multiplied by 12 to convert from average deployments per interval to average deployments per hour. The allowed range for Regulating Reserve Offers is currently $0 to $500.00/MW. As with the Energy Offer Curves, there is no connection between the Regulating Reserve Offers for the Day-Ahead and Real-Time Energy and Operating Reserve Markets (i.e., Day-Ahead Schedule Offers only roll over to the next Day-Ahead Energy and Operating Reserve Market. Day-Ahead Schedule Offers do not roll over into the Real-Time Energy and Operating Reserve Market and vice-versa.). A data submission to one hour of the Day-Ahead Energy and Operating Reserve Market does not affect the same hour for the Real-Time Energy and Operating Reserve Market and vice-versa. If Regulating Reserve Capacity or Mileage prices are not submitted for any hour for either market, then the values are treated as the quantity zero (0).

An Electric Storage Resource may submit up to three MW/Price pairs for its Regulating Capacity Offer. Similar to Energy Offer Curves, the MP may designate whether the Regulation Offer MW/Price pairs are considered as a slope or block Offer. The MW values are accepted to the 10th of a MW and the Offer values from $0 to $500. The MW/Price pairs must be monotonically increasing for price and strictly increasing for MW.

4.2.7.2.3 Contingency Reserve Offers

Electric Storage Resources that are Spin Qualified Resources may submit Contingency Reserve Offers in $/MW for use in the Energy and Operating Reserve Markets. The allowed range for Contingency Reserve Offers is currently $0 to $100.00/MW. Electric Storage Resources that are Supplemental Qualified Resources but are not Spin Qualified Resources may submit Supplemental Reserve Offers in $/MW for use in the Energy and Operating Reserve Markets. The allowed range for Supplemental Reserve Offers is currently $0 to $100.00/MW. As with the Energy Offer Curves, there is no connection between the Regulating Reserve, Spinning Reserve or Supplemental Reserve Offers for the Day-Ahead and Real-Time Energy and Operating Reserve Markets (i.e., Day-Ahead Schedule Offers only roll over to the next Day-Ahead Energy and Operating Reserve Market. Day-Ahead Schedule Offers do not roll over into the Real-Time Energy and Operating Reserve Market and vice-versa.). A data submission to one hour of the Day-Ahead Energy and Operating Reserve Market does not affect the same hour for the Real-Time Energy and Operating Reserve Market and vice-versa. If Operating Reserve Offer prices are not submitted for any hour for either market, then the values are treated as the quantity zero (0).

Electric Storage Resources may submit up to three MW/Price pairs for its Contingency Reserve Offers. Similar to Energy Offer Curves, the MP may designate whether the Contingency Reserve Offer MW/Price pairs are considered as a slope or block Offer. The MW values are accepted to the 10th of a MW and the Offer values from $0 to $100. The MW/Price pairs must be monotonically increasing for price and strictly increasing for MW.

4.2.7.2.4 Start-Up Offers and No-Load Offers

The Start-Up Offer may be submitted as part of the default Offer and then overridden on a daily basis for both Day-Ahead and Real-Time Schedule Offers. The No-Load Offer may be submitted as part of the default Offer and then overridden on an hourly basis for both Day-Ahead and Real-Time Schedule Offers. The Real-Time Energy and Operating Reserve Market Start-Up Offers and No-Load Offers may be modified at any time prior to 1430 EPT (OD-1) for consideration in the pre Day-Ahead RAC. The Start-Up Offers may be only one value for each type of Start-Up for the day whereas the No-Load Offers may vary for each hour of the day. If a Resource was started more than once per day during the commitment, each start would be considered separately.

4.2.7.3 Commitment Operating Parameter Offer Data

The Resource Offer parameters associated with the starts, run time, and down time used in the Day-Ahead Energy and Operating Reserve Market and RAC commitment and dispatch decisions are described in Exhibit 4-32.

Exhibit 4-32: Electric Storage Resource Commitment Offer Parameters

Parameter	Validation	Use
Condition Times	The Hot to Cold Time and the Hot to Intermediate Time can only be submitted as part of the Day-Ahead and Real-Time Schedule Offer. The times are submitted in hh:mm format. The time prior to the Hot to Intermediate Time is considered as Hot.	The Hot to Cold Time and the Hot to Intermediate time are used in evaluating commitment in the Day-Ahead Energy and Operating Reserve Market commitment and the Real-Time Energy and Operating Reserve Market RAC. These parameters determine the Start-Up costs as a function of the unit state.
Start-Up Notification Times	The cold Start-Up Notification Time, intermediate Start-Up Notification Time and hot Start-Up Notification Time parameters are submitted as part of the Day-Ahead and Real-Time Schedule Offer. These times are accepted in hh:mm format. These values must be less than or equal to 23:59.	The notification times are used in evaluating the commitment in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market. These parameters, in conjunction with the associated Start-Up Times establish the time required to start the unit from the applicable unit state of hot, intermediate, or cold.
Start Times	The cold Start-Up Time, intermediate Start-Up Time, and hot Start-Up Time parameters are	The cold Start-Up Time, intermediate Start-Up Time, and hot Start-Up Time parameters are used in

Parameter	Validation	Use
	submitted as part of the Day-Ahead and Real-Time Schedule Offer. These times are accepted in hh:mm format.	evaluating commitment in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market. These parameters, in conjunction with the associated Notification Times, establish the time required to start the unit from the applicable unit state of hot, intermediate, or cold.
Minimum Charge Time	The Minimum Charge Time is submitted as part of the Day-Ahead and Real-Time Schedule Offer. This time is accepted in hh:mm format.	Scheduled Charging in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market are for at least as many consecutive hours as specified by Minimum Charge Time.
Maximum Charge Time	The Maximum Charge Time is submitted as part of the Day-Ahead and Real-Time Schedule Offer. This time is accepted in hh:mm format.	Scheduled Charging in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market is restricted by Maximum Charge Time.
Minimum Discharge Time	The Minimum Discharge Time is submitted as part of the Day-Ahead and Real-Time Schedule Offer. This time is accepted in hh:mm format.	Scheduled Discharging in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market are for at least as many consecutive hours as specified by Minimum Discharge Time.
Maximum Discharge Time	The Maximum Discharge Time is submitted as part of the Day-Ahead and Real-Time Schedule Offer. This time is accepted in hh:mm format.	Scheduled Discharging in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market is restricted by Maximum Discharge Time.
Minimum Down Time	The Minimum Down Time is submitted as part of the Day-Ahead and Real-Time Schedule Offer. This time is accepted in hh:mm format.	The Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market commitments respect the Minimum Down Time in determining when a unit is available for Start-Up.
Maximum Daily Starts	The Maximum Daily Starts are submitted as part of the Day-Ahead and Real-Time Schedule Offer. These times are accepted in integer number of times.	The Maximum Daily Starts are the maximum number of times a unit may receive a Start-Up per day during the Day-Ahead Energy and Operating Reserve Market or during a study period of the Real-Time Energy and Operating Reserve Market.
Maximum Daily Energy	The Maximum Daily Energy is submitted as part of the Day-Ahead and Real-Time Schedule Offer, in MWh.	The Maximum Daily Energy is the maximum MWh a Resource is able to supply over a 24 hour period during the Day-Ahead Energy and Operating Reserve Market or during a study period of the Real-Time Energy and Operating Reserve Market.
Maximum Weekly Starts	The Maximum Weekly Starts are submitted as part of the Day-Ahead and Real-Time Schedule Offer. These times are accepted in integer number of times.	The Maximum Weekly Starts are the maximum number of times a unit may receive a Start-Up per week during the Day-Ahead Energy and Operating Reserve Market or during a study period of the Real-Time Energy and Operating Reserve Market.

Parameter	Validation	Use
Maximum Weekly Energy	The Maximum Weekly Energy is submitted as part of the Day-Ahead and Real-Time Schedule Offer, in MWh.	The Maximum Weekly Energy is the maximum MWh a Resource is able to supply over a 24 hour period during the Day-Ahead Energy and Operating Reserve Market or during a study period of the Real-Time Energy and Operating Reserve Market.
Fast Ramp Participation	Fast Ramp Participation flag is submitted as a part of the Day-Ahead and Real-Time Offer Schedule, as Yes/No.	Fast Ramp Participation flag indicates whether the Resource is available for Fast Regulation service.

Further explanations of specific Resource parameters used for commitment purposes are provided below:

- ***Start-Up Notification Time*** – The amount of notification time required by an Electric Storage Resource prior to the initiation of start-up procedures. The minimum time required prior to receiving an order from MISO to initiate start-up procedures. Three different Start-Up Notification Times (hot, intermediate, and cold) can be submitted to allow the MP to reflect the difference in the length of time for each condition. For an off-line Quick Start Resource with cleared Contingency Reserve, the Notification Time is assumed to be zero for Contingency Reserve deployment purposes. Submitted notification times cannot exceed 23 hours, 59 minutes.
- ***Start-Up Time*** – The number of hours required to start an Electric Storage Resource and synchronize with the MISO Region to Hourly Economic Minimum Limit consistent with the Applicable Reliability Standards. Three different Start-Up Times (hot, intermediate, and cold) can be submitted to allow the MP to reflect the difference in the length of time for each condition. For an off-line Quick Start Resource with cleared Contingency Reserve, the Start-Up Time is assumed to be zero for Contingency Reserve deployment purposes.

Minimum Down Time – The minimum number of hours that the Resource owner requires between the time the Resource is released for shutdown by MISO and the time the Resource is scheduled to be released for dispatch to MISO. MPs should include the Shut-Down Time and the Start-Up Time (as defined in Exhibit 4-9) in the Minimum Down Time to ensure the software recognizes the constraints described by all of the Resource parameters on cycling the Resource in the commitment process. Resources clearing in the Day-Ahead Energy and Operating Reserve Market or committed in the RAC will have schedules that do not violate the Minimum Down Time.

4.2.7.3.1 Dispatch Operating Parameter Offer Data

The Resource Offer parameters shown in Exhibit 4-7 associated with the Electric Storage Resource dispatch used in the Day-Ahead Energy and Operating Reserve Market and within the Operating Hour in the Real-Time Energy and Operating Reserve Market are described in the following Subsections.

4.2.7.3.2 Dispatch Limits and Ramp Rates

There are three sets of overall operating limits that can be submitted as part of the Day-Ahead Schedule Offer and Real-Time Schedule Offer data: Hourly Economic Minimum and Maximum Limits, Hourly Regulation Minimum and Maximum Limits and Hourly Emergency Minimum and Maximum Limits.[43] The Hourly Emergency Maximum Limit must be greater than or equal to the Hourly Economic Maximum Limit, which must be greater than or equal to the Hourly Regulation Maximum Limit, which must be greater than or equal to the Hourly Regulation Minimum Limit, which must be greater than or equal to the Hourly Economic Minimum Limit which must be greater than or equal to the Hourly Emergency Minimum Limit. Electric Storage Resources have Charging and Discharging operating limits and the limits used in market clearing are determined by the selected Commitment Status. Electric Storage Resources will always submit twelve separate limits in their offers and the appropriate limits will be used depending on the selected Commitment Status

Exhibit 4-33 shows the relationship between all twelve (12) Electric Storage Resource operating limits.

[43] Dispatchable Intermittent Resources do not submit Hourly Economic, Regulation, or Emergency Maximum Limits as part of the Real-Time Schedule Offer data. See Section 4.2.3.4.2 for more information on DIR Forecast Maximum Limit.

Exhibit 4-33: Electric Storage Resource Dispatch Limits (all)

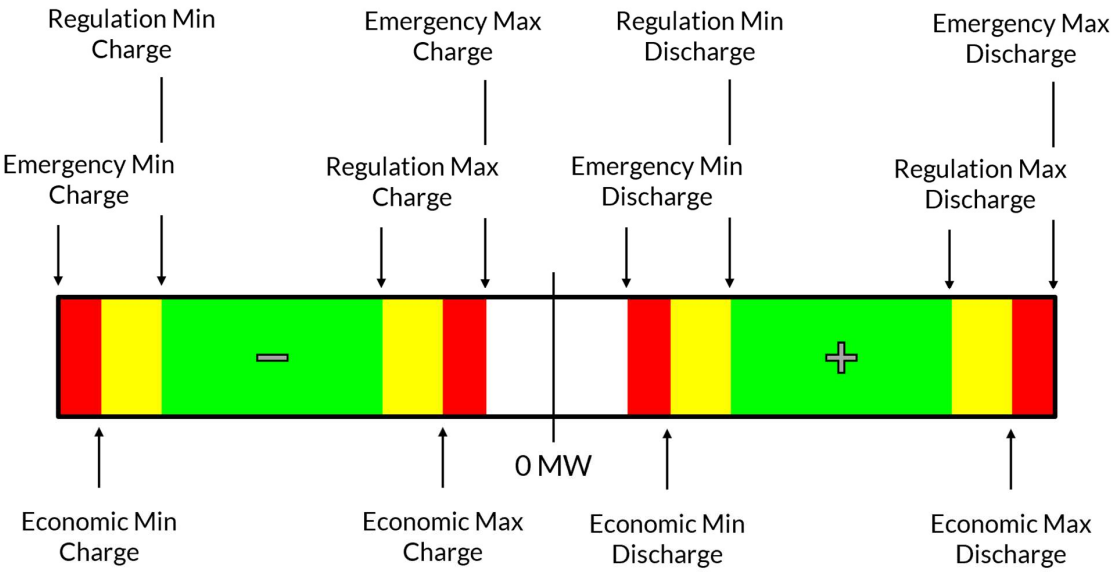


Exhibit 4-11 shows the relationship between operating limits for an Electric Storage Resource that has selected a Commitment Status of Discharge or Emergency Discharge.

Exhibit 4-34: Electric Storage Resource Dispatch Limits with Commitment Status of Discharge and Emergency Discharge

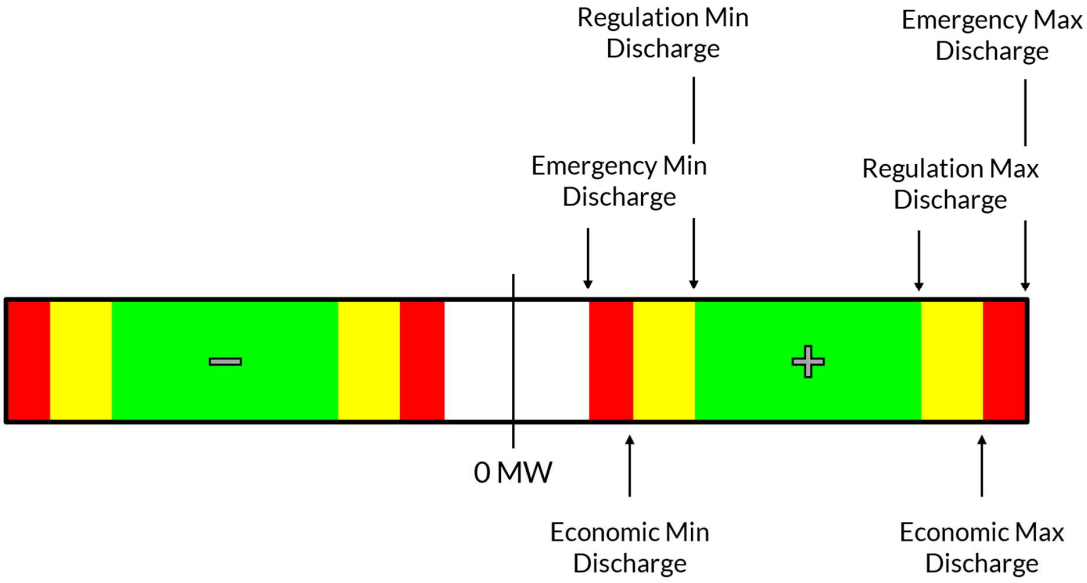


Exhibit 4-11 shows the relationship between operating limits for an Electric Storage Resource that has selected a Commitment Status of Charge or Emergency Charge.

Exhibit 4-35: Electric Storage Resource Dispatch Limits with Commitment Status of Charge and Emergency Charge

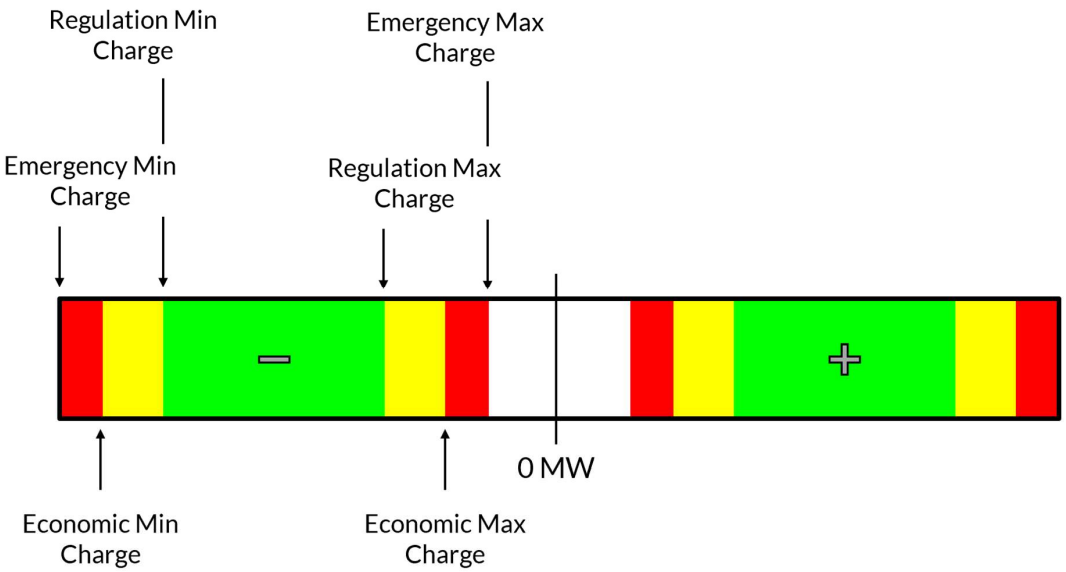
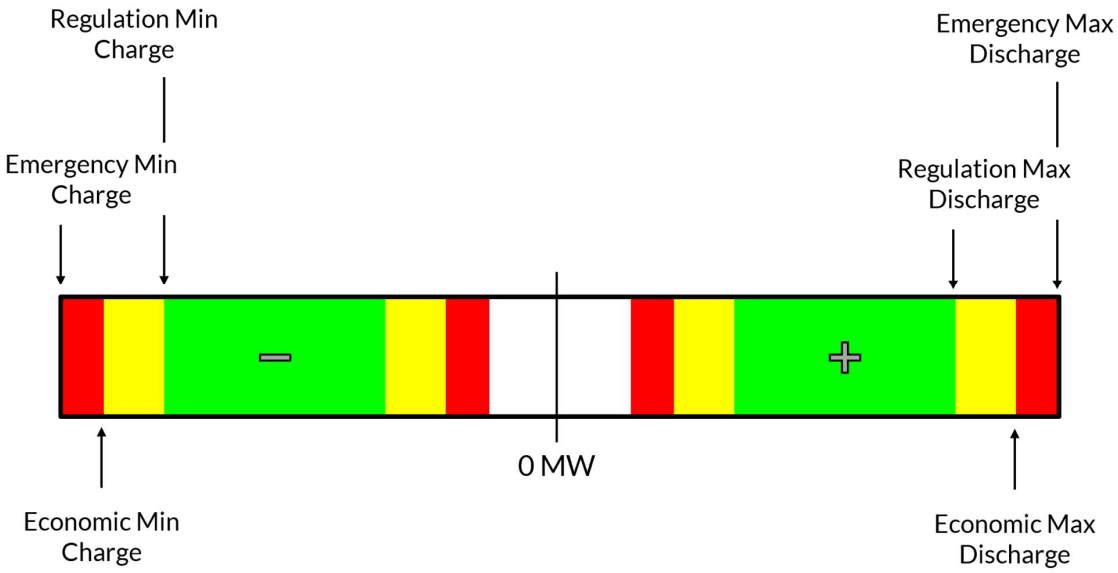


Exhibit 4-11 shows the relationship between operating limits for an Electric Storage Resource that has selected a Commitment Status of Continuous.

Exhibit 4-36: Electric Storage Resource Dispatch Limits with Commitment Status of Continuous



Ramp Rates

Market Participants should be able to specify Charge Ramp Rate and Discharge Ramp Rate for each hour for DA and RT markets. If the Commitment Status is Continuous, Ramp Rate would be determined which side of zero (0) the Resource is getting dispatched. If the Electric Storage Resource is being dispatched between zero (0) and the corresponding Maximum Discharge Limit, then the Discharge Ramp Rate curve is used. Conversely, if the Electric Storage Resource is being dispatched between zero (0) and the corresponding Maximum Charge Limit, then the Charge Ramp Rate curve is used.

Exhibit 4-37 describes the use and validation of each of the ramp rates and limits.

Exhibit 4-37: Overall Ramp Rate, Storage Level and Limit Use

Limit	Validation	Use
Charge Ramp Rate or Charge Ramp Rate Curve	An Hourly Charge Rate may be submitted as part of the Real-Time Schedule Offer to override the default value. A Charge Ramp Rate Curve may also be submitted as part of the Real-Time Schedule Offer. If the Curve is submitted, it will always override the Hourly value.	The Charge Ramp Rate or the Charge Ramp Rate Curve is only applicable for use in real-time and will apply to Resources scheduled to potentially provide Regulating Reserve to limit the change in Energy Dispatch Target and/or limit the total amount of Operating Reserve that can be cleared on the Resource. The Charge Ramp Rate or Charge Ramp Rate Curve is used when an Electric Storage Resource has selected a Commitment Status of Charge or Emergency Charge or when the Commitment Status is Continuous and the initial dispatch MW is below zero (Resource is charging).
Discharge Ramp Rate or Discharge Ramp Rate Curve	An Hourly Discharge Rate may be submitted as part of the Real-Time Schedule Offer to override the default value. A Discharge Ramp Rate Curve may also be submitted as part of the Real-Time Schedule Offer. If the Curve is submitted, it will always override the Hourly value.	The Discharge Ramp Rate or the Discharge Ramp Rate Curve is only applicable for use in real-time and will apply to Resources scheduled to potentially provide Regulating Reserve to limit the change in Energy Dispatch Target and/or limit the total amount of Operating Reserve that can be cleared on the Resource. The Discharge Ramp Rate or Discharge Ramp Rate Curve is used when an Electric Storage Resource has selected a Commitment Status of Discharge or Emergency Discharge or when the Commitment Status is Continuous and the initial dispatch MW is above zero (Resource is discharging).
Initial Energy Storage Level	The Initial Energy Storage Level is submitted as a part of the Day-Ahead Schedule Offer as a MWh value.	The Initial Energy Storage Level is the starting Storage Level Value (MWh) value in the Day-Ahead Market clearing.

Limit	Validation	Use
Maximum Energy Storage Level	The Maximum Energy Storage Level is submitted as a part of the Day-Ahead Schedule Offer and Real-Time Schedule Offer as a MWh value.	The Maximum Energy Storage Level is a hard limit not to be exceeded in Market Clearing under non-Emergency conditions.
Minimum Energy Storage Level	The Minimum Energy Storage Level is submitted as a part of the Day-Ahead Schedule Offer and Real-Time Schedule Offer as a MWh value.	The Minimum Energy Storage Level is a hard limit not to be exceeded in Market Clearing under non-Emergency conditions.
Emergency Maximum Energy Storage Level	The Emergency Maximum Energy Storage Level is submitted as a part of the Day-Ahead Schedule Offer and Real-Time Schedule Offer as a MWh value.	The Emergency Maximum Energy Storage Level is a hard limit not to be exceeded in Market Clearing under Emergency conditions.
Emergency Minimum Energy Storage Level	The Emergency Minimum Energy Storage Level is submitted as a part of the Day-Ahead Schedule Offer and Real-Time Schedule Offer as a MWh value.	The Emergency Minimum Energy Storage Level is a hard limit not to be exceeded in Market Clearing under Emergency conditions.
Electric Storage Efficiency Factor	The Electric Storage Efficiency Factor is submitted as a part of the Day-Ahead Schedule Offer and Real-Time Schedule Offer as the ratio of [Discharge Energy] / [Charge Energy] and is a percentage between 0 and 1.	The Electric Storage Efficiency Factor is used to account for charging efficiency losses and is applied only to charging MWs.
Hourly Economic Minimum Charge Limit	The Hourly Economic Minimum Charge Limit may be submitted to override the default Offer, for both the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Economic Minimum Charge Limit designates the minimum charging Energy available, in MW, from the Resource under non-Emergency conditions. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Overall Economic Minimum Charge Limit affects dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets. Energy and Operating Reserve Market dispatch is from Hourly Economic Minimum Charge Limit to Hourly Economic Maximum Charge Limit under normal conditions.
Hourly Economic Maximum Charge Limit	The Hourly Economic Maximum Charge Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Economic Maximum Charge Limit designates the maximum charging Energy available, in MW, from the Resource under non-Emergency conditions. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Overall Economic Maximum Charge Limit affects dispatch in both the

Limit	Validation	Use
		Day-Ahead and Real-Time Energy and Operating Reserve Markets. Energy and Operating Reserve Market dispatch is from Hourly Economic Minimum Charge Limit to Hourly Economic Maximum Charge Limit under normal conditions
Hourly Regulation Minimum Charge Limit	The Hourly Regulation Minimum Charge Limit may be submitted to override the default offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Regulation Minimum Charge Limit designates the minimum operating level, in MW, at which the Resource can operate while scheduled to potentially provide Regulating Reserves. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Hourly Regulation Minimum Charge Limit may affect Energy dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets.
Hourly Regulation Maximum Charge Limit	The Hourly Regulation Maximum Charge Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Regulation Maximum Charge Limit designates the maximum operating level, in MW, at which the Resource can operate while scheduled to potentially provide Regulating Reserves. This value may vary from hour to hour through submission in the Day-ahead Offer and Real-Time Schedule Offer. The Hourly Regulation Maximum Charge Limit may affect Energy dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets.
Hourly Emergency Minimum Charge Limit	The Hourly Emergency Minimum Charge Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Emergency Minimum Charge Limit designates the minimum level of charging energy, in MW, the Resource can produce and maintain a stable level of operation under Emergency conditions.
Hourly Emergency Maximum Charge Limit	The Emergency Maximum may be submitted to override the Default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Emergency Maximum Charge Limit designates the maximum level of charging Energy, in MW, the Resource can produce and maintain a stable level of operation under Emergency conditions.
Hourly Economic Minimum Discharge Limit	The Hourly Economic Minimum Discharge Limit may be submitted to override the default Offer, for both the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Economic Minimum Discharge Limit designates the minimum discharging Energy available, in MW, from the Resource under non-Emergency conditions. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Overall Economic Minimum Discharge Limit affects dispatch in both the

Limit	Validation	Use
		Day-Ahead and Real-Time Energy and Operating Reserve Markets. Energy and Operating Reserve Market dispatch is from Hourly Economic Minimum Discharge Limit to Hourly Economic Maximum Discharge Limit under normal conditions.
Hourly Economic Maximum Discharge Limit	The Hourly Economic Maximum Discharge Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Economic Maximum Discharge Limit designates the maximum discharging Energy available, in MW, from the Resource under non-Emergency conditions. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Overall Economic Maximum Discharge Limit affects dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets. Energy and Operating Reserve Market dispatch is from Hourly Economic Minimum Discharge Limit to Hourly Economic Maximum Discharge Limit under normal conditions
Hourly Regulation Minimum Discharge Limit	The Hourly Regulation Minimum Discharge Limit may be submitted to override the default offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Regulation Minimum Discharge Limit designates the minimum operating level, in MW, at which the Resource can operate while scheduled to potentially provide Regulating Reserves. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Hourly Regulation Minimum Discharge Limit may affect Energy dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets.
Hourly Regulation Maximum Discharge Limit	The Hourly Regulation Maximum Discharge Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Regulation Maximum Discharge Limit designates the maximum operating level, in MW, at which the Resource can operate while scheduled to potentially provide Regulating Reserves. This value may vary from hour to hour through submission in the Day-ahead Offer and Real-Time Schedule Offer. The Hourly Regulation Maximum Discharge Limit may affect Energy dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets.
Hourly Emergency Minimum Discharge Limit	The Hourly Emergency Minimum Discharge Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Emergency Minimum Discharge Limit designates the minimum level of discharging energy, in MW, the Resource can produce and maintain a stable level of operation under Emergency conditions.

Limit	Validation	Use
Hourly Emergency Maximum Discharge Limit	The Hourly Emergency Maximum Discharge Limit may be submitted to override the Default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Emergency Maximum Discharge Limit designates the maximum level of discharging Energy, in MW, the Resource can produce and maintain a stable level of operation under Emergency conditions.

4.2.7.3.3 Electric Storage Resource Commitment Status

In order to facilitate State of Charge (SOC) management, MISO's Electric Storage Resource model requires Market Participants to choose when and how the Resource is used in the MISO Markets. The Commitment Status of an Electric Storage Resource will determine how it is used in the Day-Ahead and Real-Time Markets and will govern which Operating Limits are used as Regulation, Economic, and Emergency Minimum and Maximum limits in the Day-Ahead and Real-Time Market clearing. Electric Storage Resources shall have the following Commitment Status Options:

- Charge
- Discharge
- Continuous
- Emergency Charge
- Emergency Discharge
- Available
- Outage
- Not Participating

4.2.7.3.3.1 Charge

An Electric Storage Resource submitting a Charge Commitment Status will be committed and dispatched for Energy and/or cleared for ancillary services between its Economic Minimum Charge Limit and Economic Maximum Charge Limit when not selected for regulation or emergency limit use. If selected for regulation, the Regulation Minimum Charge Limit, and Regulation Maximum Charge Limit will be the applied ESR limits. During system Emergency conditions, the ESR's Emergency Minimum Charge Limit and/or Emergency Maximum Charge Limit may be used. The figure below demonstrates the required relationship between limits for Charge Commitment Status.

- Regulation Charge limits within (or equal to) Economic Charge Limits
- Economic Charge limits within (or equal to) Emergency Charge limits
- Emergency Maximum Limit less than or equal to zero MW

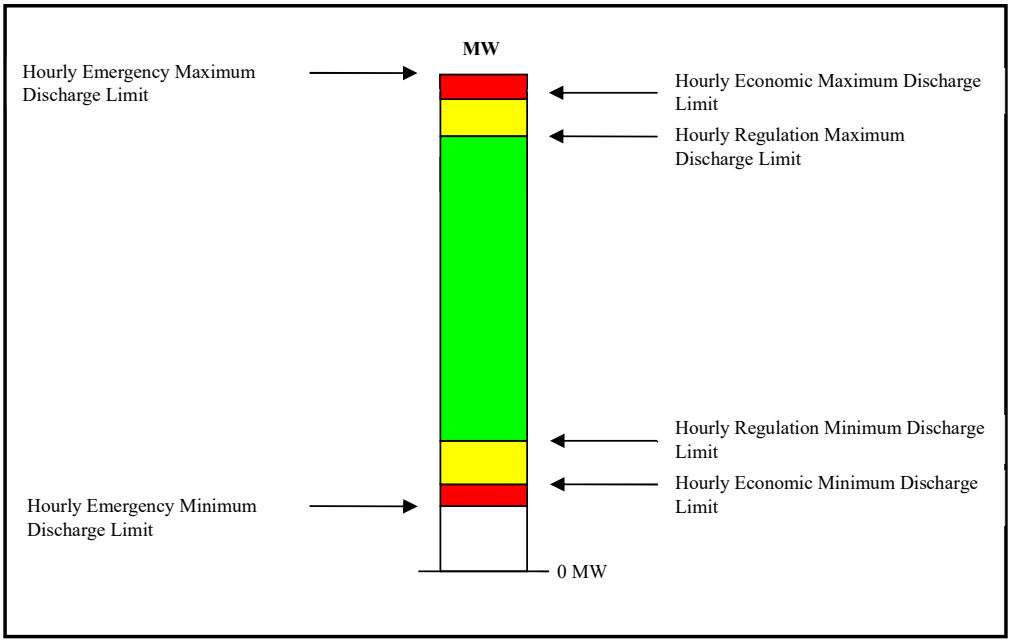
Exhibit 4 Effective Resource limits will be non-positive values for intervals with a Charge Commitment Status.

4.2.7.3.3.2 Discharge

An Electric Storage Resource submitting a Discharge Commitment Status will be committed and dispatched similar to committed Generation Resources and be dispatched by the Day-Ahead Market and Unit Dispatch System (UDS) for Energy and/or cleared for on-line ancillary services between its Economic Minimum Discharge Limit and Economic Maximum Discharge Limit when not selected for regulation or emergency limit use. Like Generation Resources, if selected for regulation, the Regulation Minimum Discharge Limit, and Regulation Maximum Discharge Limit will be the applied ESR limits. The figure below illustrates the required relationship between limits for Discharge Commitment Status.

- Regulation Discharge limits within (or equal to) Economic Discharge limits
- Economic Discharge limits within (or equal to) Emergency Discharge limits
- Emergency Minimum Discharge Limit greater than or equal to zero MW

Exhibit 4-38: Electric Storage Resource Operating Limits with Commitment Status of Discharge



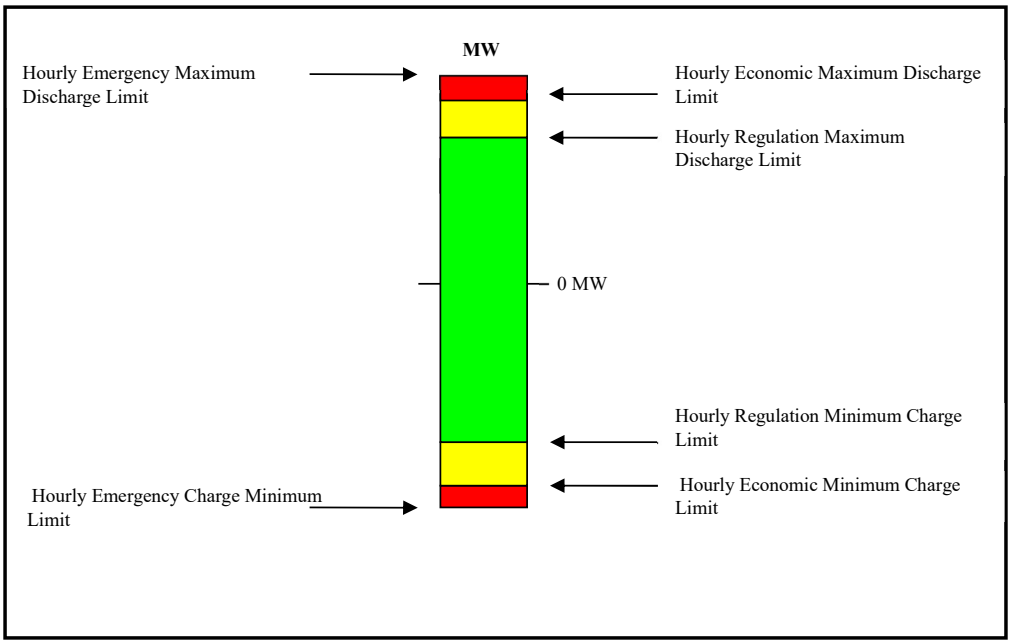
4.2.7.3.3.3 Continuous

An Electric Storage Resource submitting a Continuous Commitment Status will be committed and dispatched for Energy and eligible to clear for Operating Reserves between its Economic Maximum Discharge Limit and Economic Minimum Charge Limit when not selected for regulation or emergency limits. With this status, the ESR moves continuously between charging and discharging within the market interval (e.g., Regulation deployments may result in the ESR setpoint crossing zero within seconds). If selected for Regulation, the Regulation Minimum Charge Limit and Regulation Maximum Discharge Limit will be the applied ESR limits. During system Emergency conditions, the ESR's Emergency Minimum Charge Limit and/or Emergency Maximum Discharge Limit may be used. The figure below demonstrates the required relationship between limits for Continuous Commitment Status.

- Regulation Minimum Charge Limit, Regulation Discharge Maximum Limit within (or equal to) the range between the Economic Minimum Charge Limit and the Economic Maximum Discharge Limit

- The range between the Economic Minimum Charge Limit and the Economic Maximum Discharge Limit within (or equal to) Emergency Minimum Charge Limit and Emergency Maximum Discharge Limit
- Emergency Minimum Charge Limit less than or equal to zero MW
- Emergency Maximum Discharge Limit greater than or equal to zero MW

Exhibit 4-39: Electric Storage Resource Operating Limits with Commitment Status of Continuous



In Continuous Commitment Status, the Emergency Minimum Charge Limit, Economic Minimum Charge Limit, and Regulation Minimum Charge Limit, are entered as negative values. In Continuous Commitment Status, Economic Maximum Charge Limits, Regulation Maximum Charge Limits, Emergency Maximum Charge Limits, Economic Minimum Discharge Limits, Regulation Minimum Discharge Limits and Emergency Minimum Discharge Limits are not used in market dispatch.

4.2.7.3.3.4 Emergency Discharge

While the Discharge Commitment Status is treated as a self-commitment by the Market Participant, ESRs offering the Emergency Discharge status will be available for a commitment by MISO to assist with identified emergency conditions.

Once committed, any Electric Storage Resource in Emergency Discharge Commitment Status will be dispatched the same as an Electric Storage Resource with a Discharge Commitment Status.

ESRs in Emergency Discharge Commitment Status may clear on-line Short-Term Reserve up to Emergency Maximum Discharge Limit.

4.2.7.3.3.5 Emergency Charge

While the Charge Commitment Status is treated as a self-commitment by the Market Participant, ESRs offering the Emergency Charge status will be available for a commitment by MISO to assist with identified emergency conditions.

Once committed, any ESR with an Emergency Charge Commitment Status will be dispatched the same as an ESR with a Charge Commitment Status.

4.2.7.3.3.6 Available

Electric Storage Resources submitting an Available Commitment Status are indicating that the Resource will be offline and available for providing only Off-line Supplemental Reserve. If qualified to provide Offline Supplemental Reserve, Off-line Supplemental Reserve will be cleared when economic as determined by the ESR's Economic Offer parameters and feasible within the applicable constraints. If called on for a Contingency Reserve event, the Electric Storage Resource will come online and discharge at the required level within the appropriate time. Because the ESR may come online to discharge, the remainder of its submitted offer parameters must be compatible with discharge operations in any interval in which the Available Commitment Status is submitted. An ESR's offline reserve deployment compliance will be evaluated using the same rules applied to Generation Resources.

4.2.7.3.3.7 Not Participating

Electric Storage Resources submitting a Not Participating Commitment Status are not available for clearing any market products.

4.2.7.3.3.8 Outage

Electric Storage Resources submitting an Outage Commitment Status are not available for clearing any market products. Similar to other Resource types, ESRs submitting outages through the Outage Scheduler will be treated the same as the Outage Commitment Status regardless of the ESR's submitted Commitment Status.

4.2.7.3.4 Resource Offer Dispatch Status

Dispatch Status can be selected on an hourly basis for Energy, Regulating Reserve, Spinning Reserve, Supplemental Reserve, Ramp Capability, and Short-Term Reserve on a Resource by Resource basis as part of the Day-Ahead and Real-Time Schedule Offer and such selections will override the default dispatch status values. The default dispatch status values are set during asset registration.

Exhibit 4-40 Valid Dispatch Status selections

Status	Product						
	Energy	Regulating Reserve	Spinning Reserve	On-Line[44] Supplemental Reserve	Off-line Supplemental Reserve[45]	Up and Down Ramp Capability	On-line Short-Term Reserve
Economic	√	√	√	√	√	√	√
Self-Schedule	√	√	√	√	√	N/A	N/A
Emergency	N/A	N/A	N/A	N/A	√	N/A	N/A
Not Qualified[2]	N/A	√	√	√	√	N/A	N/A
Not Participating[1]	√	√	N/A	N/A	√	√	√

Note 1: ESR can choose to not participate in Energy only with a Continuous Commitment Status. When ESR Energy Dispatch Status = Not Participating and Reserve products are Economic, the Electric Storage Resource could clear Regulating, Spinning and On-line Supplemental Reserve, with the Energy Dispatch Target = 0.

Note 2: Not Qualified Status will only be available if the higher order Reserve Product is also Not Qualified.

[44] Only applies to Resources that are not Spin Qualified Resources, or to Spin Qualified Resources that have selected "Not Qualified" for an Hour, and that are Supplemental Qualified Resources. Based on current reliability standards which do not require Spinning Reserve to be frequency responsive, resources that are synchronized to the system will always be Spin Qualified Resources.

[45] Only applicable to uncommitted Quick-Start Resources.

The five valid Dispatch Status selections and rules associated with each are as follows. The default value is set during asset registration.

- **Economic –** Designates that Electric Storage Resources that have been committed are available for dispatch by MISO and Dispatch Targets for Energy, Regulating Reserve, Spinning Reserve and Supplemental Reserve may be calculated for the Resource. For Electric Storage Resources that are Quick-Start Resources with a Commitment Status of Available, only the selection for Off-Line Supplemental Reserve would apply.
- **Self-Schedule –** Indicates that the product is Self-Scheduled. The MW amounts of the Self-Schedules for Energy, Regulating Reserve, Spinning Reserve or Supplemental Reserve will be indicated as part of the Day-Ahead Schedule Offer or Real-Time Schedule Offer.
- **Not Qualified –** Indicates that Resource is not qualified to provide Regulating Reserve, Spinning Reserve, On-Line Supplemental Reserve and/or Off-Line Supplemental Reserve in an Hour. This status is only selected in the event of a physical Resource restriction that prevents the otherwise qualified Resource from providing the service in that Hour.
- **Not Participating –** Indicates that the Resource has elected not to provide either Regulating Reserve or Off-Line Supplemental Reserve in an Hour but is otherwise available to provide the service. An Electric Storage Resource can choose to not participate in Energy only with a Continuous Commitment Status. When an Electric Storage Resource Energy Dispatch Status = Not Participating and Reserve products are Economic, the Electric Storage Resource could clear Regulating, Spinning and On-line Supplemental Reserve, with the Energy Dispatch Target = 0.
- **Emergency –** Selection of this status option indicates that the Resource will be cleared for Off-Line Supplemental Reserve only in an Emergency.

4.2.7.3.5 Ramp Capability Dispatch Status

Ramp Capability Dispatch Status can be selected on an hourly basis on a Resource by Resource basis as part of the Day-Ahead and Real-Time Schedule Offer and such selections will override the default dispatch status values. The default dispatch status values are set during asset registration. The two valid Ramp Capability Dispatch Status selections and rules associated with each are as follows. The default value is set during asset registration.

- **Economic –** Designates that Electric Storage Resources that have been committed are available for ramp capability by MISO.
- **Not Participating –** Designates that an Electric Storage Resource is not participating for ramp capability and won't be committed or dispatched to meet ramp needs.

4.2.7.3.6 Short-Term Reserve Dispatch Status

On-line and off-line Short-Term Reserve Dispatch Status can be selected on an hourly basis on a Resource by Resource basis as part of the Day-Ahead and Real-Time Schedule Offer and such selections will override the default dispatch status values. The default dispatch status values are set during asset registration. The two valid selections and rules associated with each are as follows. The default value is set during asset registration.

- **Economic –** Designates that Electric Storage Resources that have been committed are available for On-line Short-Term Reserve by MISO.
- **Not Participating –** Designates that Electric Storage Resources are not participating for Short-Term Reserve.

4.2.7.3.7 Resource Self-Schedule

MPs may submit Self-Schedules, which consist of a fixed quantity (in MW) of Energy, Regulating Reserve and Spinning Reserve or On-Line Supplemental Reserve[46] per hour that may be dispatched from the Resource if it is on-line. In addition, an MP with a Quick-Start Resource may choose to Self-Schedule Off-Line Supplemental Reserve from that Resource.

- To submit a Self-Schedule for Energy, the MP submits a Resource Self-Schedule MW value for Energy and sets Energy Dispatch Status to Self-Schedule. If the Self-Schedule MW value is positive and less than the Resource's Hourly Economic Maximum Limit, the Resource may be dispatched above the Self-Schedule MW amount, based upon the Resource's Energy Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing and dispatch process. If the Self-Schedule MW value is negative and greater than the Resource's Hourly Economic Minimum Limit, the Resource may be dispatched below the Self-Schedule MW amount, based upon the Resource's Energy Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing and dispatch process.

[46] If not a Spin Qualified Resource.

- To submit a Self-Schedule for Regulating Reserve, the MP submits a Resource Self-Schedule MW value for Regulating Reserve and sets the Regulating Reserve Dispatch Status to Self-Schedule. If the Self-Schedule MW value is less than the Resource's Regulating Reserve capability, the Resource may clear Regulating Reserve above the Self-Schedule MW amount, based upon the Resource's Regulating Reserve Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing process. The maximum amount of Regulating Reserve that can be self-scheduled on a Resource is equal to the lesser of i) the applicable ramp rate multiplied by the Regulation Response Time or ii) the difference between the applicable regulation maximum limit and regulation minimum limit divided by 2. The Self-Schedule MW value shall be relaxed if necessary, to enforce Resource limits or ramp rates and may be relaxed if necessary, to manage transmission congestion, the Sub-Regional Power Balance constraint, supply Energy and/or meet Operating Reserve requirements.
- To submit a Self-Schedule for Spinning Reserve or On-Line Supplemental Reserve, the MP submits a Resource Self-Schedule MW value for Spinning Reserve or On-Line Supplemental Reserve and sets the Spinning Reserve Dispatch Status or On-Line Supplemental Reserve Dispatch Status to Self-Schedule. If the Self-Schedule MW value is less than the Resource's Spinning Reserve or On-Line Supplemental Reserve capability, the Resource may clear Spinning Reserve or On-Line Supplemental Reserve above the Self-Schedule MW amount, based upon the Resource's Spinning Reserve Offer or On-Line Supplemental Reserve Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing process. The maximum amount of Contingency Reserve that can be self-scheduled on an on-line Resource is equal to the lesser of i) the applicable ramp rate multiplied by the Contingency Reserve Deployment Period or ii) the difference between the applicable maximum limit and minimum limit. The Self-Schedule MW value shall be relaxed if necessary to enforce Resource limits or ramp rates and may be relaxed if necessary to manage transmission congestion, the Sub-Regional Power Balance constraint, supply Energy and/or meet Operating Reserve requirements.
- Self-Schedules for Off-Line Supplemental Reserve can only be submitted for an uncommitted Quick-Start Resource that is a Supplemental Qualified Resource. To submit a Self-Schedule for Off-Line Supplemental Reserve, the MP submits a Resource Self-Schedule MW value for Off-Line Supplemental Reserve and sets the Off-Line Supplemental Reserve Dispatch Status to Self-Schedule. If the Self-Schedule

MW value is less than the Resource's Maximum Off-Line Response Limit, the Resource may clear Off-Line Supplemental Reserve above the Self-Schedule MW amount, based upon the Resource's Off-Line Supplemental Reserve Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing process. The maximum amount of Supplemental Reserve that can be self-scheduled on an off-line Resource is equal to the lesser of i) the Maximum Off-Line Response Limit or ii) the applicable economic maximum limit of the Resource. The Self-Schedule MW value shall be relaxed if it becomes necessary to commit the Resource.

An Electric Storage Resource may self-schedule Energy MW less than zero in its negative operating range.

Submitting a Self-Schedule value does not guarantee the unit is committed; the Electric Storage Resource must submit an appropriate Commitment Status to achieve this result. A Self-Schedule is a price taker up to Self-Schedule MW level. Any amounts cleared above Self-Scheduled amounts are eligible to set price.

Submitted Self-Schedules will be reduced by MISO if such submitted schedules cannot be physically implemented based upon submitted Resource limits and ramp rates. Additionally, MISO may reduce accepted Self-Schedules as necessary to manage transmission constraints, the Sub-Regional Power Balance Constraint, maintain Operating Reserve requirements, satisfy Energy demand and/or maintain reliable operating conditions. In no case will the Transmission Provider violate the Resource limits or ramping capabilities.

4.2.8 Emergency Demand Response

The Emergency Demand Response ("EDR") provisions are designed to encourage parties that have demand response capabilities, other than those registered as DRRs – Type I or DRRs – Type II, to offer such capabilities for use by MISO during specified Emergency conditions. Such demand response capabilities include Market Participants that are able to either reduce Load during Emergency conditions (e.g., through existing demand response programs) or to operate back-up generation resources (also referred to as "behind-the-meter" generation) to the same effect. For further information regarding the submission of EDR Offer data please refer to the EDR Participant XML Specification.

During an EEA2 event, EEA3 event, Transmission System Emergency and/or Local Transmission Emergency, MISO can issue an EDR Dispatch Instruction which will contain details regarding when the demand reduction will begin, the demand reduction amount, and necessary duration of the demand reduction. Further information regarding the commitment and EDR Dispatch Instruction communication will be provided in a Real Time Operating Procedure prior to the issuance of an EDR Dispatch Instruction. EDR Participants that reduce demand in response to an EDR Dispatch Instruction will be compensated the greater of Real-Time LMP or the EDR Offer Cost for the amount of verifiable demand reduction provided. EDR Participants that do not sufficiently reduce demand in response to an EDR Dispatch Instruction will receive a penalty.

For further information regarding the submission of EDR Demand Reduction data, Emergency Demand Reduction Make Whole Payment, and Emergency Demand penalty provisions please refer to the Emergency Demand Reduction section of Attachment C of the BPM for *Market Settlements*. For further information regarding the Registration of Emergency Demand Response Resource please refer to the Emergency Demand Response section of the BPM for *Market Registration*.

Offer Data:

Once an EDR has been submitted and validated via the EDR registration process, EDR offers can be submitted. The EDR Offer data must contain the following Offer Data parameters:

- Commercial Pricing Node Name
- Emergency Demand Response Name
- Effective Date, representing the first day of the month for which the monthly offer is valid
- Minimum Reduction Megawatt value
- Maximum Reduction Megawatt value
- Minimum Reduction Time in Hours
- Maximum Reduction Time in Hours
- Reduction Notification Time in Hours
- Shut Down Cost in dollars, representative of the cost to reduce
- Reduction Offer in dollars per MWh

For further information regarding the validation and format of the EDR offer data, please refer to the EDR Participant XML Specification.

4.2.9 Resource Operating Parameter Limitations

The following limitations prevent changing Resource Operating Parameters to result in forced commitments and/or forced costs to the system.

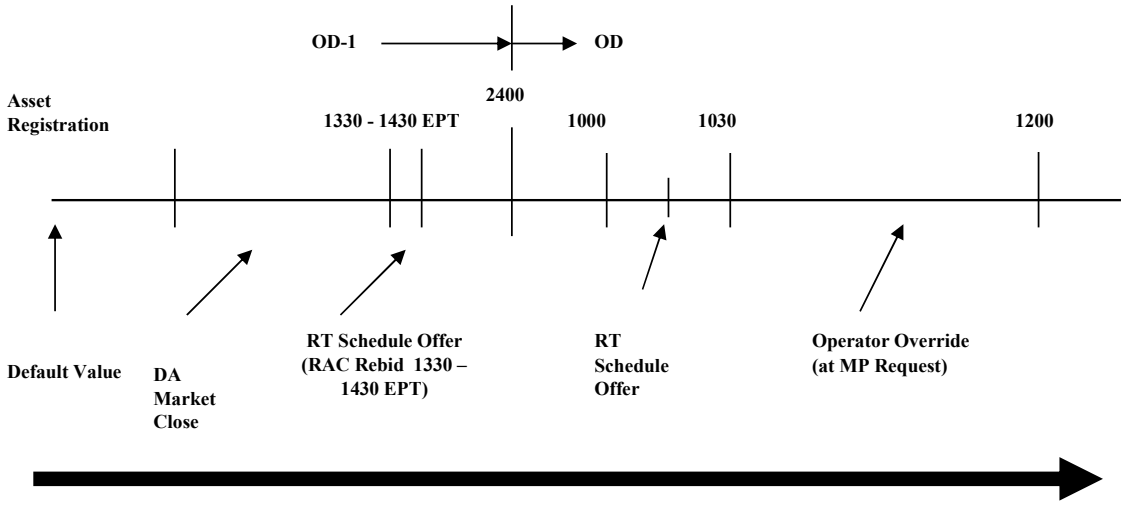
- If the initial conditions for a Day-Ahead, RAC, or LAC study are such that a Resource is on-line, and the initial commitment period is a Must-Run commitment period, then the Minimum Run Time of the Resource is set to 0 for the study interval.
- If the initial conditions for a Day-Ahead, RAC, or LAC study are such that a Resource is on-line, and the initial commitment period is an Economic commitment period, then the Minimum Run Time of the Resource is set to the lesser of the offered Minimum Run Time at the time the commitment was made, and the Minimum Run Time as offered for the study interval.
- During Day-Ahead, RAC, and LAC studies, if the offers for Must-Run Commit Status violate the offered Minimum Run-Time (or Minimum Interruption Duration, for a Demand Response Resource), then the Minimum Run-Time (or Minimum Interruption Duration) will be set to zero for the study interval. As an example, if the Minimum Run Time of a resource is three hours, and a segment of hourly commit status offers consist of: Economic, Must-Run, Must-Run, Economic; then the set of offers violates the offered Minimum Run Time.
- During Day-Ahead, RAC, and LAC studies, if the offers for Must-Run Commit Status violate the offered Minimum Down Time (or Minimum Non-Interruption Interval, for a Demand Response Resource), then the Minimum Down Time (or Minimum Non-Interruption Interval) will be set to zero for the study interval. As an example, if the Minimum Down Time of a resource is three hours, and a segment of hourly commit status offers consist of: Must-Run, Economic, Economic, Must-Run; then the set of offers violates the offered Minimum Down Time.
- During Day-Ahead, RAC, and LAC studies, if the offers for Must-Run Commit Status violate the offered Maximum Daily Starts (or Maximum Daily Interruptions, for a Demand Response Resource), then the Maximum Daily Starts (or Maximum Daily Interruptions) will be set to 99 for the study interval. As an example, if the Maximum Daily Starts of a resource is 1 per day, and a segment of hourly commit status offers

consist of: Must-Run, Economic, Economic, Must-Run; then the set of offers violates the offered Maximum Daily Starts.

4.2.10 Resource Offer Hierarchy

Exhibit 4-41 presents the hierarchy of the data associated with Real-Time Resource Offers. Each data source starting at the right with Operator overrides supersedes the data source to the left, ending at the far left with default data. Submitted Day-Ahead Schedule Offer data will always override the Day-Ahead Schedule Offer default values.

Exhibit 4-41: Real-Time Resource Offer Hierarchy (all time in EST unless noted otherwise)



Submission times are governed by the following rules:

- Default values for Resource limits, ramp rates and other non-price related Offer parameters are submitted during the asset registration process for the both the Day-Ahead Schedule Offer and Real-Time Schedule Offer and may be changed at any time by the MP.
- Temperature sensitive maximum limits and daily Resource parameters may be submitted up to seven days prior to the Operating Day and until 1030 EPT on OD-1 when the Day-Ahead Energy and Operating Reserve Market closes.
- Hourly Resource parameters may be submitted up to seven days prior to and until 1030 EPT on OD-1 when the Day-Ahead Energy and Operating Reserve Market closes for use in the Day-Ahead Energy and Operating Reserve Market. Real Time Hourly offers for the next OD may not be submitted during DA Market Clearing (1030 to 1330 EPT). Hourly offers for the next OD may again be submitted during the re-bid period for use in the RAC processes from 1330 EPT to 1430 EPT on OD-1.
- Additionally after the RAC re-bid period, Real Time offers may be submitted up to 30 minutes prior to the Real-Time Energy and Operating Reserve Market Operating Hour for use in the Intra Day RAC, LAC and in Real Time dispatch processes in the Operating Hour.

- Limit and/or hourly Resource parameter updates between 30 minutes prior to the Real-Time Energy and Operating Reserve Market Operating Hour and during the Operating Hour cannot be updated via the Market Portal nor programmatically and require a phone call to MISO's Real-Time Operator.
- Limit and/or hourly Resource parameter updates for subsequent hours are accepted through the Market Portal without requiring a phone call.
- Physical limitations occurring after the Real Time Offer window closes at 30 minutes prior to the Operating Hour should be reflected by entering a Real Time Offer Override request via an API submission through the Market Portal.

4.2.10.1 Ramp Rate Priority

Within the Operating Hour, the following priorities apply to use of ramp rates:

- Operator overrides have the highest priority;
- MP overrides submitted through Real-Time Offer Override Enhancement (RTOE) request
- If ramp rate curves are not activated, Hourly Bi-Directional Ramp Rate, Hourly Single-Directional-Up Ramp Rate and Hourly Single-Directional-Down Ramp Rate submitted no later than 30 minutes prior to the Operating Hour have priority;
- If ramp rate curves are not activated and no Hourly Bi-Directional Ramp Rate, Hourly Single-Directional-Up Ramp Rate and Hourly Single-Directional-Down Ramp Rate have been submitted as part of the Real-Time Schedule Offer, then the default values for Hourly Bi-Directional Ramp Rate, Hourly Single-Directional-Up Ramp Rate and Hourly Single-Directional-Down Ramp Rate are used.

4.2.11 Resource Modeling

The following Subsections describe the special modeling requirements associated with DRRs-Type I, DRRs-Type II, External Asynchronous Resources, Jointly-Owned Generation Resources, Combined Cycle Resources, Cross Compound Resources, Energy Limited Resources, System Support Resources, Intermittent Resources, Resources under 5 MW, and Dispatchable Intermittent Resources. As Stored Energy Resources are modeled in an equivalent manner to Generation Resources, no resource modeling detail is needed. For Schedule Offer information specific to Stored Energy Resources, see Section 4.2.5.3.5.

4.2.11.1 Demand Response Resources-Type I

A Demand Response Resource-Type I ("DRR"-Type I) is defined as any Resource hosted by an Energy Consumer, an Aggregator of Retail Customers or a Load Serving Entity that is capable of supplying a specific amount of Energy, Contingency Reserve or Short-Term Reserve, at the choice of the Market Participant, to the Energy and Operating Reserve Markets through physical Load interruption or behind-the-meter generation. This specific amount of Energy, Contingency Reserve or Short-Term Reserve is determined through the Targeted Demand Reduction Level Offer parameter.

No special modeling of a DRR-Type I is required in the Network Model. For Commercial Modeling purposes, a DRR-Type I Resource is modeled as an Aggregate CPNode, and is linked directly to the underlying EPNode or EPNodes that constitute the physical locations of the Load interruption or behind-the-meter generation. A single DRR-Type I is limited to Load interruption or behind-the-meter generation located within a single Local Balancing Authority Area.

If the DRR-Type I is committed for Energy, a Dispatch Target for Energy is created for the DRR-Type I that is equal to the Targeted Demand Reduction Level. If the DRR-Type I is cleared for Contingency Reserve, amounts cleared can range from 1 MW up to the Targeted Demand Reduction Level, however, any Contingency Reserve Deployment Instructions issued to the DRR-Type I in Real-Time will be equal to the Targeted Demand Reduction Level. If the DRR-Type I is cleared for Short-Term Reserve, amounts cleared can range from 1 MW up to the Targeted Demand Reduction Level, but any deployment instructions issued to the DRR-Type I in Real-Time will be equal to the Targeted Demand Reduction Level

More information regarding metering and baseline methodology requirements, as well as Settlements regarding DRRs-Type I can be found in the BPM for *Demand Response* and BPM for *Settlements*, respectively.

4.2.11.2 Demand Response Resources-Type II

A Demand Response Resource-Type II ("DRR – Type II") is defined as any Resource hosted by an energy consumer, an Aggregator of Retail Customers, or a Load Serving Entity that is capable of supplying a range of Energy, Operating Reserve, and/or other reserves, at the choice of the MP, to the Energy and Operating Reserve Markets through behind-the-meter generation and/or controllable Load. Because a DRR-Type II may consist of both behind-the-meter generators and

controllable Load and MISO is modeling the DRR-Type II as a supply Resource and revenue metering and telemetering are provided on a net basis at the Bus, the DRR-Type II is modeled as a negative generator. The minimum dispatch limit of the resource represents the consumption baseline, and demand response is calculated as the difference between the net telemetered output and the minimum limit.
The following illustration shows a DRR-Type II providing 10 MW of demand response:

More information regarding metering and baseline methodology requirements, as well as Settlements regarding DRRs-Type II can be found in the BPM for *Demand Response, BPM-026* and BPM for *Market Settlements, BPM-005*, respectively.

Each MP representing a DRR-Type II that is qualified to provide Regulating Reserves must submit to MISO telemetered output via ICCP for each DRR-Type II.

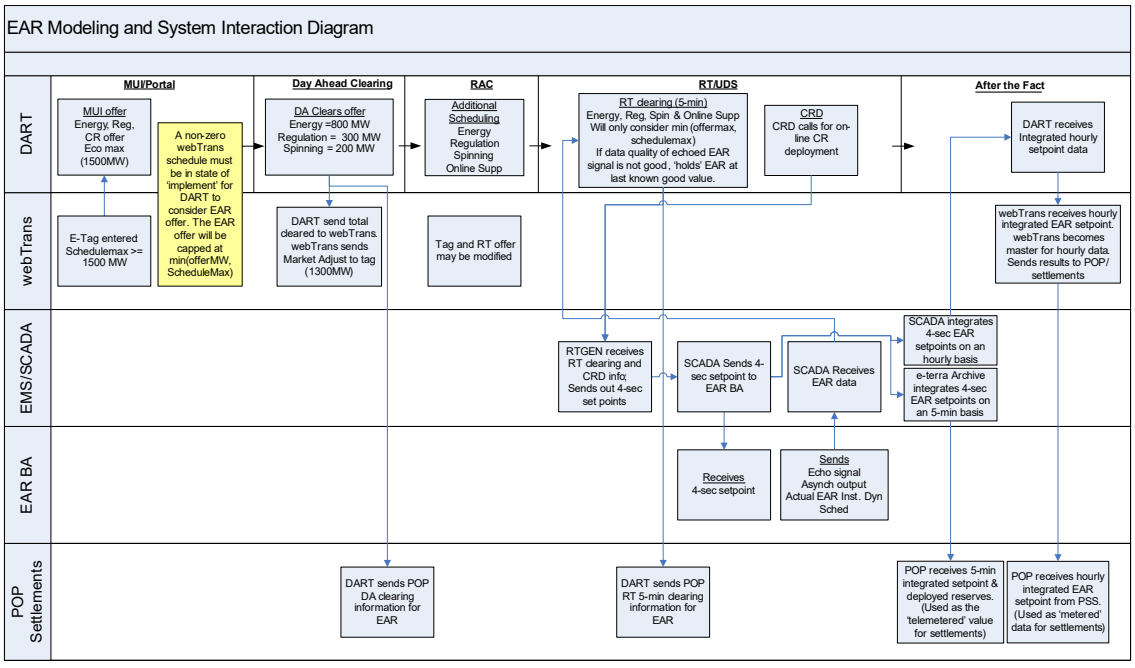
4.2.11.3 External Asynchronous Resources

An External Asynchronous Resource is defined as a DC tie between the synchronous Eastern Interconnection grid and an asynchronous grid that is represented within the MISO Region through a Fixed Dynamic Interchange Schedule Import Schedule and/or Fixed Dynamic Interchange Schedule Export Schedule. External Asynchronous Resources are located where the asynchronous tie terminates in the synchronous Eastern Interconnection grid. An EPNode and CPNode are created for the EAR at the time of asset registration. Even though an EAR is modeled as a Resource internal to the MISO BA Area similar to a Pseudo-Tied External Resource, an EAR must have an associated Fixed Dynamic Interchange Schedule Import Schedule and/or Fixed Dynamic Interchange Schedule Export Schedule to participate in either the Day-Ahead and Real-Time Energy and Operating Reserve Markets or just the Real-Time Energy and Operating

Reserve Market that is linked to the EAR CPNode. This Fixed Dynamic Interchange Schedule Import Schedule and/or Fixed Dynamic Interchange Schedule Export Schedule is used to ensure that the proper transmission reservation and corresponding estimated schedule has been made prior to accepting the EAR Offers for use in market clearing. The estimated schedule amounts are then updated Day-Ahead via a Market Adjust to reflect the actual EAR clearing results (which are equal to the sum of Energy, Regulating Reserve, Contingency Reserve, and other reserve clearing) which, in turn, flow into Real-Time as the Real-Time Fixed Dynamic Interchange Schedule estimate. This Real-Time schedule estimate is then updated after-the-fact to reflect the actual Real-Time EAR Energy deployment which includes 5-minute Dispatch Targets for Energy adjusted for Regulating Reserve deployment and Contingency Reserve deployment.

Exhibit 4-42 summarizes this process and identifies the systems involved.

Exhibit 4-42 : EAR Modeling and Systems Interaction



Note: Cleared Ramp Capability and Online Short-Term Reserve are not passed over to EMS. Ramp Capability and Online Short-Term Reserve are treated similarly to Operating Reserve products in DART, webTrans, and POP settlements in this table.

4.2.11.4 Jointly-Owned Unit Resources

Each MP representing an owner of a JOU has two options for submitting Offer data for unit output:

24) ***Pseudo-Tie JOU*** – The unit is modeled as separate physical units in different LBA Areas. Each MP submits offers for its share of the JOU and receives Setpoint Instructions and price from MISO for its share.

25) ***Combined Offer JOU*** – One owner can aggregate on behalf of the other owners. JOUs where the owners have decided to have a single entity Offer and dispatch the unit on behalf of all owners are modeled as a single unit in MISO's Energy Management System ("EMS"). MISO settles only with the single entity. Each of the other owners settles with the dispatching entity outside of the MISO Energy Markets. The unit does not appear as a JOU to MISO.

The desired option must be specified during the registration process, however, and it cannot be changed on a day-to-day basis.

JOUs modeled as multiple units in MISO's EMS (i.e., "pseudo-tie" JOUs) are modeled as independent Resources in the Day-Ahead and Real-Time Energy and Operating Reserve Markets. Offers for these JOUs are treated independently. Each owner has an asset and MISO settles independently with each owner.

4.2.11.5 Combined Cycle Resources

A Combined Cycle CT Generation Resource typically incorporates one or more gas-fired CTs, followed by heat recovery steam Generator(s) that use the exhaust heat from the CTs to generate steam, powering one or more steam turbine Generators. A Combined Cycle CT is normally offered as a single (aggregate) unit; however, the component CTs and/or steam turbine ("ST") with an alternate steam or thermal source may be offered as separate units (for example, when the steam turbine unit or CTs are not in service).

When the Combined Cycle CT is offered as a single aggregate unit, it will be associated with a single aggregated CPNode. The Ex Ante and Ex Post LMP for this aggregated CPNode is

calculated as the weighted average of the Ex Ante and Ex Post LMPs of the individual unit EPNodes.

In the Day-Ahead Energy and Operating Reserve Market, a Combined Cycle CT's aggregate Resource Offer consists of the same information required for any Generation Resource. Similar to CTs, Combined Cycle CTs are allowed to submit weather curve data that specify MW limits as a function of temperature. For any changes anticipated in the configuration of the component units of a Combined Cycle CT during the future day, the MP must submit the Combined Cycle CT's aggregate Day-Ahead Energy and Operating Reserve Market Offer that matches the aggregate characteristics of the various operating modes.

If an aggregate Offer exists for a Combined Cycle CT, then it is used and any individual Offers for CTs that are components of the Combined Cycle CT are ignored. If an aggregate Offer for a Combined Cycle CT does not exist, individual CT or ST Offers are used.

In the Day-Ahead Energy and Operating Reserve Market, transitions between a Combined Cycle CT's aggregate Offer and its individual CT Offers are not permitted within the same day. If the aggregate Offer is used for any hour in a day, the aggregate Offer's hourly values will be used for the entire day.

In the Real-Time Energy and Operating Reserve Market for the purposes of Forward RAC and Intra-Day RAC, if the Combined Cycle Resource was not committed in the Day-Ahead Energy and Operating Reserve Market or any RAC process (for both aggregate and single unit modeling), the MP may elect to change its Offer from aggregate to single unit or vice versa. However, once the Resource is committed, no further changes in modeling are allowed for that Operating Day.

For the purposes of compliance with Contingency Reserve Deployment Instructions, an MP must elect Common Bus treatment for each individual component (steam turbine and each CT) EPNode associated with a Combined Cycle Generation Resource during the asset registration process in order for the output of any individual components in an Aggregate Combined Cycle Offer to be included in the determination of compliance.

4.2.11.6 Cross Compound Resources

A Cross Compound Resource consists of a high-pressure turbine/Generator and a low-pressure turbine/Generator connected to separate electrical Nodes in the Network Model.

The Cross Compound Resource will have an EPNode and corresponding CPNode for each Generator and if desired, a third CPNode will be defined representing the aggregate of the two. Since the two Generators usually must operate in a coordinated fashion, a single Resource Offer must be submitted to represent the combined output of the two Generators.

4.2.11.7 Energy Limited Resources

MISO has the ability to optimize the output of an energy limited Resource within its Offer parameters in the Day-Ahead Energy and Operating Reserve Market and will do this in a manner that minimizes total system production cost within this market. This functionality exists on a one day-at-a-time basis only. The Resource must specify the maximum MWhs that can be supplied from the Resource via the Maximum Daily Energy offer parameter.

4.2.11.8 System Support Resources

SSRs are Generation Resources (DRRs are not eligible) and Synchronous Condenser Units that are operated to maintain power system reliability at the direction of MISO. These are Resources that were/are planned for decommissioning but are kept in service by SSR Agreements between the MPs and MISO. The following rules apply to SSRs:

- MISO shall notify Market Participants with SSR Units, with respect to those resources' startup/notification offer, as to the time period of Energy, Operating Reserve and/or Other Ancillary Services required from each SSR Unit. Notifications will correspond with the posting of the results of the Day-Ahead Energy and Operating Reserve Markets, Reliability Assessment Commitment processes, or the Look Ahead Commitment processes.
- MPs may offer capacity from SSRs in the Day-Ahead Energy and Operating Reserve Market, RAC, or the Real-Time Energy and Operating Reserve Market during times when MISO has requested the MP to run the SSR at less than full capacity, unless this would impair the ability of the SSR to provide Reactive Supply and Voltage Control requested by MISO.
- A Generation Resource which is identified as an SSR:
- May offer Energy not requested by MISO into the Day-Ahead and Real-Time Energy and Operating Reserve Markets.

- MPs that own or operate SSRs are not permitted to use the SSRs to:
- Participate in Bilateral Transactions (see Exhibit 4-1).
- Supply energy as a Self-Scheduled Resource, except if it was committed or for plant auxiliary Load obligations under the SSR Agreements.
- Self-Schedule Operating Reserve.
- MISO determines the appropriate Settlement and compensation for the MPs that own SSRs, according to negotiation and contractual agreement between the MPs and MISO.
- MISO performs an annual review of SSR status to determine if the SSR is still qualified to remain as an SSR.

4.2.11.9 Resources Under 5 MWs

MISO has chosen a threshold of 5 MW for its cut-off point for Network Modeling purposes. All Generation Resources, External Asynchronous Resources and DRRs-Type II greater than or equal to 5 MW will be modeled explicitly in the Network Model[47]. Generation Resources smaller than 5 MW will not be modeled explicitly in the Network Model. Exceptions to this rule will be handled on a case-by-case basis.

However, the following rules will apply in order for Generation Resources, External Asynchronous Resources and DRRs-Type II smaller than 5 MW to be modeled:

- The Resource must have Real-Time telemetry.
- If this Resource is on a lower voltage than is included in the Network Model, it will need to be reflected up to the appropriate Node in the Network Model.
- If this Resource provides reactive support for Network Model solution that cannot be effectively represented by a negative Load.

If a Resource smaller than 5 MW wants or needs to be settled by the Energy and Operating Reserve Markets, MISO will provide a CPNode for this Resource that will allow the Resource to be represented by an MP, designate an MDMA, and submit Metered values After-the-Fact ("ATF") that will be used for Settlement purposes.

[47] Except in the case of Behind-the-Meter generation that has not been registered as a DRR-Type I or DRR-Type II.

However, the Resource will not be able to offer into the Energy and Operating Reserve Markets and will be a price taker at the appropriate Ex Ante and Ex Post LMP price for its output unless Real-Time telemetry is available to MISO through ICCP.

4.2.11.10 Intermittent Resources

MISO supports Intermittent Resources. Intermittent Resources are Resources that are not dispatchable and can be designated as such in the Customer Care System, subject to Intermittent registration provisions as set forth in the Tariff. See the BPM for *Network and Commercial Models* for more information regarding Intermittent Resource qualification requirements.

Intermittent Resources are not charged Excessive/Deficient Energy Deployment Charges, and as such, they are not eligible to submit Energy, Operating Reserve, or RampCapability Product or Short-Term Reserve Offers, and for each Dispatch Interval, will receive a Dispatch Target for Energy equal to their Energy output in the previous State Estimator solution. These Resources may also register in whole as Generation Resources to the extent they are partially dispatchable. The Market Participant must then select the Off-Control Flag during periods when the Resources cannot follow dispatch. If the Off-Control Flag is set, the Resource is not eligible to clear Operating Reserve or other reserves and would clear Energy as described above.

4.2.11.11 Dispatchable Intermittent Resources

Dispatchable Intermittent Resources ("DIRs") are Generation Resources whose maximum limit is dependent on a forecast of their variable fuel source. Resources that are fueled by wind, solar, or other types of variable energy can be DIRs. Because DIRs have a maximum limit that can vary, even over short time durations, DIRs do not submit maximum limits to the Real-Time Energy and Operating Reserve Markets. Instead, they provide a Forecast Maximum Limit in Real-Time, submitted through the MUI. More information regarding the Forecast Maximum Limit can be found in Section 4.2.3.4.24.2.3.4.2.

In the Day-Ahead Energy and Operating Reserve Markets, DIRs are treated in the same manner as other Generation Resource types, including the submittal of Economic and Emergency Maximum Limits. In both Day-Ahead and Real-Time Markets, DIRs are eligible for commitment in the same manner as other Generation Resource types, including being considered for Economic commitment. A DIR with an 'Economic' Commit Status may or may not be committed; commitment of all 'Economic' Resources is dependent on the economic value of each commitment decision, weighed against other commitment decisions.

DIRs are not eligible to provide Operating Reserves or Short-Term Reserve to the Day-Ahead or Real-Time Energy and Operating Reserves Markets. For this reason, DIRs do not submit Dispatch Statuses for Regulating, Spinning, On-Line Supplemental, Off-line Supplemental or Short-Term Reserves.

4.2.11.12 Non-Telemetered Resources

All Generation Resources, External Asynchronous Resources and Regulating Reserve-Qualified DRRs-Type II greater than 5 MW must have Real-Time telemetry. Such Resources without Real-Time telemetry (smaller than 5 MW) are price takers in the Real-Time Energy and Operating Reserve Market. These Resources can have a CPNode established that allows them to submit meter values for energy settlements, but will not be dispatched in the Real-Time Energy and Operating Reserve Market.

4.3 Demand Bids

Demand Bids apply to the Day-Ahead Energy and Operating Reserve Market only and represent a financially binding Bid to purchase Energy at Day-Ahead prices for Real-Time consumption in the next Operating Day. Only MPs that are Load Serving Entities ("LSEs") or are purchasing Energy on behalf of an LSE as an SA may submit Demand Bids.

MISO maintains a list of Load Zones represented by CPNodes. Each Load Zone is a representation of the relative size and location of the Load represented by the Load Zone. The Demand Bids submitted to the Load Zone CPNodes are distributed to its individual Loads according to the Load Zone Load Distribution Factors ("LDFs"). The Load Zone LDFs describe the daily allocation of MW activity at the Load Zone to its member Loads, based on the average of the State Estimator over the twenty-four (24) hours of seven (7) Days prior to the Operating Day. Demand Bids are allowed to be submitted only to Load Zone CPNodes.

At 1330 EPT MISO posts the Day-Ahead Energy and Operating Reserve Market Awards results and Ex-Ante LMP and MCP prices. The results include the cleared Day-Ahead Demand Bids at the same Load Zone CPNode that MPs specified when they submitted their Demand Bids. Between 1330 EPT and 1630 EPT Ex-Post LMP and MCP prices will be posted. Cleared Day-Ahead Demand Bids are settled using the Day Ahead Ex Post LMPs for that Load Zone CPNode. MPs must submit Settlement quality meter data for Loads to MISO using the same aggregations

that are used when submitting the Demand Bids. Deviations between cleared Day-Ahead Demand Bids and the settlement quality meter data are settled at the Real-Time Ex Post LMPs.

There are two types of Demand Bids.

- Fixed Demand Bids
- Price-Sensitive Demand Bids as illustrated in Exhibit 4-43

4.3.1 Fixed Demand Bids

Fixed Demand Bids are “price takers” and are charged the Ex Post LMP determined in the Day-Ahead Energy and Operating Reserve Market for that CPNode location. MPs may submit only one Fixed Demand Bid at a CPNode location. The following information is submitted for a Fixed Demand Bid:

- MW quantity, with a default of zero MW
- Location (Load Zone CPNode) at which the purchase occurs
- Hours over which the Fixed Demand Bid applies

MPs may only indicate their desire to purchase a particular Fixed Demand Bid MW of Energy if the MPs have demonstrated to MISO in advance that they are financially capable of paying the highest possible price for the designated MW of Energy in accordance with MISO’s credit policy.

4.3.2 Price-Sensitive Demand Bids

MPs are able to express a willingness to buy Energy at specified prices by submitting Price-Sensitive Demand Bids. This type of Demand Bid is modeled in blocks as shown in Exhibit 4-43. Price-Sensitive Demand Bids are accepted in separate bid blocks only. Up to nine Bid blocks can be submitted per CPNode location. This is in addition to the one Fixed Demand Bid at that CPNode location. The following information is submitted for a Price-Sensitive Demand Bid:

- MW quantity/price representing the maximum price (positive or negative without price caps) the MP is willing to pay to purchase the desired MW of Energy. The (MW/Price) blocks can be entered in an arbitrary sequence with respect to MW block size and price as illustrated in Exhibit 4-43. The application software will process the blocks in the proper sequence, as required.
- Location (Load Zone CPNode) at which the purchase occurs.
- Hours over which the Price-Sensitive Demand Bid applies.

- The $/MWh Offer values may range from -$500 to $2,000. (Energy Offer Hard Price Cap)[48]

An MP may only indicate their desire to purchase a particular Price-Sensitive Demand Bid MW of Energy if the MP has demonstrated to MISO in advance that they are financially capable of paying the highest submitted price for the designated MW of Energy in accordance with MISO's credit policy.

MPs external to the Market Footprint may purchase Energy from the Day-Ahead Energy and Operating Reserve Market through Export Schedules as previously described in this Section 4.

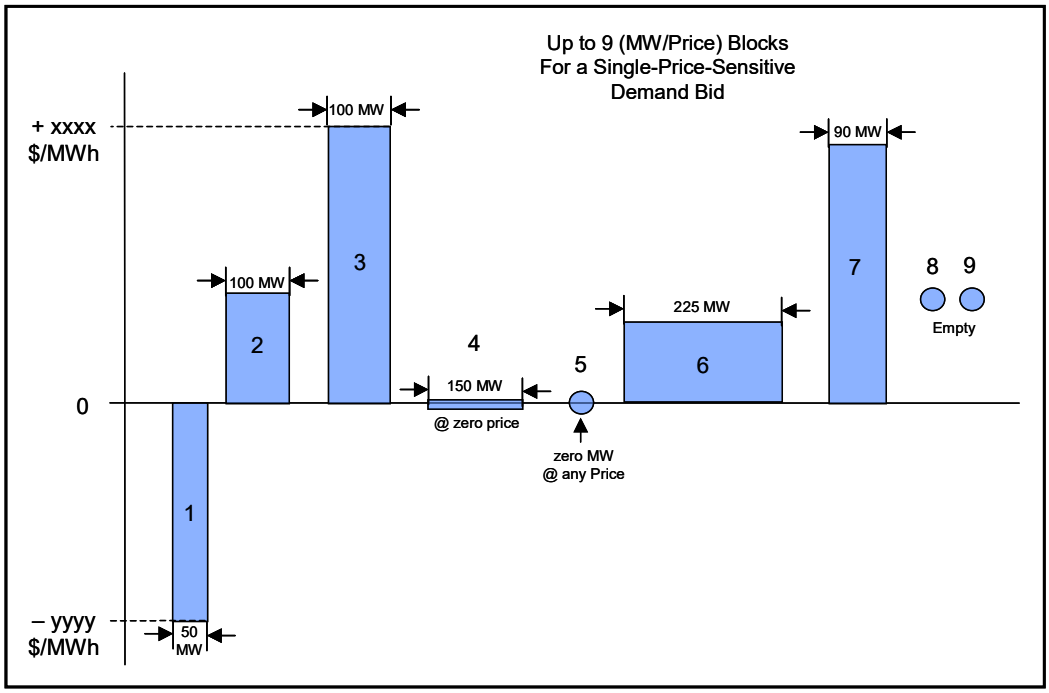


Exhibit 4-43: Price-Sensitive Demand Bid Submittal Example

[48] Energy Offer Hard Cap is the maximum price permitted for a Verified Energy Offer, a Verified Fast Start Resource Offer, or a Verified Emergency Operations Resource Offer to set price in the Energy and Operating Reserve Markets. The Energy Offer Hard Cap is $2,000/MWh.

MPs may submit the Bid blocks in any order as illustrated in Exhibit 4-43; however, when queried after submittal, the Price-Sensitive Demand Bid blocks will appear sorted in descending price order, starting with the highest priced block (#3 in the example).

4.4 Virtual Transactions

Virtual Transactions are generally used by MPs to hedge against changes in Ex Ante and Ex Post LMP between the Day-Ahead Energy Operating Reserve Market and Real-Time Energy and Operating Reserve Market. Virtual Transactions are supported in the Day-Ahead Energy and Operating Reserve Market only and are available to all MPs.

There are two types of Virtual Transactions:

- Virtual Supply Offers
- Virtual Demand Bids

Virtual Transactions have a price at which MPs are willing to inject Energy (Virtual Supply Offer) or withdraw Energy (Virtual Demand Bid) in response to the dispatch in the Day-Ahead Energy and Operating Reserve Market. Virtual Transactions are financial in that they are not required to be backed by physical generation or Load. There are several uses for Virtual Transactions, including:

- Covering one side of an Interchange Schedule (use a Virtual Supply Offer or Virtual Demand Bid)
- Protecting a Day-Ahead Generation Offer (use a Virtual Demand Bid)
- Covering congestion (use a Virtual Supply Offer and a Virtual Demand Bid)

4.4.1 Virtual Supply Offers

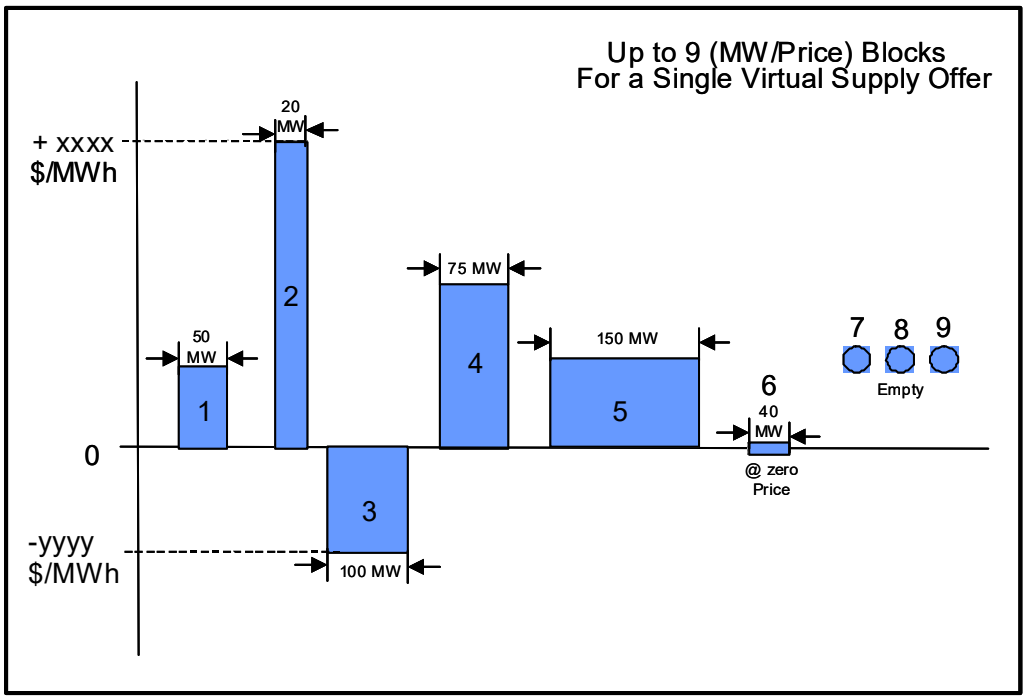
Virtual Supply Offers are Offers to supply Energy in the Day-Ahead Energy and Operating Reserve Market. They are not necessarily supported by a Generation Resource in the Real-Time Energy and Operating Reserve Market and, as such, Virtual Supply Offers cannot be used to supply Operating Reserve.

MPs submit the following information for Virtual Supply Offers:

- MW, at least 0.1 MW, subject to credit limits and Independent Market Monitor (“IMM”) volume limits.
- Location (any CPNode).

- Hours over which the Offer applies.
- Offer price (the minimum price the market seller is willing to accept for Energy sold into the Day-Ahead Energy Market, where the $/MWh Offer values may range from -$500 to $2,000 (Energy Offer Hard Price Cap)
- Up to 9 (MW/Price) blocks per Virtual Supply Offer.

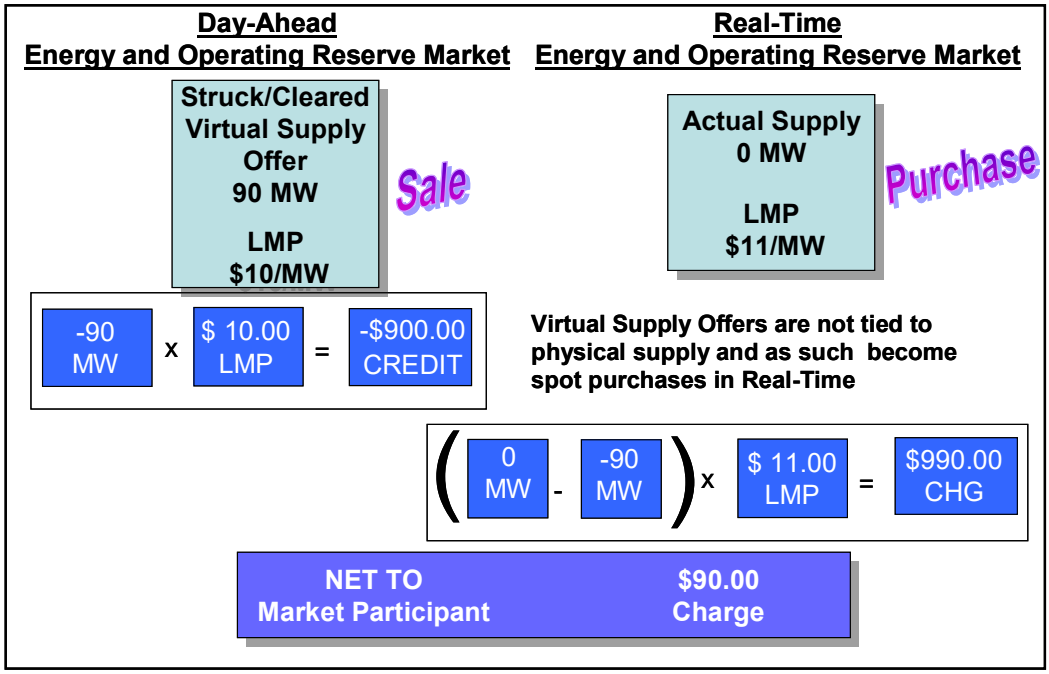
The (MW/Price) blocks in a Virtual Supply Offer can be entered in an arbitrary sequence with respect to MW block size and price as illustrated in Exhibit 4-44.Exhibit 4-44Exhibit 4-44: Virtual Supply Offer Submittal Example



MPs may submit the Offer blocks in any order as illustrated in Exhibit 4-44. However, when queried after submittal, the Virtual Supply Offer blocks will appear sorted in ascending price order, starting with the lowest priced block (#3 in the example).

Exhibit 4-45 is an example of a Virtual Supply Offer with a single (MW/Price) block.

Exhibit 4-45: Virtual Supply Offer Example



For simplicity, this Virtual Supply Offer example consists of one (MW/Price) block. The Virtual Supply Offer clears in the Day-Ahead Energy and Operating Reserve Market for $10/MWh or -$900, meaning this MP is paid $900 in the Day-Ahead Settlement. In the Real-Time Energy and Operating Reserve Market, the MP supplies no Energy, creating a short position in the Real-Time Energy and Operating Reserve Market with a clearing price of $11/MWh or $990. The net to the MP that submits the Virtual Supply Offer is a $90 charge.

4.4.2 Virtual Demand Bids

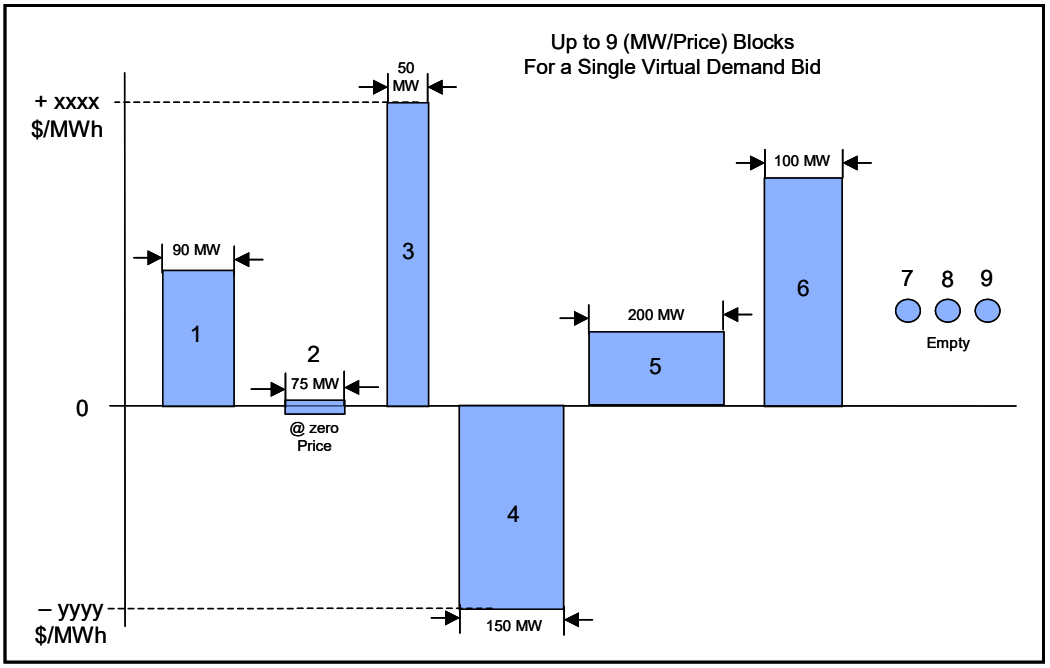
A Virtual Demand Bid is a Bid to purchase Energy in the Day-Ahead Energy and Operating Reserve Market. There is not necessarily the intent to consume the Energy in the Real-Time Energy and Operating Reserve Market.

MPs submit the following information for Virtual Demand Bids:

- MW, at least 0.1 MW, subject to credit limits and IMM volume limits.
- Location (any CPNode).
- Hours over which the Bid applies.
- Bid price (the maximum price the market buyer is willing to pay for Energy purchased in the Day-Ahead Energy and Operating Reserve Market, where the $/MWh Offer values may range from -$500 to $2,000(Energy Offer Hard Price Cap)
- Up to 9 (MW/Price) blocks per Virtual Demand Bid.

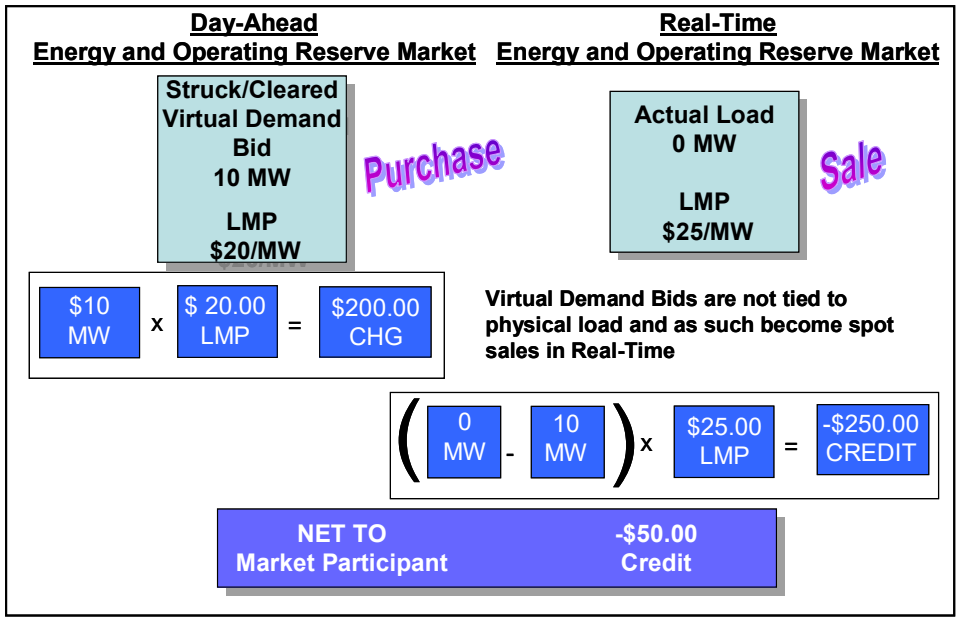
The (MW/Price) blocks in a Virtual Demand Bid can be entered in an arbitrary sequence with respect to MW block size and price as illustrated in Exhibit 4-46.

Exhibit 4-47: Virtual Demand Bid Submittal Example



MPs may submit the Bid blocks in any order as illustrated in Exhibit 4-45; however, when queried after submittal, the Virtual Demand Bid blocks will appear sorted in descending price order, starting with the highest priced block (#3 in the example).
Exhibit 4-48 is an example of a Virtual Demand Bid with a single (MW/Price) block.

Exhibit 4-48: Virtual Demand Bid Example



For simplicity, this Virtual Demand Bid example consists of one (MW/Price) block. The Virtual Demand Bid clears in the Day-Ahead Energy and Operating Reserve Market for $20/MWh or $200, meaning this MP owes $200 in the Day-Ahead Settlement. In the Real-Time Energy and Operating Reserve Market, the MP consumes no Energy, creating a long position in the Real-Time Energy and Operating Reserve Market with a clearing price of $25/MWh or $250. The net to the MP that submits the Virtual Demand Bid is a $50 credit.

4.5 Market User Interface Bid/Offer Validations

The Market User Interface places limitations on the values that can be submitted for certain parameters for several reasons, including reasonability and Tariff compliance. The following list of validations can be used to determine whether a submittal to the MUI will be accepted.

Validations on Resource Limits and Ramp Rates

- EmerMax >= EcoMax >= RegMax >= RegMin >= EcoMin >= EmerMin
- EmerMin > =0 (except for EARs)
- If a "NULL" value is submitted for one Resource Limit parameter, then "NULL" values must be submitted for ALL Resource Limit parameters
- EmerMax >= OfflineResponseMax
- Down Ramp Rate >= Up Ramp Rate >= BiDirectional Ramp Rate > 0
- Day-Ahead Ramp Rate > 0
- Real-Time Studies Ramp Rate > 0
- Maximum Off-Line Short-Term Reserve Response Limit >= Ecomin for Off-line Short-Term Reserve Qualified Resources
- For Electric Storage Resources with the following Commitment Status, operating limits must be entered according to the following logic:

Commitment Status	Limit Hierarchy
Discharge, Emergency Discharge, Available	Emergency Max Discharge ≥ Economic Max Discharge ≥ Regulation Max Discharge ≥ Regulation Min Discharge ≥ Economic Min Discharge ≥ Emergency Min Discharge
Charge, Emergency Charge	Emergency Max Charge ≥ Economic Max Charge ≥ Regulation Max Charge ≥ Regulation Min Charge ≥ Economic Min Charge ≥ Emergency Min Charge
Continuous	Emergency Max Discharge ≥ Economic Max Discharge ≥ Regulation Max Discharge ≥ Regulation Min Charge ≥ Economic Min Charge ≥ Emergency Min Charge
Charge, Emergency Charge, Discharge, Emergency Discharge, Available, Continuous	Emergency Maximum Energy Storage Level >= Maximum Energy Storage Level>= Minimum Energy Storage Level> Emergency Minimum Energy Storage Level>=0

Other Resource Operating Parameter Validations

- Cold StartUp Time >= Intermediate StartUp Time >= Hot StartUp Time
  - Also true for shutdown times on Demand Response Resources
- Resources qualified as Quick-Start Resources must provide Minimum Run Time <= 3)
  - Also true for Minimum Interruption Duration for Demand Response Resources

- Self-Scheduled MW (for Energy, Reg, Spin, Supp) >= 1
- Minimum Run Time <= 24 (also true for Minimum Interruption Duration)
- Maximum Run Time >= Minimum Run Time
- Hot-to-cold Time >= Hot-to-Intermediate Time

Validations on Resource Offers

- Cold Startup Cost >= Intermediate Startup Cost >= Hot Startup Costs>=0
- Cold Startup Notification Time >= Intermediate Startup Notification Time >= Hot Startup Notification Time

Validations on Temperature Sensitive Limits

- Temperature sensitive limits only apply for Resources registered as Combustion Turbine or Combined Cycle Combustion Turbine Resources.
- Temperature Limits: If one value is provided during a submittal then all values must be provided.
- Upper Temp >= Mid Temp >= Lower Temp

Validations on Operating Reserve Offer Parameters

- If a resource is offered in Regulation Market (Dispatch Status is Economic or Self-Schedule) then the Resource must have Spin Dispatch Status of Economic or Self-Schedule and Online Supplemental Dispatch Status of Economic or Self-Schedule
- If a Resource is offered in Spin Market (Dispatch Status is Economic or Self-Schedule), then the Resource must have Online Supplemental Dispatch Status of Economic or Self-Schedule

Validations on Bid/Offer Prices

- -$500 >= Energy Bids and Offers <= $9999.99
- $0 >= Regulating Reserve Offers <= $500
- $0 >= Spinning Reserve Offers <= $100
- $0 >= Supplemental Reserve Offers <= $100
- $0 >= Off-Line Short-Term Reserve Offers <= $100

5. Locational Marginal Prices and Market Clearing Prices

MISO calculates both Ex Ante and Ex Post Locational Marginal Prices ("LMPs") for Energy at Load Zone, Hub, Interface, and Resource Commercial Pricing Nodes and Ex Ante and Ex Post Market Clearing Prices ("MCPs") for Regulating Reserve, Spinning Reserve, Supplemental Reserve and other reserve products at Resource CPNodes on a simultaneously co-optimized basis using a SCED and SCED-Pricing algorithm, respectively, for both the Day-Ahead and Real-Time Energy and Operating Reserve Markets. The SCED-Pricing algorithm is based on the SCED algorithm but is enhanced with the Extended Locational Marginal Pricing ("ELMP") mechanism that allows the cost of committing Fast Start Resources and Emergency Operations Resources, the Energy cost of Fast Start Resources and Emergency Operations Resources dispatched at limits and Emergency Demand Response Resources to set price. Also, under Maximum Generation Emergency conditions, where available economic supply is insufficient to meet fixed demand, emergency pricing is utilized to price the Emergency Energy and Demand Response Resources to provide proper pricing signals reflective of the emergency conditions and thus prevent inefficient price depression associated with injection of the emergency supply. For the Day-Ahead Energy and Operating Reserve Market, Ex Ante LMPs, Ex Post LMPs, Ex Ante MCPs and Ex Post MCPs are calculated on an hourly basis. For the Real-Time Energy and Operating Reserve Markets, LMPs and MCPs are calculated for each five-minute Dispatch Interval on both an ex-ante and ex-post basis. Inputs to SCED and SCED-Pricing for Day-Ahead and Real-Time calculations will differ based on forecasted versus actual system conditions. These inputs are described under Sections 7. and Section 8. of this BPM.

The following Sections further describe how LMPs and MCPs are calculated.

5.1 LMP Calculations

The LMP represents the cost incurred, expressed in $/MWh, to supply the last incremental amount of Energy at a specific Elemental Pricing Node on the transmission grid. The Ex Ante LMP does this in a manner that respects the physical and operational limitations of generation and transmission facilities while the Ex Post LMP does not necessarily respect the physical limit of Fast Start Resources.[49] Ex Post LMPs are calculated through Extended LMP ("ELMP"), an enhanced pricing mechanism expanding upon LMP and MCP in which Fast Start Resources

[49] Emergency Operations Resources are treated the same as Fast Start Resources when they are activated during emergency procedures.

("FSR") that are scheduled to operate at limits, certain off-line FSR, and the start-up or shut-down and no-load or curtailment costs of these FSR resources, may be included in the calculation of prices at the CPNodes located throughout the Transmission Provider Region. ELMP also provides the mechanism to introduce emergency pricing, in ex post manner, to prevent inefficient price depression during system or local area shortage conditions when MISO utilizes Emergency Resources, including Emergency range of available resources, Emergency Demand Response Resources, Load Modifying Resources, External Resources that are qualified as Planning Resources or Emergency Energy purchases.

Regardless of Ex Ante or Ex Post, the LMP can be impacted by Energy Offers and Bids, Operating Reserve Offers, Short-Term Reserve Offers and Demand Curves. Stated another way, the LMP is the marginal cost of Energy at a specific EPNode, where marginal costs include marginal Energy costs, marginal Operating Reserve costs, marginal Ramp Capability product costs, marginal Short-Term Reserve costs and marginal Reserve Scarcity costs. Marginal Energy costs are the marginal costs incurred to produce the last incremental amount of Energy, including any associated transmission loss impacts, at a specific EPNode. Marginal Operating Reserve and marginal Short-Term Reserve costs are the Operating Reserve and Short-Term Reserve costs associated with the incremental shifting of Operating Reserve or Short-Term Reserve from one Resource to another to accommodate the least cost production of the last incremental amount of Energy, including any associated transmission loss impacts, at a specific EPNode. Marginal Reserve Scarcity costs are the costs associated with any increase in Reserve Scarcity that is necessary to accommodate the production of the last incremental amount of Energy, including any associated transmission loss impact, at a specific EPNode. MISO establishes LMPs for both EPNodes and APNodes. APNodes represent the weighted average of two or more EPNodes and may include Hubs, External Interfaces, Load Zones and Resources with multiple injection points. The LMPs include separate components for the marginal costs of Energy at the Reference Bus, the marginal cost of losses with respect to the Reference Bus, and the marginal cost of congestion with respect to the Reference Bus.

5.1.1 LMP Components

The following is true for both Ex Ante and Ex Post LMPs. There is a specific LMP calculated for each EPNode in the network. The LMP at a specific EPNode is very closely approximated by the cost incurred to supply the last MWh of Energy demanded at the EPNode. Therefore, for the purpose of understanding how LMPs and their associated components are determined, it is

convenient to assume that a MWh of Energy is incremental, and that the LMP is equal to the cost incurred to supply the last MWh of Energy demanded at the corresponding EPNode. In a lossless transmission system with infinite transmission branch flow limits, all LMPs would be the same, and would represent the cost to supply the last MWh of system Energy from the least cost Resource. The least cost Resource is the marginal Energy Resource in this scenario, and could represent an aggregation of two or more Resources based on the Energy Offer curves. The cost to supply the last MWh from the marginal Energy Resource is referred to as the system λ.

In the real world, the existence of transmission losses, transmission branch flow limits and the need to manage intra-regional flows in accordance with applicable seams agreements results in an increase in the cost to supply the last MWh of Energy demanded at all EPNodes other than the least cost Resource Bus (i.e., there are no transmission flow impacts of serving demand at the least cost Resource Bus, thus there are no associated marginal loss and congestion impacts). That is, for an incremental increase in Energy demand at any EPNode other than the least cost Resource Bus, the marginal Energy Resource is no longer represented by the least cost Resource, but instead is represented by the Resource (or Resources) that results in the lowest total cost of Energy taking into consideration both the impact on losses, physical transmission constraints and the Sub-Regional Power Balance Constraint. The additional cost incurred to supply the last MWh of Energy at EPNodes other than the least cost Resource Bus can be thought of as the marginal cost of losses and congestion at that EPNode. Since the marginal costs of losses and congestion is zero at the least cost Resource Bus, the marginal costs of losses and congestion at all other EPNodes are stated with respect to the least cost Resource Bus. Therefore, the least cost Resource Bus can be thought of as a Reference Bus, and the marginal loss and congestion impacts of Energy injections and withdrawals at other EPNodes can be modeled based on the linearized sensitivity of the Energy flow changes on specific branches resulting from an injection at the EPNode in question coupled with a withdrawal at the Reference Bus to maintain power balance.

Unfortunately, the least cost Resource Bus is not known in advance. To solve this problem, an arbitrary Bus can be chosen as the Reference Bus, and the LMP at this Reference Bus, which is referred to as the Marginal Energy Component at the reference Bus or MEC*r*, can be used in place of the system λ. By definition, the marginal cost of losses and congestion at this arbitrary Reference Bus is equal to zero, thus depending on which Bus is selected to be the Reference Bus, other EPNodes may have either a positive or negative marginal cost of losses and