# Nodal Protocol Revision Request

| NPRR Number | 410 | NPRR Title | Definition of an Energy Storage Resource |
|---|---|---|---|
| **Date Posted** | | September 7, 2011 | |

| | |
|---|---|
| **Requested Resolution** (Normal or Urgent, and justification for Urgent status) | Normal |
| **Nodal Protocol Sections Requiring Revision** | 2.1, Definitions<br>3.4.1, Load Zone Types<br>3.4.2, Load Zone Modifications<br>3.4.5, Additional Load Buses<br>3.4.5, Energy Storage Load Zones (new)<br>6.6.1.4, Load Zone LMPs |
| **Revision Description** | This Nodal Protocol Revision Request (NPRR) creates a definition for an Energy Storage Resource and creates an Energy Storage Load Zone for each Energy Storage Resource capable of storing and generating one MW or greater. |
| **Reason for Revision** | This NPRR allows Energy Storage Resources to participate in the ERCOT market by addressing unintended consequences of treating the "Load" function and the "Generation" function of storage technologies under separate Settlement formulas. Failure to address this issue will result in either an unreasonable barrier to market entry for beneficial emerging technologies or in inefficient market outcomes where differences between Resource Node and Load Zone prices provide inappropriate market incentives. |
| **Credit Implications** (Yes or No, and summary of impact) | To be determined. |

| **Business Case** |
|---|

| | | |
|---|---|---|
| **Business Case** | 1 | To properly address the issues particular to Energy Storage Resources in the Protocols, such Resources must be defined. |
| | 2 | Positive overall market impact due to increased diversity of Resources available to System Operators, the addition of very flexible Resources on the ERCOT System, and the ability to reduce the marginal production requirements (and, therefore, the marginal cost) of energy during system peaks. |
| | 3 | To avoid inefficient market outcomes or inappropriate market incentives, energy into Energy Storage Resources should be settled using the same methodology as energy injected to the ERCOT System by Energy Storage Resources. |
| | 4 | |
| | 5 | |

# Nodal Protocol Revision Request

| Sponsor | |
|---|---|
| **Name** | Amanda Stevenson |
| **E-mail Address** | astevenson@xtremepower.com |
| **Company** | Xtreme Power, Inc. |
| **Phone Number** | 512-268-3949 x 4409 |
| **Cell Number** | 512-924-4910 |
| **Market Segment** | N/A |

| Market Rules Staff Contact | |
|---|---|
| **Name** | Yvette M. Landin |
| **E-Mail Address** | ylandin@ercot.com |
| **Phone Number** | 512-248-4513 |

**Comments**

Energy storage technologies provide significant value to bulk electricity systems by providing new tools for managing the Real-Time requirement to balance supply and demand by taking wholesale energy from the grid at times when it is plentiful and/or inexpensive to produce and returning it to the system when energy is more scarce and/or expensive. Storage technologies may also provide additional options for cost-effective Ancillary Services and other system operations functions. However, the current Protocols do not define energy storage technologies, their role in the market, or the requirements applicable to them.

In particular, the current ERCOT wholesale market Settlement rules do not address the Settlement of energy stored in such devices and may, in fact, create structural inefficiencies which erode the system benefits of storage deployment or which fail to provide accurate price signals for the energy that storage facilities ultimately return to the grid. The disconnect between the wholesale Settlement price of energy into a storage device vs. energy out of a storage device is rooted in the treatment of Loads and Resources.

Energy storage technologies are not Loads in the common sense of the term because they do not consume energy but rather recycle energy to convert it or store it until discharging it back to the grid, less any conversion or efficiency losses. Without clarifying language, it is assumed energy storage devices which draw energy off the system to store and recycle will be treated as Load and, therefore, the energy drawn into the storage device (the MWh used to charge batteries, pump water, compress air, spin flywheels, etc.) will be priced at the Load Zone under the current Protocols. But

because storage devices are considered Generation Resources when producing electricity, the energy returned to the wholesale market by a storage device is priced at the Resource Node.

It is reasonable to expect that for a significant percentage of Settlement Intervals, there will be a difference between the Load Zone price and a given Resource Node price on the system. If the pricing methodologies for removing and returning wholesale energy to the grid are not aligned, the energy storage device will be either unfairly rewarded or punished independent of its actions. Such scenarios divorce market signals from market behaviors and lead to inefficient market outcomes.

The most straightforward approach to align wholesale market price signals for energy storage technologies is to create a Load Zone for each storage device which encompasses only that storage device's node. This is the same concept used for Direct Current Ties (DC Ties) to allow for economic transactions over those interconnections. Similar to DC Ties, Energy Storage Resources import and export power from the system but do not consume power, absent conversion losses. Using this approach, an Energy Storage Load Zone would be created for each Energy Storage Resource with a capacity of one MW or greater that is interconnected to the ERCOT System. Note, the current DC Tie Load Zone definition meets the requirement of zonal energy prices for Loads in PUCT Subst. R. 25.501, Wholesale Market Design for the Electric Reliability Council of Texas.

Please note that NPRR385, Security Violation Analysis and Reporting and Negative Price Floor, also proposes revisions to Section 6.6.1.4.

**Proposed Protocol Language Revision**

**2.1 DEFINITIONS**

**Resource**

The term is used to refer to ~~both~~ a Generation Resource ~~and,~~ a Load Resource and an Energy Storage Resource. The term "Resource" used by itself in these Protocols does not include a Non-Modeled Generator.

. . .

***Energy Storage Resource***
A Resource with a capacity of one MW or greater which is capable of both storing (withdrawing) and generating (injecting) energy.

### *3.4.1 Load Zone Types*

(1) The Load Zone types are:

(a) the Competitive Load Zones;

(b) the NOIE Load Zones created pursuant to Section 3.4.3, NOIE Load Zones~~; and~~

(c) the DC Tie Load Zones as defined in Section 3.4.4, DC Tie Load Zones; and~~.~~

(d) the Energy Storage Load Zones as defined in Section 3.4.5, Energy Load Zones.

(2) The Competitive Load Zones are the four zones in effect during the 2003 ERCOT market unless they are changed pursuant to Section 3.4.2, Load Zone Modifications, less any Electrical Buses that are assigned to a NOIE Load Zone, ~~or~~ a DC Tie Load Zone, or an Energy Storage Load Zone.

### *3.4.2 Load Zone Modifications*

(1) Load Zones may be added, deleted, or changed, only when approved by the ERCOT Board, with the exception of paragraphs (2)(a) and (2)(d) of Section 3.4.3, NOIE Load Zones and Section 3.4.5, Energy Storage Load Zones. Approved additions, deletions, or changes go into effect 36 months after the end of the month in which the addition, deletion, or change was approved.

(2) A member who is a part of the group of NOIEs that have the same pre-1999 power supply arrangements and therefore establish an automatic NOIE Load Zone under paragraph (2)(d) of Section 3.4.3 may elect to be assigned to an appropriate Competitive Load Zone after giving notice of termination of its power supply arrangement to ERCOT. Such notice must be given to ERCOT no later than 90 days prior to the next annual Congestion Revenue Right (CRR) Auction. This type of Load Zone change will go into effect on January 1st of the next calendar year if the change was approved by the ERCOT Board.

(3) Requests for Energy Storage Load Zone changes will go into effect after an Energy Storage Resource is registered with ERCOT.

### *3.4.5 Energy Storage Load Zones*

An Energy Storage Load Zone contains only the Electrical Bus in the ERCOT Transmission Grid that connects the Energy Storage Resource and is used in the Settlement of energy withdrawn by the Energy Storage Resource.

**Formatted:** Body Text

### *3.4.6~~5~~ Additional Load Buses*

ERCOT shall assign new Electrical Buses to a Load Zone and Cost Allocation Zone in accordance with the following rules; changes are effective immediately:

(a) For each new Electrical Bus serving Load of a NOIE that is a part of a NOIE Load Zone, the new Electrical Bus will be assigned to that NOIE Load Zone;

(b) For each new Electrical Bus not covered in paragraph (a) above, connected via Transmission Facilities to Electrical Buses all located within the same Competitive Load Zone, the new Electrical Bus will be assigned to that Competitive Load Zone;

(c) For each new Electrical Bus not covered in paragraphs (a) or (b) above, ERCOT shall simulate LMPs for the annual peak hour of the system with the new Electrical Bus incorporated into the model. ERCOT shall assign that new Electrical Bus to the Competitive Load Zone with the closest matching zonal Settlement Point Price to the new Electrical Bus's LMP;

(d) For each new Electrical Bus covered in paragraph (a) above and connected via Transmission Facilities to Electrical Buses all located within the same Cost Allocation Zone, then the new Electrical Bus will be assigned to that Cost Allocation Zone;

(e) For each new Electrical Bus covered in paragraph (a) above and not covered in paragraph (d) above, ERCOT shall simulate LMPs for the annual peak hour of the system with the new Electrical Bus incorporated into the model. ERCOT shall assign each new Electrical Bus associated with a NOIE that is a part of a NOIE Load Zone to the Cost Allocation Zone with the closest matching zonal Settlement Point Price to the new Electrical Bus's LMP.

(f) For each new Electrical Bus not covered in paragraph (a) above or Section 3.4.5, Energy Storage Load Zone, the new Electrical Bus is assigned to the same Cost Allocation Zone as its designated Load Zone;

### 6.6.1.4 Load Zone LMPs

**Comment [yml1]:** Please note that NPRR385 also proposes revisions to this section.

The Load Zone LMPs shall be posted on the Market Information System (MIS) Public Area. The Load Zone LMP is based on the state-estimated Loads in MW and the Real-Time LMPs at the Electrical Buses included in the Load Zone. The Load Zone LMP for a Load Zone for a SCED Interval is calculated as follows:

$$\mathbf{LZLMP}_{y} = \sum_{b} (\mathbf{RTLMP}_{b,y} * \mathbf{LZWF}_{b,y})$$

For all Load Zones except DC Tie Load Zones and Energy Storage Load Zones:

$$\mathbf{LZWF}_{b,y} = \mathbf{SEL}_{b,y} / (\sum_{b} \mathbf{SEL}_{b,y})$$

For ~~a~~ DC Tie Load Zones and Energy Storage Load Zones:

$$\mathbf{LZWF}_{b,y} = \mathbf{[Max\ (0.001, SEL}_{b,y}\mathbf{)]\ /\ [Max\ (0.001, SEL}_{b,y}\mathbf{)]}$$

The above variables are defined as follows:

| Variable | Unit | Description |
|---|---|---|
| $LZLMP_y$ | $/MWh | *Load Zone Locational Marginal Price*—The Load Zone LMP for the Load Zone for the SCED Interval *y*. |
| $RTLMP_{b,y}$ | $/MWh | *Real-Time Locational Marginal Price at bus per SCED interval*—The Real-Time LMP at Electrical Bus *b* in the Load Zone, for the SCED interval *y*. |
| $LZWF_{b,y}$ | None | *Load Zone State Estimator Load Weighting Factor per bus per SCED interval*—The weight used in the Load Zone LMP calculation for Electrical Bus *b* for the SCED interval *y*. |
| $SEL_{b,y}$ | MW | *State Estimator Load at bus per SCED interval*—The Load from the State Estimator for Electrical Bus *b* in the Load Zone, for the SCED interval *y*. |
| *y* | None | A SCED interval. |
| *b* | None | An Electrical Bus in the Load Zone. The summation is over all of the Electrical Buses in the Load Zone. |