Uncertainty and Power Market Design

ESIG Meteorology and Market Design for Grid Services Workshop

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The issue

- How much capacity should RTO/ISOs commit and how far ahead of real time?
- Given:
  - Standard uncertainties: load forecast error, generation outages
  - New uncertainties: weather driven generation output, gas availability
  - Amount of long duration vs energy-limited resources
  - Modern forecasting and computing capabilities

Topics

1. Current RTO/ISO activity—ISO-NE, PJM, MISO, NYISO

2. Whose job is it to mitigate this risk—RTOs vs market participants?

3. Surprise bonus topic

ISO-NE energy security concerns

- Increasing reliance on energy-limited and fuel-constrained resources
- Not procuring reserves in advance currently
  - Exposed to 4-6 GW daily shortfall to cover generator failure to perform, flexibility needs, forecast error in a 25 GW peak load system.
- Fixed costs of securing firm supply not being compensated
  - “Up-front cost to arrange trucking for a prompt oil replenishment, or up-front fees for an intra-day notice gas contract with an LNG terminal, or other fixed costs associated with arranging fuel/inputs in advance relevant to a resource’s technology”

https://www.pjm.com/-/media/committees-groups/task-forces/fsstf/20190426/20190426-item-05-iso-ne-fuel-security-efforts.ashx

ISO-NE Design Changes

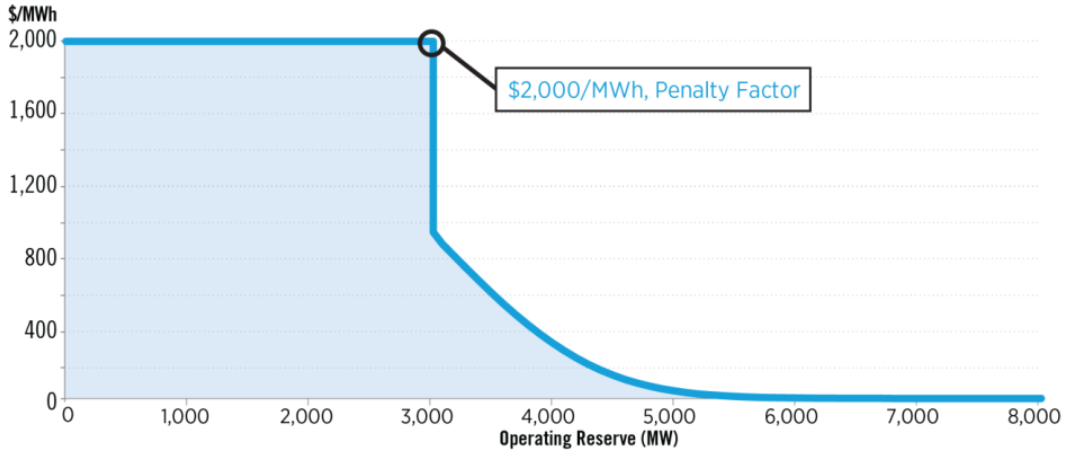
- ISO-NE proposal:
  - Day ahead ancillary service markets—replacement energy (flexibility), generation contingency, energy imbalance (forecast error)
  - Seasonal forward market to optimize winter fuel arrangements
  - Capacity market to remain
  - Multi-day ahead market to optimize stored fuel
    - Unclear how much, how far in advance, how fits with market participant hedging
- What role for market participants vs the ISO?
  - ISO-NE says “over-the-counter forward power markets:
    - Do not have access to the system-level supply information
    - Do not have the ability or means to price the value of preserving energy for future days
    - Do not have the ability or means to coordinate suppliers’ production over multiple days in an efficient way.”
  - What about months ahead of time? Where does one draw the line?

PJM fuel security gap analysis:
Do existing mechanisms avoid loss of load in all scenarios?

- **Scenarios:**
  - Primary concern: 2 week winter cold snap with natural gas vulnerability, limited oil tank inventory, high winds affecting nuclear
- **Existing mechanisms:**
  - Capacity market with must offer obligation, 3 yrs forward
  - Day Ahead Scheduling Reserves, real time reserves and regulation (800 MW during ramping hours)
- **Criteria:**
  - “Potential plausible future FERC/NERC reliability standards/guidelines”

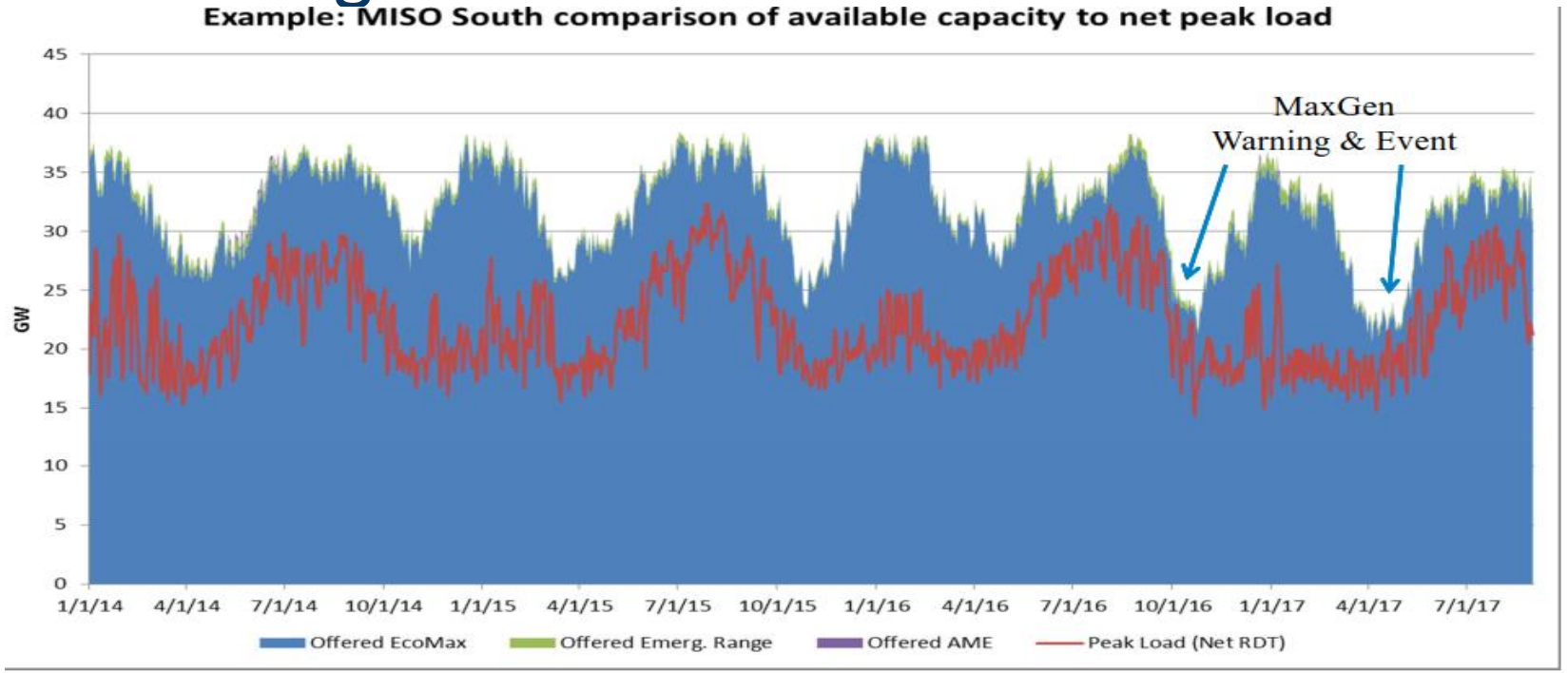
PJM Design Changes

- Energy security: considering advance procurement—days, weeks, months
- Proposing to keep capacity markets
- Operating Reserve Demand Curve, shape driven by uncertainty



MISO Resource Availability and Need

- "Less certain available capacity…more than a dozen MaxGen alerts, warnings, or events in the last two years…in all four seasons." "Emergence of forecast resources."



https://cdn.misoenergy.org/20170913%20RASC%20Item%2003c%20Seasonal%20Resource%20Availability%20and%20Need%20Presentation87594.pdf

MISO Potential Design Changes

- Capacity ratings to account for correlations and seasonal variation
- Better forecasts of generation, load
- Post more outage information
- More granular capacity market—seasonal
- “Procure reliability services through markets and planning”

https://cdn.misoenergy.org/Resource%20Availability%20and%20Need%20RAN%20Evaluation%20Whitepaper274537.pdf

NYISO Grid in Transition

- "The grid will likely need more load-following capability, and possibly more fast-response and flexible resources that provide operating reserves to address expected and unexpected changes in net load."
- Considering
  - fuel security ("incentives so that resources will invest in and maintain energy supply arrangements and/or alternative fuel capabilities")
  - shortage pricing
  - ancillary service product design
  - intertie scheduling
  - capacity ratings

https://www.nyiso.com/viewasset/-/asset_publisher/ahT3AkSLVccA/document/id/6785810

RTO vs market participants' role in risk management

- **Why an RTO should procure more resources further ahead of time**
  - Has most information
  - Can optimize through central clearing auction
  - Experience managing risk--day ahead markets and Financial Transmission Rights
- **Why market participants should do it on their own, with RTOs only providing spot market price signals, data and analysis**
  - Risk management is not an RTO core competency. Example: Green Hat default.
  - No particular advantage over market participants more than days or weeks ahead of time
  - RTO bias in over-procuring resources—capacity market reserve margins and pricing
  - Market participants know their resources best and can forecast and optimize

Standard Market Structure still robust?

- CUSTOMERS (wholesale or direct access) Procure the types, quantity, term, of energy and risk management products
- RTO
  - balance power system with market mechanisms for energy and reliability services—bid-based SCED day ahead and real time
    - Forecast and provide information to market
  - plan transmission for reliability and efficiency
- IPPs and marketers build projects, manage risks, sell products to customers including utilities, end-users, and the RTO
- Utilities own and operate T&D under regulation.
- Financial participants & marketers offer risk management products
- Environmental and energy policy makers internalize externalities

Bonus Topic: Transmission Helps Manage Uncertainties

- NYISO: "…resiliency is closely linked to the importance of maintaining and expanding interregional interconnections, the building out of a robust transmission system…" NYISO filing in FERC Docket No. AD18-7, p. 4.
- PJM: "Robust long-term planning, including developing and incorporating resilience criteria into the RTEP, can also help to protect the transmission system from threats to resilience." PJM filing in FERC Docket No. AD18-7, p. 49-50.
- SPP: "The transmission infrastructure requirements that are identified through the ITP process are intended to ensure that low cost generation is available to load, but the requirements also support resilience in that needs are identified beyond shorter term reliability needs. For example, the ITP identified the need for a number of 345 kV transmission lines connecting the panhandle of Texas to Oklahoma. These lines were identified as being economically beneficial for bringing low-cost, renewable energy to market, but their construction has also supported resilience by creating and strengthening alternate paths within SPP." SPP, Docket No. AD18-7