Renewable Integration
MISO

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About MISO

• MISO is a FERC approved Regional Transmission Organization (RTO) and Independent System Operator (ISO)
• MISO operates Day-ahead, Real-time and Ancillary Services markets
• Operate in 12 states and one Canadian province
• Peak market load in 2011 – approximately 104,000 MW
• Approximately 9,000 MW of wind on system
  – Adding 1,000 MW of wind per year
  – Over 50,000 in GI queue
• MISO does not own generation or transmission
• MISO plans for the transmission system
Integration of Renewables Drivers

- **Renewable energy planning initiatives**
  - Primarily policy driven
- **Transmission needed to implement energy initiatives**
  - Meet policy needs, reduce curtailments
- **Cost allocation needed to implement transmission initiatives**
- **Diversity of resources needed to provide capacity benefits and operational flexibility**
- **Quality wind forecasts to provide additional operational flexibility through Market initiatives**
  - Dispatchable Intermittent Resources
Public Policy and Regional Transmission Intersect

- The development of a MISO energy and operating reserve market allowed for regional transmission to provide regional benefits in increasing market efficiency and enabling low cost generation to be delivered to load.
- Simultaneously, an increase in public policy energy mandates drove the need for a robust regional transmission network that can respond to legislated changes in generation requirements.
MISO’s transmission planning process is focused on minimizing the total cost of delivered power to consumers: energy, capacity and transmission.
As an increasing number of renewable energy mandates were passed by MISO states, analyses were performed to determine the least cost wind generation siting methodology.

The least-cost approach to wind generation siting, when both generation and transmission capital costs are considered, is a combination of local and regional generation locations.
Regional Generation Outlet Study
Renewable Energy Zones
Proposed Candidate MVP Configuration

MISO - using Ventyx, Velocity Suite © 2011
MVPs reliably and economically enable established energy policy choices

- The 2011 MVP Portfolio
  - Provides benefits in excess of its costs under all scenarios studied, with its Benefit–to–Cost ratio ranging from 1.7 to 5.4
  - Maintains system reliability by resolving reliability violations on about 700 elements for more than 5,000 system conditions that would require operator action
  - Mitigates at least 10 system stability conditions that could otherwise cause cascading outages
  - Enables approximately 10 GW of nameplate renewable capacity to meet renewable energy mandates and goals.
# MISO Transmission Cost Allocation Approach seeks to match the business case with the allocation method

<table>
<thead>
<tr>
<th>Allocation Category</th>
<th>Driver(s)</th>
<th>Allocation to Beneficiaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant Funded (“Other”)</td>
<td>Transmission Owner identified project that does not qualify for other cost allocation mechanisms.</td>
<td>Paid by requestor (local zone)</td>
</tr>
<tr>
<td>Generator Interconnection Project</td>
<td>Interconnection Request</td>
<td>Paid for by requestor; 345 kV and above 10% postage stamp to load</td>
</tr>
<tr>
<td>Market Efficiency Project¹</td>
<td>Reduce market congestion when benefits are 1.2 to 3 times in excess of cost</td>
<td>Distribute to planning regions commensurate with expected benefit; 345 kV and above 20% postage stamp to load</td>
</tr>
<tr>
<td>Baseline Reliability Project</td>
<td>NERC Reliability Criteria</td>
<td>Primarily shared locally through Line Outage Distribution Factor Methodology; 345 kV and above 20% postage stamp to load</td>
</tr>
<tr>
<td>Multi Value Project</td>
<td>Address energy policy laws and provide widespread benefits across footprint</td>
<td>100% postage stamp to load</td>
</tr>
</tbody>
</table>

¹. Market Efficiency Project cost allocation methodology currently under review by stakeholders
Diversity – Important Integration Component

Wind Correlation vs Distance

Calculated from data provided though the DOE Eastern Wind Integration and Transmission Study
Market Initiatives - Dispatchable Intermittent Resource (DIR)

• A DIR is very similar to a standard generation resource
  – Difference: Generation resource supplies Max Limit as a portal offer-parameter; Dispatchable Intermittent will provide a forecast that will be used as Max Limit

• The resource is included in the day-ahead and real-time co-optimization, and is eligible to set price

• The resource can submit offers for Energy, and will clear between Min and Max Limits, based on Economics

• The resource cannot submit offers for Operating Reserves (reg, spin or supp), and will not clear Operating Reserves in day-ahead or real-time
Dispatchable Intermittent Forecast

- **Primary source for Max Limit will be the participant-submitted forecast**
  - CP-Node Level Forecast to have **five-minute** granularity; rolling 12 periods will be submitted via XML
  - Forecast needs to be **independent of dispatch**.

  Example: if wind has been dispatched down to 0, but the resource could produce 100MW if dispatched up, the forecast submittal must be 100MW.

- **Midwest ISO will have a CP-Node Level Forecast that will be used as a backup under scenarios where the participant forecast is unavailable**
Questions

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