Resource Adequacy
Current Issues in North American Power Markets

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Alberta Power Summit

Prepared by:
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Introduction
Resource Adequacy Constructs in North America

♦ **Regulated Planning**
  • Utility or administrative entity conducts integrated resource planning (IRP) for resource adequacy
  • Cost recovery through regulated approval
  • Risk of uneconomic investment decisions borne by customers

♦ **Market-Based**
  • Focus of this presentation
  • Market design challenge
    - Sufficient market-based revenues to attract and retain supply when and where needed for resource adequacy
    - Prices low enough to discourage new investments during surplus
  • Risk of uneconomic investment decisions borne by suppliers (increases investment and financing costs)
  • Price volatility and uncertainty are a key concern
## Introduction

### Resource Adequacy Constructs in North America

<table>
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<tr>
<th>Regulated Planning (Customers Bear Risk)</th>
<th>Market Mechanisms (Suppliers Bear Risk)</th>
</tr>
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<tbody>
<tr>
<td><strong>Regulated Utilities</strong></td>
<td><strong>LSE RA Requirement</strong></td>
</tr>
<tr>
<td><strong>Administrative Contracting</strong></td>
<td></td>
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<tr>
<td>BC Hydro, SaskPower, most of WECC, Southeast U.S.</td>
<td>California, MISO</td>
</tr>
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</table>

### Examples

<table>
<thead>
<tr>
<th><strong>Resource Adequacy Requirement?</strong></th>
<th><strong>How are Capital Costs Recovered?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (Utility IRP)</td>
<td>Rate Recovery</td>
</tr>
<tr>
<td>Yes (Administrative IRP)</td>
<td>Long-Term Contracts</td>
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<tr>
<td>Yes (Creates Bilateral Capacity Market)</td>
<td>Bilateral Capacity Payments and Energy Market</td>
</tr>
<tr>
<td>Yes (Mandatory Capacity Auction)</td>
<td>Capacity and Energy Markets</td>
</tr>
<tr>
<td>No (RA Not Assured)</td>
<td>Energy Market</td>
</tr>
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Alberta Energy-Only Market Review

- We studied challenges to resource adequacy and market sustainability
- Found that net revenues were consistent with market conditions:
  - Sufficient to attract investment when reserve margins were low
  - Below new plant costs when reserve margins were high
- Economic outlook favors gas over coal

Recommendations

- Need phased approach to environmental regs to prevent large simultaneous retirements
- Consider raising price cap to Value of Lost Load (VOLL) and refining administrative scarcity pricing

Source: Pfeiferberger & Spees (2010).
Alberta Projected 2020 Returns by Technology

### Energy Margins

<table>
<thead>
<tr>
<th>Technology</th>
<th>Cost of New Plant</th>
<th>Operating Margins and Fixed Costs ($/kW-yr)</th>
<th>Reserves Revenue</th>
<th>CO₂e Price Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas CT</td>
<td></td>
<td>Anemous Lines based on historic years 2006-10</td>
<td>Fixed O&amp;M</td>
<td></td>
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<tr>
<td>Gas CC</td>
<td></td>
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<tr>
<td>Gas Cogen</td>
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<tr>
<td>Coal</td>
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<tr>
<td>Hydro</td>
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<tr>
<td>Wind</td>
<td></td>
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</tbody>
</table>

Source: Pfeifenberger & Spees (2010).
Energy-Only Markets: Texas

Texas Effort to Refine Shortage Pricing

Substantial RA Challenges

- Low gas prices and high wind penetration (12% of ICAP) have suppressed ERCOT prices
- IMM estimated returns to generators were sufficient to attract new plants only one in the past four years (over 2006-10)
- Shortages during a February cold snap and summer heat wave required ERCOT to sign out-of-market contracts to bring mothballed units back online
- Upcoming environmental regs (HAP, CSAPR, CWA 316(b)) expected to induce retirements

Effort to Refine Scarcity Pricing

- Price floors ($120-180/MWh) when reserves are dispatched for reliability (to prevent suppressed prices during these reliability-dispatch events)
- “Power Balance Penalty Curve”
  - Administrative price adder when ERCOT is deficient of reserves
  - Prices rise to $3,000/MWh price cap with severity of shortage

Sources: EPA CWA 316(b) Info; ERCOT May 2011 retirement risk study; Ventyx; November news coverage from SNL, MW Daily, RT, and Energy Choice Matters; PUCT project 37897 materials; ERCOT stakeholder materials.
# Summary of RA and Capacity Market Constructs

## Forward Period

<table>
<thead>
<tr>
<th>Market</th>
<th>Procurement</th>
<th>Demand Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>Bilateral Only</td>
<td>n/a</td>
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<tr>
<td>MISO</td>
<td>Bilateral + Voluntary Auction</td>
<td>n/a</td>
</tr>
<tr>
<td>NYISO</td>
<td>Bilateral + Mandatory Auction</td>
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<tr>
<td>PJM</td>
<td>Bilateral + Mandatory Auction</td>
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<tr>
<td>ISO-NE</td>
<td>Bilateral + Mandatory Auction</td>
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## Forward Period Diagram

- **California**: Bilateral Only
- **MISO**: Bilateral + Voluntary Auction
- **NYISO**: Bilateral + Mandatory Auction
- **PJM**: Bilateral + Mandatory Auction
- **ISO-NE**: Bilateral + Mandatory Auction

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California PUC imposes a RA requirement on LSEs (their customers’ peak load plus reserve margin)

- LSEs can self-supply capacity or procure it bilaterally
- CAISO administers a “Standard Capacity Product” mechanism to enable the bilateral market

Local RA Requirements
- LSEs in load pockets must purchase a fraction of their capacity locally
- Local requirement is assigned proportionally to the LSE’s contribution to local peak load

LSE RA Requirements: MISO

MISO’s RA Enhancement Proposal

Current Mechanism
♦ Monthly LSE RA requirement
♦ Bilaterally tradable capacity product
♦ Voluntary Capacity Auction (VCA) a few days before the monthly planning deadline
♦ Most states also oversee utility IRP for major investments

Proposed Enhanced Mechanism
♦ Locational mechanism (imposed by FERC)
♦ Annual construct with a mandatory auction
♦ Opt-out provisions:
  • Self-suppliers may opt out of the auction
  • Self-suppliers may be subject to locational deliverability charges if they procure too little capacity locally

Sources: MISO FERC RA Enhancements Filing, July 20, 2011; https://www.midwestiso.org/Events/Pages/SAWG20110317.aspx

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Capacity Markets

Price Volatility and Uncertainty are a Concern

♦ Example from our PJM review:
  • Single biggest concern for all stakeholder sectors was price volatility and uncertainty
  • Related concerns about the lack of long-term hedging options

♦ Several contributing factors:
  • Market Fundamentals – not a concern, prices should move with market fundamentals
  • Previous Design Changes – one-time design changes contribute to volatility, but not a persistent concern
  • Ongoing Administrative Uncertainties – importance of uncertain administrative parameters is an ongoing concern

Capacity Price Comparison Across RTOs

Sources: PJM, ISO-NE, MISO, and NYISO Capacity Market Results.
## Capacity Markets

...but Not All Concerns Are Supported by the Facts

<table>
<thead>
<tr>
<th>Concern</th>
<th>Reality</th>
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<tr>
<td>“Capacity prices are too high (or too low)”</td>
<td>Prices have been consistent with the fundamentals, mostly below Net CONE (reflecting surplus)</td>
</tr>
<tr>
<td>“Capacity markets have not attracted new generation”</td>
<td>ISO-NE exception, with price floor contributing to supply excess</td>
</tr>
<tr>
<td>“Capacity markets cannot maintain reliability under environmental regulations”</td>
<td>New generation has not been needed in most places, and cheaper alternatives have been available (DR, uprates, reinvestment)</td>
</tr>
<tr>
<td></td>
<td>4.8 GW of new gen added in RPM</td>
</tr>
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<td></td>
<td>PJM and ISO-NE 2014/15 auctions cleared excesses despite NESHAP</td>
</tr>
<tr>
<td></td>
<td>Some new safeguards needed (e.g. for co-located retirements)</td>
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Capacity Markets

Substantial Capacity Additions Committed in PJM

Capacity Markets

Rapid Demand Response Growth

Surprising Growth

♦ Major success of capacity markets is large influx of DR

♦ Lower-cost supplies than traditional gen

Future of DR

♦ Will eventually reach saturation and stabilize
  • More calls on DR customers will be required, increasing interruption costs
  • May top out at 12-15% of peak load

♦ High DR means lower gen reserve margin (i.e. higher energy prices)

Capacity Markets
U.S. Environmental Regulations

HAP and CSAPR

♦ 2012: Cross-state air pollution rule (CSAPR) will increase NO\textsubscript{x} and SO\textsubscript{2} costs
♦ 2015: Hazardous air pollutant (HAP) regulation for air toxics including Hg and acid gases will force retire/reinvest decisions on much of the U.S. coal fleet

PJM & ISO-NE 2014/15 Auctions

♦ HAP rule was an important “stress test”
  • Both procured sufficient capacity
  • PJM prices increased substantially (still below Net CONE); ISO-NE prices remained at the floor
  • Some uncleared gen (from coal likely to retire), partly offset by DR increases
♦ Remaining concern that retirements may be co-located in unmodeled subzones
♦ Shorter-term markets yet to pass test

PJM Cleared Capacity

Before HAP
$28
155
150
145
140
135
130
125
2013/14

After HAP
$126
RTO Price ($/MW-d)

155
150
145
140
135
130
125
2014/15

Reliability Target
Demand Response and Energy Efficiency (5.0 GW Increase)
Generation (7.7 GW Reduction)

Source: PJM 2014/15 BRA Results.
Minimum Offer Price Rules (MOPR)

- MOPRs introduced to prevent artificial price suppression
  - Net short buyers and/or states may have incentive to suppress prices
  - In some cases a single new plant can suppress capacity prices for years
- MOPR prevents new supply offers at uncompetitive low levels
- “Incentive test” was targeted only net buyers w/ incentive to crash price
  - Failed to account for states or other contractual counterparties’ incentives
  - NJ (and possibly MD) above-market contracts would have been exempt

Concerns

- Move to eliminate “incentive tests” will apply MOPR to all suppliers
  (including merchant plants or integrated planning entities that have no
  incentive to suppress prices)
- Unclear whether MOPR application will be strict enough to prevent price
  suppression when needed in all places (current issue in PJM, ISO-NE,
  NYISO, and MISO)
Take Aways

Key challenge for both energy-only and capacity markets is to create appropriate investment signals:

- Total returns to suppliers should be high enough to attract new investment during shortages; below investment costs during surplus
- Scarcity prices that reflect the marginal cost of emergency actions
- Price cap at the VOLL (especially in energy-only markets)

Price volatility and uncertainty increase investment costs and may postpone investments until prices are higher (but volatility should not be artificially muted if it reflects underlying fundamentals)

Avoid administrative uncertainties to the extent possible

- Political interventions in response to price spikes
- Out-of-market capacity procurement
- Impact of administrative parameters

Careful introduction of environmental regulations

- Forward capacity markets seem robust; remaining risk of co-located retirements
- Short-term capacity markets not yet tested
- Energy-only markets at risk to all-at-once environmental mandates
Additional Reading


The Brattle Group provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governmental agencies around the world. We combine in-depth industry experience, rigorous analyses, and principled techniques to help clients answer complex economic and financial questions in litigation and regulation, develop strategies for changing markets, and make critical business decisions.

Our services to the electric power industry include:

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Kathleen Spees is an associate of The Brattle Group with expertise in electric resource adequacy and capacity market design. Her project work for RTOs has included independent market design reviews and market design development related to resource adequacy in energy-only markets, capacity market design, and energy and capacity market seams. For market participants and regulators, she has developed market models for wholesale energy, capacity, and ancillary price projections; energy and ancillary dispatch; asset valuation; and coal fleet retirement risk analysis.

Kathleen earned a B.S. in Mechanical Engineering and Physics from Iowa State University. She earned an M.S. in Electrical and Computer Engineering and a Ph.D. in Engineering and Public Policy from Carnegie Mellon University.

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On behalf of his clients—which include ISOs, transmission owners, utilities, generators, and regulators—he has addressed RTO market designs, the economic benefits and cost allocation of transmission projects, the reasons behind rate increases, implications of restructuring policies, competitive conduct in electric power markets, and the effects of proposed mergers.