Disclaimer

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This Business Practices Manual (BPM) contains information to augment the filed and accepted Open Access Transmission, Energy and Operating Reserve Markets Tariff for the Midwest ISO, Inc. (Tariff). In all cases the Tariff is the governing document and not the BPMs. Additionally, if not otherwise defined herein, all capitalized terms in this BPM have the meaning as defined in the Tariff.

Time Zone

In 2006, Central Indiana, where the Midwest ISO offices are located, began observing Daylight Savings Time. However, the Midwest ISO, its systems, and the Midwest Markets, will continue to do business in Eastern Standard Time year-round.
## Revision History

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1. Introduction

This introduction to the Midwest Independent System Operator (ISO) Business Practices Manual (BPM) for Network and Commercial Models includes basic information about this BPM and the other Midwest ISO BPMs. The first section (Section 1.1) of this Introduction provides information about the Midwest ISO BPMs. The second section (Section 1.2) is an introduction to this BPM. The third section (Section 1.3) identifies other documents in addition to the BPMs, which can be used by the reader as references when reading this BPM.

1.1 Purpose of the Midwest ISO Business Practices Manuals

The BPMs developed by the Midwest ISO provide background information, guidelines, business rules, and processes established by the Midwest ISO for the operation and administration of the Midwest ISO markets, provisions of transmission reliability services, and compliance with Midwest ISO settlements, billing, and accounting requirements. A complete list of the Midwest ISO BPMs is contained in the List of BPMs and Definitions BPM. This and other BPMs are available for reference through the Midwest ISO’s website.

1.2 Purpose of this Business Practices Manual

This BPM for Network and Commercial Models describes the models used for the Energy Management System (EMS) power system and market operations applications and the associated real-time data submitted via Inter Control Center Protocol (ICCP) needed to support those applications. The Network Model referenced in this BPM reflects only the Network Model associated with the Integrated Control Center Systems (ICCS) and Midwest Market system applications and does not refer to other power system models developed and maintained by the Midwest ISO to support functions such as long-range planning.

The Midwest ISO prepares and maintains this BPM for Network and Commercial Models as it relates to the reliable operation of the Midwest ISO’s region of authority. This BPM conforms and complies with the Midwest ISO’s Open Access Transmission, Energy and Operating Reserve Markets Tariff (Tariff), the North American Electric Reliability Council (NERC) also known as the Electric Reliability Organization (ERO) operating policies, and the applicable NERC Regional Reliability Council (RRC) reliability principles, guidelines, and standards and is designed to facilitate administration of efficient Energy and Operating Reserve Markets.

This BPM benefits readers who want answers to the following questions:

- What are the Network and Commercial Models and how are they used?
What are the contents of the Network Model?
What are the contents of the Commercial Model?
What contribution do the Market Participants (MPs) need to make to the maintenance of the models?

1.3 References

Other reference information related to this BPM includes:

Posted on the Midwest ISO website:

- Other BPMs
- Tariff for the Midwest ISO, Inc.
- Midwest ISO ICCP Data Exchange Specification

Posted on the Midwest ISO Extranet website under FTR Modeling Task Force:

- Midwest ISO Network/Commercial Data Modification Web Tool
- Midwest ISO EMS Model Representation Details
2. **Network and Commercial Modeling Overview**

The Network and Commercial Models are databases used the ICCS and Market System respectively. Most of the applications used to perform the real-time and short-term business functions of the Midwest ISO are fully dependent on the network and/or commercial aspects of the model. Refer to Exhibit 2-1 for a graphical representation of the use of the Network and Commercial Models.

**Exhibit 2-1: Business Applications Using the Network and Commercial Models**

The Network Model is accessed by those functions used for circuit analysis of the electric power system. These functions include both Real-Time and study applications. The Real-Time applications include:
- **State Estimator (SE):** The SE is a steady state power system analysis function that calculates the complex voltages at all network Buses using the power flow equations and redundant Real-Time measurements. The voltages are then used to calculate real and reactive power flows even though measurements are not available at all locations.

- **Real-Time Line Outage Distribution Factor Calculator (RTLODFC):** The RTLODFC determines the contingency flow distribution factor for monitored elements of flowgates based on real-time topology.

- **Real-Time Contingency Analysis (RTCA):** The RTCA is used to determine the secure feasibility of the existing power system if components are removed from operation. Both real and reactive power flow and bus voltage violations are determined. The RTCA uses the results of the SE as the basecase for its calculations.

The study applications include:

- **Power Flow (PF):** The PF is used for the steady state study of specified power system conditions. The PF uses values of generation and load along with the power flow equations to determine real and reactive power flows, bus voltages, and limit violations.

- **Study Contingency Analysis (STCA):** The STCA performs the same analysis as the RTCA, but uses a base case that is established for specified power system conditions. The base case is usually developed from power flow results.

- **Voltage Stability Analysis Tool (VSAT):** VSAT performs dynamic studies to determine voltage security problems and provides information about voltage stability margin, voltage decline and reactive power reserves.

The Network Model is also used for the Dispatcher Training Simulator (DTS).

The Commercial Model is accessed by those functions used to process financial reconciliation tasks. These include:

- **Open Access Same-Time Information System (OASIS):** OASIS is used to manage transmission service reservations. Reservations for Firm Transmission Service may also be accompanied by a Financial Transmission Right (FTR) request via the OASIS.

- **Settlements System:** The Settlements system is used to calculate the MP charges and credits for the Day-Ahead Energy and Operating Reserve Market, the Real-Time Energy and Operating Reserve Market, and the FTR auctions.
- **Customer Care System**: The Customer Care System provides customer services and the Midwest ISO response to market enquires.

- **Physical Scheduling System (PSS)**: The PSS is used for entering and disseminating Interchange Schedule information including. Interchange Schedules are submitted to the PSS via NERC E-Tag.

There is a group of functions that access both the Network and Commercial Models. These include:

- **Financial Transmission Rights (FTR)**: The FTR system maintains records of FTR Holders, allocates new FTRs, and conducts auctions.

- **Independent Market Monitor (IMM)**: IMM provides the independent observation of the Market Activities to detect market rule violations and the exercise of market power.


### 2.1 Relationship between Network and Commercial Models

The Commercial Model is related to the Network Model through the basic element of the Commercial Model, the Elemental Pricing Node (EPNode). The EPNodes have a one-to-one relationship with the electrical Nodes connecting all of the loads and generators represented in the Network Model. In certain instances, EPNodes will also be created at locations within the Midwest ISO that do not represent an injection or withdrawal from a generator or load but simply a Node at a transmission substation. EPNodes are also associated with a Local Balancing Authority (LBA). The LBA in which the EPNode is defined in the Commercial Model must match the LBA in which the EPNode is defined in the Network Model. A description of EPNodes and their relation to the Commercial Pricing Nodes (CPNodes) is provided in Section 4 of this BPM.
3. Network Model

The Network Model supports the Real-Time and study network analysis functions used to determine the power system reliability and certain market operations functions that are used to securely commit and dispatch generation, and the assessment of the availability of FTRs. The Network Model is populated with data provided by authorized Transmission Owners and MPs and provides a mathematical representation of the electric power system. The Network Model consists of two types of data – static and telemetered.

3.1 Network Static Data

The static data consists of mathematical representations of each power system component. The power system components are connected together to represent the actual power system circuits. The linking of the power system components describes the topology of the bulk power network.

The Midwest ISO Network/Commercial Data Modification Web Tool document contains the list of data supplied by authorized representatives of Transmission Owners and MPs that describes the power system components and the base topology of the Network Model.

3.1.1 Resource Modeling

The Midwest ISO’s general policy is that each Generation Resource, Demand Response Resources-Type II (DRR-Type II) and External Asynchronous Resources, registered to participate in the Energy and Operating Reserve Markets, must be represented in the Network Model. Additionally, applicable Resources that are not registered to participate in the Energy and Operating Reserve Markets but that are connected to the Midwest ISO Transmission System must be represented in the Network Model. This section discusses some of the exceptions to the general policy and guidelines related to cutoff thresholds, combining Resources and behind-the-meter representations.

3.1.1.1 Below Threshold Generation

All generators greater than or equal to 5MW that are directly connected to Midwest ISO’s Transmission System will be modeled explicitly in the Network Model. Generators modeled in the Network Model must have Real-Time telemetry or they will be considered Intermittent Resources and be price takers only. If the generator is connected at a lower voltage than is included in the Network Model, the generator must be reflected up to an appropriate transmission system bus in the Network Model.
Generating units smaller than 5 MW or connected to distribution facilities that are not under Midwest ISO authority will not be modeled explicitly in the Network Model. Exceptions to this rule are generators that are modeled as DRR-Type II. Please refer section 3.1.1.5 and 4.2.2.3 for the specifics of modeling DRR-Type II Resources. A generator that has output less than 5 MW but is determined to be necessary source of reactive power support for Power Flow or State Estimator solution may be explicitly modeled in the Network Model.

3.1.1.2  Modeling of Multiple Small Generating Units at a Single Bus

In some instances, plants having multiple small units or distributed generation on distribution level facilities may be modeled as a single unit. For example, a wind farm made up of fifty 1.5 MW units with one meter indicating the total energy injection to the Transmission System would qualify for modeling treatment as a Generation Resource of 75 MW. Considerations for granting this exception to the general policy include:

- Size of units
- Type of units
- Number of units
- Telemetry/metering availability
- Offer/Instruction implications, that is, if individual units or the entire plant will be considered.

3.1.1.3  Behind-the-Meter Generation

There are many units owned and operated by municipal and cooperative systems that operate in a behind-the-meter mode. This is also true for some industrial retail customers. Load served by behind-the-meter generation may be excluded from the LBA Market Load if such behind-the-meter generation is not being modeled as a DRR-Type II. Although the load and generation can be netted from a commercial perspective, not all of these situations allow the removal of the generators from the Network Model. If these generators are not required in the Network Model, there will be a simple representation of a net load that will be associated with a Load Zone and the generator will be removed. If the true generation provides a large enough reactive power component to have an impact on the convergence capability or solution quality\(^1\) of Alternating Current (AC) analysis applications such as SE and Contingency Analysis,

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\(^1\) As a measure of the SE solution quality, the SE needs to solve or converge consistently under all types of power system conditions. Also, when the SE solves, the valid measured flows and solved SE flows must be “close” within an acceptable threshold. More details pertaining to the SE solution quality measures can be found at the following
or if the facilities behind-the-meter are actually networked with the Midwest ISO Transmission System and not just radial, the Midwest ISO may require that the generation and load be included in the Network Model. See Section 4 of this BPM for more information on commercial aspects of behind-the-meter situations.

3.1.1.4 Modeling of Demand Response Resources – Type I

A DRR-Type I is defined as any Resource hosted by an energy consumer or Load Serving Entity that is capable of supplying a specific amount of Energy or Contingency Reserve, at the choice of the Market Participant, to the Energy and Operating Reserve Markets through physical load interruption. DRRs – Type I may represent end-use customer programs such as industrial interruptible load programs, controlled hot water heater programs, and controlled air conditioner programs. No special modeling of a DRR-Type I is required in the Network Model, the Network Model will continue to model a DRR-Type I capable load as regular load.

See Section 4.2.6.1 of the BPM for Energy and Operating Reserve Markets for modeling examples.

3.1.1.5 Demand Response Resources – Type II

A DRR-Type II is defined as any Resource hosted by an energy consumer or Load Serving Entity that is capable of supplying a range of Energy and/or Operating Reserve, at the choice of the Market Participant, to the Energy and Operating Reserve Markets through behind-the-meter generation and/or controllable load. The effective load can be physically curtailed in total or incrementally. Because a DRR-Type II may consist of both behind-the-meter generators and controllable load, special modeling is required to account for the DRR-Type II properly as a Resource and to properly settle the host LSE or energy consumer demand. For Network Modeling purposes, both load and generation are modeled. The load represents the gross behind-the-meter load and the generation represents the amount of gross load reduction that can be realized, either from behind-the-meter generation and/or controllable load;

See Section 4.2.6.2 of the BPM for Energy and Operating Reserve Markets for modeling examples.

3.1.2 Load Modeling

The Midwest ISO’s general policy is that loads be created at all buses to which step down transformers are connected that are used to take Energy from the Transmission System and supply the distribution system. Some of these loads may be serving customers of multiple MPs at the distribution level. Each MP
may have a separately modeled load representing its share, but it is not a requirement. Each MP can be assigned a static share of the load that will be used for their respective Load Zone. For behind-the-meter situations and DRR-Type I and DRR-Type II modeling, see Sections 3.1.1.3, 3.1.1.4 and 3.1.1.5 above.

3.1.2.1 Auxiliary Loads

In the Midwest ISO, as a general rule, auxiliary loads for generation stations can be modeled explicitly with gross generation or the auxiliary load and gross generation can be modeled as net generation. The exception to this rule is when the auxiliary load is served from a different Bus than the generator interconnection Bus. In that case, the auxiliary load must be explicitly modeled with gross generation.

3.1.3 Transmission Facilities

All transmission facilities including transmission lines, transformers, phase shifters and shunt reactive power devices must be modeled in the Midwest ISO Network Model. Transmission level facilities are typically operated at 100 kV and above. Any requests for modeling facilities at or below 69 kV will be reviewed for justification and must have telemetered measurements available to the Midwest ISO through ICCP.

3.2 Network Model Telemetered Data

If the Network Model is used to support Real-Time analyses, telemetered data supplied to the Midwest ISO by the Transmission Owners and the MPs is mapped to the static model components. The telemetered values used to support Real-Time analyses are:

- Switching Device Status (Open/Close)
- Line and Transformer Flow (MW and MVAR)
- Circuit Breaker Flows (MW and MVAR)
- Net or Gross Generation (MW and MVAR)
- Generation Auxiliaries (MW and MVAR)
- Synchronous Condenser and Static VAR Compensator (MW and MVAR)
- Load (MW and MVAR)
- Bus Voltage Magnitudes (kV)
- Transformer and phase shifter tap positions

The SE can use both paired and unpaired real and reactive power measurements. The more telemetry that is available to the SE, the more likely the SE will return a more accurate solution. The SE will make use of forecast and default values if Real-Time data is unavailable.
Refer to the Midwest ISO ICCP Data Exchange Specification for the frequency and data formats for real-time ICCP data collection.

For study functions using the Network Model, the modeled loads will be derived from load forecast results or load schedules based on load distribution factors. The output of each generator will be derived from economic dispatch results or participation factors.

Limits for transmission lines, loads, transformers, and shunts supplied by the Transmission Owners are assigned to each measurement. The Midwest ISO operators are alerted to limit violations that are detected as a result of the processing by the analysis programs. Typically, for Real-Time monitoring and study of the electric system the Midwest ISO operator will be concerned with three ratings for each piece of equipment. These ratings are the:

- Normal ratings
- Emergency ratings
- Interconnection Reliability Operating Limit ratings

These ratings are described in the Midwest ISO Network/Commercial Data Modification Web Tool document.

For generators the capability limits used for network studies are the unit Maximum/Minimum Operating Limits as described in the Midwest ISO Network/Commercial Data Modification Web Tool document.

### 3.3 Representation of Areas External to the Midwest ISO

The Midwest ISO Reliability Coordinator Footprint is a subset of the Eastern Interconnection. To accurately analyze the Midwest ISO area covered by the Network Model and to accurately implement the various Joint Operating Agreements or other coordinated operations with various neighboring electric systems, it is necessary that the Network Model include not only the electric system within the Midwest ISO Reliability Coordinator Footprint but those portions of neighboring electric systems that will have an impact on the secure operation of the Midwest ISO and vice versa. Inclusion of the entire Eastern Interconnection would be impractical so only selected external regions are considered. A combination of full circuit representations and equivalent circuits of the selected regions are used to complete the Midwest ISO Network Model.

For detailed information on the model representation of equipment in the Network Model refer to the Midwest ISO EMS Model Representation Details document.
4. **Commercial Model**

The Commercial Model contains information used to identify assets, the owners of the assets, and the Asset Owner’s representative MP. It also defines all of the locations where prices are established and can be used for business transactions in the Midwest ISO markets. The data in the Commercial Model is stored in the following categories:

- Elemental Pricing Nodes (EPNodes)
- Commercial Pricing Nodes (CPNodes)
- Assets
- Asset Owners
- Market Participants (MPs)

Exhibits 4-1 and 4-2 illustrate the data storage hierarchy of the Commercial Model.
Exhibit 4-1: Commercial Model Data Hierarchy - Internal Balancing Authority

Note 1: CC assets can be offered either individually or as an aggregate.
Exhibit 4-2: Commercial Model Data Hierarchy—External Balancing Authority

4.1 Elemental Pricing Node

The EPNode is the lowest level of the hierarchy of data in the Commercial Model. EPNodes are directly related to the Network Model. EPNodes can either be Load EPNodes, Generation EPNodes, or Non-injection/Non-withdrawal (NINW) EPNodes. Load EPNodes have a one-to-one relationship to loads in the Network Model. Generation EPNodes have a one-to-one relationship with generating units in the Network Model. NINW EPNodes have a one-to-one relationship to a transmission node that does not
have generation or load directly connected. A Locational Marginal Price (LMP) is calculated at each EPNode. Any Node in the Network Model can have an LMP. The price for generating electricity and consuming it are the primary concerns for Settlements so each generation and load location will have an EPNode associated with the electrical Node where it is connected. NINW EPNodes are created at select locations and may be used in the representation of Hubs, External Interfaces, and behind-the-meter loads.

EPNode names are established automatically based on LBA, station name, and equipment ID. The three types of EPNodes identified above are defined by a standard Network Model naming convention. Each has a four-part unique name. The convention for each is described as follows:

- **Generation EPNodes** – The letter “U” concatenated with the EMS LBA name, the EMS station name, and the EMS Unit ID.
  
  Example: U WECPORTWAS0 PWASH PW1

- **Load EPNodes** – The letter “L” concatenated with the EMS LBA name, the EMS station name, and the EMS Load ID.
  
  Example: L CIN 08OBRIEN LD

- **NINW EPNodes** – The letter “N” concatenated with the EMS LBA name, the EMS station name, and the node ID.
  
  Example: N CWLP EASTDALE 51

### 4.2 Commercial Pricing Nodes and Assets

The CPNode is the next level of the hierarchy of the Commercial Model. Each CPNode consists of a grouping of one or more EPNodes. Market Settlements utilizes the CPNode to calculate the LMPs that are published and used for Settlement. The relationship of EPNodes to CPNodes determines how the LMP is aggregated for use by Market Settlements.

The standard naming convention for CPNodes is to have the NERC Registered BA or LBA acronym followed by a “.” and then an asset name of the MP’s choosing made up of with the rest of the characters. The only two special characters allowed are the dot “.” and the underscore “_”. The CPNode name cannot exceed 14 characters.

CPNodes are grouped into the following types:

- Generation Resource, including DRR-Type II
- DRR-Type I
- Combined Cycle or Cross Compound Collection
- Load Zone
- External Interface
- Hub
- External Asynchronous Resource (EAR)
- External Pseudo-Tied Generator (PSG)
- External Pseudo-Tied Load

A CPNode must be assigned to an asset that is in turn associated with an Asset Owner.

The resource CPNode is for all market Generation Resources and DRRs-Type II operating within the Midwest ISO Market Footprint only. External PSG CPNodes are for generators connected to the Midwest ISO Transmission System but Pseudo-Tied to an External BA. These two types of CPNodes have one-to-one relationships to EPNodes.

A Combined Cycle (or Cross Compound) Collection CPNode has a one-to-many relationship with the associated EPNodes.

Load Zone, DRR-Type I, External Interface, Hub, and External Pseudo-Tie Load CPNodes have one-to-one or one-to-many relationships with EPNodes.

EAR CPNodes have one-to-one relationships with EPNodes.

**4.2.1 Generation Assets**

CPNodes representing individual Generation Resources are considered Assets and must be assigned to an Asset Owner.

A single generation Asset will have one Asset Owner and will be represented for Market Settlements by one CPNode. The CPNode will contain the EPNode that is the direct representation of the generator. Generation Asset Owners may have multiple Generation Resources, each represented by a CPNode.

External PSG Nodes represent units that are telemetered into an External BA but that are connected directly to the Midwest ISO Transmission System and require Transmission Service from the Midwest ISO. These CPNodes are associated with an Asset Owner but are considered external to the Midwest ISO.
To register a generating asset in the Midwest ISO’s commercial model all the parameters mentioned in Attachment E should be provided.

**4.2.1.1 Behind-the-Meter Generation**

Where the behind-the-meter facilities must remain in the Network Model for reliability purposes as described in Section 3.1.1.3, a commercial Load Zone will be created that will represent the net flow into or out of the behind-the-meter facilities.

The owner of the Load Zone may submit Day-Ahead Demand Bids for the net load and FTRs may be obtained to the Load Zone representing the net. The load reported to the Market Settlements system by the MDMA for the MP of these load entities will be reported net of the behind-the-meter generation used to serve these loads. In the case where the after-the-fact metered net flow is an injection, the Load Zone would be settled as a price taker injection and receive a credit.

One consequence of this policy is that these generators that are effectively netted against load cannot be offered into the Energy and Operating Reserve Markets as a dispatchable Generation Resource and will not be explicitly settled by the Market Settlements system. However, there may be opportunity to have a DRR-Type II in conjunction with this representation.

The LBA load forecast implication of this policy is that the load forecast must include the total load behind the meter if the facilities are explicitly modeled in the Network Model.

Examples of Behind-the-Meter modeling are presented in Attachment D.

**4.2.1.2 Jointly-Owned Unit Data**

A JOU will have multiple Asset Owners. There are two different conditions that determine how a JOU will be handled in the Commercial Model. The CPNode to EPNode relationship will depend on which on the following options are chosen.

- **Single Asset Owner to the Midwest ISO** – All Asset Owners agree contractually to allow one entity to Offer on behalf of all parties and settle for their shares through Financial Schedules or outside of the Midwest ISO Energy and Operating Reserve Markets. This results in one unit modeled in one LBA in the Network Model. There will be a single EPNode with a corresponding CPNode and Asset. The one Asset Owner will submit all relevant data and only that Asset Owner’s MP settles financially with the Midwest ISO. In essence, this unit would be represented exactly like any other unit that the Asset Owner owned outright.
Pseudo-tie Units – A different CPNode can represent each portion of the JOU that is owned by a different Asset Owner. For JOU assets linked by Pseudo-Ties there will be a pseudo unit explicitly modeled in the Network Model representing each share, therefore, multiple EPNodes will exist in the Commercial Model related one-to-one to distinct Nodes in the Network Model. There will be a CPNode for each asset related to the EPNode for the Asset Owner’s respective share. As the name implies in this case, a “Pseudo-Tie” line is also added to the Network Model and Energy flow is included in the actual Interchange reported/used in the LBA market load equation. There are some instances where the Pseudo-Tie representation is used within the same LBA. In that case, the JOU is modeled as described above with the exception that each share is not necessarily in a different station and LBA in the Network Model and the “Pseudo-Tie” line could actually be a pseudo bus-tie within the same station.

MISO will perform SCADA calculations to represent the sum of the target base points for Pseudo-tied JOUs if requested by the unit owner/owners. This data will be provided for informational purpose only and will be transmitted, via ICCP, to the operator of the generating unit. For explicitly represented units in the network model, current practice of calculating and sending out target base points for each unit will continue in the new Ancillary Services Market. Settlements will be done on each of the explicitly modeled units in the network model.

Note: JOU share that is represented explicitly in the network model must have a minimum output of 1 MW. MISO recommends all the JOUs shares that are less than 1 MW to include their share of the unit into a suitable other owner’s share of the unit. ICCP data must be provided for all the units that are explicitly represented in the network model. Also, each unit should be capable of receiving dispatch signal from MISO if the unit is to be dispatched by MISO.

Examples of JOU representations as Pseudo-Tie units are provided in Attachment A.

4.2.1.3 Pumped Storage Units

Pumped Storage units should be modeled as a combination of a generation unit and a load. ICCP values for the load and generator should be sent to the Midwest ISO. The load measurement would be a positive value and the generator measurement zero when pumping. When generating, the generation measurement is positive and the load measurement is zero. Although not required, it may provide more accuracy for submitting Demand Bids in the Day-Ahead Market if the pumped storage loads are separated from larger Load Zones of conforming loads. That will provide more control to Bid in zero load at that location for expected generating times and specific load amounts at expected pumping times. Load at a pumped storage facility when operating in the pumping mode should be included in the mid-term and short-term...
load forecast supplied by the LBA for the Reliability Assessment Commitment (RAC) and Real-time operations. For the Real-Time Energy and Operating Reserve Market, load forecasting for the load representing pumping operation can be handled in the same manner as described in Section 4.2.2.4, Non-Conforming Loads.

4.2.1.4 Aggregate Generation Assets

There are two types of units that can be modeled as independent units in the Network Model but due to the dependency of one or more units on the other, they may be combined for Offer purposes as aggregates. This decision is at the MP’s discretion. These two types of units are the combined cycle and the cross compound. Refer to the BPM for Energy and Operating Reserve Markets for definitions of these units. For operational purposes, if an aggregate Asset is created, the decision on whether to Offer as independent units or as an aggregate must be done on a daily basis. MPs will not be allowed to change their Offer basis from the aggregate to individual units on an hourly basis. If an aggregate Offer is made and cleared in the Day-Ahead Energy and Operating Reserve Market, the Real-Time Offers must also be submitted on an aggregate basis for that Operating Day. For more Offer details see the BPM for Energy and Operating Reserve Markets. Refer to the Midwest ISO Network/Commercial Data Modification Web Tool for the details of the data required to define the aggregate combined cycle/cross compound CPNode.

4.2.1.4.1 Combined Cycle Generation

Combined cycle plants have steam turbines that use the exhaust heat produced by one or more combustion turbine units to create the steam for the steam turbine. Although the combustion turbines can run independently, Offer curves are often developed for the plant as a whole. An EPNode will be assigned to each component unit. The number of component units varies per generator but the aggregate should have at least one steam turbine and one combustion turbine. There will be one CPNode for each EPNode so that each component unit can be offered individually. One additional CPNode will be established to represent the aggregate of the component EPNodes. CPNodes representing combined cycle aggregates are considered Assets and must be assigned to an Asset Owner. The Asset Owner of the aggregate must also be the Asset Owner of each of the individual component generators.

4.2.1.4.2 Cross Compound Generation

Cross compound units have both a high and low-pressure turbine that are often represented as two separate units in the Network Model. These may also be represented as an aggregate for offering purposes. As with the combined cycle plant, the cross compound unit will have an EPNode and corresponding CPnode for each generator and if an aggregate is desired, a third CPNode will be defined representing the aggregate of the two. CPNodes representing cross compound aggregates are considered
Assets and must be assigned to an Asset Owner. The Asset Owner of the aggregate must also be the Asset Owner of each of the individual component generators.

4.2.1.5  External Asynchronous Resources

EARs represent an asynchronous DC tie between the synchronous Eastern Interconnection grid and an asynchronous grid that is represented within the Midwest ISO Region through a Fixed Dynamic Interchange Schedule. EARs are located where the asynchronous tie terminates in the synchronous Eastern Interconnection grid. Qualified EARs are eligible to provide Regulating Reserve, Spinning Reserve, and Supplemental Reserve in addition to Energy.

A special EAR EPNode/CPNode is created that is modeled internal the Midwest ISO BA. An EAR CPNode is not the same as an Interface CPNode but may have the same definition as an Interface CPNode.

EAR Fixed Dynamic Interchange Schedules are a special type of Dynamic Interchange Schedule that needs to be specifically linked to an EAR CPNode. The Fixed Dynamic Interchange Schedule is required to provide a mechanism to move EAR Energy into the Midwest ISO BA when dispatched. EAR Settlement is based upon the EAR Resource dispatch and not on the Fixed Dynamic Interchange Schedule Energy.

To register an EAR asset in the Midwest ISO’s commercial model, all the parameters specific to an EAR in Attachment E must be provided.

For additional information about the operation and settlement of the EAR, please refer to the BPM for Energy and Operating Reserve Markets and the BPM for Energy Markets Settlements.

4.2.1.6  External Pseudo-Tie Generation

External PSG Nodes represent units that are electronically telemetered into an External BA but that are connected directly to the Midwest ISO Transmission System and require Transmission Service from the Midwest ISO. These CPNodes are associated with an Asset Owner but are considered external to the Midwest ISO Market. They are only used for Settlement of the Midwest ISO congestion and losses charges for the Asset Owner to move Energy from the Resource to the External Interface.

The following conventions will be followed. Assume the unit is connected to the Transmission System of BA 1 (BA1) and is metered into a different BA 2 (BA2).
If BA1 is in the Midwest ISO Market Footprint and BA2 is outside the Midwest ISO Market Footprint then the portion in BA1 is assigned to a generator CPNode. The portion outside the Midwest ISO will be registered for congestion and loss only as an external Pseudo-Tie generation CPNode. An EPNode must be defined for the Asset Owner’s share (AO2) in BA2 in order to create the external PSG CPNode.

If BA1 is outside the Midwest ISO Market Footprint and BA2 is in the Midwest ISO Market Footprint then the portion in BA2 will be assigned to a generator CPNode and that portion of the Asset needs to have Transmission Service arrangements with the Transmission Provider of BA1. The portion in BA1 need not be registered and is not considered in the Midwest ISO Commercial Model.

Graphical examples of External Pseudo-Tie Generation are provided in Attachment B.

### 4.2.2 Load Assets

The following types of load assets are described in this section:

- Load Zones
- External Pseudo-Tie Loads
- Dynamic Response Resources
- Non-Conforming Loads

#### 4.2.2.1 Load Zones

CPNodes representing Load Zones are considered assets and must be assigned to an Asset Owner. The CPNode to EPNode relationship for these is typically one to many except for isolated municipal or industrial load assets that have only one elemental load point in the Network Model. EPNode Loads must be aggregated into Load Zone assets and must be associated with an Asset Owner. A Load Zone is represented by a CPNode that contains an aggregate of EPNodes. One EPNode can belong to multiple Load Zone CPNodes with the percent of Node ownership defined for the amount in each Load Zone CPNode. Individually owned loads can also be aggregated in a single Load Zone CPNode. Refer to the Midwest ISO Network/Commercial Data Modification Web Tool document for details on the data required to define Load Zones.
4.2.2.2 External Pseudo-Tie Load Zone

External Pseudo-Tie Load Zone CPNodes are associated with an Asset Owner but are considered external. As with internal Load Zones, the CPNode to EPNode relationship is typically a one to many. If a load is represented by Pseudo-Ties, the following conventions will be followed:

- If the load is physically in BA1 that is in the Midwest ISO but pseudo-tied to BA2 that is outside the Midwest ISO Market Footprint, then the load is considered in BA2. The load will be represented in the Network Model in BA2 and be registered as a Pseudo-Tie Load Zone for congestion and loss charges.

- If the load is physically in BA1 which is outside the Midwest ISO Market Footprint but pseudo-tied to BA2 that is within the Midwest ISO Market Footprint, then the load is considered in BA2 and assigned to a Load Zone in BA2. However, appropriate Transmission Service arrangements must be in place with the Transmission Provider of BA1.

If a load is represented by a Dynamic Schedule, the following conventions will be followed:

- If the load is physically in BA1 that is within the Midwest ISO Market Footprint with a Dynamic Schedule from BA2 that is outside the Midwest ISO Market Footprint, then the load is considered in BA1 and assigned to a Load Zone in BA1.

- If the load is physically in BA1 that is outside the Midwest ISO Market Footprint with a Dynamic Schedule from BA2 that is either in or out of the Midwest ISO Market Footprint, then the load is considered in BA1 and will not be included in the Commercial Model and need not be registered. There will be a PBT Schedule out of the Midwest ISO to serve the load.

Graphical examples of external pseudo-tied loads are presented in Attachment C.

4.2.2.3 Non-Conforming Loads

There are two options to be used for handling non-conforming loads. These options are provided on a LBA by LBA basis. The Midwest ISO will work with each BA to determine the best approach to use for that LBA. The two options are as follows:

- **Midwest ISO Forecasting Approach**: Under this approach, the Midwest ISO will forecast the total load for an LBA, including the Non-Conforming Load; or

- **Combined Forecasting Approach**: Under this approach, the Midwest ISO will forecast the conforming load for an LBA, and will allow the LBA to continuously update the non-conforming
load estimate in Real-Time. The Midwest ISO will add the non-conforming load forecast to its conforming load forecast before it runs the dispatch algorithm.

The Combined Forecasting Approach should be used if the LBA has information that would allow it to better know the forecast than the Midwest ISO. Examples of information of this sort would include knowledge of maintenance or forced outages and may also include knowledge of returns from maintenance, whether forced or scheduled.

Refer to the BPM for Energy and Operating Reserve Markets for additional information on non-conforming loads.

4.2.3 Modeling of Demand Response Resources – Type I

Customer programs such as industrial interruptible load programs, controlled hot water heater programs, and controlled air conditioner programs can register them as DRR-Type I resource to provide a specific amount of Energy or Contingency Reserve into Midwest ISO Market through physical load interruption. Commercial modeling of DRR-Type I is done using a special DRR-Type I (DRRNODE1) CPNode. This CPNode is linked to its associated Host Load Zone CPNode. The following rules apply to modeling of DRR-Type I resources.

- DRR-Type I resource CPNode will have the same EPNode relationship as the EPNodes that make up the associated Host Load Zone CPNode.

- Multiple DRR-Type I CPNodes can be created that are associated with the same host CPNode as long as the all of the DRR-Type I CPNodes and the host Load Zone CPNode are represented by the same Market Participant.

- DRR-Type I resource CPNode are considered assets and must be assigned to the same Asset Owner as host Load Zone CPNode. Asset Owner can submit offers for target demand reduction through Portal.

To register a DRR-Type I asset in the Midwest ISO’s commercial model, all the parameters specific to DRRs-Type I in Attachment E must be provided.

For qualification requirements to register a DRR-Type I resources and modeling examples please refer Section 4.2.6.1 of the BPM for Energy and Operating Reserve Markets.
4.2.4 Modeling of Demand Response Resources – Type II

Behind the meter generators that are capable of receiving electronic (via ICCP) dispatch instructions from Midwest ISO can register them as DRR-Type II resources in Midwest ISO Energy and Operating Reserve Market to supply a range of Energy and/or Operating Reserves. Commercial modeling of DRR-Type II resource is similar to that of modeling the Generator. The following rules apply to modeling of DRR-Type II:

- A single Load EPNode/host Load Zone CPNode and a single Resource EPNode/DRR-Type II CPNode representation is used to model DRR-Type II resource in Commercial Model. If the DRR-Type II is not committed, the host Load Zone CPNode represents the net metered amount for Settlement purposes. If the DRR-Type II is committed, the host Load Zone CPNode represents the DRR-Type II Load Forecast for Settlement purposes;

- Multiple DRR-Type II CPNodes can be created that are associated with the same host CPNode as long as all of the DRR-Type II CPNodes and the host Load Zone CPNode are represented by the same Market Participant.

- The behind-the-meter generation and/or controllable load associated with the DRR-Type II must be less than or equal to the host Load Zone gross Load.

To register a DRR-Type II asset in the Midwest ISO’s commercial model, all the parameters specific to DRRs-Type II in Attachment E must be provided.

For qualification requirements to register a DRR-Type II resources and modeling examples please refer Section 4.2.6.2 of the BPM for Energy and Operating Reserve Markets.

4.2.5 External Interfaces

CPNodes representing External Interfaces are used for Settlement of all PBT Schedules with the Midwest ISO, excluding Dynamic Dispatchable PBT (PBT). The CPNode to EPNode relationship is typically a one to many with each EPNode representing a location within an External BA. These CPNodes and the relationships to EPNodes are established and maintained by the Midwest ISO and are not related to any specific Asset Owner.

CPNodes representing External Interfaces for Dynamic Dispatchable PBTs are very similar to the External Interfaces defined above. The primary difference is that these interfaces are specifically related to an Asset Owner and are treated like a dispatchable Resource. In many cases they may mirror an External Interface in definition.
The naming convention for interfaces follows the NERC registered acronym for all BAs in the Eastern Interconnection. For those BAs that have an External Dynamic Dispatchable Interface, that interface will have the BA name followed by the letters “_DYN”. If an External BA has more than one External Interface CPNode defined, it will have the BA acronym followed by a dot “.” followed by a unique identifier developed by the Midwest ISO.

4.2.6  Hubs

CPNodes representing the Hubs are not related to any specific Asset Owner. All Participants are allowed to submit Virtual Supply Offers and Virtual Demand Bids at these locations as well as use them as a delivery point for trading. The Hubs have a one to many CPNode to EPNode relationship and the locations. The weighting factors, for each EPNode are established by the Midwest ISO as equal weighting in HUB LMP calculations.

4.2.7  Non-Commercial Aggregates

MPs will be allowed to define custom aggregates of EPNodes or CPNodes that may be used strictly for MP reference. The prices for these aggregate nodes will be viewable in the Midwest ISO Portal publicly and can be downloaded but will not be eligible for use as a Midwest ISO settled Commercial Node. No transactions can be created using these aggregates and the prices calculated will not go to settlements.

4.3  Asset Owners

The next level of the Commercial Model hierarchy represents the Asset Owners. An Asset Owner must represent each Asset. This is the operating entity level where all Bid and Offer data submittals, portal and Extensible Markup Language (XML) security, Settlement Statement aggregation, and Bilateral Transactions are conducted. Asset Owners are commonly referred to as LSEs or Generation Owners but an Asset Owner can own any combination of generation and load. However, not all Asset Owners must have physical Assets of load and generation. The operating entities associated with Bilateral Transactions and FTRs are also considered Asset Owners. All Energy and Operating Reserve Markets transactions for generation, load, FTRs and bilateral schedules are settled to the level of the Asset Owners and then invoiced to the MP. Asset Owners must be represented by one MP, but a MP may have multiple Asset Owners. This second entity layer allows for full flexibility for a MP to manage its users’ access and to separate internal business units or provide MP services for multiple entities with separate settlements for each.
4.4 Market Participant

The MP represents the highest-level data component of the Commercial Model. The MP is the entity that is financially obligated to the Midwest ISO for Market Settlements. The MP must have associations with at least one Asset Owner. The Local Security Administrator for the MP is the sole authority responsible to the Midwest ISO for establishing the security roles for its Asset Owners to submit all operating information. Refer to the Midwest ISO BPM for Market Registration for details on the data required to register a MP.

4.5 Common Bus

Common Bus is a single nominal Bus to which two or more resources (Generator and DRR-Type II) are connected in an electrically equivalent manner when all breakers are placed in their normal status. Multiple resources connected to a single Common Bus are treated as a single resource for compliance monitoring purpose. Common Buses are nominated by a Market Participant during the asset registration process. Each Common Bus nominated by a Market Participant will be checked and verified against the nominal network model with all breakers in their nominal or normal positions that is built during the regular network model update. The accepted Common Bus definitions will be implemented in the Commercial Model and will remain active unless a network model change reconfigures the nominal bus or a Market Participant chooses to terminate it.

All combined cycle child nodes will automatically be defined on a common bus to monitor Contingency Reserve Deployment Compliance.

Common Bus information is used in calculating:

- Contingency Reserve Deployment Failure Charge
- Excessive/Deficient Energy Calculation
- Excessive/Deficient Energy Deployment Charge

For more information on Common Bus implementation details please refer to the BPM for Market Settlements.
5. Model Maintenance

Both the Network Model and the Commercial Model must be kept current in order to support the reliable and economic operation of the power system and the Energy and Operating Reserve Markets. The following changes must be reflected in the models when they are made:

- Addition, deletion, or change of electric power system components
- Asset registration changes, additions, or deletions
- Changes to CPNodes
- Change in an MP registration

Changes to the Network and Commercial Models are submitted through the Midwest ISO Network/Commercial Data Modification Web Tool. The data requirements and “How To” guide are in the Midwest ISO Network/Commercial Data Modification Web Tool document that describes the on-line Web Tool application.

Changes to the Network and Commercial Models are made on the Midwest ISO Test System. Once the change has been verified on the Midwest ISO Test System, the change is then made on the Midwest ISO Production System.

Process diagram for Network and Commercial Model Updates:

1. MISO Requests Network and Commercial Model Changes from TOs and MPs
2. TOs and MPs Submit Changes Reflecting Asset Ownership Changes, New Construction or Upgrade of Existing Equipment
3. MISO Verifies Data Submitted by Members and Requests Additional Information, if Necessary
4. Prepare and Post Quarterly Model Update Schedule
5. MISO Makes Incremental Changes to Network, Commercial, FTR and SCADA Models
6. TOs and MPs Review, Verify and Confirm Changes made to the Network and Commercial Model Models
7. Post Updated Network and Commercial Models for Review by Stakeholders
8. MISO Makes Corrections Provided by TOs and MPs
9. Build Additional Databases such as Contingencies, Generation and Equipment Rating
10. Model Build Complete and Ready for Propagation to Test Environment
5.1  Network Model Change Times

The Midwest ISO will follow a three month Network Model update cycle. Minimally, the Midwest ISO shall perform a model update at least 90 days prior to the annual FTR allocation. During the three months, any Network Model changes that will become effective during the three month window will be included in the Network Model. Those changes that are not effective immediately at the loading time of the Network Model will be inactivated through outages until such time as the equipment is switched in. Likewise, once a configuration is switched in, any old configurations will be switched out until the next Network Model update when they will be terminated and removed from the Network Model. Given the three-month update cycle, all Network and Commercial Model changes must be submitted to the Midwest ISO through the Web-Tool at least 150 days in advance of their operational or termination date in order to be included in the appropriate Network Model update. As shown in Exhibit 2-1, many of the Midwest ISO applications use or depend on the Network Model. Therefore, sufficient time must be allowed to implement changes into the Network Model, test all the applications that will use the new Network Model and coordinate with all the users of the applications before the new Network Model is put into production. At least, one month must be allowed for the testing, coordination and data propagation. The Midwest ISO reserves the operational authority to keep any new equipment connected to the Midwest ISO Transmission System out of service if:

- The information is submitted later than 150 days in advance of the expected start date; and
- The equipment has the potential to disrupt reliability assessment and/or Energy and Operating Reserve Market operations if activated in the field without updating all relevant models including the Network and Commercial models, the FTR model, the RFCALC database, and the Day-Ahead and Real-Time market databases.

In the event a model change is required that is deemed an emergency correction necessary to ensure reliable operation of the Midwest ISO Transmission System and Market Operations, the Model Team will make the necessary corrections and apply the model changes between the normal quarterly updates. Any such change requires the Transmission Owner and/or MP to supply all relevant data for the Network and Commercial Model changes through the Web Tool as soon as they are known. All steps for validation and testing of the models must still be concluded according to the change management process for propagating models to production.

5.2  Commercial Model Change Times

The Midwest ISO follows a cyclic update of Commercial Model coinciding with the Network Model changes. All the topology / non-topology dependent changes are updated during this quarterly model
updates. Midwest ISO also provides four more opportunities in the months following quarterly model update to perform non-topology based changes.

During the quarterly updates for the periods beginning June, September, December all changes except for Load Zone reconfiguration as explained below will be allowed in the Commercial Model.

- Market Participants who have load zone Cnodes with uniform slice definition can change the ownership percentages given that uniform slice definition is still being maintained. For example, if a Cnode is currently defined with 10% ownership of all Epnodes, a new definition of 20% ownership of all Epnodes is allowed. However, a new definition of 20% ownership of one Epnode and 30% ownership of another Epnode will not be allowed since that change will modify the load zone Participation Factors and could potentially have adverse impacts on simultaneous feasibility conditions of the FTR models based on existing FTRs. Such Epnode ownership percentage changes must be coordinated with the control area in which the load resides.

For the quarterly model update beginning March all changes including Load Zone reconfiguration will be allowed in the Commercial Model.

During the non-topology updates for the months beginning April, July, October, January the following Commercial Model changes will be allowed:

- Creation of New Market Participant / Asset Owner.
- Termination of Market participant / Asset Owner.
- Asset transfer / termination.
- Scheduling and Metering Agent change.
- Asset parameter updates.

The Commercial Model is always kept up to date with the Network Model. Whenever the Network Model is changed, the Commercial Model is also be updated to reflect the Network Model changes. Changes that occur in the Network Model which require corresponding Commercial Model changes are Substation name changes, adding loads/generators, adding a new substation and moving loads/generators to the new substation, aggregating loads/generators at a higher KV substation level, moving loads/generators to a lower KV substation level, moving loads/generators from one transformer to the other, etc. These kind of changes require that EPNodes be added, terminated or changed. These changes will be communicated to the Transmission Owner and/or MP for review and conformation.
In the event of generator ownership change if market participants are not able to establish a firm transaction date and still want this change to reflect in the commercial model, MISO proposes the following procedure to be adopted by both the parties (Asset Owners).

- Both Asset Owners submit Attachment B’s during regular commercial model with suggested transfer date well into the future (more than 3 months out)
- MISO implements the asset transfer with future effective date
- Both Asset Owners will review and confirm the asset ownership changes
- MISO will propagate this change into production after thoroughly testing all the systems
- When the actual transfer date is firmly established both asset owners inform MISO registration via e-mail at least 14 days in advance
- MISO will make a patch update to all the impacted development and production systems to respect the actual transfer date.
- Exit Strategy – In the event the deal is not successful both asset owners can withdraw the Attachment B’s. The withdrawal should happen before the future effective date or they have to update the future effective date to a new date in the regular commercial model data submission cycle.

5.3 FTR Allocation Model Changes

The following sections describe Monthly and Annual FTR model changes for both the Network and Commercial models.

5.3.1 Model Changes for Monthly FTR True-up and Auction Models

It is important to first note that all monthly and annual FTR models are derived from the Network Model by adding known future equipment to the Network Model that is used for real-time operations. The resulting modified Network Model is converted to a bus-branch model in the PTI PSS/E format and used as the FTR model. The main difference between the Network Model and bus-branch model formats is that circuit breakers are not represented in the FTR model.

In the case of a monthly FTR true-up and FTR Auction model in particular, all known future equipment that will be in service on the first day of the month of interest is added to the Network Model used in
operations. The timeline and criteria for submitting model changes for monthly FTR true-up and FTR Auction models are the same as those described in Section 5.1 for the Network Model updates.

5.3.2 Annual FTR Allocation Model Changes

An Annual FTR Allocation will be conducted on a seasonal basis and the Midwest ISO will develop four Network Models to represent the Transmission System topology for the following seasons:

1) Winter (Dec 1 to Feb 28)
2) Spring (Mar 1 to May 30)
3) Summer (June 1 to Aug 31)
4) Fall (Sept 1 to Nov 30)

For example:

- The Spring 2005 FTR model will include all equipment that will be operational by March 1, 2005.
- The Summer 2005 FTR model will include all equipment that will be operational by June 1, 2005.
- The Fall 2005 FTR model will include all equipment that will be operational by September 1, 2005.
- The Winter 2005 FTR model will include all equipment that will be operational by December 1, 2005.

The initial list of the future equipment for the seasonal FTR models will be developed with information obtained from the following sources:

- The Midwest ISO Transmission Expansion Plan
- The Midwest ISO Access Planning Group that performs System Impact Studies for long term reservations
- The Midwest ISO Generation Interconnection Study Group

Thereafter, the Midwest ISO will contact the owner of each entry of future equipment in the initial list to verify that the associated project has been planned, budgeted, and has received regulatory approval. Also, the Midwest ISO will request any additional information that may be required to implement the necessary FTR model changes to reflect the future equipment.
5.4 Network, Commercial, and FTR Model Reviews

The Midwest ISO has developed processes and methods that allow Transmission Owners and MPs to review the Network Model and provide feedback to the Midwest ISO. The feedback provided is used to improve and keep the Network Model up-to-date. The following processes and methods currently exist for reviewing the Midwest ISO Network, Commercial, and FTR models:

- **On-site Model Review**: Transmission Owners and MPs who have a Non-Disclosure Agreement (NDA) on file are able to perform on-site review of the Network Model and the SE solution by visiting the Midwest ISO control room in Carmel or St. Paul. The NDA is required for the on-site review of the Network Model since the SE solution represents Real-Time system data.

- **Using Remote Terminals**: Transmission Owners and MPs who have an NDA on file are able to perform off-site review of the Network Model and the SE solution via remote terminals installed at their sites by the Midwest ISO. The NDA is required for the off-site review of the Network Model since the SE solution represents Real-Time system data.

- **Using the Daily Posted Model**: Transmission Owners and MPs who have an NDA on file are able to perform off-site review of the Network Model and the SE solution by downloading the model posted daily on the Midwest ISO Reliability Coordinator page. The NDA is required for this off-site review of the Network Model since the SE solution that is posted with the Network Model represents Real-Time system data.

- **Using 14-day Old Posted Models**: All Transmission Owners and MPs whether they have NDA on file or not, have access to the 14-day old Network Models that are posted on the Midwest ISO Extranet as long as they have a Midwest ISO Extranet Account. In other words, no NDA is required to have access to the 14-day old models that are posted at the following Midwest ISO Extranet site (Path: Home > Ems Model Information > EMS_FTR models : SE_Models):
  

- **Reviewing Commercial Model Data**: Whenever the Network Model is updated, the Commercial Model is updated to be consistent with the Network Model. The updated Commercial Model changes are posted for review by Transmission Owners and MPs at the same Midwest ISO Extranet site listed above.

- **Reviewing FTR Models**: The seasonal FTR models are posted on the same Extranet site as described above for review by Transmission Owners and MPs.
Attachment A

PSEUDO-TIE JOU EXAMPLES
A. Pseudo-Tie JOU Examples

JOU representations as Pseudo-tie

- A JOU with Pseudo-Tie arrangements will be represented as two Pseudo Units in the Network Model.
  - For Pseudo-Tie arrangements between LBAs, both portions need to be claimed by appropriate Asset Owners.
  - If the unit is physically located in LBA1 within the Midwest ISO and BA2 is out of the Midwest ISO, then the portion in LBA1 needs to be claimed by Asset Owners. The portion in BA2 needs to be registered for congestion and loss only.
  - If the unit is physically located in BA2 out of the Midwest ISO and LBA1 is within the Midwest ISO, then the portion in LBA1 needs to be registered. The portion in BA2 is considered out of the Midwest ISO Market Footprint both physically and electrically and it does not need to be registered. The generator share for LBA1 must have appropriate transmission arrangements with these external entities and the Midwest ISO is not a party to these arrangements.
Example A1: The JOU is physically in LBA1 (within the Midwest ISO) with Pseudo-Tied second party share to LBA2 (within the Midwest ISO)

- Each share is physically modeled in the Network Model as a separate generator
- Each share also has a CPNode and asset created for the respective owner.
Example A2: The JOU is physically in LBA1 (within the Midwest ISO) but the BA2 owner share is Pseudo-Tied to BA2 (out of the Midwest ISO). This share falls under the same rules identified earlier for Pseudo-Tie units. Again it must be registered for congestion and loss charges only.

- Generator share in LBA1 treated as any other Midwest ISO Energy and Operating Reserve Markets Resource
- Generator share in BA2 in special BA2.xxxx PSG
- Generator share for BA2 falls under Pseudo-Tie rules previously stated.
- Only generator share in LBA1 is subject to the Midwest ISO Energy and Operating Reserve Markets dispatch.
Example A3: The JOU is physically in BA2 (outside the Midwest ISO) and the BA1 share is Pseudo-Tied to LBA1 (inside the Midwest ISO).

- All shares represented in the Network Model
- Generator share in LBA1 treated as any other Midwest ISO Energy and Operating Reserve Markets Resource
- Only the generator share in LBA1 is subject to the Midwest ISO Energy and Operating Reserve Markets dispatch.
- Same rules apply for the generator share in LBA1 as discussed previously for a Pseudo-Tied Resource physically outside the Midwest ISO Market Footprint.
Attachment B

EXTERNAL PSEUDO-TIE GENERATION EXAMPLES
B. External Pseudo-Tie Generation Examples

Pseudo-Tie and Dynamic Schedule Generators

- A generator physically in LBA1 (within the Midwest ISO) but Pseudo-Tied to LBA2 (within the Midwest ISO) will be considered in BA2 and assigned as a Generation Resource in LBA2.

- Generator physically in LBA1 (within the Midwest ISO) but Pseudo-Tied to BA2 (out of the Midwest ISO) will be considered in BA2. The generator must be registered for congestion and loss charges only.

- A generator physically in BA1 (out of the Midwest ISO) but Pseudo-Tied to LBA2 (within the Midwest ISO) will be considered in BA2 and assigned as a Generation Resource in BA2.
  - The generator will be a Resource for the Midwest ISO Energy and Operating Reserve Markets and accounted for in the centralized dispatch.
  - The generator is subject to Transmission Service requirements of the external Transmission Service Providers in order to move the Energy from the generator into the Midwest ISO Transmission System. The Midwest ISO is not a party to these arrangements but will verify that appropriate service exists to bring Energy in from this Resource.

- A generator physically in LBA1 (within the Midwest ISO) supplying a Dynamic Schedule to BA2 (out of the Midwest ISO) will be considered in LBA1 and assigned as a Resource defined in LBA1.
Example B1: A generator physically in LBA1 (within the Midwest ISO) but Pseudo-Tied to LBA2 (within the Midwest ISO) will be considered in LBA2 and assigned as a Generation Resource in LBA2

- Generator is a BA2.xxxx Resource
- Looks like and acts like all other BA2 Resources.
Example B2: A generator physically in LBA1 (within the Midwest ISO) but Pseudo-Tied to BA2 (out of the Midwest ISO) will be considered in BA2. The generator must be registered for congestion and loss charges only.

- Generator is special BA2.xxxx PSG
- Registered for the Midwest ISO congestion and losses only
- Settled for LMP difference between PSG and BA2 Interface
- FTRs can be granted from the PSG to the BA2 Interface.
Example B3: A generator physically in BA1 (out of the Midwest ISO) but Pseudo-Tied to LBA2 (within the Midwest ISO) will be considered in LBA2 and assigned as a Generation Resource in BA2.

- Generator is a normal BA2.xxxx Resource
- Subject to the Midwest ISO Energy and Operating Reserve Markets dispatch and Settlement
- FTRs granted the same as for Load Zones wholly within the Midwest ISO Market Footprint
- Transmission Service across adjoining Transmission Service Provider to the Midwest ISO Market Footprint handled separately from the Midwest ISO Energy and Operating Reserve Markets and Transmission Service
- The Midwest ISO will verify applicable service arrangements exist for these Resources.
Attachment C

EXTERNAL PSEUDO-TIED LOAD EXAMPLES
C. External Pseudo-Tied Load Examples

Pseudo-tie and Dynamic Schedule Loads

- A Load physically in LBA1 (within the Midwest ISO) but Pseudo-Tied to LBA2 (within the Midwest ISO) will be considered in LBA2 and assigned to Load Zones defined in LBA2

- A Load physically in LBA1 (within the Midwest ISO) but Pseudo-Tied to BA2 (out of the Midwest ISO) will be considered in BA2. The Loads must be registered for congestion and loss charges only.

- A Load physically in BA1 (out of the Midwest ISO) but Pseudo-Tied to LBA2 (within the Midwest ISO) will be considered in LBA2 and assigned to Load Zones defined in LBA2.
  - The Load will be subject to the Midwest ISO Energy and Operating Reserve Markets and accounted for in the centralized dispatch.
  - The Load is only subject to Transmission Service arrangements it has with these external entities and the Midwest ISO is not a party to these arrangements.

- A Load physically in LBA1 (within the Midwest ISO) with Dynamic Schedule to BA2 (out of the Midwest ISO) will be considered in LBA1 and assigned to Load Zones defined in LBA1

- A Load physically in BA1 (out of the Midwest ISO) with Dynamic Schedule to LBA2 (within the Midwest ISO) will be considered in BA1 and need not be registered.
**Example C1**: A Load physically in LBA1 (within the Midwest ISO) but Pseudo-Tied to LBA2 (within the Midwest ISO) will be considered in LBA2 and assigned to Load Zones defined in LBA2

- Load in LBA2.xxxx Load Zone
- Can be part of larger LBA2 Load Zone aggregated with load in primary LBA2 area
- Load in Pseudo-Tie area included in LBA2 Load Forecast
**Example C2:** A Load physically in LBA1 (within the Midwest ISO) but Pseudo-Tied to BA2 (out of the Midwest ISO) will be considered in BA2. The Load must be registered for congestion and loss charges only.

- Load in special BA2.xxxx Pseudo-Tie Load Zone (PSL)
- Registered for the Midwest ISO congestion and losses only
- Load not included in BA1 Load Forecast
- Settled for LMP difference between BA2 interface and PSL
- FTRs can be granted from the BA2 interface to the PSL
Example C3: A Load physically in BA1 (out of the Midwest ISO) but Pseudo-Tied to LBA2 (within the Midwest ISO) will be considered in LBA2 and assigned to Load Zones defined in LBA2.

- Load in normal LBA2.xxxx Load Zone
- Subject to the Midwest ISO Energy and Operating Reserve Markets dispatch and Settlement
- Load included in LBA2 Load Forecast
- FTRs granted the same as for Load Zones wholly within the Midwest ISO Market Footprint
- Transmission Service from the Midwest ISO to adjoining Transmission Service Provider handled separately from the Midwest ISO Energy and Operating Reserve Markets.
- **Example C5**: A Load physically in BA1 (out of the Midwest ISO) and dynamically scheduled to LBA2 (within the Midwest ISO) will be considered in LBA1 and not required to be registered for the Midwest ISO Energy and Operating Reserve Markets.

- Load not in the Midwest ISO Energy and Operating Reserve Markets
- Must have PBT Schedule
- Delivery settled at the interface like all PBT Schedules
- Load expected to be accounted for in BA1 NERC System Data Exchange (SDX) Load Forecast.
Attachment D

BEHIND-THE-METER MODELING EXAMPLES
D. Behind-the-Meter Modeling Examples

<table>
<thead>
<tr>
<th>Legend:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter</td>
</tr>
</tbody>
</table>

Example D1: Behind-the-Meter Modeling: Small generator, not necessary for reactive support.

Example D2: Behind-the-Meter Modeling: Large generator, necessary for flexible reactive support – NINW Node option.
Example D3: Behind-the-Meter Modeling: Large generator, necessary for flexible reactive support – Unit/Load option.

Network Model maintains Generation and Load while Commercial Model reflects aggregate of Gen EPNode and Load EPNode as single load zone.

Example D4: Behind-the-Meter Modeling: Networked large Municipal, need flexible reactive support and flow through representation.
Attachment E

Asset Parameters for Commercial Model
Note on Dispatch Status:

The following default dispatch statuses are set during the Asset Registration for various asset types by the participants. All of these fields can be updated on an hourly basis, independently for the Day-Ahead and Real-Time Markets.

Energy Dispatch Status:

The Energy Dispatch Status determines if energy will be dispatched economically on a resource by the SCED algorithm (Economic) or if the energy will be a fixed value specified by the participant (Self-Scheduled). Valid values are

- Economic
- Self-Schedule

Regulation Reserve Dispatch Status:

The Regulation Reserve Dispatch Status determines if regulating reserve capacity will be dispatched economically on a resource by the SCED algorithm (Economic), be set to a fixed value specified by the participant (Self-Scheduled), or be made unavailable by the participant (Not Qualified/Not Participating). This field applies only to resources that have the Regulation Qualified Resource set to "TRUE". Valid values are

- Economic
- Self-Schedule
- Not Qualified
- Not Participating

Spinning Reserve Dispatch Status:

The Spinning Reserve Dispatch Status determines if spinning reserve will be dispatched economically on a resource by the SCED algorithm (Economic) or if the spinning reserve will be a fixed value specified by the participant (Self-Scheduled) or be made unavailable by the participant (Not Qualified). This field applies only to on-line resources that have the Spin Qualified Resource Flag set to "TRUE". Valid values are

- Economic
- Self-Schedule
- Not Qualified

Supplemental Reserve Dispatch Status:

The Supplemental Reserve Dispatch Status (Online Supplemental Reserve) determines if supplemental reserve will be dispatched economically on an ON-LINE resource by the SCED algorithm (Economic) or
if the supplemental reserve will be a fixed value specified by the participant (Self-Scheduled) or be made unavailable by the participant (Not Qualified). This field applies only to those on-line resources that are defined with the Spin Qualified Resource Flag set to "FALSE" and Supplemental Qualified Resource Flag set to "TRUE". Valid values are

- Economic
- Self-Schedule
- Not Qualified

**Off-line Supplemental Reserve Dispatch Status:**

The Off-line Supplemental Reserve Dispatch Status determines if supplemental reserve on an off-line or uncommitted quick-start resource will be dispatched economically by the SCED algorithm (Economic), dispatched only under emergency conditions (Emergency), specified by the participant (Self-scheduled) or be made unavailable by the participant (Not Qualified). This field applies only to those off-line resources that are defined with the Quick Start Qualified Resource Flag set to "TRUE" and Maximum Offline Limit of the Resource is defined with a positive value. Valid values are

- Economic
- Emergency
- Self-Schedule
- Not Qualified

Following table describes parameters that should be provided to model a generator in the Commercial Model.

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Values</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Node Name</td>
<td>CPNode Name (Character)</td>
<td>Required</td>
<td>Commercial Node Name. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Maximum Output</td>
<td>Number(MW)</td>
<td>Required</td>
<td>Default unit maximum output (either economic or emergency). This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI). Default values for Hourly Economic Maximum Limit and Hourly Emergency Maximum Limit are submitted by MP via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Minimum Output</td>
<td>Number(MW)</td>
<td>Required</td>
<td>Default unit minimum output (either economic or emergency). This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------</td>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>UNITTYPE</td>
<td>Name</td>
<td>Required</td>
<td>Unit type (Diesel, Steam Turbine, Combustion Turbine, Combined Cycle ST, Combined Cycle CT, Hydro, Wind, Pumped Storage, Other Peaker, Other)</td>
</tr>
<tr>
<td>FUELTYPE</td>
<td>Name</td>
<td>Required</td>
<td>Fuel type (Coal, Coal/Gas, Coal/Oil, Gas, Nuclear, Oil, Oil/Gas, Pet Coke, Waste, Water, Wind, Other)</td>
</tr>
<tr>
<td>Weather Point</td>
<td>Name</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Intermittent</td>
<td>Yes/No</td>
<td>Required</td>
<td>Intermittent flag indicates whether the unit is dispatchable or not. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI). Only Wind Farms, Run-Of-River hydro units and other generation resources where the fuel cannot be stored can be represented as intermittent (Yes) in Midwest ISO market model.</td>
</tr>
<tr>
<td>EIA Plant No</td>
<td>Name</td>
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</tr>
<tr>
<td>EIA Unit No</td>
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<tr>
<td>Default Status</td>
<td>Name</td>
<td>Required</td>
<td>Default Commit Status of the unit (Economic, Emergency, Must Run, Outage, Not Participating). Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Default Ramp Rate</td>
<td>Number (MW/min)</td>
<td>Required</td>
<td>Default Ramp Rate of the unit. This single value applies to Hourly Ramp Rate, Hourly Bi-Directional Ramp Rate, Hourly Single-Directional-Up Ramp Rate and Hourly Single-Directional Down Ramp Rate for both Day-Ahead and Real-Time Schedule Offer. Separate default values for each individual ramp rate for Day-Ahead and Real-Time may be entered via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>MDMA</td>
<td>Metering Agent</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>24 Hour Contact Email</td>
<td></td>
<td>Optional</td>
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</tr>
<tr>
<td>24 Hour Contact Mobile</td>
<td></td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
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<tr>
<td>24 Hour Contact Name</td>
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<td>24 Hour Contact Pager</td>
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<td>24 Hour Contact Primary Phone</td>
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<tr>
<td>24 Hour Contact Secondary Phone</td>
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<td></td>
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<tr>
<td>Zip Code</td>
<td>Required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of bands</td>
<td>Number $\leq \max(12, \frac{P_{max}}{50})$</td>
<td>Optional</td>
<td>Dispatch bands will determine which ramp rates and limits apply to a specific day-ahead / real-time market dispatch interval. This value is set and updated through asset registration only and cannot be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Max Limit</td>
<td>Number (MW)</td>
<td>Optional</td>
<td>The maximum output for which a Regulation Qualified Resource can immediately respond to automatic control signals in the day-ahead / real-time market. Must be less than or equal to the day-ahead / real-time Economic Maximum Limit. Applies to regulating resources only. Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Min Limit</td>
<td>Number (MW)</td>
<td>Optional</td>
<td>The minimum output for which a Regulation Qualified Resource can immediately respond to automatic control signals in the day-ahead / real-time market. Must be less than the day-ahead / real-time Regulation Maximum Limit. Applies to regulating resources only. Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Max Offline Limit</td>
<td>Number (MW)</td>
<td>Required</td>
<td>The maximum amount of capacity that can be loaded in the lesser of ten minutes or the Contingency Reserve Deployment Period from a cold-start. Must be less than or equal to the day-ahead / real-time Economic Maximum Limit and greater than or equal to the day-ahead / real-time Economic Minimum Limit. Applies only to Quick Start Resources qualified and available to supply.</td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
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<td>Description</td>
</tr>
<tr>
<td>------------------------------------</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>supplemental reserve as off-line</td>
<td></td>
<td></td>
<td>units. Default value is set through asset registration only and may be overridden by MP via Schedule Offer submittal via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation</td>
<td>Yes / No</td>
<td>Required</td>
<td>Regulation Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Spinning</td>
<td>Yes / No</td>
<td>Required</td>
<td>Spin Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Supplemental</td>
<td>Yes / No</td>
<td>Required</td>
<td>Supplemental Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Designated Network Resource</td>
<td>Yes / No</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
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<tr>
<td>Quick Start</td>
<td>Yes / No</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Energy Dispatch Status</td>
<td>Economic/Self-Schedule</td>
<td>Required</td>
<td>Energy dispatch status of this unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Reserve Dispatch Status</td>
<td>Economic/Self-Schedule/Not Qualified/Not Participating</td>
<td>Required</td>
<td>Default Regulating Reserve Dispatch Status of the unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Spinning Reserve Dispatch Status</td>
<td>Economic/Self-Schedule/Not Qualified</td>
<td>Required</td>
<td>Default Spinning Reserve Dispatch Status of the unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Supplemental Reserve Dispatch Status</td>
<td>Economic/Self-Schedule/Not Qualified</td>
<td>Required</td>
<td>On-Line Supplemental Reserve Dispatch Status of the unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Off-line Supplemental Reserve Dispatch Status</td>
<td>Economic/Self-Schedule/Not Qualified/Emergency</td>
<td>Required</td>
<td>Off-Line Supplemental Reserve Dispatch Status of the unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Common Bus</td>
<td>Common Bus Name</td>
<td>Optional</td>
<td>If this generator becomes part of the Common Bus definition then</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Values</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNITTYPE</td>
<td>Name</td>
<td>Required</td>
<td>Unit type (DRR1)</td>
</tr>
<tr>
<td>Reference load zone</td>
<td>load zone Cpnode</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Spinning</td>
<td>Yes / No</td>
<td>Required</td>
<td>Spin Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Supplemental</td>
<td>Yes / No</td>
<td>Required</td>
<td>Supplemental Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Designated Network Resource</td>
<td>Yes / No</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Commercial Node Name</td>
<td>Cpnode name</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>MDMA</td>
<td>Metering Agent Name</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Default Status</td>
<td>Economic/Emergency / Not Participating</td>
<td>Required</td>
<td>Default Energy Commit Status. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Contingency Reserve Dispatch Status</td>
<td>Economic/Self-Schedule/Emergency/Not Qualified/Not Participating</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI). MP may enter default values for Spinning Reserve Dispatch Status, if Spin Qualified and Supplemental Reserve Dispatch Status, in not Spin Qualified but Supplemental Qualified, via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Target Demand Reduction Level</td>
<td>MW</td>
<td>Required</td>
<td>Default value for Targeted Demand Reduction Level. This value is set through asset registration only and may be overridden by MP via the</td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
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<td>----------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MaxLoadForecastMWH</td>
<td>= MW</td>
<td>Required</td>
<td>Peak Load Forecast Cap of the host load zone for a model update cycle. Defined in MW. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Common Bus</td>
<td>Common Bus Name</td>
<td>Optional</td>
<td>Two or more Demand Reduction Programs attached to the same host load zone can be defined on a Common Bus for compliance monitoring. The name of such Common Bus should be defined with this parameter. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
</tbody>
</table>

Following table describes parameters that should be provided to model External Asynchronous Resource (EAR) in the Commercial Model.

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Values</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Node Name</td>
<td>Cnode name</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>UNITTYPE</td>
<td>Name</td>
<td>Required</td>
<td>Unit type (EAR)</td>
</tr>
<tr>
<td>MDMA</td>
<td>Metering Agent</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Maximum Limit</td>
<td>Number (Mw)</td>
<td>Required</td>
<td>The maximum output attainable by an external market generation resource under emergency / economic conditions in the Day-ahead / real-time market. (either economic or emergency). This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI). Default values for Hourly Economic Maximum Limit and Hourly Emergency Maximum Limit are submitted by MP via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Commercial Node Name</td>
<td>Cnode name</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation</td>
<td>Yes / No</td>
<td>Required</td>
<td>Regulation Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------------</td>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Spinning</td>
<td>Yes / No</td>
<td>Required</td>
<td>Spin Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Supplemental</td>
<td>Yes / No</td>
<td>Required</td>
<td>Supplemental Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Min Limit</td>
<td>Number (MW)</td>
<td>Optional</td>
<td>The minimum output for which a resource can immediately respond to automatic control signals in the day-ahead / real-time market. Must be less than the day-ahead / real-time Regulation Maximum Limit. Applies to regulating resources only Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Max Limit</td>
<td>Number (MW)</td>
<td>Optional</td>
<td>The maximum output for which a resource can immediately respond to automatic control signals in the day-ahead / real-time market. Must be less than or equal to the day-ahead / real-time Economic Maximum Limit. Applies to regulating resources only. Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Default Ramp Rate</td>
<td>Number (MW/min)</td>
<td>Required</td>
<td>Default Ramp Rate of the unit. This single value applies to Hourly Ramp Rate, Hourly Bi-Directional Ramp Rate, Hourly Single-Directional-Up Ramp Rate and Hourly Single-Directional Down Ramp Rate for both Day-Ahead and Real-Time Schedule Offer. Separate default values for each individual ramp rate for Day-Ahead and Real-Time may be entered via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Designated Network Resource</td>
<td>Yes / No</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Energy Dispatch Status</td>
<td>Economic/Self-Schedule</td>
<td>Required</td>
<td>Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Reserve Dispatch Status</td>
<td>Economic/Self-Schedule/Not Qualified/Not Participating</td>
<td>Required</td>
<td>Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Spinning Reserve</td>
<td>Economic/Self-Schedule/Not</td>
<td>Required</td>
<td>Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
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</table>
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<table>
<thead>
<tr>
<th>Parameter Name</th>
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<tr>
<td>Dispatch Status</td>
<td>Qualified</td>
<td></td>
<td>may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Supplemental Reserve</td>
<td>Economic/Self-Schedule/Not Qualified</td>
<td>Required</td>
<td>Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
</tbody>
</table>

Following table describes parameters that should be provided to model DRR-Type II Resource in the Commercial Model

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Values</th>
<th>Required</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Number of bands</td>
<td>Number &lt;= max(12,Pmax / 50 )</td>
<td>Required</td>
<td>Dispatch bands will determine which ramp rates and limits apply to a specific day-ahead/real-time market dispatch interval. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Max Limit</td>
<td>Number (MW)</td>
<td>Required</td>
<td>The maximum output resource can immediately respond to automatic control signals in the day-ahead / real-time market. Must be less than or equal to the day-ahead / real-time Economic Maximum Limit. Applies to regulating resources only. Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Min Limit</td>
<td>Number (MW)</td>
<td>Required</td>
<td>The minimum output resource can immediately respond to automatic control signals in the day-ahead / real-time market. Must be less than the day-ahead / real-time Regulation Maximum Limit. Applies to regulating resources only. Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Max Offline Limit</td>
<td>Number (MW)</td>
<td>Required</td>
<td>The maximum amount of capacity that can be loaded in the lesser of ten minutes or the Maximum Contingency Reserve Deployment Time from a cold-start. Must be less than or equal to the day-ahead / real-time Economic Maximum Limit and greater than or equal to the day-ahead / real-time Economic Minimum Limit. Applies only to quick-start type 2 demand response resources qualified and available to supply supplemental reserve as off-line resources. Default value is set through asset registration only and may be overridden by MP.</td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------</td>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Regulation</td>
<td>Yes / No</td>
<td>Required</td>
<td>Regulation Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Spinning</td>
<td>Yes / No</td>
<td>Required</td>
<td>Spin Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Supplemental</td>
<td>Yes / No</td>
<td>Required</td>
<td>Supplemental Qualified Resource Flag. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Designated Network Resource</td>
<td>Yes / No</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Quick Start</td>
<td>Yes / No</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>24 Hour Contact Email</td>
<td>Email Id</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>24 Hour Contact Mobile</td>
<td>Mobile Number</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>24 Hour Contact Name</td>
<td>Name of the person</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>24 Hour Contact Pager</td>
<td>Pager Number</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>24 Hour Contact Primary Phone</td>
<td>Phone number</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>24 Hour Contact Secondary Phone</td>
<td>Phone number</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>Address</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Facility Address</td>
<td>Address</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>MDMA</td>
<td>Metering Agent</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Reference Load Zone</td>
<td>Load Zone Cnode</td>
<td>Required</td>
<td>This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>State</td>
<td>Address</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Zip Code</td>
<td>Address</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>UNITTYPE</td>
<td>Type of the unit</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>FUELTYPE</td>
<td>Fuel type</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Commercial Node Name</td>
<td>Cnode name</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Minimum output</td>
<td>MW</td>
<td>Required</td>
<td>Default unit minimum output (either economic or emergency). This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI). Default values for Hourly Economic Minimum Limit and Hourly Emergency Minimum Limit</td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>----------------------------</td>
<td>-----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Maximum output</td>
<td>MW</td>
<td>Required</td>
<td>Default unit maximum output (either economic or emergency). This value is set and updated through asset registration only and cannot be changed via the Market Portal (DART MUI). Default values for Hourly Economic Maximum Limit and Hourly Emergency Maximum Limit are submitted by MP via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Default Ramp Rate</td>
<td>Number (MW/min)</td>
<td>Required</td>
<td>Default Ramp Rate of the unit. This single value applies to Hourly Ramp Rate, Hourly Bi-Directional Ramp Rate, Hourly Single-Directional-Up Ramp Rate and Hourly Single-Directional Down Ramp Rate for both Day-Ahead and Real-Time Schedule Offer. Separate default values for each individual ramp rate for Day-Ahead and Real-Time may be entered via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Default Status</td>
<td>Name</td>
<td>Required</td>
<td>Default Commit Status of the unit (Economic, Emergency, Must Run, Outage, Not Participating). Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Energy Dispatch Status</td>
<td>Economic/ Self-Schedule</td>
<td>Required</td>
<td>Energy dispatch status of this unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Reserve Dispatch Status</td>
<td>Economic/ Self-Schedule / Not Qualified / Not Participating</td>
<td>Required</td>
<td>Default Regulating Reserve Dispatch Status of the unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Spinning Reserve Dispatch Status</td>
<td>Economic/ Self-Schedule</td>
<td>Required</td>
<td>Default Spinning Reserve Dispatch Status of the unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Supplemental Reserve Dispatch Status</td>
<td>Economic/ Self-Schedule</td>
<td>Required</td>
<td>On-Line Supplemental Reserve Dispatch Status of the unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Off-line Supplemental Reserve Dispatch Status</td>
<td>Economic/ Self-Schedule/ Not Qualified / Emergency</td>
<td>Required</td>
<td>Off-Line Supplemental Reserve Dispatch Status of the unit. Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Common Bus</td>
<td>Common Bus Name</td>
<td>Optional</td>
<td>If this DRR becomes part of the Common Bus definition then the name of such Common Bus should be defined with this parameter. This value is set and updated through asset registration only.</td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------</td>
<td>----------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MaxLoadForecastMWH</td>
<td>= MW</td>
<td>Required</td>
<td>Peak Load Forecast Cap of the host load zone for a model update cycle. Defined in MW. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
</tbody>
</table>

Following table describes parameters that should be provided to model Combined Cycle Aggregate Resource in the Commercial Model

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Values</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Output</td>
<td>Number(MW)</td>
<td>Required</td>
<td>Default unit minimum output (either economic or emergency). This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Minimum Output</td>
<td>Number(MW)</td>
<td>Required</td>
<td>Default unit maximum output (either economic or emergency). This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>UNITTYPE</td>
<td>Name</td>
<td>Required</td>
<td>Unit type (Combined Cycle Aggregate, Other)</td>
</tr>
<tr>
<td>FUELTYPE</td>
<td>Name</td>
<td>Required</td>
<td>Fuel type (GAS, Water, Other)</td>
</tr>
<tr>
<td>Weather Point</td>
<td>Name</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Intermittent</td>
<td>Yes/No</td>
<td>Required</td>
<td>Intermittent flag indicates whether the unit is dispatchable or not. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI). Only Wind Farms, Run-Of-River hydro units and other generation resources where the fuel cannot be stored can be represented as intermittent (Yes) in Midwest ISO market model.</td>
</tr>
<tr>
<td>EIA Plant No</td>
<td>Name</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------</td>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>EIA Unit No</td>
<td>Name</td>
<td>Required</td>
<td>Default Commit Status of the unit (Economic, Emergency, Must Run, Outage, Not Participating). Default value may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Default Status</td>
<td>Name</td>
<td>Required</td>
<td>Default Ramp Rate of the unit. This single value applies to Hourly Ramp Rate, Hourly Bi-Directional Ramp Rate, Hourly Single-Directional-Up Ramp Rate and Hourly Single-Directional Down Ramp Rate for both Day-Ahead and Real-Time Schedule Offer. Separate default values for each individual ramp rate for Day-Ahead and Real-Time may be entered via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Default Ramp Rate</td>
<td>Number (MW/min)</td>
<td>Required</td>
<td>Dispatch bands will determine which ramp rates and limits apply to a specific day-ahead / real-time marker dispatch interval. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Number of bands</td>
<td>Number ( \leq \max(12, \frac{P_{max}}{50}) )</td>
<td>Optional</td>
<td>The maximum output for which an Internal Market Generation resource can immediately respond to automatic control signals in the day-ahead / real-time market. Must be less than or equal to the day-ahead / real-time Economic Maximum Limit. Applies to regulating resources only. Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Max Limit</td>
<td>Number (MW)</td>
<td>Optional</td>
<td>The minimum output for which an Internal Market Generation resource can immediately respond to automatic control signals in the day-ahead / real-time market. Must be less than the day-ahead / real-time Regulation Maximum Limit. Applies to regulating resources only. Default value set in asset registration may be overridden by MP via Market Portal (DART MUI).</td>
</tr>
<tr>
<td>Regulation Min Limit</td>
<td>Number (MW)</td>
<td>Optional</td>
<td>The maximum amount of capacity that can be loaded in the lesser of ten minutes or the Maximum Contingency Reserve Deployment</td>
</tr>
<tr>
<td>Max Offline Limit</td>
<td>Number (MW)</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>Parameter Name</td>
<td>Values</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------------------------------</td>
<td>----------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Common Bus</td>
<td>Common Bus Name</td>
<td>Required</td>
<td>Parent and child nodes of the combined cycle will automatically be defined as part of the Common Bus definition. This value is set and updated through asset registration only and can not be changed via the Market Portal (DART MUI).</td>
</tr>
</tbody>
</table>