Responsive Demand: Lessons for a Low-Carbon Transformation

Roundtable discussion

NH Energy Efficiency & Sustainable Energy Board

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Key points:

- Direction of travel best understood in context of market fundamentals
- Role of responsive demand undergoing fundamental transformation
- Success depends on who can play and how they’re compensated
- Technology, retail tariff design & consumer education are key enablers...or barriers
1 Context

What are we talking about?
Reliability, objectively

Imputed Average Value of Lost Load

One event in ten years

24 hours in ten years

Optimal?

Price cap

Average value of lost load (\$/MWh)

Annual duration of firm load curtailment (hours/year)

(Assumes new-build CT as marginal capacity @ $106,000/MW-yr)

Source: W. Hogan, Harvard University, Kennedy School of Government.
New role for responsive demand

“Demand response”: Exploiting the fact the VoLL* for a given end use is often far less than what it costs to ensure (and far more than the price we’re charging to ensure it)

*Value of lost load: the value lost when electricity for a given end use is curtailed.

**Maybe we should start looking at “VoSL” – Value of Shifting Load.
The real supply curve:
Is there a different way to look at this?

We’re talking about a fundamental change in the nature of the supply mix

Can we really afford to continue to build a power system and charge customers based on the assumption that they are happy to pay $35,000-$250,000/MWh for the luxury of no one shifting their flexible loads by a few hours?
The changing role of demand response
From limited-use capacity to everyday energy
DR as limited capacity resource

Traditional Demand Response
Flexibility is the scarce resource

The infamous CAISO “Duck Curve”
System flexibility: More valuable than ever

Controllable load acting as supply

Example:

PJM frequency regulation signal vs. Water heater power consumption +/- 2.25kW base point
New role for responsive demand

Moving from a world where we forecast load and schedule generation, to a world where we forecast generation and schedule load

will now need to shape, not just shave, demand
New roles for responsive demand

Participation and compensation

The right to play & to be paid for the value delivered
Demand response in PJM’s RPM

Source: PJM Demand Response Strategy (June 2017)
Diversity of value...lack of access

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<tr>
<th>DR Service Product</th>
<th>California Market</th>
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<tr>
<td>Peak Capacity</td>
<td>System and Local RA Credit</td>
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<td>Economic DR</td>
<td>Economic DR / Proxy Demand Resource</td>
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<td>Contingency Reserve Capacity</td>
<td>AS- spinning</td>
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<td>Contingency Reserve Capacity</td>
<td>AS- non-spin reserves</td>
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<td>Emergency DR</td>
<td>Emergency DR / Reliability DR Resource</td>
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<td>DR for Distribution System</td>
<td>Distribution</td>
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<td>Economic DR</td>
<td>Combination of Energy Market Participation</td>
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<td>Flexible Ramping Capacity</td>
<td>Flexible RA -- energy market participation w/ ramping response availability</td>
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<td>Load Following</td>
<td>Flexible Ramping Product (similar)</td>
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<td>Regulating Reserve Capacity</td>
<td>AS- Regulation</td>
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<td>Load modifying DR - Event-based</td>
<td>CPP</td>
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<td>Load Modifying DR - Load shaping</td>
<td>TOU</td>
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Capital-intensive ≠ capacity-intensive
Dispatchable demand response

Source: PJM and Enbala
Price-responsive DR: The next frontier

Example:
ERCOT Real Time Pricing pilot – 14,700 customers, $500-600/MWh price – 5% reduction or shift in demand

Source: ERCOT Demand Side Working Group (2017 report)
Innovation: 3rd party access is essential
Other considerations:

• Retail tariff design matters…a *lot*
• Consumer education is critical
• Distribution-level “grid constraint engines”
• Optimize TSO/DSO interface (transactive energy)
• Others?
Resources

- Teaching the Duck to Fly (2nd Edition) (RAP, 2016)
- Hitting the Mark on Missing Money – How to Ensure Reliability at Least Cost to Consumers (RAP, 2016)
- Revenue Regulation and Decoupling: A Guide to Theory and Application (RAP, 2016)
- Time-Varying and Dynamic Rate Design (RAP, 2012)
- Smart Rate Design for a Smart Future (RAP, 2015)
About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org