Resource Adequacy

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Resource Adequacy vs. Reliability

For end users, “reliability” is a combination of three distinct components:

♦ Distribution system reliability
♦ Transmission system reliability
♦ Resource adequacy (bulk power supply vs. load)

Estimates for U.S.-wide customer cost of power outages range from $20 billion to $150 billion per year:

♦ EPRI (1993): $26 billion/yr
♦ Swaminathan and Sen (Sandia 1998): $150 billion/yr
♦ Primen (EPRI 2001): $119 billion/yr
♦ LaCommare and Eto (LNBL 2004): $80 billion/yr
(ranging from $22-135 billion)
Resource Adequacy’s Share of Power Outages

Major Outage Events

- Insufficient Generation (81) 15%
- Human Error (59) 11%
- Equipment Failure (165) 31%
- Sabotage (16) 3%

All Retail Service Outages

- Weather & Fire (208) 40%
- Equipment Overhead (OH) 12%
- Equipment Underground (UG) 22%
- Weather 16%
- Tree Related 16%
- Public 8%
- Substation 6%
- Transmission 4%
- Utility Error 2%
- Other 7%

Why Resource Adequacy Standards?

RAS offer several attractive benefits
- Ensure adequate supply, prevent high levels of curtailments
- Address common-good/free-ridership problem
- Reduce price volatility and investment risk premiums
- Mitigate market power in spot energy markets

Do RAS distort energy markets?
- Yes, but similar to requirements imposed in other markets
- Examples: environmental rules, vehicle safety standards, building codes, appliance efficiency requirements

Will RAS be able to fully “fade away” as DR grows?
- Not likely: creating additional “non-firm” service (DR) does not eliminate the need for reliability of serving the residual “firm” load
- Only if (1) customers can choose to purchase higher reliability for their firm residual load and (2) the ISO can curtail others
What is the “Right” Level of Resource Adequacy?

Resource Adequacy Constructs

♦ Administrative Mechanisms
  • Resource adequacy achieved through administrative means
  • **Examples**: Regulated utility planning, administrative PPAs, administratively-determined capacity payments
  • Cost recovery through regulated approval or contract payments
  • Risk of uneconomic investment decisions borne by customers

♦ Market-Based Mechanisms
  • Utilize market forces to achieve resource adequacy
  • **Examples**: Energy-only markets, RA requirements for LSEs, near-term or forward capacity markets
  • Challenge: achieve revenues to attract and retain supply when/where needed for resource adequacy; discourage investments during surplus
  • Risk of uneconomic investment decisions borne by suppliers (but increases investment and financing costs)
  • Price volatility and uncertainty are a key concern
# Resource Adequacy Constructs

<table>
<thead>
<tr>
<th>Administrative Mechanisms</th>
<th>Market-based Mechanisms</th>
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</thead>
<tbody>
<tr>
<td>(Customers Bear Risk)</td>
<td>(Suppliers Bear Risk)</td>
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<tr>
<td><strong>Regulated Utilities</strong></td>
<td><strong>LSE RA Requirement</strong></td>
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<tr>
<td><strong>PPAs or Capacity Payments</strong></td>
<td><strong>Capacity Markets</strong></td>
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<tr>
<td><strong>Energy-Only Markets</strong></td>
<td><strong>Examples</strong></td>
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<td><strong>Examples</strong></td>
<td><strong>California, MISO</strong></td>
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<tr>
<td><strong>Resource Adequacy Requirement?</strong></td>
<td><strong>PJM, NYISO, ISO-NE, Brazil,</strong></td>
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<tr>
<td><strong>Yes (Utility IRP)</strong></td>
<td><strong>Australia’s SWIS, Italy, Russia</strong></td>
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<tr>
<td><strong>Yes/No (Yes through PPAs; No if relying on capacity payments)</strong></td>
<td><strong>Texas, Alberta, Australia’s NEM, NordPool, Great Britain (current)</strong></td>
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<td><strong>How are Capital Costs Recovered?</strong></td>
<td><strong>Bilateral capacity payments and energy market</strong></td>
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<td>Regulated retail rate recovery</td>
<td>Capacity and energy markets</td>
</tr>
<tr>
<td>Long-term PPAs or capacity payment plus energy market</td>
<td>Energy market only</td>
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</tbody>
</table>

# Summary of RA and Capacity Market Constructs

## Forward Period

<table>
<thead>
<tr>
<th>Region</th>
<th>Bilateral + Mandatory Auction</th>
<th>Bilateral + Mandatory Auction</th>
<th>Bilateral Only</th>
<th>n/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td></td>
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<tr>
<td>MISO</td>
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<tr>
<td>NYISO</td>
<td></td>
<td></td>
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<tr>
<td>PJM</td>
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<td>ISO-NE</td>
<td></td>
<td></td>
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<td>n/a</td>
</tr>
</tbody>
</table>

## Procurement

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

## Demand Curve

- **California**: n/a
- **MISO**: n/a
- **NYISO**: n/a
- **PJM**: n/a
- **ISO-NE**: n/a

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*The Brattle Group*
Capacity Price Comparison Across RTOs

The Brattle Group


About The Brattle Group

The Brattle Group provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governmental agencies around the world.

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- Energy Asset Valuation
- Energy Contract Litigation
- Environmental Compliance
- Fuel and Power Procurement
- Incentive Regulation
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- Renewables
- Resource Planning
- Retail Access and Restructuring
- Risk Management
- Market-Based Rates
- Market Design and Competitive Analysis
- Mergers and Acquisitions
- Transmission
Johannes (Hannes) Pfeifenberger is an economist with a background in power engineering and over 20 years of experience in the areas of public utility economics and finance. He has published widely, assisted clients and stakeholder groups in the formulation of business and regulatory strategy, and submitted expert testimony to the U.S. Congress, courts, state and federal regulatory agencies, and in arbitration proceedings.

Hannes has extensive experience in the economic analyses of electricity wholesale markets and transmission systems. His recent experience includes reviews of RTO capacity market and resource adequacy designs, testimony in contract disputes, and the analysis of transmission benefits, cost allocation, and rate design. He has performed market assessments, market design reviews, asset valuations, and cost-benefit studies for investor-owned utilities, independent system operators, transmission companies, regulatory agencies, public power companies, and generators across North America.

Hannes received an M.A. in Economics and Finance from Brandeis University and an M.S. in Power Engineering and Energy Economics from the University of Technology in Vienna, Austria.