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Demand Curves for Operating Reserve, Regulating and Spinning
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Demand Curves for Operating Reserve, Regulating and Spinning Reserve, and Regulating Reserve, Up Ramp Capability, Down Ramp Capability, and Market-Wide Short-Term Reserve

I.   INTRODUCTION

Demand Curves shall be used by the Transmission Provider to determine the incremental value of Market-Wide Operating Reserve, Market-Wide Regulating and Spinning Reserve, Market-Wide Regulating Reserve, Market-Wide Up Ramp Capability, Market-Wide Down Ramp Capability, and Market-Wide Short-Term Reserve to Load Serving Entities and, if applicable, Market Participants with Exports. Demand Curves shall be used in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets.

II.   GENERAL

The Reserve Demand Curves shall be developed to price Operating Reserve when sufficient Operating Reserves, Regulating and Spinning Reserves, or sufficient Regulating Reserves are not cleared to meet the corresponding Operating Reserve, Regulating and Spinning Reserve, or Regulating Reserve requirement. The Up Ramp Capability Demand Curve shall be developed to price Up Ramp Capability when sufficient Up Ramp Capability is not cleared to meet the Market-Wide Up Ramp Capability Requirement. The Down Ramp Capability Demand Curve shall be developed to price Down Ramp Capability when sufficient Down Ramp Capability is not cleared to meet the Market-Wide Down Ramp Capability Requirement. The Market-Wide Short-Term Reserve Demand Curve shall be developed to price Short-Term Reserve when sufficient Short-Term Reserve is not cleared to meet the Market-Wide Short-Term Reserve Requirement.

Effective On: September 30, 2025

III.   **MARKET-WIDE OPERATING RESERVE DEMAND CURVE**

When the cleared Operating Reserve level is less than the Market-Wide Operating

Reserve Requirement, the Operating Reserve price is determined using a Market-Wide Operating

Reserve Demand Curve. The price is related to the amount of Operating Reserve cleared relative

to the Operating Reserve Requirement, determined as follows:

    i.   If the cleared level of Operating Reserve is less than the minimum of 100%, or the

        percentage amount required to satisfy the Most Severe Single Contingency, as

        defined by NERC, and as determined by the Reserve Sharing Group, times the

        Operating Reserve Requirement, the price is the product of (i) the System VOLL and

        (ii) the Loss of Load Probability Curve. This price has maximum and minimum

        limits. The maximum price is $6,000/MWh. The minimum price is $1,100/MWh

        (sum of the lower bound of the Emergency Tier II Offer Floor, $1,000 and the

        Contingency Reserve Offer Price Cap, $100).

    ii.   If the cleared level of Operating Reserve is less than 100% of the Operating Reserve

        Requirement, but greater than or equal to the percentage amount required to satisfy

        the Most Severe Single Contingency, as defined by NERC, and as determined by the

        Reserve Sharing Group, the price is $600/MWh (sum of the lower bound of the

        Emergency Tier I Offer Floor, $500 and the Contingency Reserve Offer Cap, $100).

        This provision will not apply when the percentage amount required to satisfy the

        Most Severe Single Contingency, as defined by NERC, and as determined by the

        Reserve Sharing Group is greater than or equal to 100% of the requirement level.

IV.   **MARKET-WIDE REGULATING RESERVE DEMAND CURVE**

Availability of Regulating Reserves depends both upon the Resources that are committed and on how the committed Resources are dispatched. When the Transmission Provider is not able to meet the Market Wide Regulating Reserve Requirement using committed Resources, it can take actions such as changing the commitment of Resources to make Capacity available to meet Regulating Reserve Requirements. For cleared Market-Wide Regulating Reserve levels less than the Market-Wide Regulating Reserve Requirement, the Market-Wide Regulating Reserve Demand Curve price will be set based upon the greater of (i) the Contingency Reserve Offer Cap or (ii) the average cost per MWh of committing and running a peaking unit for an hour.

The Market-Wide Regulating Reserve Demand Curve price shall be established monthly and posted on the Transmission Provider's website seven (7) days prior to the beginning of the month for which it will be effective. The average cost per MWh of committing and running a peaking unit for an hour shall be calculated based upon:

(a) A spot gas price index in $/MMBtu, which will be specified, and amended when necessary, in the Transmission Provider's Business Practices Manuals or other documentation on the Transmission Provider's website. Prior to each month, the average of the spot gas price index over the first three weeks of the month prior to the month for which the Market-Wide Regulating Reserve Demand Curve price is being calculated will be calculated.

(b) An annual proxy heat rate determined once a year by the Transmission Provider as the mean of the single hour Offer prices of peakers offered in the Day Ahead and Real-Time Markets over the past year, as specified in (c) through (f) below. The product of the

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monthly average spot gas price from (a) and the annual proxy heat rate from (b) will be the Market Wide Regulating Reserve Demand Curve Price for each Hour for cleared Market Wide Regulating Reserve levels less than the Market Wide Regulating Reserve Requirement.

(c) AnnualProxyHeatRate is an effective heat rate based on the peaker Offers submitted each day and the spot gas prices for that day for each of the days in the year (to the date of calculation). This value will be expressed as MMBtu/MWh and will be calculated annually as follows:

$$\text{Annual Proxy Heat Rate} = \frac{\left(\sum_{o} \sum_{d} \text{Average Daily Proxy Heat Rate}_{o,d} \right)}{\text{Offer Count}}$$

where:

"o" is an index of the Day-Ahead and Real-Time Market peaker Offers in a day;

"d" is an index of the days in the year to the date of calculation, and

"Offer Count" is the total number of Offers by peakers in the Day-Ahead and Real-Time Markets over the year to the date of calculation.

The average daily proxy heat rate for each Offer o on each day d, AverageDailyProxyHeatRate$_{o,d}$, will be calculated as

$$\frac{\sum_{h} \left(\text{AIE Cost}_{o,d,h} + \text{ASU Cost}_{o,d,h} + \text{ANL Cost}_{o,d,h} \right)}{\text{Number Hours} \times \text{Spot Gas Price}_{d}}$$

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where:

"d" indexes the day;

"h" indexes the hours of the day d;

"NumberHours" is the number of hours for Offer o on day d;

$SpotGasPrice_d$ is the spot gas price on day d as given in the index specified in (a);

$AIECost_{o,d,h}$ is the average Incremental Energy Price in \$/MWh for Offer o on day d in Hour h as defined in (d) below;

$ASUCost_{o,d,h}$ is the average start-up cost in \$/MWh for Offer o on day d in Hour h as defined in (e) below; and

$ANLCost_{o,d,h}$ is the average no-load cost in \$/MWh for Offer o on day d in Hour h as defined in (f) below.

(d) $AIECost_{o,d,h}$ is defined as

$$\frac{\int_0^{EconMax_{o,d,h}} IEOffer\ Curve_{o,d,h}(x)dx}{EconMax_{o,d,h}}$$

where:

$IEOfferCurve_{o,d,h}(x)$ is the Incremental Energy Price curve in Offer o on day d in Hour h;

$EcoMax_{o,d,h}$ is the economic maximum output for Offer o on day d in Hour h.

(e) $ASUCost_{o,d,h}$ is defined as

$\underline{SUOffer_{o,d,h}}$

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EconMax $_{o, d, h}$

where:

SUOffer$_{o,d,h}$ is the cold Start-Up Offer price in Offer o on day d in Hour h.

(f) ANLCost$_{o,d,h}$ is defined as

<u>NLOffer $_{o, d, h}$</u>

EconMax $_{o, d, h}$

where:

NLOffer$_{o,d,h}$ is the No-Load Offer price in Offer o on day d in Hour h.

V.   MARKET-WIDE REGULATING AND SPINNING RESERVE DEMAND CURVE

For each cleared Regulating and Spinning Reserve level less than the Market-Wide

Regulating and Spinning Reserve Requirement, the Market-Wide Regulating and Spinning

Reserve Demand Curve shall be used to set the Market-Wide Regulating and Spinning Reserve

constraint Shadow Price. The Regulating and Spinning Reserve Demand Curve is established

based on the level of Regulating and Spinning Reserve shortages. As the Regulating and

Spinning Reserve shortage increases, the corresponding Regulating and Spinning Reserve

Demand Curve value increases as well.

For cleared Market- Wide Regulating and Spinning Reserve levels greater than ninety

percent (90%) but less than one hundred percent (100%) of the Market-Wide Regulating and

Spinning Reserve Requirement, the Market- Wide Regulating and Spinning Reserve will be

priced at $65 per MWh. For cleared Market-Wide Regulating and Spinning Reserve levels less

than ninety percent (90%) of the Market-Wide Regulating and Spinning Reserve Requirement,

the Market- Wide Regulating and Spinning Reserve will be priced at $98 per MWh.

VI.   MARKET-WIDE UP RAMP CAPABILITY DEMAND CURVE

When the cleared Up Ramp Capability level is less than the Market-Wide Up Ramp

Capability Requirement, the Up Ramp Capability price is determined using a Market-Wide Up

Ramp Capability Demand Curve. The price is related to the amount of Up Ramp Capability

cleared relative to the Market-Wide Up Ramp Capability Requirement, determined as follows:

i.   If less than 9% of the requirement level has cleared, the price is $31/MWh.

ii.   If less than 13% of the requirement level has cleared, but more than or equal to 9% of
the requirement level has cleared, the price is $29/MWh.

iii.   If less than 18% of the requirement level has cleared, but more than or equal to 13%
of the requirement level has cleared, the price is $27/MWh.

iv.   If less than 21% of the requirement level has cleared, but more than or equal to 18%
of the requirement level has cleared, the price is $25/MWh.

v.   If less than 26% of the requirement level has cleared, but more than or equal to 21%
of the requirement level has cleared, the price is $23/MWh.

vi.   If less than 37% of the requirement level has cleared, but more than or equal to 26%
of the requirement level has cleared, the price is $18/MWh.

vii.   If less than 47% of the requirement level has cleared, but more than or equal to 37%
of the requirement level has cleared, the price is $14/MWh.

viii.   If less than 53% of the requirement level has cleared, but more than or equal to 47%
of the requirement level has cleared, the price is $12/MWh.

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ix. If less than 100% of the requirement level has cleared, but more than or equal to 53% of the requirement level has cleared, the price is $5/MWh.

x. If more than or equal to 100% of the requirement level has cleared, the price is $0/MWh.

xi. The Market-Wide Up Ramp Capability Demand Curve price will be determined by the Transmission Provider to balance tradeoffs between increased costs of the additional system flexibility and the operational savings. Because Up Ramp Capability provides capacity that can be converted to Energy in a future Dispatch Interval in response to uncertain events, the Transmission Provider approach for determining the Market-Wide Up Ramp Capability Demand Curve price shall include the variability of the market-wide forecasted changes in load and Scheduled Interchange while considering the contribution of non-dispatchable generation served by the dispatchable system resources. It is not required that the Market-Wide Up Ramp Capability Demand Curve price attempts to ensure that Up Ramp Capability levels will cover all potential events.

VII. MARKET-WIDE DOWN RAMP CAPABILITY DEMAND CURVE

When the cleared Down Ramp Capability level is less than the Market-Wide Down Ramp Capability Requirement, the Down Ramp Capability price is determined using a Market-Wide Down Ramp Capability Demand Curve. The price is related to the amount of Down Ramp Capability cleared relative to the Market-Wide Down Ramp Capability Requirement, determined as follows:

i. A single demand curve price is used for all levels of cleared Down Ramp

Capability.

The Market-Wide Down Ramp Capability Demand Curve price will be determined by the Transmission Provider to balance tradeoffs between increased costs of the additional system flexibility and the operational savings. Because Down Ramp Capability provides capacity that can be converted to Energy in a future Dispatch Interval in response to uncertain events, the Transmission Provider approach for determining the Market-Wide Down Ramp Capability Demand Curve price shall include the variability of the market-wide forecasted changes in load and Scheduled Interchange while considering the contribution of non-dispatchable generation served by the dispatchable system resources. It is not required that the Market-Wide Down Ramp Capability Demand Curve price attempts to ensure that Down Ramp Capability levels will cover all potential events. The Market-Wide Down Ramp Capability Demand Curve price will be set to $0/MWh, to disable the product after the removal of Dispatchable Intermittent Resource eligibility.

VIII.   MARKET-WIDE SHORT-TERM RESERVE DEMAND CURVE

When the cleared Short-Term Reserve level is less than the Market-Wide Short-Term Reserve Requirement, the Market-Wide Short-Term Reserve Demand Curve shall be used to set the Market-Wide Short-Term Reserve constraint Shadow Price. The price is determined as follows:

i.   If less than 2500 MW of the requirement level has cleared, the price is $500/MWh.

ii.   If less than 2600 MW of the requirement level has cleared, but more than or equal to 2500 MW of the requirement level has cleared, the price is $478/MWh.

iii.   If less than 2800 MW of the requirement level has cleared, but more than or equal to 2600 MW of the requirement level has cleared, the price is $434/MWh.

iv.   If less than 2900 MW of the requirement level has cleared, but more than or equal to 2800 MW of the requirement level has cleared, the price is $394/MWh.

v.   If less than 3000 MW of the requirement level has cleared, but more than or equal to 2900 MW of the requirement level has cleared, the price is $393/MWh.

vi.   If less than the Market-Wide Short-Term Reserve Requirement has cleared, but more than or equal to 3000 MW of the requirement level has cleared, the price is $100/MWh.

vii.   If more than or equal to the Market-Wide Short-Term Reserve Requirement has cleared, the price is $0/MWh. The Market-Wide Short-Term Reserve Requirement shall be no less than 3000 MW.

viii.   The Market-Wide Short-Term Reserve Demand Curve price will be determined by the Transmission Provider to balance tradeoffs between increased costs of the additional system flexibility and the operational savings. The determination of the Market-Wide Short-Term Reserve Demand Curve price is not required to ensure that Short-Term Reserve levels will cover all potential events.