



RAP

Energy solutions
for a changing world

Energy Markets, then Capacity, then... what?

Ideas for a grid with increasing amounts of variable power

NPCC Governmental/Regulatory Affairs Advisory Group

Presented by Richard Sedano

December 3, 2013

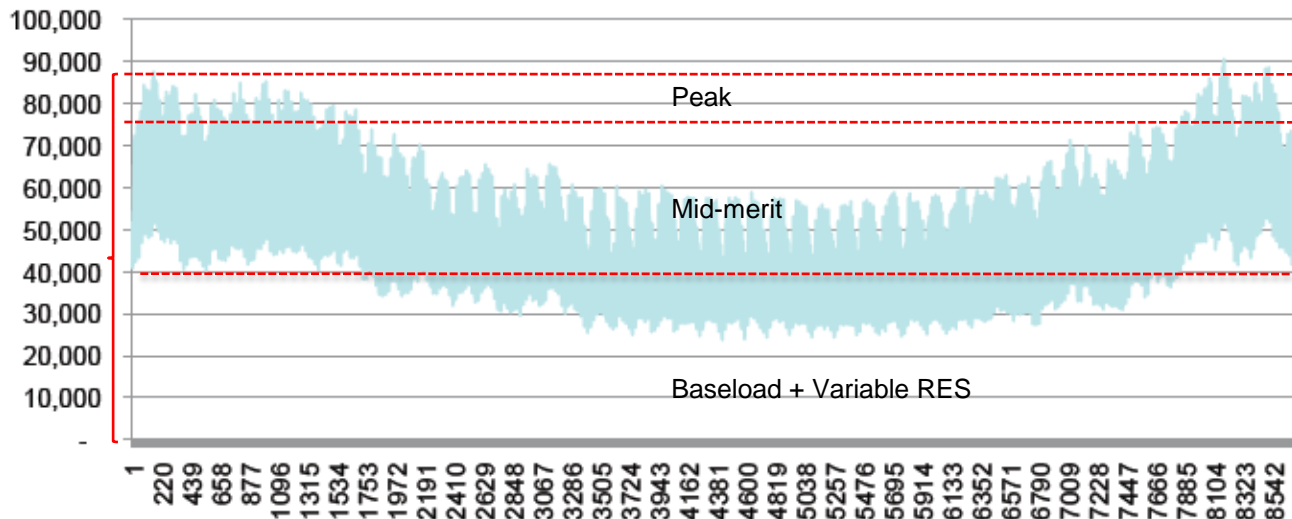
The Regulatory Assistance Project

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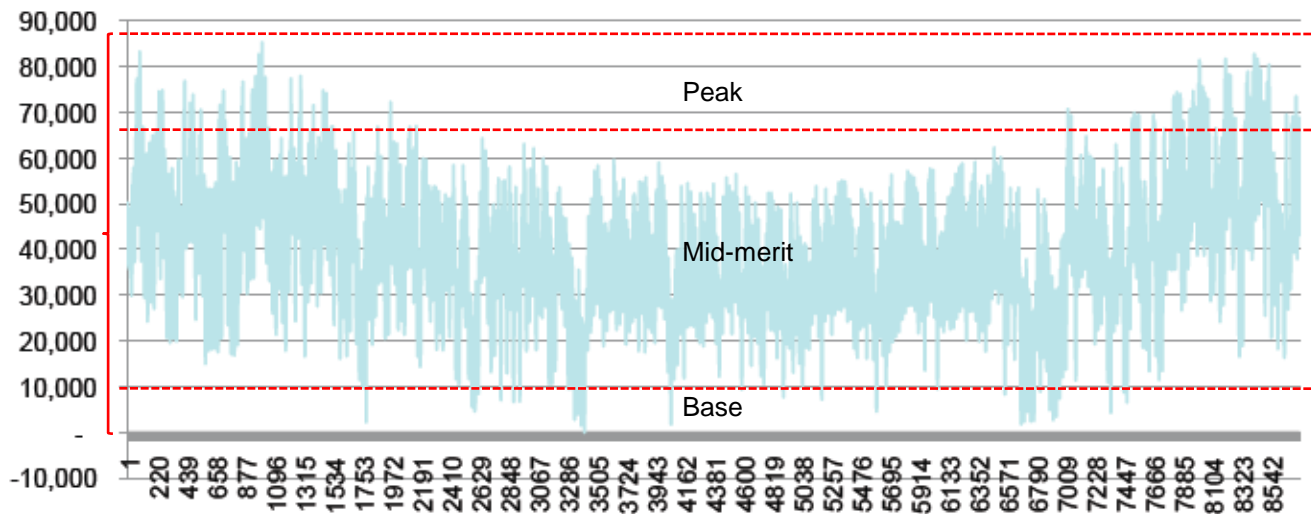
Challenges Here and Emerging

Gross Demand



Gross & net demand in UK_South in 2030...

Net Demand

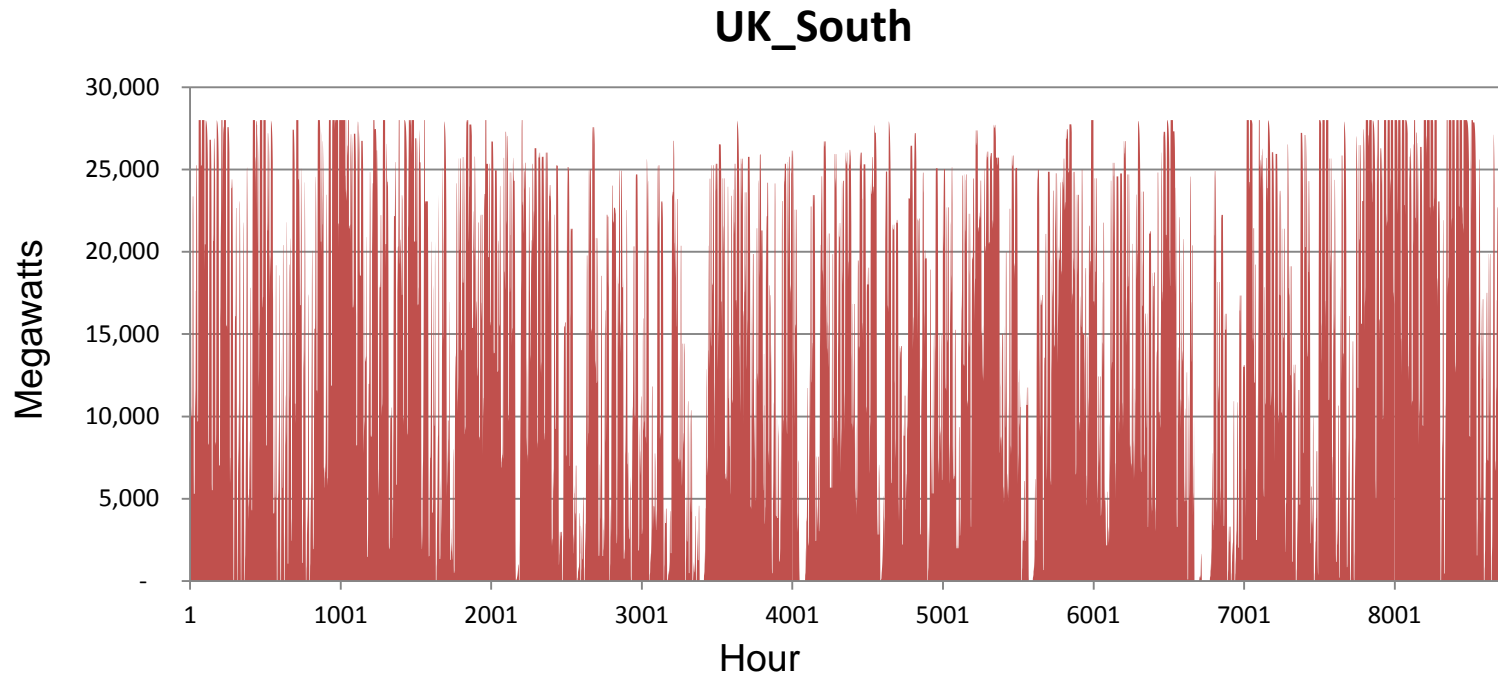


Net demand is gross demand minus wind and solar

Challenges

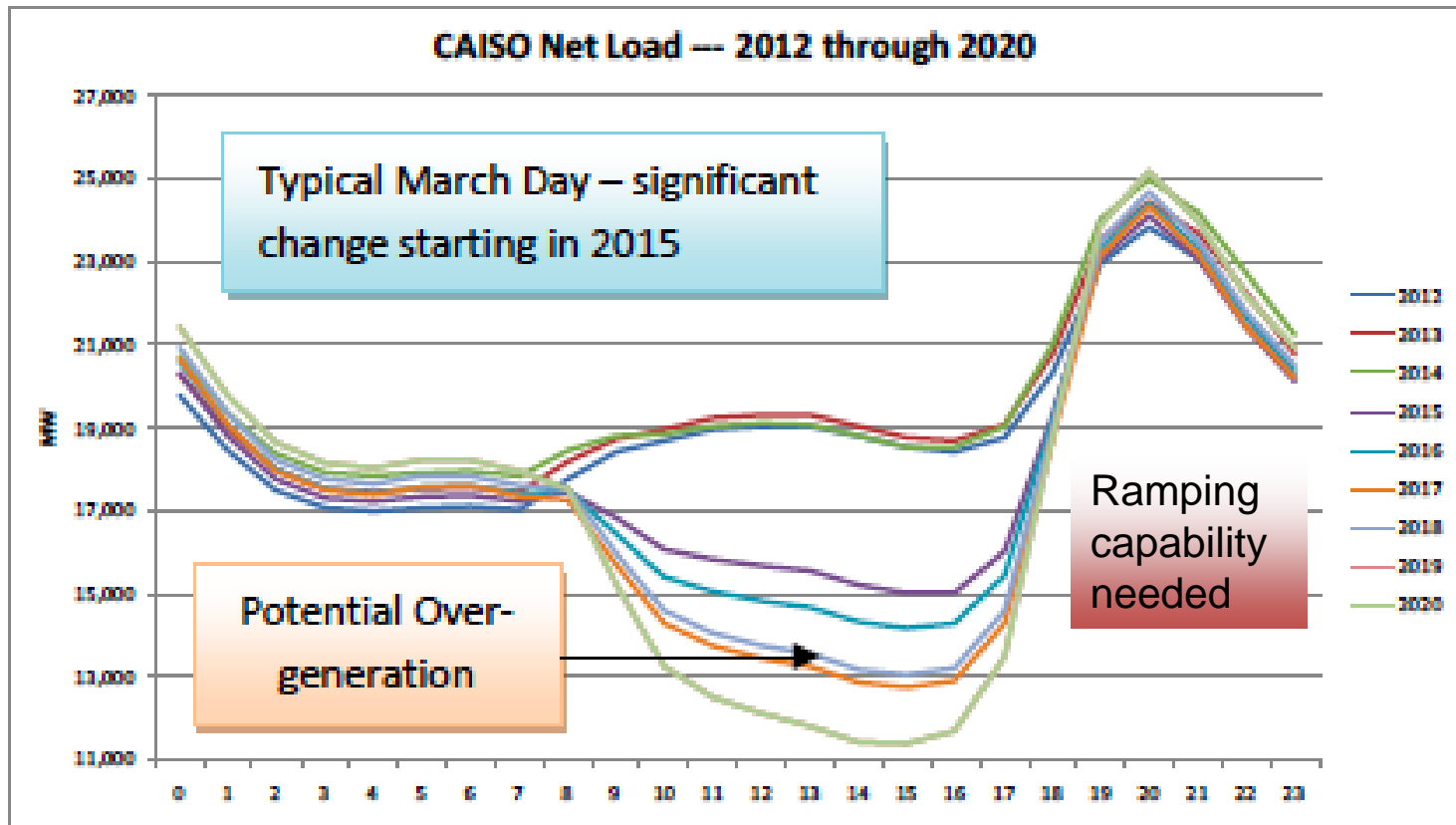
Operating Profile of mid-merit CCGTs in 2030

Example of large CCGT fleet with “typical” average load factor (58%)

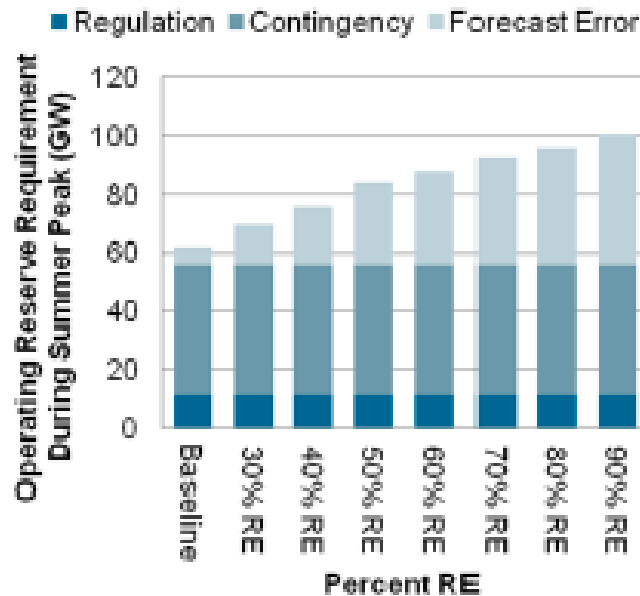


Requiring 264 stop-starts per year of those generators in the middle of the bid stack

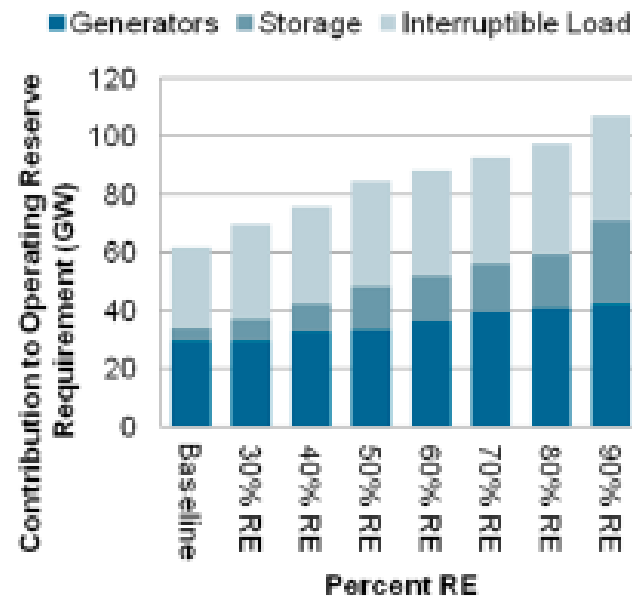
Challenges from good news on PV deployment



Challenges



(a) 2050 operating reserve requirement during the summer peak by reserve type



(b) 2050 contributions toward total operating reserve requirement by technology type

Needs to

RE Futures, Fig 2.7 (Vol. 1, pg 2-18): "...an increasing fraction of the existing conventional fossil fleet may evolve from an energy-providing role to a reserve-providing role as renewable energy supply increases, thereby reducing the need to install new generation capacity solely to meet operating reserve requirements."

Capacity markets: The temptation of the familiar

Capacity markets: investment incentives designed to address resource adequacy

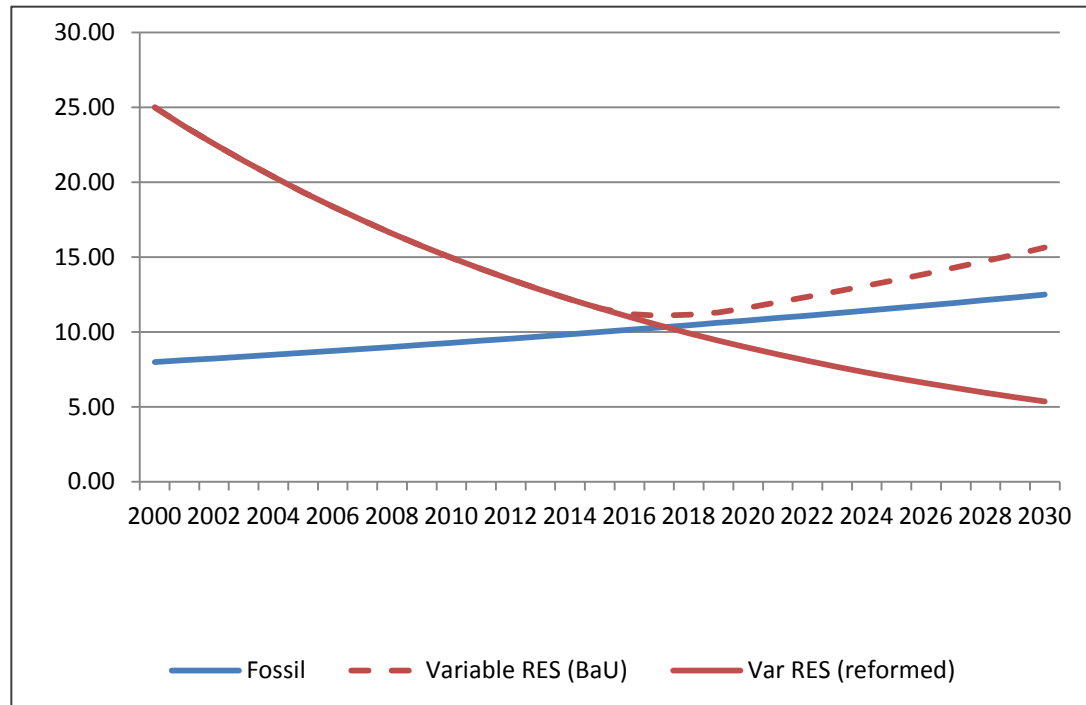
Corollary: System security will be handled by flexibility inherent to resources acquired to meet resource adequacy

What happens when flex in the system is insufficient?

When system stability needs “more flex?”

Success brings new risks, complexity

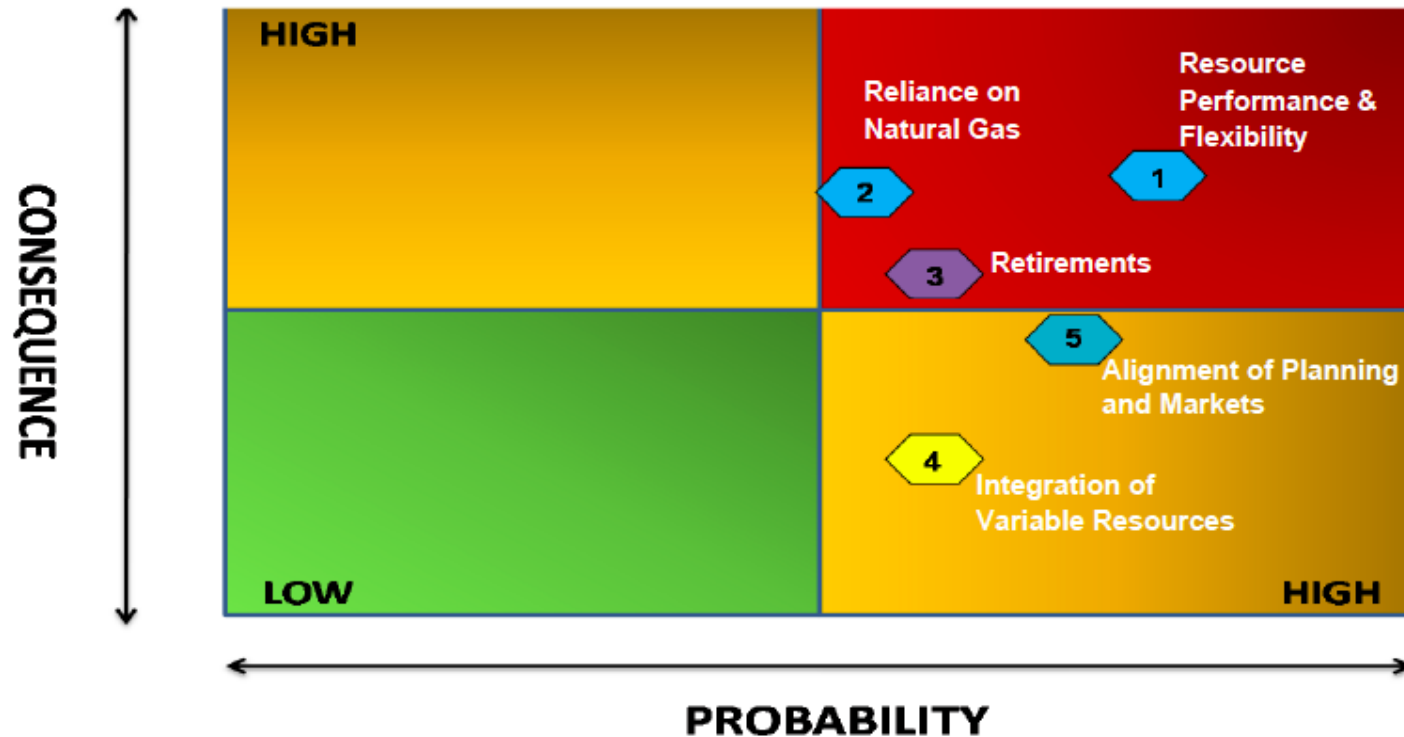
“System cost” of variable RES vs. average market price



Wind Integration costs could become a barrier if not addressed
Reaching “grid parity” will require more than just deployment

ISO-NE's Strategic Planning risk matrix (ca. 2011)

Strategic Planning – Risk Summary



NOTES

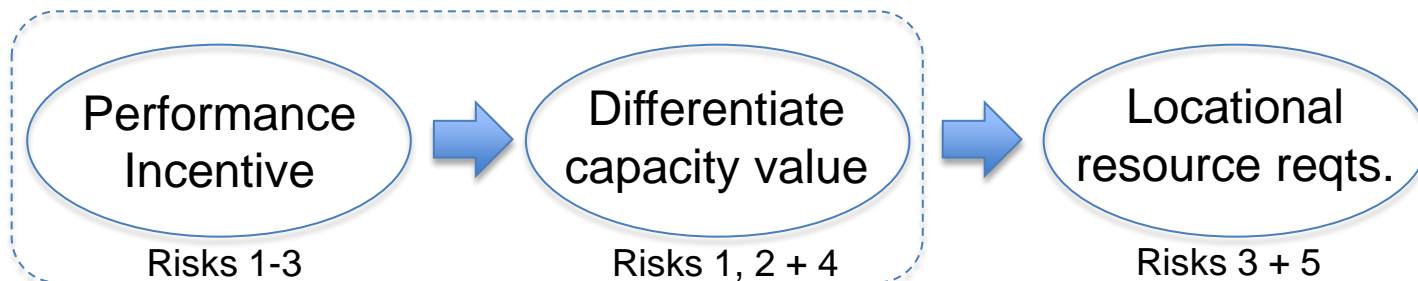
1. Assessment regarding impact and likelihood reflects the collective assessment of ISO-NE senior staff, and are described in the pages that follow.
2. Color coding on category markers: **BLUE**: Risk is already evident or likely to materialize over the near-term (0-3 years); **PURPLE** Risk is likely to materialize over the mid-term (3-6 years); **YELLOW** Risk is likely to materialize over the long term (6-7 years)

Market Flaws

- **Limitations in participation from demand resources**
- **Scarcity pricing for energy and ancillary services**
- **Price caps**

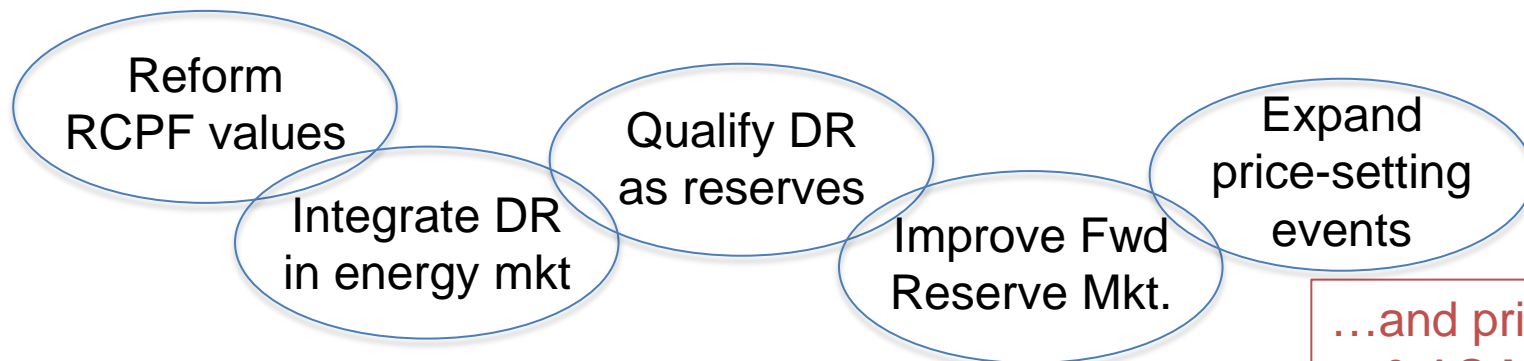
Flexible resource value (important with more renewables) distorted by market flaws

Proposed market reforms



*Combine: one instrument, lower cost,
more market-based, more durable
(risks 1-4)
(...and adopt sloped demand curve)*

Streamline FCM reforms...

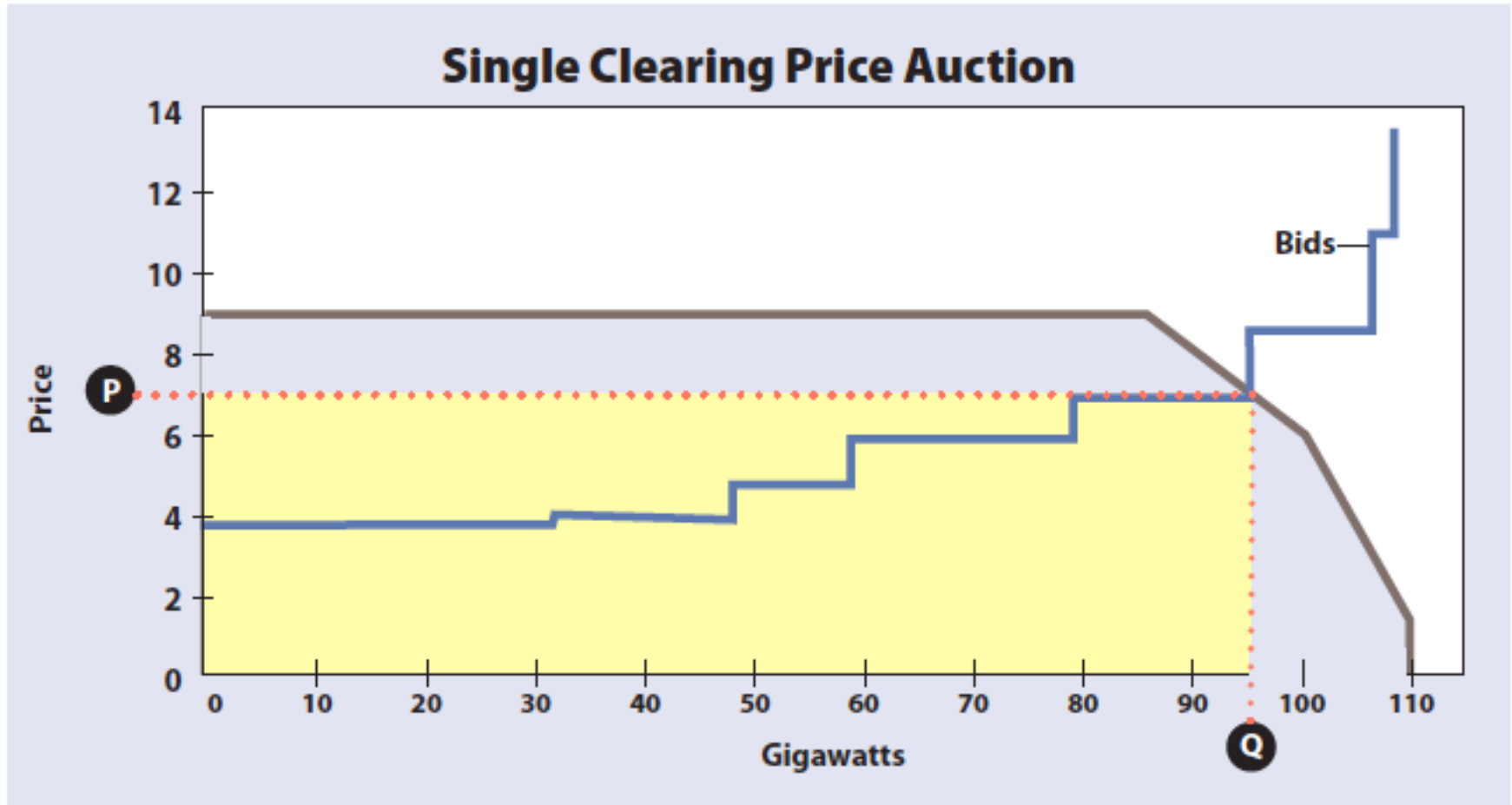


...and prioritize Energy & AS Mkt. reforms

Evaluating Market Designs

- Balance value of market intervention compared with degree of intervention
- Clarity of pricing and payment mechanism signals
- Planning, adapting markets for renewable energy targets
 - Reflect market/system value distinctions among resources
- Accommodate a range of risk/reward appetites
- Address identified risk factors

Alternative: Forward Capabilities Market



Apportioned forward capacity

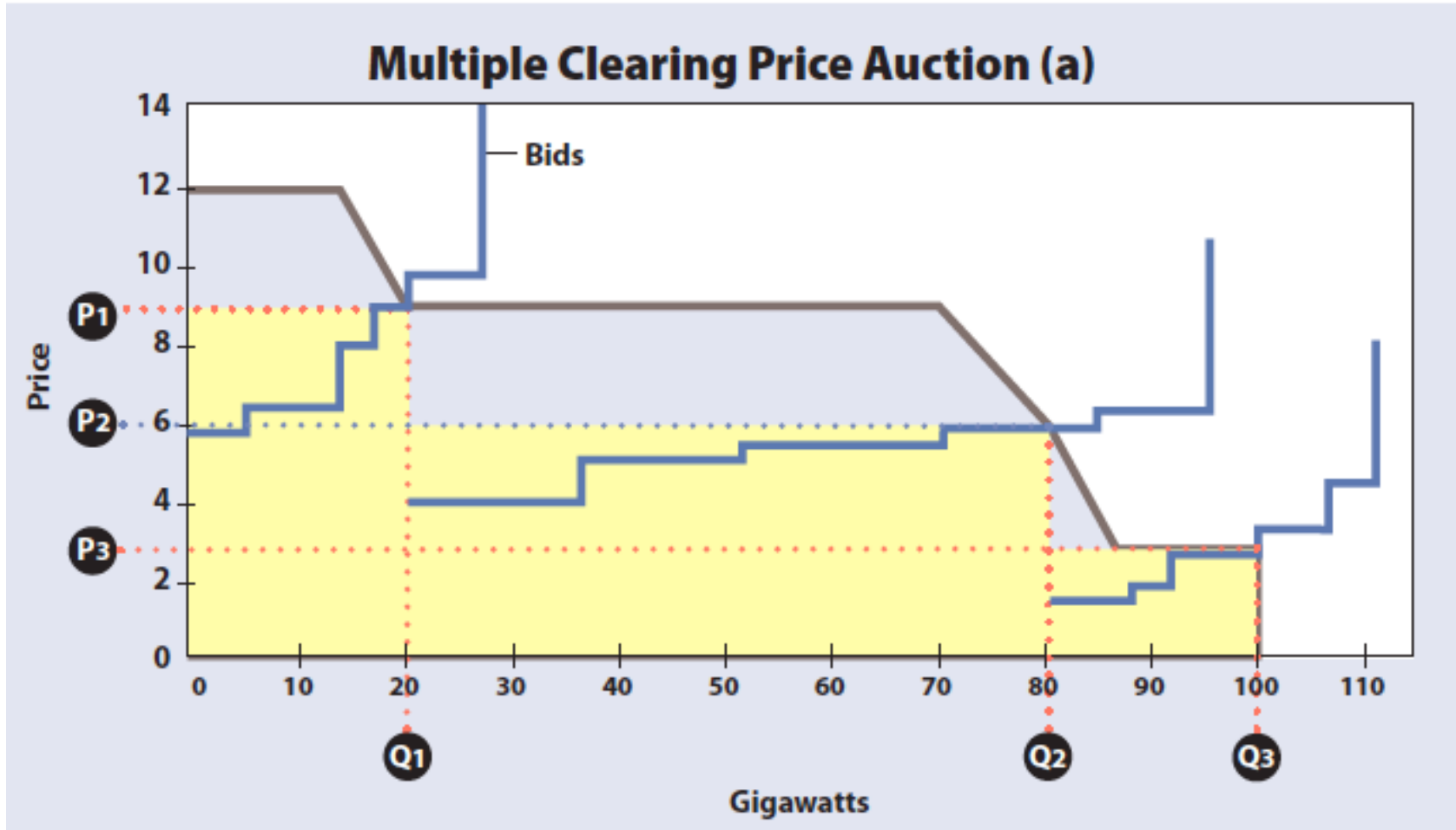
Tranches based on resource capabilities
supply, demand, storage: **functional**

Sequenced procurement

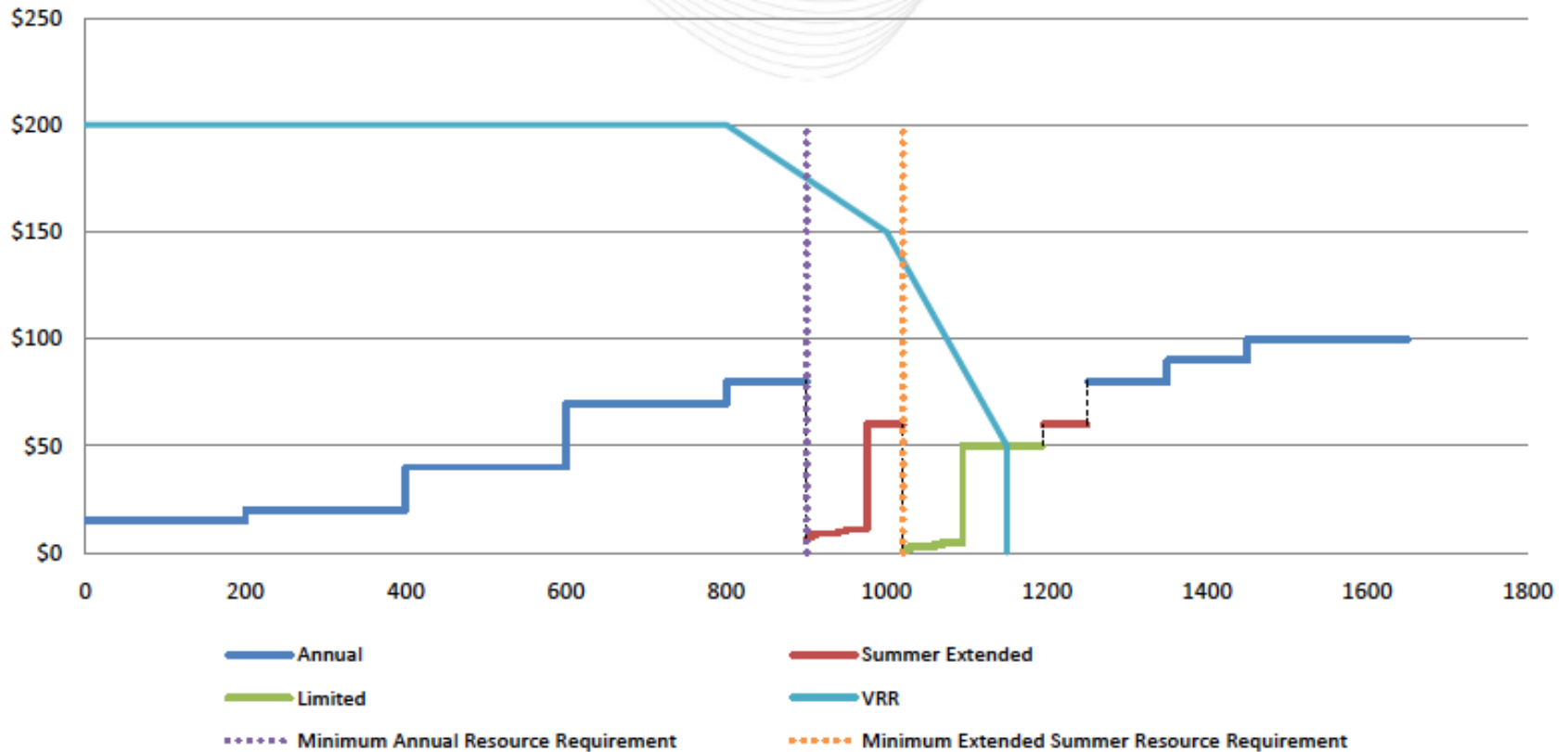
most flexible (i.e. cycling, ramping) first

Pay all firm resource for market value of
firm capacity, but pays more for resources
that possess other reliability attributes

Alternative: Forward Capabilities Market



Example: PJM apporportioned DR auction



Marginal Value Of System Capacity = \$50
 Annual Resource Price Adder = \$20
 Extended Summer Price Adder = \$10

Whither Capacity Markets?

- As importance of capabilities increases
 - And demand resources successfully participate
- And resource adequacy + system stability become more inseparable
- Value of maintaining a capacity market diminishes, centralized proxies for determining reliability standards need reassessment
 - Missing money, long term investment incentives remain important market design concerns

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 and natural gas sectors. 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.raonline.org

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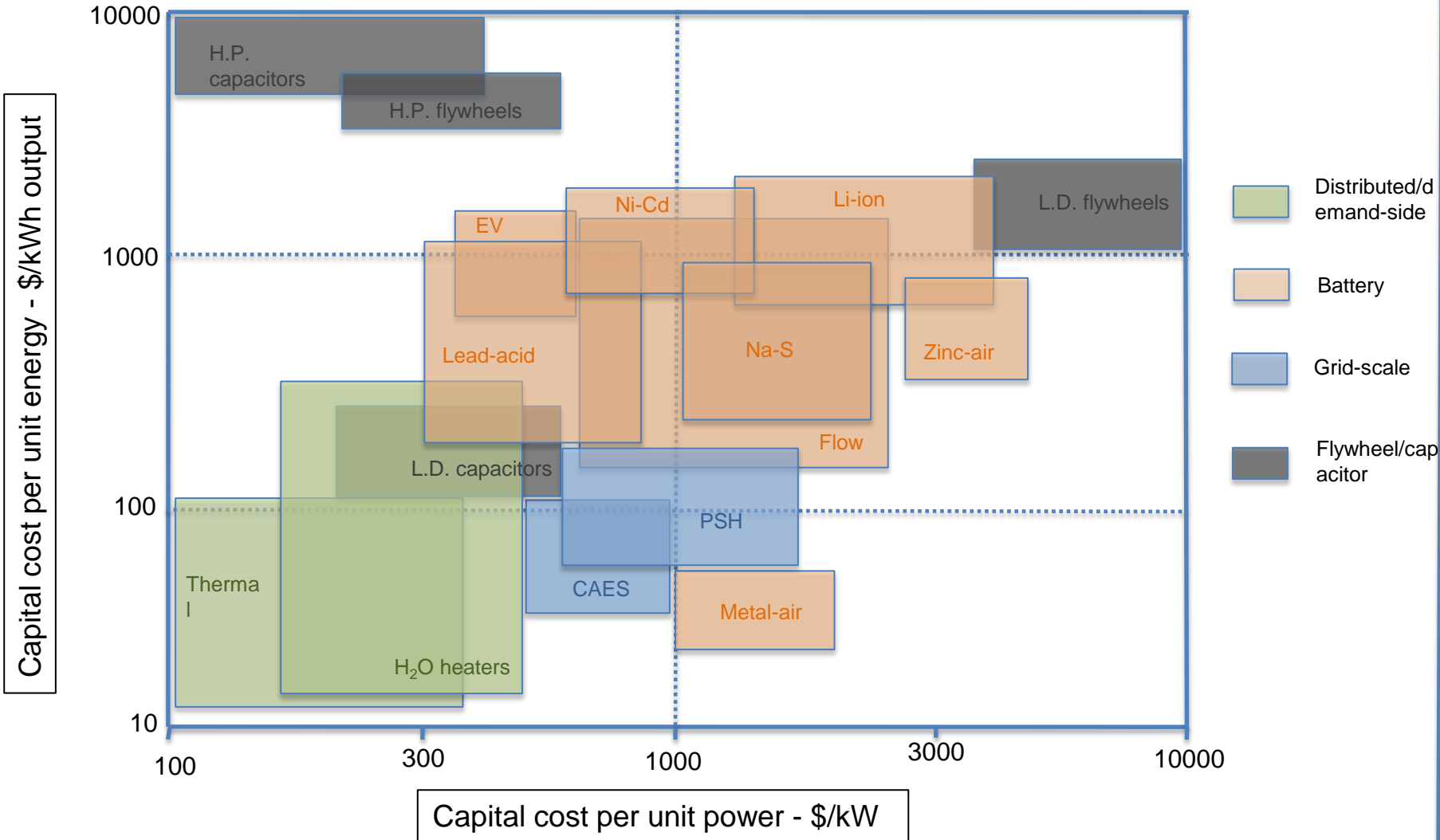


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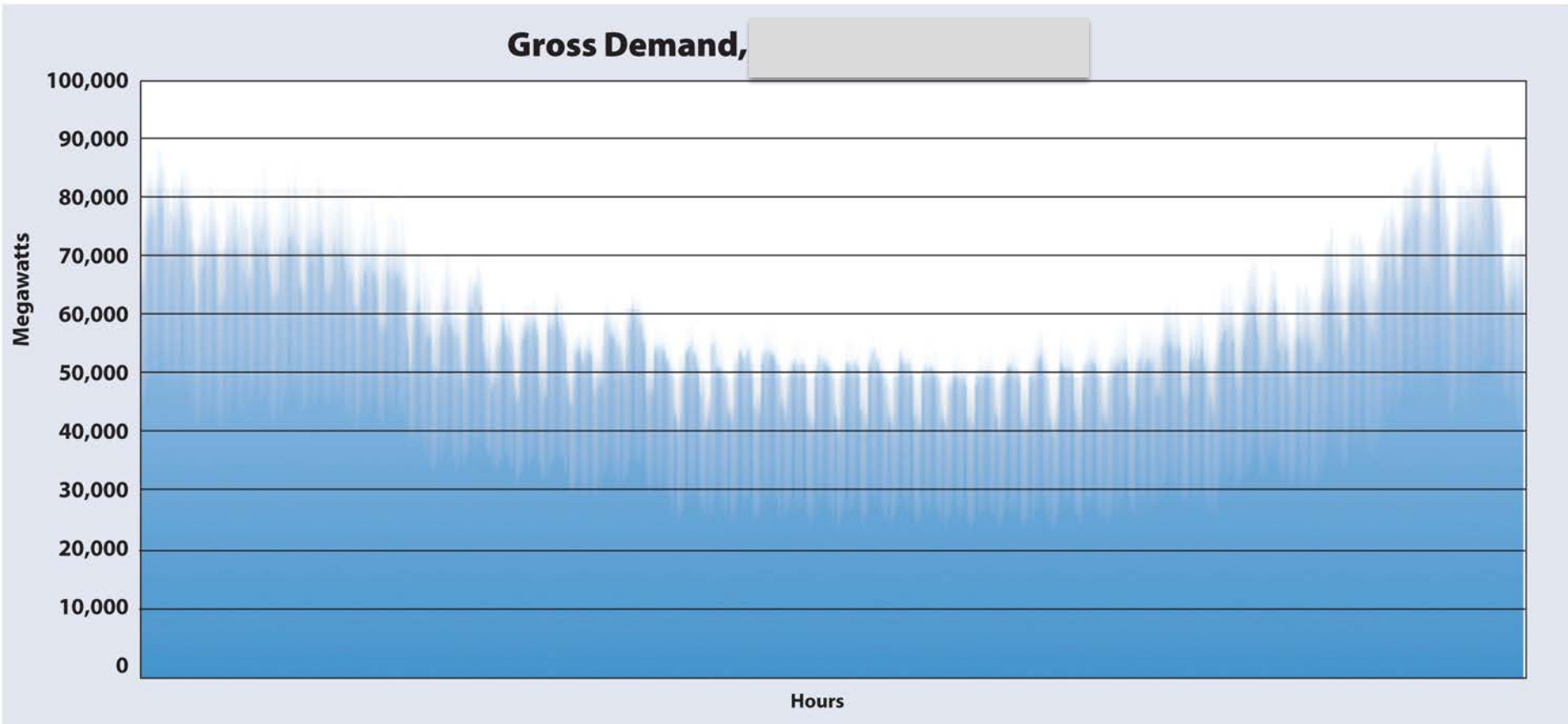
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Cost per Unit of Performance for Various Energy Storage Options

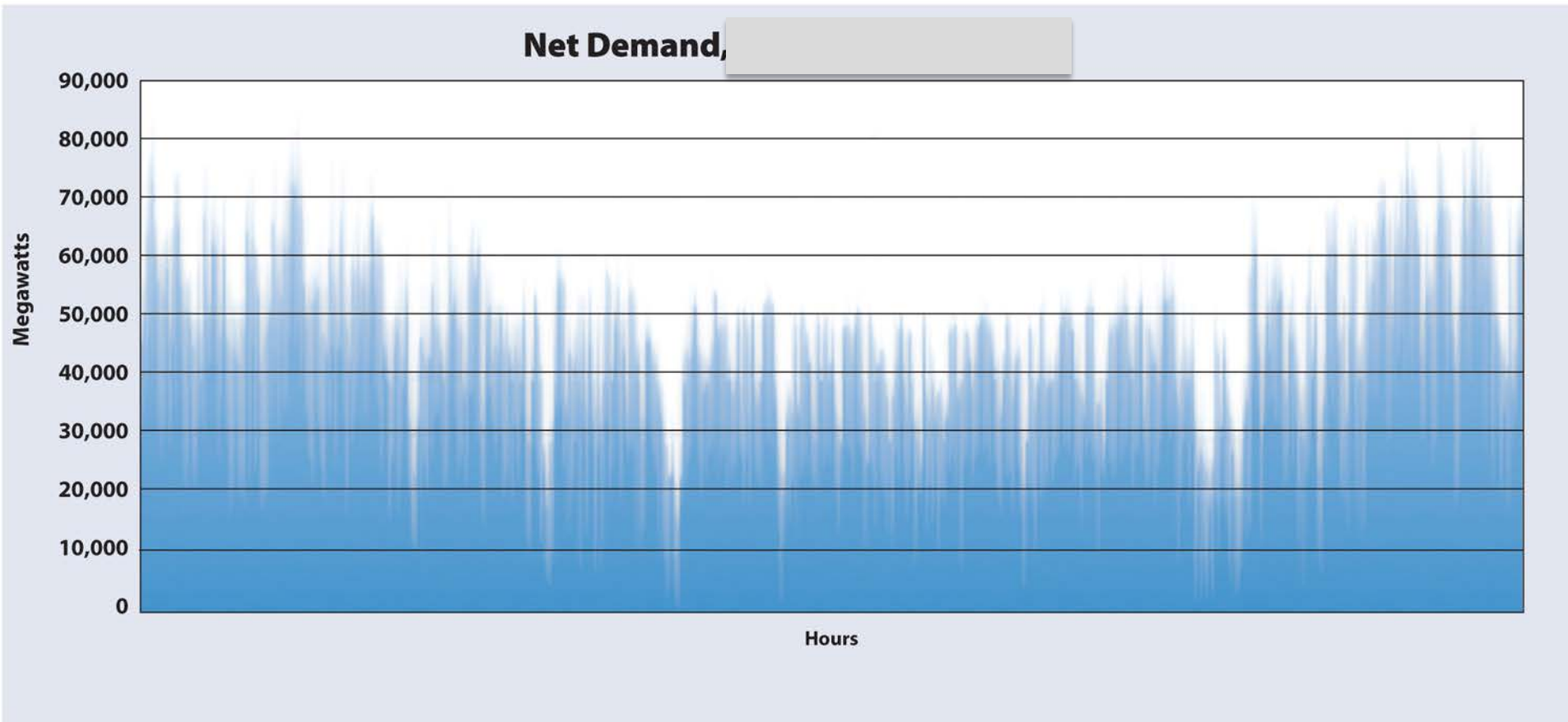


Sources: Electricity Storage Association, EPRI, Sandia National Laboratories, Ecofys

Resource Adequacy Objective



Objective with High Flexible Resources



Ramping and cycling value is revealed by accepting all variable resources

Resources

- **What Lies Beyond Capacity Markets?**
 - <http://raponline.org/document/download/id/6041>
 - <http://raponline.org/document/download/id/4854>
- **Power point**
 - <http://raponline.org/document/download/id/6054>