Cross Border Capacity Trading…
Looking Back and Looking Forward

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Presentation Outline

• PJM Overview
• U.S. Capacity Market Patchwork
• Cross - Border Capacity Trading
• Future Issues: Policy/Planning/Market Design
PJM Overview: PJM Structure and Capacity Market Design Fundamentals
PJM as Part of the Eastern Interconnection

- 27% of generation in Eastern Interconnection
- 28% of load in Eastern Interconnection
- 20% of transmission assets in Eastern Interconnection

KEY STATISTICS

- 925+ PJM member companies
- 61+ millions of people served
- 165,492 MW peak load in megawatts
- 183,604 MWs of generating capacity
- 62,556 miles of transmission lines
- 791,089 GWh of annual energy produced
- 1,376 generation sources
- 243,417 square miles of territory
- 13 states + DC area served
- 219 externally facing tie lines

21% of U.S. GDP produced in PJM

As of 9/1/2014
PJM Functions

• Operate the bulk electric power grid for reliability
• Facilitate various electric markets
• Plan for transmission expansion
• Monitor the markets to ensure competitiveness
• Provide exceptional customer/member service
• Share best practices with neighboring and international system operators
PJM Backbone Transmission
Nine Major North American RTOs / ISOs
The U.S. Capacity Market Patchwork

- **Forward Capacity Markets** – PJM/New England
- **Annual Capacity Market** – New York
- **State-Authorized Capacity Procurement** – Midcontinent ISO
- **Energy-Only Markets** – Texas, California
PJM Capacity Market Overview
PJM Maintains Reliability through Markets
Forward Commitment: PJM invites resource-specific sell offers for planning each year, three years in advance.

Open to All Resources: Products that may be offered include: existing and planned generation; planned transmission upgrades; and existing and planned demand resources.
Single Clearing Price: New generation, new demand response alternatives, and new transmission solutions can compete directly with existing resources.

Imports: Imports recognized as capacity resources subject to reliability-based import limitations.
Impacts of the Capacity Market Patchwork – PJM Solutions to Ensure Reliability
Impact #1: Capacity Chases Price

- PJM moves from net exporter of capacity in 2007 (2,616 MW) to net capacity importer year after market introduced (2,612 MW)
- Between 2012 and 2013 auctions capacity imports jump 81% (8,412 MW for 2016 vs. 4,650 MW for 2015)
- Neighboring regions fall short of capacity
**Impact #2:** Although firm transmission service required, analysis did not take into account risk of curtailment on intermediate systems
**Impact #3:** Internal reliability impacted due to impact of curtailments beyond importer’s control
**Impact #4:**

Over-delivery of potential non-deliverable resources leads to price suppression as importing capacity chases price.
**Goals**

- Enable the market to price deliverability constraints in its choice of resources
- Recognize realistic limits on dependence on neighboring systems
Features of the PJM Capacity Import Limit

• **Timing Change:** Curtailment risk factored into initial capacity procurements

• **Modeling:** Model total transmission capability at the borders under PJM Capacity Emergency Conditions

• **Individual Interface Review:** Recognize separate limits at each border
• **Recognize Existing Mutual Support:** Import limit established recognizing that mutual support already used to reduce installed reserve margin.

\[
\text{Total Transmission Capability} - \text{Emergency Assistance Available (already counted for in IRM)} = \text{Capacity Import Limit}
\]

• **Recognize Exceptions:** Exceptions for dynamically scheduled units (units not subject to TLR-V curtailment)
• **Make Realistic But Not Overly Conservative Assumptions:** Use non-coincident peaks for each interface as not all borders experiencing simultaneous emergencies
  – Assume a level of coordinated support vs. all systems simultaneously in emergency

• **Ensure Consistent Rules for Internal and External Resources:** Must Offer Requirement
Lessons Learned
Observations and Lessons Learned

• Selective introduction of capacity markets reshuffles resource mix
• Capacity imports are important resources to incorporate into a capacity market
• Potential for curtailment by neighboring systems must be considered
• Modeling of a capacity import limit should reflect availability of mutual support and differences across interfaces

• Ensure consistency of rules so as to avoid market distortions from favoring/disfavoring imported resources
Cross-Border Trading: Future Regulatory Challenges and Opportunities
Capacity Portability

- Unit Specific Commitments vs. “Slice of System” Capacity Obligation
- Pricing of Capacity Obligations: Administrative, Cost-Based, Bid-Based?
- Binding call rights on transmission and fixed rules on curtailment priorities
- Capacity Planning: Honoring each nation’s policies vs. allowing for portability of capacity resources across borders
An Added Complication:

Who Decides?
Who Decides?

• States
  – State Energy Policies: Governors/legislators
  – State PUCs

• FERC
  – FERC Review of Planning
    • Order 890: Regulating Process or Results?

• Environmental Agencies
  – Non-attainment areas
  – RGGI et al.
Avoiding The Quagmire Of Inaction

“Hanging in mid-air”: a dangerous place
LET’S TALK…

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