



Cross Border Capacity Trading...

Looking Back and Looking Forward

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IEA Expert Workshop V
Regional Resource Adequacy
January 15, 2015
Paris, France

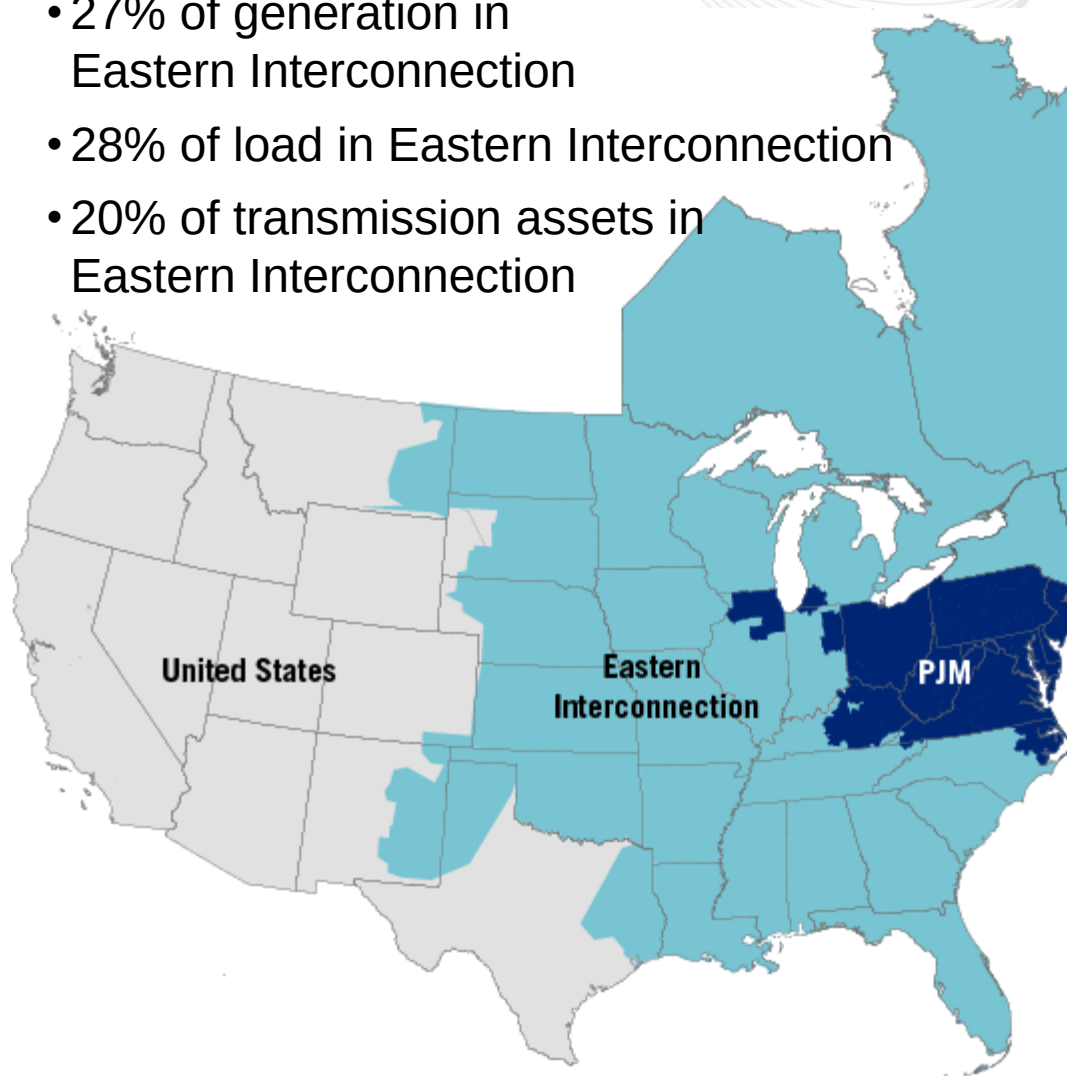
- PJM Overview
- U.S. Capacity Market Patchwork
- Cross - Border Capacity Trading
- Future Issues: Policy/Planning/Market Design

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

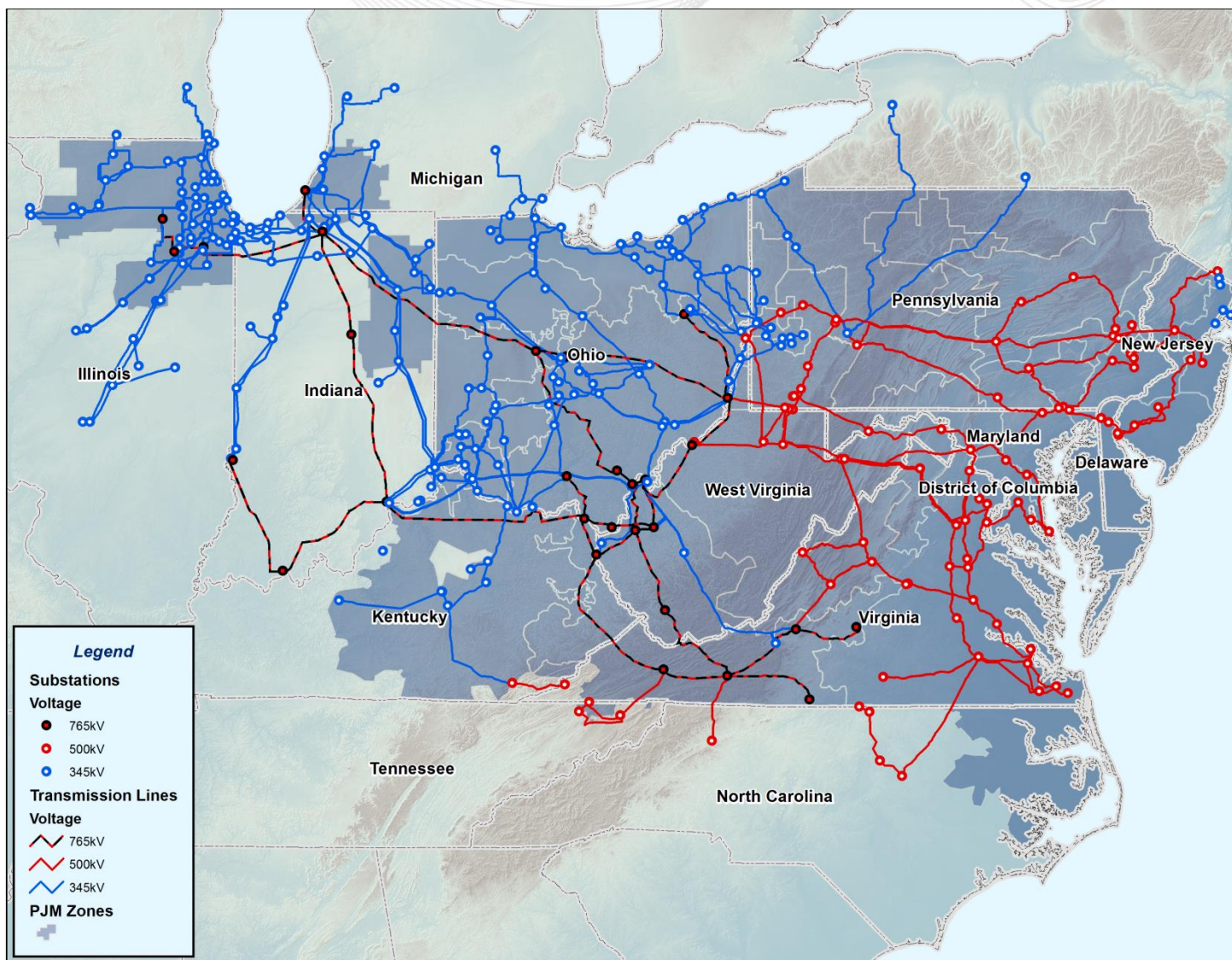
PJM member companies	925+
millions of people served	61
peak load in megawatts	165,492
MW of generating capacity	183,604
miles of transmission lines	62,556
2013 GWh of annual energy	791,089
generation sources	1,376
square miles of territory	243,417
area served	13 states + DC
externally facing tie lines	191

**21% of U.S. GDP
produced in PJM**

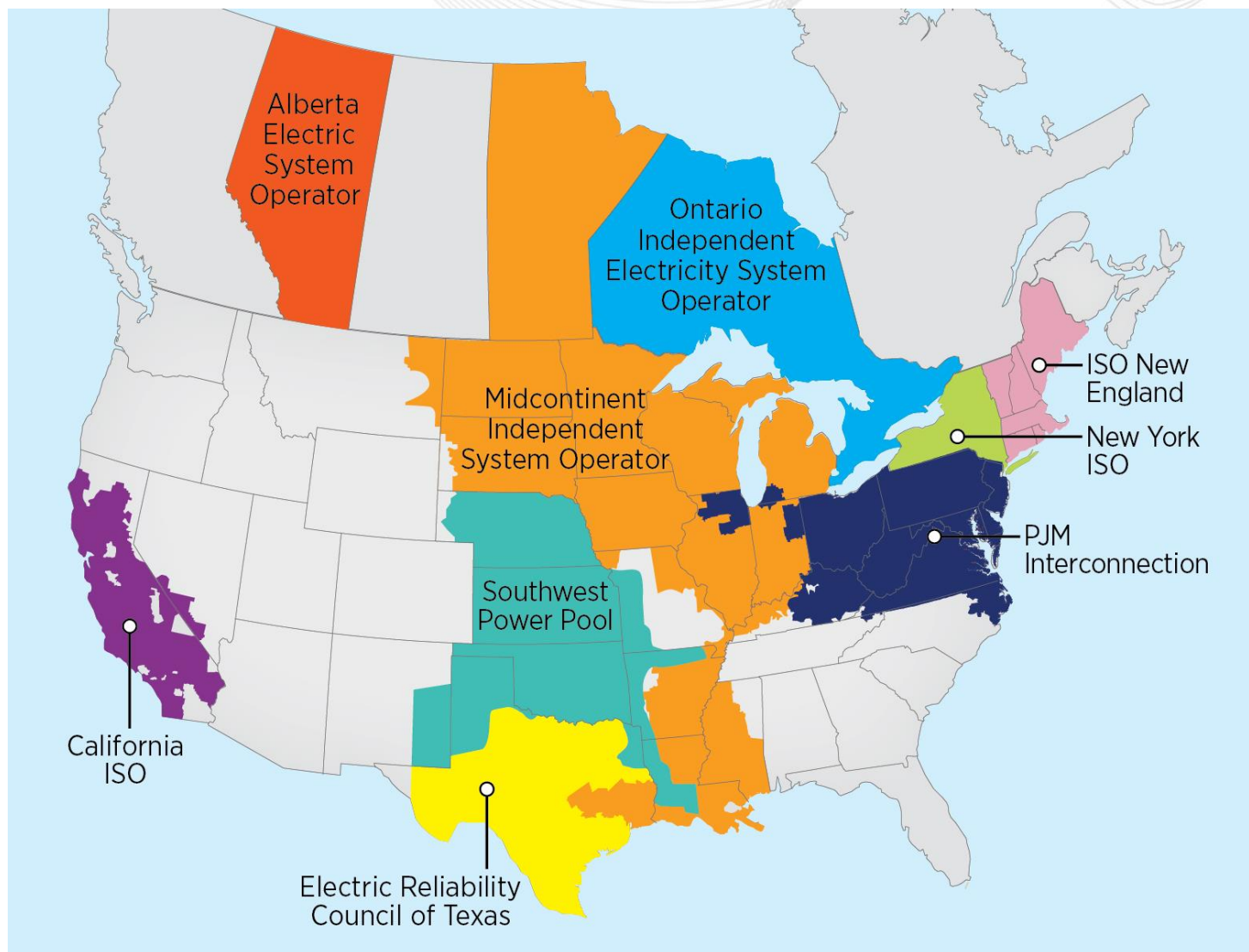
As of 9/1/2014

- 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



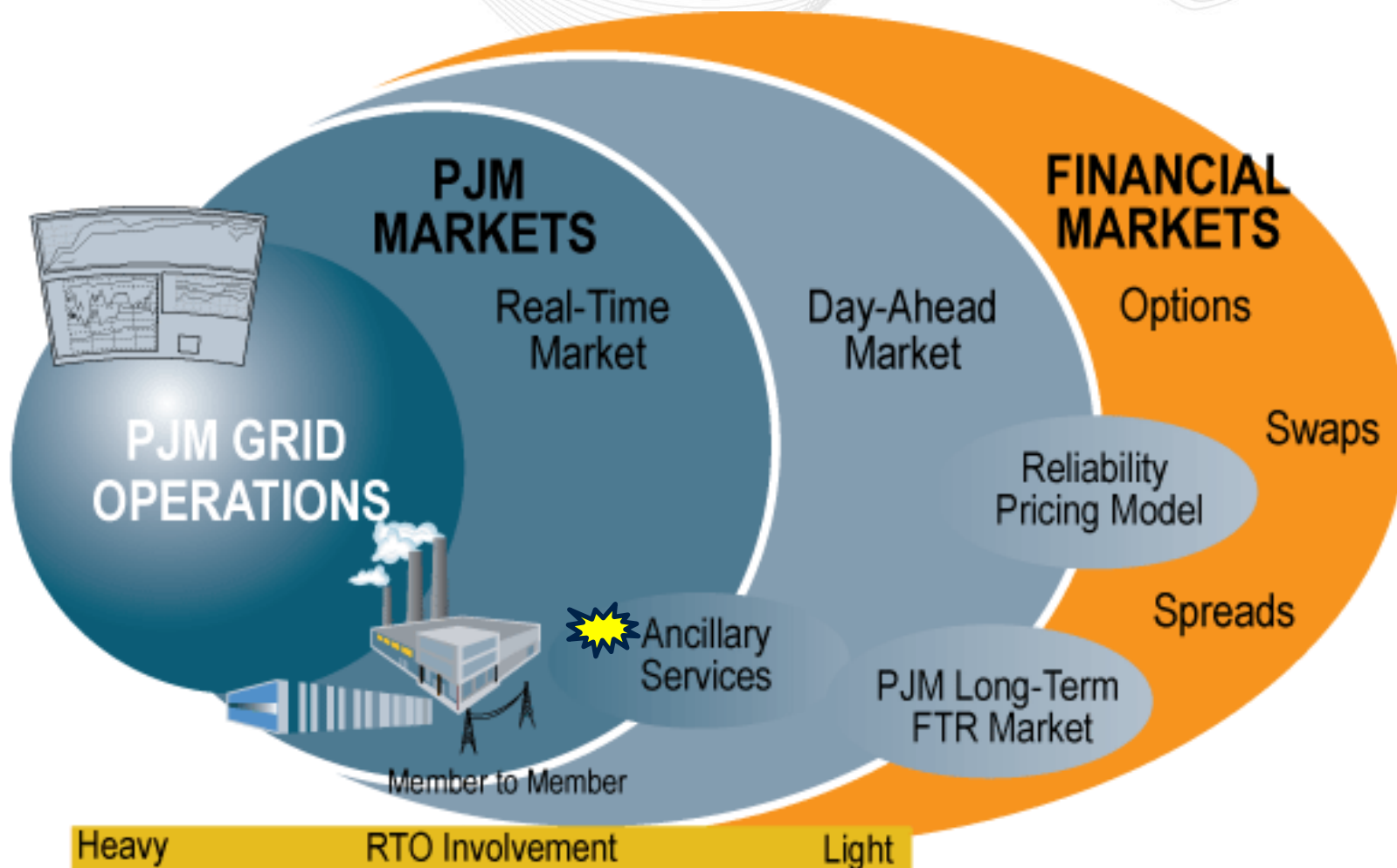
- ***Forward Capacity Markets*** – PJM/New England
- ***Annual Capacity Market*** – New York
- ***State-Authorized Capacity Procurement*** – Midcontinent ISO
- ***Energy-Only Markets***—Texas, California



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.

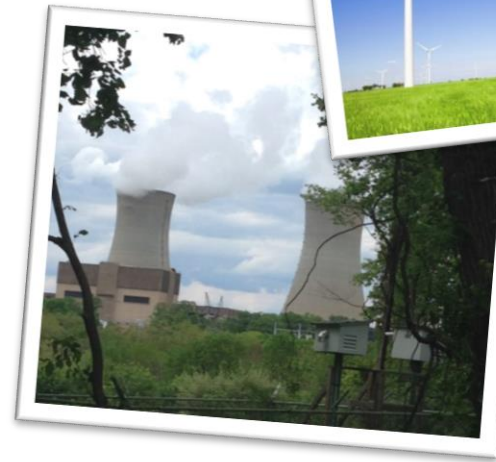


PJM Initiated Solution

Establishment of a Capacity Import Limit

Goals

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



- **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



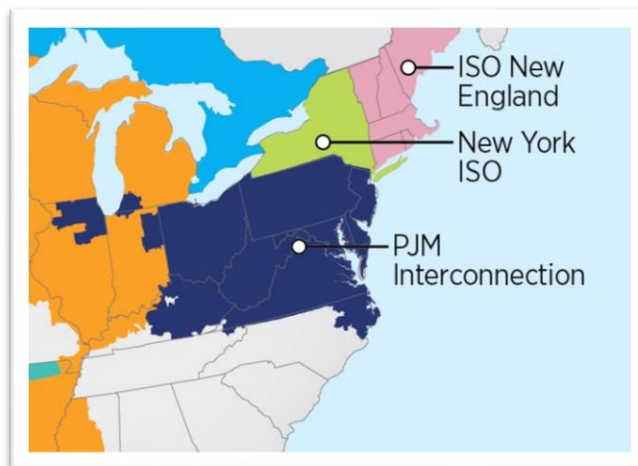
- **Recognize Existing Mutual Support:** Import limit established recognizing that mutual support already used to reduce installed reserve margin

$$\boxed{\begin{array}{c} \text{Total} \\ \text{Transmission} \\ \text{Capability} \end{array}} - \boxed{\begin{array}{c} \textit{Emergency Assistance} \\ \textit{Available (already} \\ \textit{counted for in IRM)} \end{array}} = \boxed{\begin{array}{c} \text{Capacity} \\ \text{Import Limit} \end{array}}$$

- **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

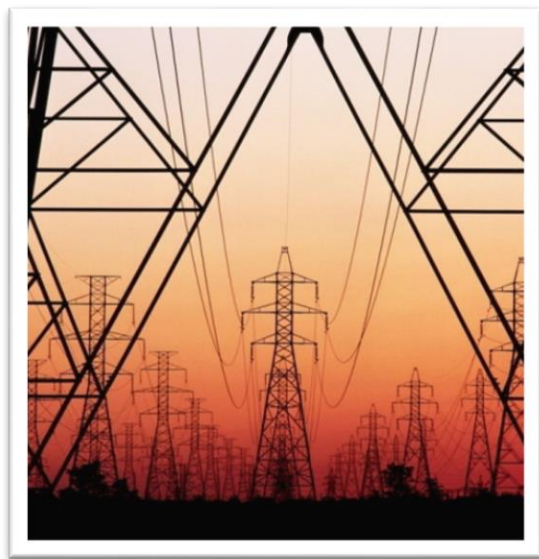


- Selective introduction of capacity markets reshuffles resource mix
- Capacity imports are important resources to incorporate into a capacity market
- Potential for curtailment by neighboring systems must be considered



- 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?

- **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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