

## NPRR282 – Grey-Boxed Language

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<b>NPRR Number</b>	<b>282</b>	<b>NPRR Title</b>	<b>Dynamic Ramp Rates Use in SCED</b>
<b>Nodal Protocol Sections Grey-Boxed</b>		2.1, Definitions 6.5.7.1.12, Resource Limits 6.5.7.2, Resource Limit Calculator	

### Current Grey-Boxed Protocol Language

#### 2.1 DEFINITIONS

Definitions are supplied for terms used in more than one Section of the Protocols. If a term is used in only one Section, it is defined there at its earliest usage.

#### LINKS TO DEFINITIONS:

[A](#), [B](#), [C](#), [D](#), [E](#), [F](#), [G](#), [H](#), [I](#), [J](#), [K](#), [L](#), [M](#), [N](#), [O](#), [P](#), [Q](#), [R](#), [S](#), [T](#), [U](#), [V](#), [W](#), [X](#), [Y](#), [Z](#);

[List of Acronyms](#)

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[...]

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[...]

#### Emergency Ramp Rate

The maximum rate of change in MW per minute of a Resource to provide Responsive Reserve that is deployed by ERCOT and that is provided to ERCOT in up to ten segments, each represented by a single MW per minute value (across the capacity of the Resource), which describes the available rate of change in output for the given range (between High Sustained Limit (HSL) and Low Sustained Limit (LSL)) of the output of a Resource.

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***[NPRR282: Replace the above definition “Emergency Ramp Rate” with the following upon system implementation:]***

### **Emergency Ramp Rate**

The maximum rate of change in MW per minute of a Resource to provide Responsive Reserve that is deployed by ERCOT and that is provided to ERCOT in up to ten segments, each represented by a single MW per minute value (across the capacity of the Resource), which describes the available rate of change in output for the given range (between High Sustained Limit (HSL) and Low Sustained Limit (LSL)) of the output of a Resource. In Real-Time SCED Dispatch, the Emergency Ramp Rate is telemetered by the QSE to ERCOT and represents the total capacity (in MW) that the Resource can change from its current actual generation within the next five minutes divided by five.

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### **Normal Ramp Rate**

The rate of change in MW per minute of a Resource, which is specified by the QSE to ERCOT by up to ten segments; each segment represents a single MW per minute value (across the capacity of the Resource) that describe the available rate of change in output for the given range (between HSL and LSL) of output of a Resource.

***[NPRR282: Replace the above definition “Normal Ramp Rate” with the following upon system implementation:]***

### **Normal Ramp Rate**

The rate of change in MW per minute of a Resource, which is specified by the QSE to ERCOT by up to ten segments; each segment represents a single MW per minute value (across the capacity of the Resource) that describe the available rate of change in output for the given range (between HSL and LSL) of output of a Resource. In Real-Time SCED Dispatch, the Normal Ramp Rate is telemetered by the QSE to ERCOT and represents the total capacity (in MW) that the Resource can change from its current actual generation within the next five minutes divided by five.

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[...]

### 6.5.7.1.12 *Resource Limits*

- (1) The following Generation Resource limits are calculated by ERCOT and used as inputs by the SCED process:
  - (a) HASL;
  - (b) LASL;
  - (c) Normal Ramp Rate by using the curve submitted by the QSE and the Resource's MW telemetry;
  - (d) Emergency Ramp Rate by using the curve submitted by the QSE and the Resource's MW telemetry;
  - (e) SCED Up Ramp Rate (SURAMP), which represents the ability of a Generation Resource to increase generation output in SCED;
  - (f) SCED Down Ramp Rate (SDRAMP), which represents the ability of a Generation Resource to decrease generation output in SCED;
  - (g) HDL, which represents a dynamically calculated MW upper limit on a Resource that describes the maximum capability of the Resource SCED dispatch for the next five minutes (the Resource's Real-Time generation plus the product of the Normal Ramp Rate at that Real-Time output level multiplied by five), restricted by HASL; and
  - (h) LDL, which represents a dynamically calculated MW lower limit on a Resource that describes the minimum capability of the Resource SCED dispatch for the next five minutes (the Resource's Real-Time generation minus the product of the Normal Ramp Rate at that Real-Time output level multiplied by five), restricted by LASL.
- (2) The following Load Resource limits are calculated by ERCOT and used in other calculations and as information for ERCOT Operators:
  - (a) HASL; and
  - (b) LASL.
- (3) For a more detailed explanation of all the Resource limits calculated by ERCOT, please reference Section 6.5.7.2, Resource Limit Calculator.

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***[NPRR282: Replace paragraph (1) above with the following upon system implementation:]***

- (1) The following Generation Resource limits are calculated by ERCOT and used as inputs by the SCED process:
  - (a) HASL;
  - (b) LASL;
  - (c) Normal Ramp Rate based on the values telemetered by the QSE to ERCOT;
  - (d) Emergency Ramp Rate based on the values telemetered by the QSE to ERCOT;
  - (e) SCED Up Ramp Rate (SURAMP), which represents the ability of a Generation Resource to increase generation output in SCED;
  - (f) SCED Down Ramp Rate (SDRAMP), which represents the ability of a Generation Resource to decrease generation output in SCED;
  - (g) HDL, which represents a dynamically calculated MW upper limit on a Resource that describes the maximum capability of the Resource SCED dispatch for the next five minutes (the Resource's Real-Time generation plus the product of the Normal Ramp Rate, as telemetered by the QSE, multiplied by five), restricted by HASL; and
  - (h) LDL, which represents a dynamically calculated MW lower limit on a Resource that describes the minimum capability of the Resource SCED dispatch for the next five minutes (the Resource's Real-Time generation minus the product of the Normal Ramp Rate, as telemetered by the QSE, multiplied by five), restricted by LASL.
- (2) The following Load Resource limits are calculated by ERCOT and used in other calculations and as information for ERCOT Operators:
  - (a) HASL; and
  - (b) LASL.
- (3) For a more detailed explanation of all the Resource limits calculated by ERCOT, please reference Section 6.5.7.2, Resource Limit Calculator.

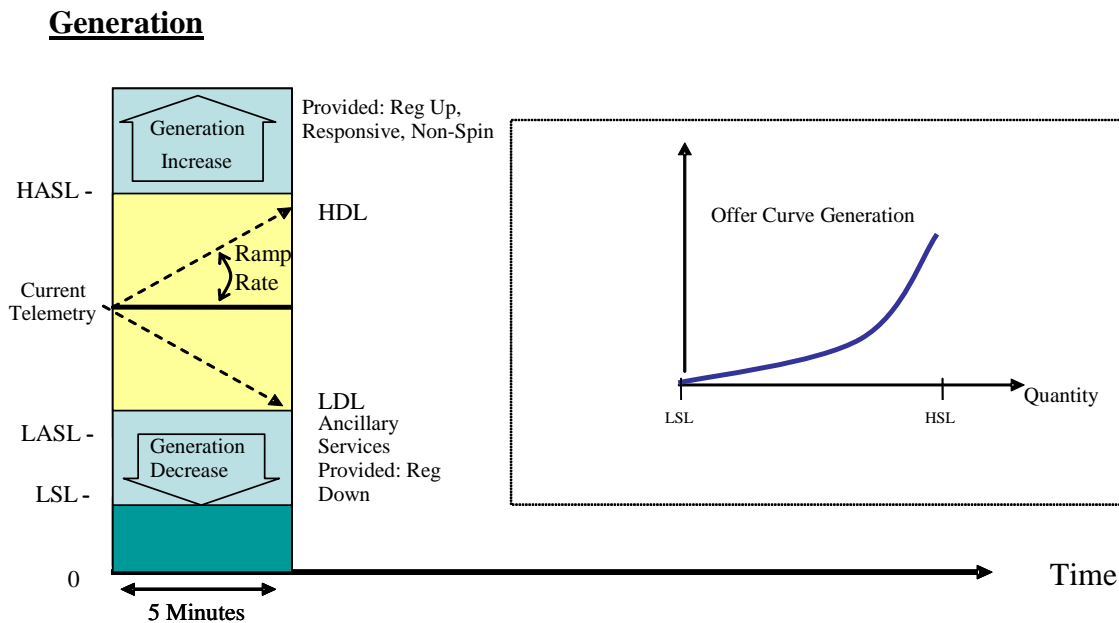
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### 6.5.7.2 Resource Limit Calculator

- (1) ERCOT shall calculate the HASL, LASL, SURAMP, SDRAMP, HDL and LDL within four seconds after a change of the Resource-specific attributes provided as part of the QSE's SCADA telemetry under Section 6.5.5.2, Operational Data Requirements. The formulas described below define which Resource-specific attributes must be used to calculate each Resource limit. The Resource limits are used as inputs into both the SCED process and the Ancillary Service Capacity Monitor as described in Section 6.5.7.6, Load Frequency Control. These Resource limits help ensure that the deployments produced by the SCED and Load Frequency Control (LFC) processes will respect the commitment of a Resource to provide Ancillary Services as well as individual Resource physical limitations.
- (2) The figures below illustrate how the Resource Limit Calculator determines the Resource limits for Generation and Load Resources:

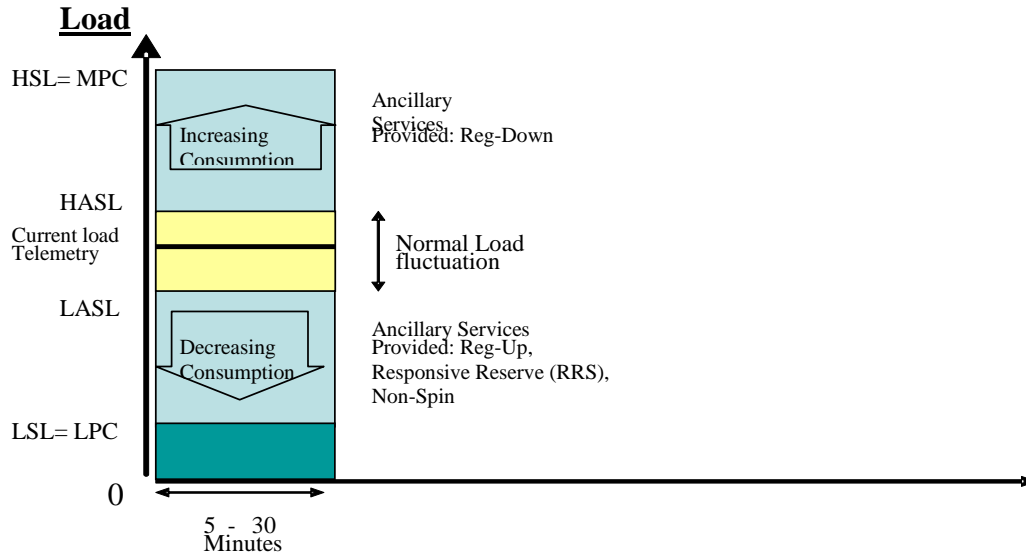
Generation Resources:



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Load Resources:



(3) For Generation Resources, HASL is calculated as follows:

$$\text{HASL} = \text{Max} (\text{LASL}, (\text{HSLTELEM} - (\text{RRSTELEM} + \text{RUSTELEM} + \text{NSRSTELEM})))$$

Variable	Description
HASL	High Ancillary Service Limit
HSLTELEM	High Sustained Limit provided via telemetry – per Section 6.5.5.2
LASL	Low Ancillary Service Limit
RRSTELEM	Responsive Reserve Ancillary Service Schedule provided by telemetry
RUSTELEM	Reg-Up Ancillary Service Resource Responsibility designation provided by telemetry
NSRSTELEM	Non-Spin Ancillary Service Schedule provided via telemetry

(4) For Generation Resources, LASL is calculated as follows:

$$\text{LASL} = \text{LSLTELEM} + \text{RDSTELEM}$$

Variable	Description
LASL	Low Ancillary Service Limit
LSLTELEM	Low Sustained Limit provided via telemetry

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RDSTELEM	Reg-Down Ancillary Service Resource Responsibility designation provided by telemetry
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(5) For each Generation Resource, the SURAMP is calculated as follows:

$$\text{SURAMP} = \text{RAMPRATE} - (\text{RUSTELEM} * \text{REGP} / 5)$$

Variable	Description
SURAMP	SCED up ramp rate
RAMPRATE	Normal Ramp Rate when RRS is not deployed or when the subject Resource is not providing RRS. Emergency Ramp Rate for Resources deploying RRS
RUSTELEM	Reg-Up Ancillary Service Resource Responsibility designation provided by telemetry
REGP	Percentage of Regulation Service for which ramp rate will be reserved in Real-Time. The value will be between one and zero. Market Participants will be notified of the change in this value.

(6) For each Generation Resource, the SDRAMP is calculated as follows:

$$\text{SDRAMP} = \text{NORMRAMP} - (\text{RDSTELEM} * \text{REGP} / 5)$$

Variable	Description
SDRAMP	SCED down ramp rate
NORMRAMP	Normal Ramp Rate
RDSTELEM	Reg-Down Ancillary Service Resource Responsibility designation by Resource provided via telemetry
REGP	Percentage of Regulation Service for which ramp rate will be reserved in Real-Time. The value will be between one and zero. Market Participants will be notified of the change in this value.

**[NPRR282: Replace paragraphs (5) and (6) above with the following upon system implementation:]**

(5) For each Generation Resource, the SURAMP is calculated as follows:

$$\text{SURAMP} = \text{RAMPRATE} - (\text{RUSTELEM} * \text{REGP} / 5)$$

Variable	Description
SURAMP	SCED up ramp rate

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RAMPRATE	Normal Ramp Rate, as telemetered by the QSE, when RRS is not deployed or when the subject Resource is not providing RRS. Emergency Ramp Rate, as telemetered by the QSE, for Resources deploying RRS
RUSTELEM	Reg-Up Ancillary Service Resource Responsibility designation provided by telemetry
REGP	Percentage of Regulation Service for which ramp rate will be reserved in Real-Time. The value will be between one and zero. Market Participants will be notified of the change in this value.

(6) For each Generation Resource, the SDRAMP is calculated as follows:

$$\text{SDRAMP} = \text{NORMRAMP} - (\text{RDSTELEM} * \text{REGP} / 5)$$

Variable	Description
SDRAMP	SCED down ramp rate
NORMRAMP	Normal Ramp Rate, as telemetered by the QSE
RDSTELEM	Reg-Down Ancillary Service Resource Responsibility designation by Resource provided via telemetry
REGP	Percentage of Regulation Service for which ramp rate will be reserved in Real-Time. The value will be between one and zero. Market Participants will be notified of the change in this value.

(7) For Generation Resources, HDL is calculated as follows:

$$\text{HDL} = \text{Min} (\text{POWERTELEM} + (\text{SURAMP} * 5), \text{HASL})$$

Variable	Description
HDL	High Dispatch Limit
POWERTELEM	Gross or net real power provided via telemetry
SURAMP	SCED up ramp rate
HASL	High Ancillary Service Limit – definition provided in Section 2, Definitions and Acronyms.

(8) For Generation Resources, LDL is calculated as follows:

$$\text{LDL} = \text{Max} (\text{POWERTELEM} - (\text{SDRAMP} * 5), \text{LASL})$$

Variable	Description
LDL	Low Dispatch Limit



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POWERTELEM	Gross or net real power provided via telemetry
SDRAMP	SCED down ramp rate
LASL	Low Ancillary Service Limit – definition provided in Section 2.

(9) For Load Resources, HASL is calculated as follows:

$$\text{HASL} = \text{Max (LPCTELEM, (MPCTELEM – RDSTELEM))}$$

Variable	Description
HASL	High Ancillary Service Limit
LPCTELEM	Low Power Consumption provided via telemetry
MPCTELEM	Maximal Power Consumption provided via telemetry
RDSTELEM	Reg-Down Ancillary Service Resource Responsibility designation provided by telemetry

(10) For Load Resources, LASL is calculated as follows:

$$\text{LASL} = \text{Min (HASL, (LPCTELEM + (RRSTELEM + RUSTELEM + NSRSTELEM)))}$$

Variable	Description
LASL	Low Ancillary Service Limit
HASL	High Ancillary Service Limit
LPCTELEM	Low Power Consumption provided via telemetry
RRSTELEM	Responsive Reserve Ancillary Service Schedule provided by telemetry
RUSTELEM	Reg-Up Ancillary Service Resource Responsibility designation provided by telemetry
NSRSTELEM	Non-Spin Ancillary Service Schedule provided via telemetry