer; minus

(d) The amount of its Self-Schedules with source specified at the Settlement Point; minus

(e) The amount of its energy offers cleared in the DAM at the Settlement Point; minus

(f) The amount of its Energy Trades at the Settlement Point where the QSE is the seller; minus

(g) Its AML at the Settlement Point excluding ESR Load that is not WSL; plus

(h) The aggregated generation of its Settlement Only Generators (SOGs) in the Load Zone.

|  |
| --- |
| [NPRR917: Replace item (h) above with the following upon system implementation:]  (h) The aggregated generation of its Settlement Only Transmission Self-Generators (SOTSGs) at the Settlement Point. SOTSG sites will be represented as a single unit in the ERCOT Settlement system.  (i) The aggregated generation of its Settlement Only Distribution Generators (SODGs) and Settlement Only Transmission Generators (SOTGs) that have elected to retain Load Zone pricing in accordance with Section 6.6.3.9, Real-Time Payment or Charge for Energy from a Settlement Only Distribution Generator (SODG) or a Settlement Only Transmission Generator (SOTG). SODG and SOTG sites will be represented as a single unit in the ERCOT Settlement system. |

(2) The payment or charge to each QSE for Energy Imbalance Service at a Load Zone for a given 15-minute Settlement Interval is calculated as follows:

RTEIAMT *q, p* = (-1) \* {[RTSPP *p* \* [(SSSK *q, p* \* ¼) + (DAEP *q, p* \* ¼) + (RTQQEP *q, p* \* ¼) – (SSSR *q, p* \* ¼) – (DAES *q, p* \* ¼) – (RTQQES *q, p* \* ¼)]] + [RTSPPEW *p* \* (RTMGNM *q, p* – (RTAML *q, p*– RTAMLESRNW *q, p*))]}

|  |
| --- |
| [NPRR917: Replace the formula “RTEIAMT q, p” above with the following upon system implementation:]  **RTEIAMT *q, p* = (-1) \* {[RTSPP *p* \* [(SSSK *q, p* \* ¼) + (DAEP *q, p* \* ¼) + (RTQQEP *q, p* \* ¼) – (SSSR *q, p* \* ¼) – (DAES *q, p* \* ¼) – (RTQQES *q, p* \* ¼)]] + [RTSPPEW *p* \* (RTMGSOGZ *q, p* – (RTAML *q, p* – RTAMLESRNW *q, p*))]}** |

And

LZIMBAL *q, p =* (SSSK *q, p* \* ¼) + (DAEP *q, p* \* ¼) + (RTQQEP *q, p* \* ¼) – (SSSR *q, p* \* ¼) – (DAES *q, p* \* ¼) – (RTQQES *q, p* \* ¼) – (RTAML *q, p* – RTAMLESRNW *q, p*) + RTMGNM *q, p*

|  |
| --- |
| [NPRR917: Replace the formula “LZIMBAL q, p” above with the following upon system implementation:]  **LZIMBAL *q, p =* (SSSK *q, p* \* ¼) + (DAEP *q, p* \* ¼) + (RTQQEP *q, p* \* ¼) – (SSSR *q, p* \* ¼) – (DAES *q, p* \* ¼) – (RTQQES *q, p* \* ¼) – (RTAML *q, p* *-* RTAMLESRNW *q, p* ) + RTMGSOGZ *q, p*** |

The above variables are defined as follows:

| Variable | Unit | Description |
| --- | --- | --- |
| RTEIAMT *q, p* | $ | *Real-Time Energy Imbalance Amount per QSE per Settlement Point*—The payment or charge to QSE *q* for Real-Time Energy Imbalance Service at Settlement Point *p*, for the 15-minute Settlement Interval. |
| RTSPP *p* | $/MWh | *Real-Time Settlement Point Price per Settlement Point*—The Real-Time Settlement Point Price at Settlement Point *p*, for the 15-minute Settlement Interval. |
| LZIMBAL *q, p* | MWh | *Load Zone Energy Imbalance per QSE per Settlement Point*—The Load Zone volumetric imbalance for QSE *q* for Real-Time Energy Imbalance Service at Settlement Point *p*, for the 15-minute Settlement Interval. |
| RTSPPEW *p* | $/MWh | *Real-Time Settlement Point Price Energy-Weighted*⎯The Real-Time Settlement Point Price at the Settlement Point *p*, for the 15-minute Settlement Interval that is weighted by the State Estimated Load for the Load Zone of each SCED interval within the 15-minute Settlement Interval. |
| RTAML *q, p* | MWh | *Real-Time Adjusted Metered Load per QSE per Settlement Point*—The sum of the AML at the Electrical Buses that are included in Settlement Point *p* represented by QSE *q* for the 15-minute Settlement Interval. |
| RTAMLESRNW *q, p* | MWh | *Real-Time Adjusted Metered Load for ESR Non-WSL per QSE per Settlement Point*—The sum of the AML for the ESR load that is not WSL at the Electrical Buses that are included in Settlement Point *p* represented by QSE *q* for the 15-minute Settlement Interval, represented as a positive value. |
| SSSK *q, p* | MW | *Self-Schedule with Sink at Settlement Point per QSE per Settlement Point*—The QSE *q*’s Self-Schedule with sink at Settlement Point *p*, for the 15-minute Settlement Interval. |
| DAEP *q, p* | MW | *Day-Ahead Energy Purchase per QSE per Settlement Point*—The QSE *q*’s DAM Energy Bids at Settlement Point *p* cleared in the DAM, for the hour that includes the 15-minute Settlement Interval. |
| RTQQEP *q, p* | MW | *Real-Time QSE-to-QSE Energy Purchase per QSE per Settlement Point*⎯The amount of MW bought by QSE *q* through Energy Trades at Settlement Point *p*, for the 15-minute Settlement Interval. |
| SSSR *q, p* | MW | *Self-Schedule with Source at Settlement Point per QSE per Settlement Point*—The QSE *q*’s Self-Schedule with source at Settlement Point *p*, for the 15-minute Settlement Interval. |
| DAES *q, p* | MW | *Day-Ahead Energy Sale per QSE per Settlement Point*—The QSE *q*’s energy offers at Settlement Point *p* cleared in the DAM, for the hour that includes the 15-minute Settlement Interval. |
| RTQQES *q, p* | MW | *Real-Time QSE-to-QSE Energy Sale per QSE per Settlement Point*⎯The amount of MW sold by QSE *q* through Energy Trades at Settlement Point *p*, for the 15-minute Settlement Interval. |
| RTMGNM *q, p* | MWh | *Real-Time Metered Generation from Settlement Only Generators per QSE per Settlement Point*—The total Real-Time energy produced by SOGs represented by QSE *q* in Load Zone Settlement Point *p*, for the 15-minute Settlement Interval. |
| |  |  |  |  | | --- | --- | --- | --- | | [NPRR917: Replace the variable “RTMGNM q, p” above with the following upon system implementation:]   |  |  |  | | --- | --- | --- | | RTMGSOGZ *q, p* | MWh | *Real-Time Metered Generation from Settlement Only Generators Zonal per QSE per Settlement Point*—The total Real-Time energy produced by SOTSGs represented by QSE *q* in Load Zone Settlement Point *p*, for the 15-minute Settlement Interval. MWh quantities for SODGs and SOTGs that have opted out of nodal pricing pursuant to Section 6.6.3.9 will also be included in this value. | | | | |
| *q* | none | A QSE. |
| *p* | none | A Load Zone Settlement Point. |

(3) The total net payments and charges to each QSE for Energy Imbalance Service at all Load Zones for the 15-minute Settlement Interval is calculated as follows:

RTEIAMTQSETOT *q* = RTEIAMT *q, p*

The above variables are defined as follows:

|  |  |  |
| --- | --- | --- |
| Variable | Unit | Definition |
| RTEIAMTQSETOT *q* | $ | *Real-Time Energy Imbalance Amount QSE Total per QSE*⎯The total net payments and charges to QSE *q* for Real-Time Energy Imbalance Service at all Load Zone Settlement Points for the 15-minute Settlement Interval. |
| RTEIAMT *q, p* | $ | *Real-Time Energy Imbalance Amount per QSE per Settlement Point*—The charge to QSE *q* for Real-Time Energy Imbalance Service at Settlement Point *p*, for the 15-minute Settlement Interval. |
| *q* | none | A QSE. |
| *p* | none | A Load Zone Settlement Point. |