Ramp Management and Participation of Storage Resources

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Illustration of Load Following Requirement

Dispatchable Resources must follow Effective Load

High Ramp Requirement due to increasing actual load and NSI and decreasing non-dispatchable resource output
Opportunities to improve Ramp Management

• Aid reliable operations by keeping sufficient ramp capability available for use in RT dispatch
  – Less dependency on quick start resources and other operator tools
  – Cost effective compared to managing with regulation reserves

• Create sufficient incentives such that offered ramp rates reflect physical capabilities of the generation resources
  – Profitability and competitive edge based on offered flexibility
  – Transparent market mechanism may obtain additional flexibility from the existing fleet and/or justify new investments
Opportunities to improve Ramp Management

• Ensure price volatility in RT is less impacted by transitory ramp shortages
  – Price signals are inefficient when market players are unable to react before corrective measures are administered

• Ensure reliable and economical operation in the presence of renewable resources and the impacts associated with the EPA mandates
  – Fuel prices making flexible resources less expensive and more heavily loaded can erode available responsiveness
  – Increasing penetration of renewable resources and interchange flexibility require additional ramp capability to ensure reliability
What are the proposed Ramp Products?

• Up Ramp Capability and Down Ramp Capability products to explicitly manage the ramp available from the controllable generation through market incentives
  – Reserve a specified level of resource ramp capability to meet RT dispatch variability
  – Requirements vary to support different operating conditions, forecasts, uncertainties, time of day, seasons, etc.

• Integrated within the commitment and dispatch functions in DA and RT markets
  – Modelled in the objective formulation as constraints with demand curve based penalty values
  – Co-optimized with Energy and Ancillary Service products
  – Prices determined by the resource opportunity cost
Ramp Products in Real Time

Current time = $t_0$

Should be capable of moving from $t_0$ to $t_1$
Should be capable of moving from $t_1$ to $t_3$ with the specified uncertainty level
Ramp Products in Real Time

Net Load

Current time = $t_1$

Should be capable of moving from $t_1$ to $t_2$ with updated net load and forecast.
Ramp Products in Real Time

Current time = $t_1$

Should be capable of moving from $t_1$ to $t_2$ with updated net load and forecast.
Should be capable moving from $t_2$ to $t_4$ with the specified uncertainty level.
Long-Term Benefits

• Price volatility reflect true market economics and allow predictable market outcomes for generation and load
• Improved market transparency will reflect true cost of service
• Smoother dispatch signals potentially reducing wear and tear of generation resources
• Cost savings for load through reduction of shortage conditions and avoiding commitment of expensive quick start resources
• Sets the stage for more efficient usage of dispatchable resources including DRR and long-term storage
Opportunities for Long-Term Stored Energy Resources in MISO markets

• System and resource efficiency can be improved if the market models and clearing process allow determination of generation and charging schedules
  – Considering coupling effect on the storage reservoir, weekly operational cycle and economics across multiple intervals
  – Current business rules puts the onus on the Market Participant to determine energy constraints based on storage targets, schedules and bids and offers

• Once adequately enabled, additional flexibility can be extracted from these resources to participate in products such as Ramp Capability
Specific Elements of Efficiency Gain

• Multi-day operational cycle can be better reflected in the daily market processes
• Proactive scheduling of limited energy generation using forward looking processes instead of reactive assessment by resource owner
• Daily energy constraints can be softened to strike a trade-off between value of energy to the system versus future value of retaining the storage
• Economic scheduling of charging of the storage instead of a fixed load schedule
Reservoir Storage Model and Participant Offers

- Reservoir model is coupled with the associated generation and pumping
  - Minimum and maximum storage limits are specified
  - Supports daily/hourly storage targets and a cost function for deviation from the targets

- Offered for Energy and Operating Reserves
  - Energy targets are replaced with reservoir limits and targets
  - Pumping is scheduled when economical to charge the storage to offset generation
  - Reservoir Target Price Curve reflecting the $/MWh price for deviation from the target reservoir storage is also specified
Market Clearing (similar for DA and RT)

- Time-coupled multi-interval commitment analysis determines hourly storage targets
- Reservoir Target Price Curve will act as soft limit on the use of stored energy
- Hourly storage targets and value of storage are fed into the single interval dispatch for setting energy targets/trajectory and penalty values
- Violations are rolled into future intervals so attempt is made to restore to the energy trajectory if it is economic
- The resource will clear for Energy, Ancillary Services and Ramp Capability
Questions?

Website
http://www.midwestiso.org > What We Do > Strategic Initiatives > Ramp Management

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