Hitting the Mark on Missing Money: How to Ensure Reliability at Least Cost to Consumers

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Introduction: What is the question?

Reliability is essential; meeting a clear standard of reliability at least cost should be the goal.

The “EOM vs. CRM” debate is fascinating but typically ignores a more fundamental question...

Is the market driving the right investments to ensure reliability at least cost? Especially in a low-carbon transition?
So you think you have a “missing money” problem...

- There are many ways to deliver reliability…
- …but how to do so at least cost to consumers?
- Especially in the low-carbon power system?
Marginal cost prices based on marginal costs

Marginal cost prices based on marginal costs

<table>
<thead>
<tr>
<th>System Resource</th>
<th>Full marginal cost (€/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation capacity (“firm” or “de-rated”)</td>
<td>20-250</td>
</tr>
<tr>
<td>Imports</td>
<td>20-1000</td>
</tr>
<tr>
<td>Secondary (operating) reserves</td>
<td>250-5000</td>
</tr>
<tr>
<td>Emergency generation</td>
<td>500</td>
</tr>
<tr>
<td>Primary (regulation) reserves</td>
<td>500-9000</td>
</tr>
<tr>
<td>30-minute responsive back-up</td>
<td>1400</td>
</tr>
<tr>
<td>30-minute controllable demand response</td>
<td>2400</td>
</tr>
<tr>
<td>10-minute controllable demand response</td>
<td>2600</td>
</tr>
<tr>
<td>10-minute responsive back-up</td>
<td>3700</td>
</tr>
<tr>
<td>Emergency load-shedding</td>
<td>9000</td>
</tr>
</tbody>
</table>

Source: Adapted from Brattle Group & Astrape Consulting (2014 report to Public Utilities Commission of Texas & 2013 report to the Federal Energy Regulatory Commission)
Marginal cost prices based on marginal costs

Marginal cost prices based on marginal costs

PJM: a decade of lessons learned

Source: Brattle Group
PJM Capacity Market 2007

Capacity – single product
PJM Capacity Market 2011

Supply

Annual
DR

Extended
Summer

Limited
DR

Capacity – single product
PJM Capacity Market 2014 (proposed)

Qualified generation

Annual DR

“Capacity Performance” capacity

Non-qual. generation

Extended Summer

Limited DR

Non-CP capacity
PJM Capacity Market 2016

Capacity Performance (Supply and Demand)

Capacity – single product

...the new business case for investors is looking a lot more like an energy-only market
“How much?” depends on “what kind?”

Source: Adapted from *The Power of Transformation* (IEA, 2014)
Administrative reserve shortage pricing

Example: ERCOT Operating Reserve Demand Curve

Source: ERCOT
Administrative reserve shortage pricing

Source: ERCOT
Experience with various “CRMs”

**avg annual new-build as % of 2014 peak**

- ERCOT
- NYISO
- PJM
- ISO-NE
- NEM
- SWIS

**ratio of actual to target reserve margins (2015)**

- North America
- Australia

Source: RAP, from published system operator data
ERCOT forecasted reserve margins 2013-2016

Source: ERCOT Capacity & Demand reports May 2013 to May 2016
Money is not missing by design, it’s missing because of the various ways, both intentional and unintentional, that market operators fail to account for all demand and all marginal costs.
Effective energy and balancing markets are essential to valuing investments in flexibility and spurring innovation; administrative remedies can & should target them instead of bypassing them.
Parting thoughts (3)

Policy support for deployment of renewables is not only compatible with well-functioning energy markets…they are essential to integrating variable renewables at least cost to consumers
Hitting the Mark on Missing Money:
How to ensure reliability at least cost to consumers

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power sector. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

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Median Load: 34,821 MW
Max Load: 65,531 MW
Min Load: 21,385 MW

Note: GED Supply Curve for the region based on GED Energy Intelligence database, Winter, 2006. Natural Gas price is assumed to be $3/MMBtu.
Negative prices likely to be reduced by new market products which are not included in this model version.
POWER MARKETS  Marginal cost is stable in an interconnected system

RES as new baseload supported by flexible gas plants.