Resilience and Emerging Issues in Wholesale Electricity Markets

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What is Resilience?

• If you ask six people, your likely to get eight answers.
  ✓ Proof: read the RTOs’ comments on resilience filed at FERC.
  ✓ Concern: ambiguous terms can be adopted opportunistically to support many agendas;
• In broad terms, resilience can address:
  ✓ Network issues:
    – Hardening the system to be less vulnerable to catastrophic failures; and
    – Preparing to restore The system quickly after a catastrophic failure.
  ✓ Reliability issues: having adequate available resources in the right locations to serve load.
• Examining and addressing network issues is a valuable focus for resilience.
  ✓ Almost all serious blackouts are caused by transmission or distribution issues.
  ✓ Unfortunately, very little of the discussion is focused on these issues.
Resilience and Reliability

- Addressing reliability issues in the name of resilience must be done carefully.
- RTO’s are very good at reliability and most RTO systems are extraordinarily resilient from a reliability perspective
  - RTOs probabilistically evaluate system contingencies and establish planning requirements to satisfy a 1-day-in-10-year planning standard.
  - However, not all types of contingencies are planned for and evaluated (e.g., pipeline contingencies, extreme weather events, etc.)
- The RTO markets employ reliability and planning processes by:
  - Identifying the contingencies to plan for
  - Quantifying the resources needed to respond to the contingencies
  - Designing a market-based procurement to acquire the resources at least cost
- However, the energy markets are generally capable of maintaining reliability/resilience without relying on this planning process.
• There are only two fundamental products: energy and reactive power
  ✓ Most other products are essentially options on energy in different timeframes (regulation, operating reserves);
  ✓ Reliability and resilience are not products, they are expressions of demand for energy that exist only because the true demand cannot participate in the markets;

• How should reliability and resilience requirements ideally be established?
  ✓ Ideally, they should be based on the fundamental value of the fundamental product: energy
  ✓ What is energy worth to its consumers?
    “value of lost load” = $4000 to $25,000/MWh
  ✓ Reliability requirements could be established that correspond to this value – stop requiring additional capacity when its costs exceed the reduction in expected value of lost load.

• RTOs do not do this, instead they plan to satisfy a 1-in-10 year planning standard.
  ✓ This standard implies a VOLL equal to $200,000 to $300,000/MWh.
So. . . How can energy markets achieve reliability and resilience?

- Set VOLL to reflect the highest value load in the market and use it to price shortages by setting reserve demand curves =
  
  VOLL * Probability of Losing Load as reserve levels fall

- When resources are not sufficient to satisfy all of the energy and reserve needs, the value of the foregone reserves will be reflected in energy and reserve prices

- The expectations of the contingencies and other conditions that could lead to shortages (and associated shortage revenues) will motivate private investments to achieve an efficient level of reliability and resilience

This approach is extremely robust and will address many issues, including:

- The entry of large quantities of intermittent resources as increasing shortages from intermittency results in increasing revenues for flexible, fast-ramping resources.

- Most fuel security issues associated with increasing dependence on natural gas; and
Example: MISO’s ORDC Compared to an Economic ORDC

Practice simulation of ORDC

$/MWh

Share of Operating Reserve Requirement

Current ORDC
Economic ORDC - IMM Model

93 percent of OR shortages in this range
When Do We Need Planning to Supplement Energy Markets?

- Energy markets can provide strong incentives to address conditions or contingencies whose probabilities can be estimated.
- They will likely be less effective in facilitating the participant actions needed to address extremely low (or unknown) probability events that would be catastrophic.
  - Participants are risk averse.
  - The costs, if the contingency happens, would be too large for the system to bear (in reality or politically).
- For example, the analysis in our upcoming annual report for New England evaluates the recently announced retirement of a LNG terminal in Boston harbor, showing that:
  - A pipeline contingency could cause ISO-NE to fail to serve 10 to 15 percent of the load in New England during a cold two-week winter period.
  - The economic and human costs of such an event are so large that making market-based procurements of a product that would insure against such an event is likely warranted.
Conclusions

• Most of the RTO markets are extremely resilient
  ✓ RTOs have been evaluating these issues for years and most concerns are overstated
  ✓ Fuel security in New England is the exception
• To improve the resilience of the RTOs in other regions and prepare than to respond to change conditions and generation mix, improve real-time price formation:
  ✓ Improve shortage pricing so it reflects VOLL and ensure that all shortages are priced
  ✓ Price transmission shortages (when transmission flows cannot be managed)
  ✓ Price high-cost emergency actions by operators that prevent shortages
  ✓ Increase participation and price-setting by demand in the real-time market
  ✓ Then…trust that the markets will respond
• Except in cases that energy markets cannot address, RTOs should avoid:
  ✓ Creating new products, pricing attributes, or making other market changes to generate additional revenues streams outside of the current energy markets