

2 June 2020

Optimization: How much is too much?

ESIG Webinar – Keynote Session

Michael Hogan
Senior Advisor
The Regulatory Assistance Project (RAP)[®]

Sunapee, New Hampshire
United States

mhogan@raponline.org
raponline.org

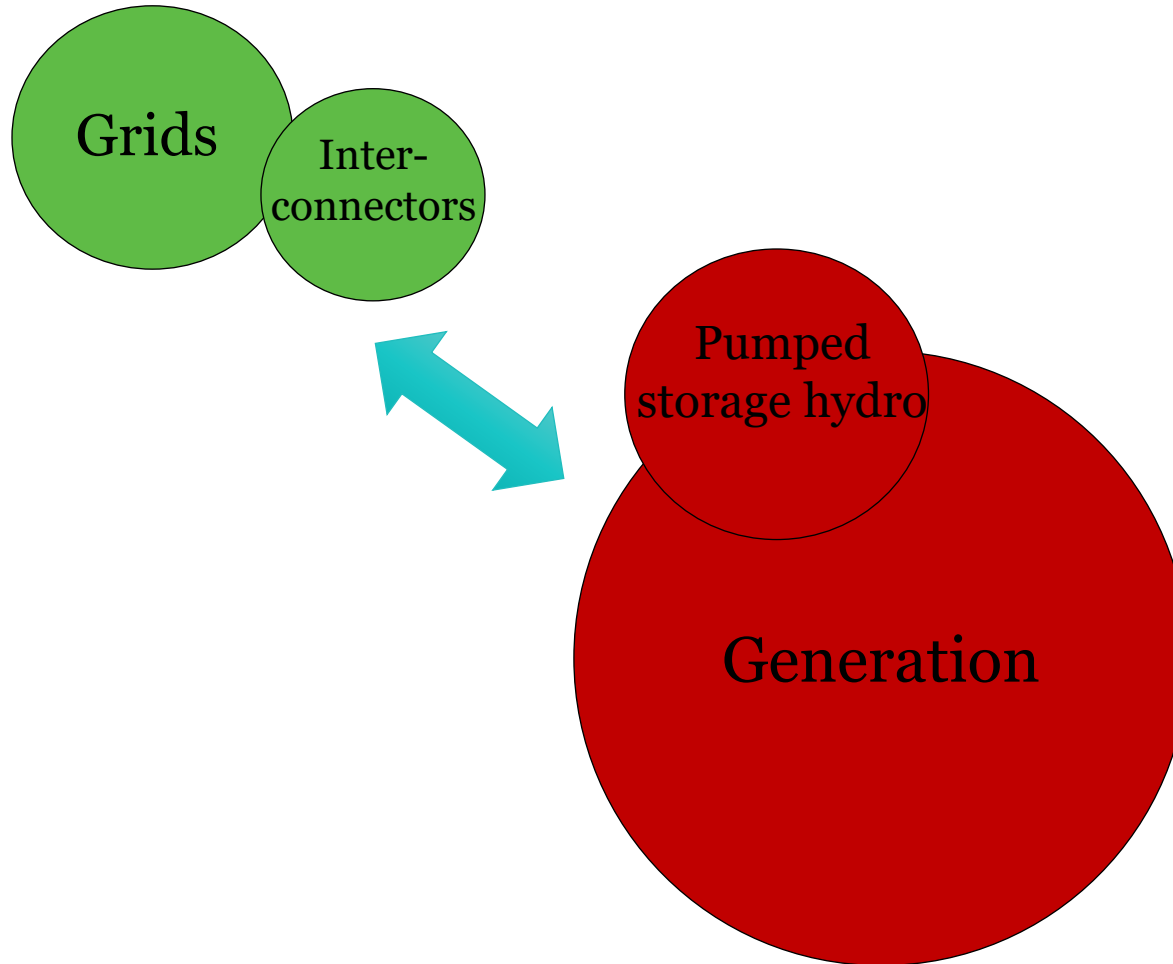


Expected benefits of optimization

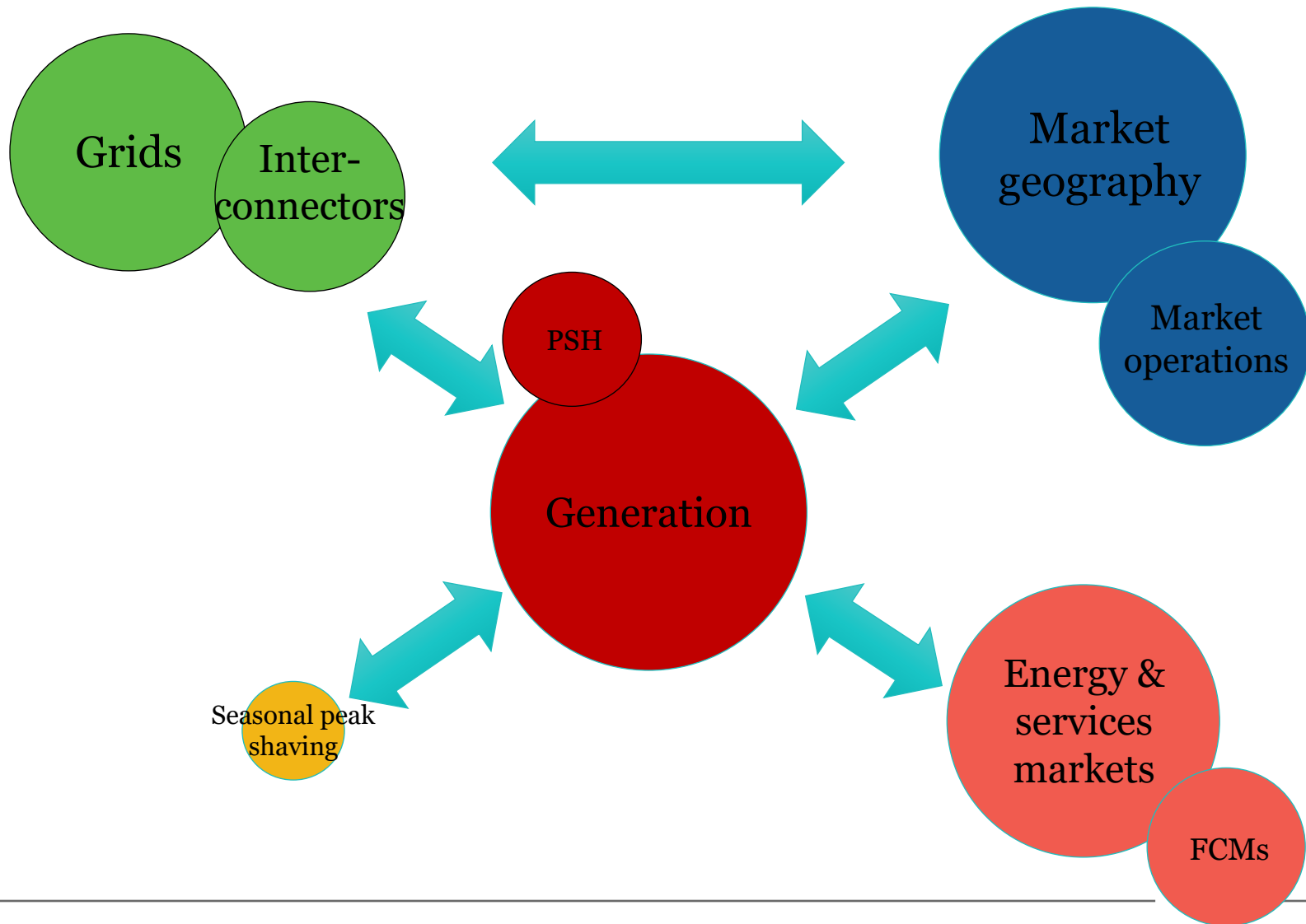
- Operational cost efficiency
- System flexibility
- Investment cost efficiency

But optimizing what? Based on what information?

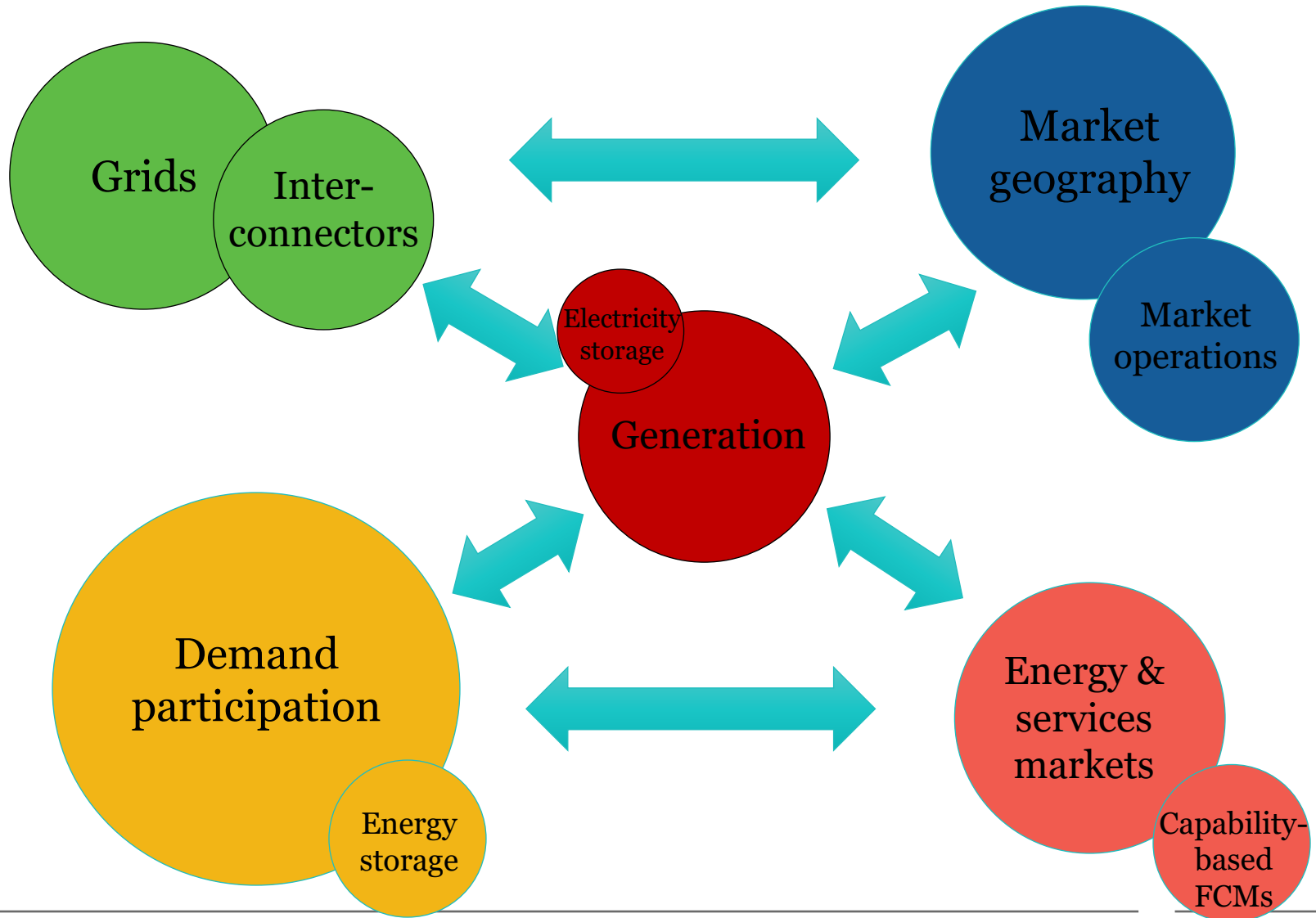
Traditional monopoly optimization field



Supply-side ISO/RTO optimization field

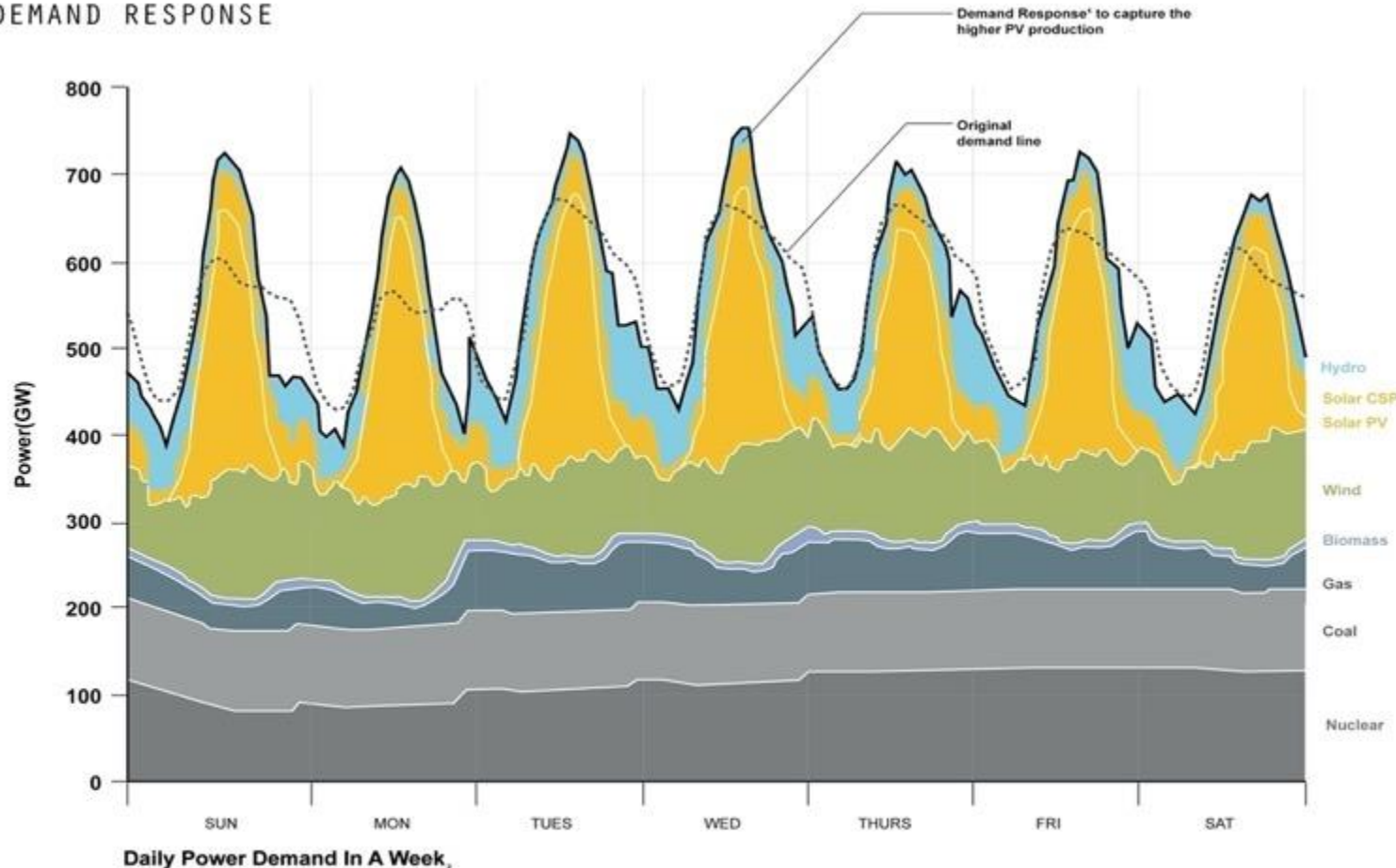


Bottom-up 360° optimization field



Summer week, 35% annual variable RES

DEMAND RESPONSE



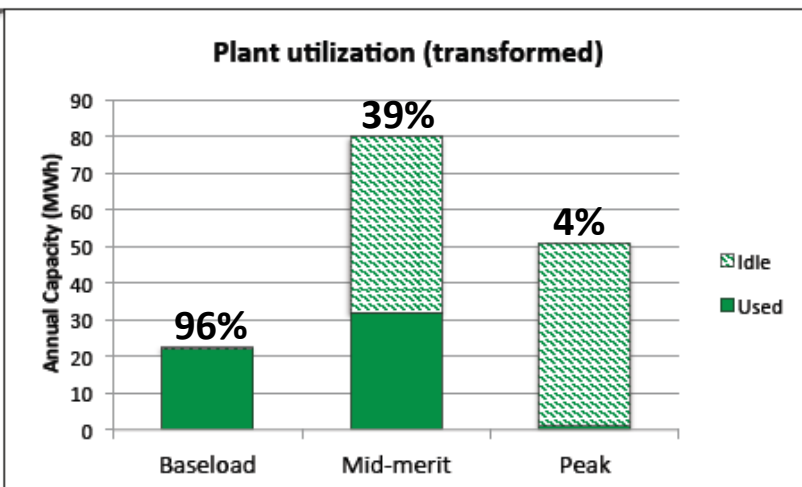
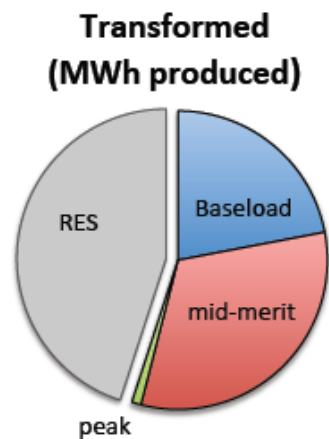
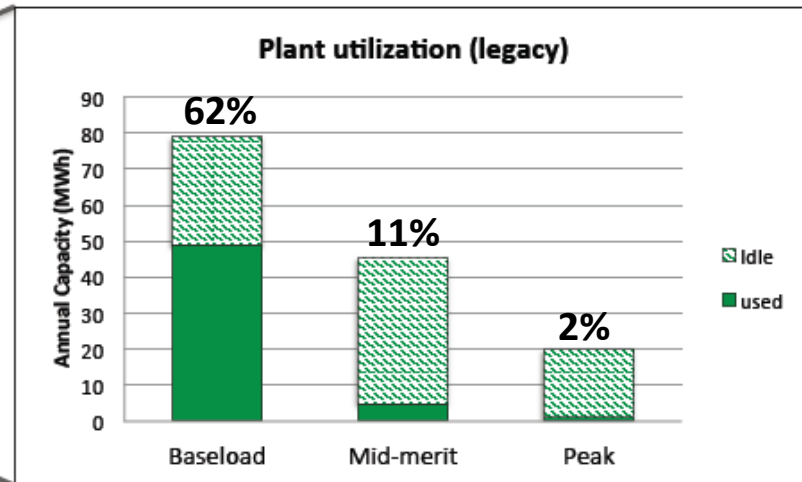
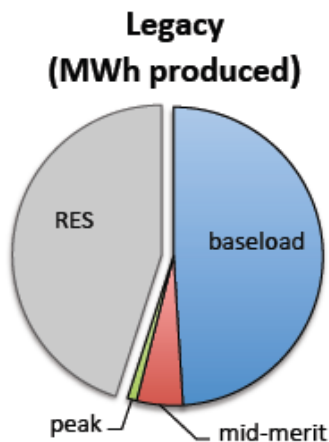
"Demand response as used in this paper refers to changing a customer's electricity demand in response to dispatch instructions or price signals through communications technologies. In the Volume 1 analysis, it is assumed that any such changes retained the total energy consumed within the day, that is, moved or shifted demand rather than reduced total daily consumption."

1) The graph shows how the original demand line (dashed) is shifted to a higher level (solid line) by DR to capture the higher PV production.

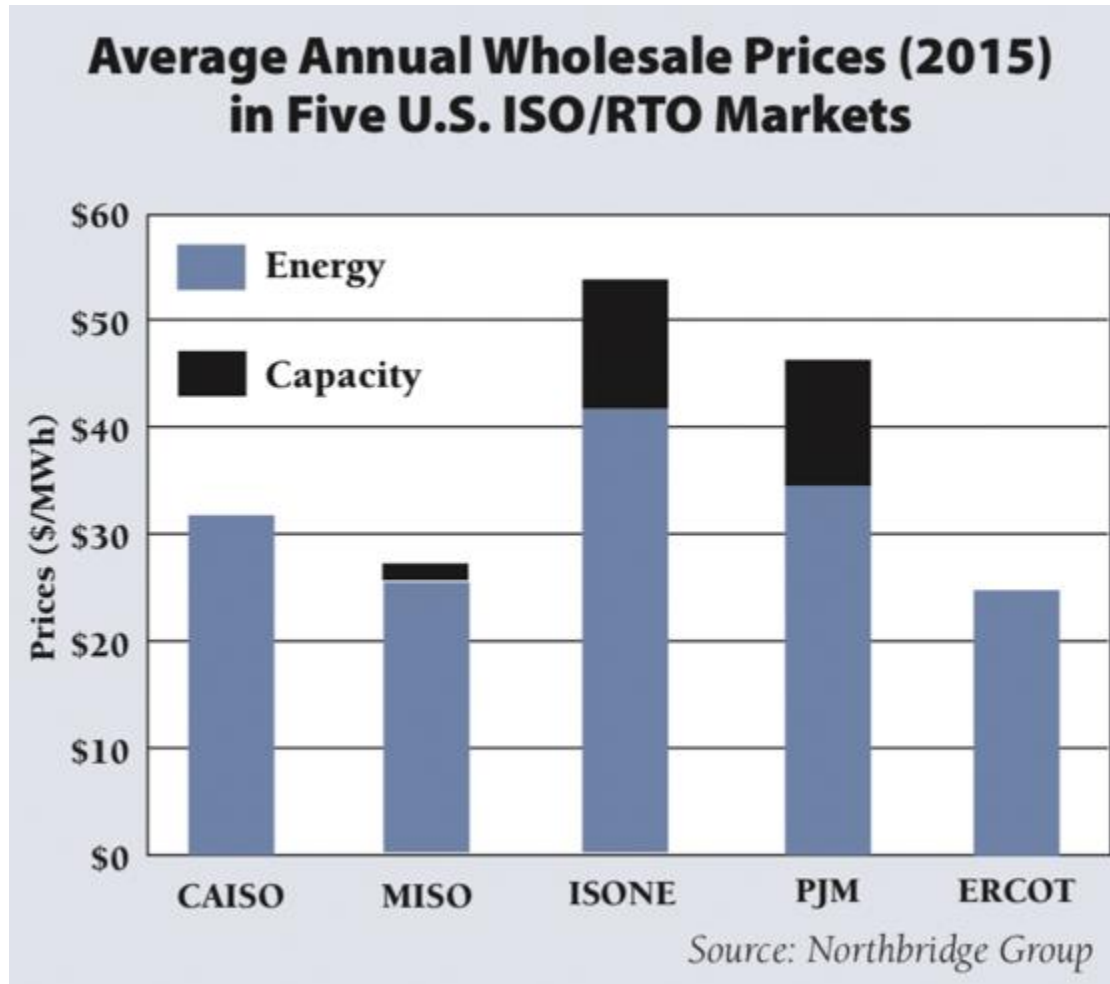
2) 90% RES, 20% DR, Week 32 - Sunny week.

SOURCE: Roadmap 2050 Technical Analysis

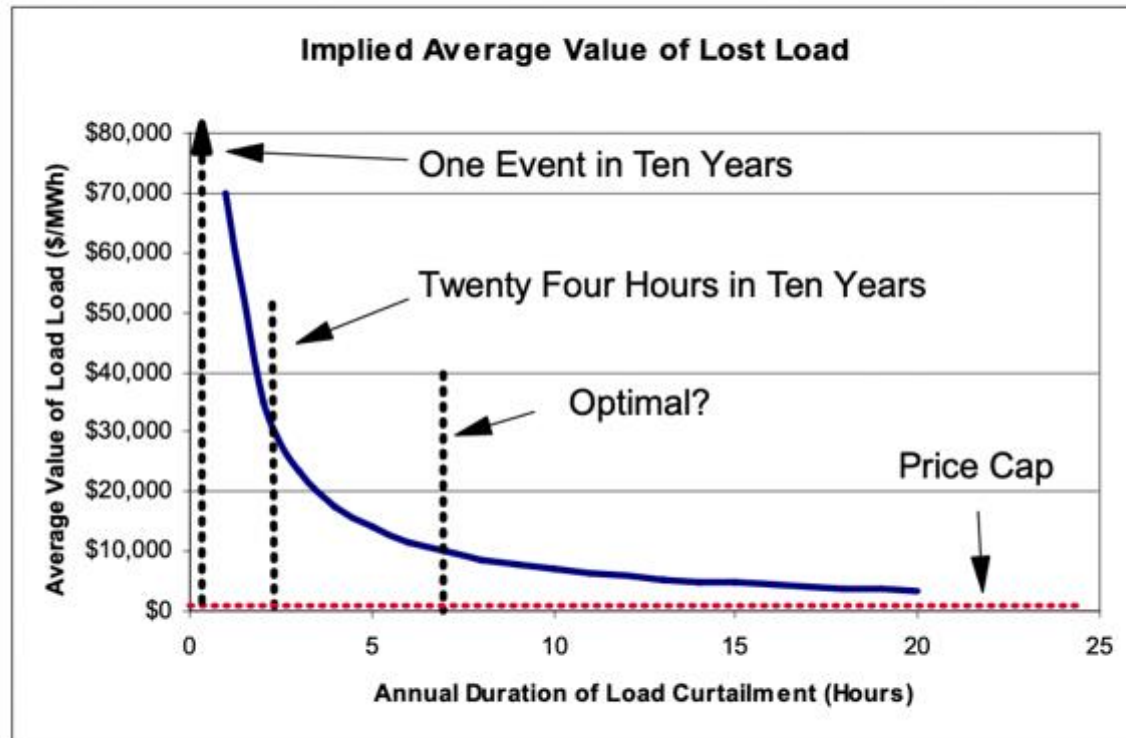
“How much?” depends on “what kind?”



Limits of operational optimization?



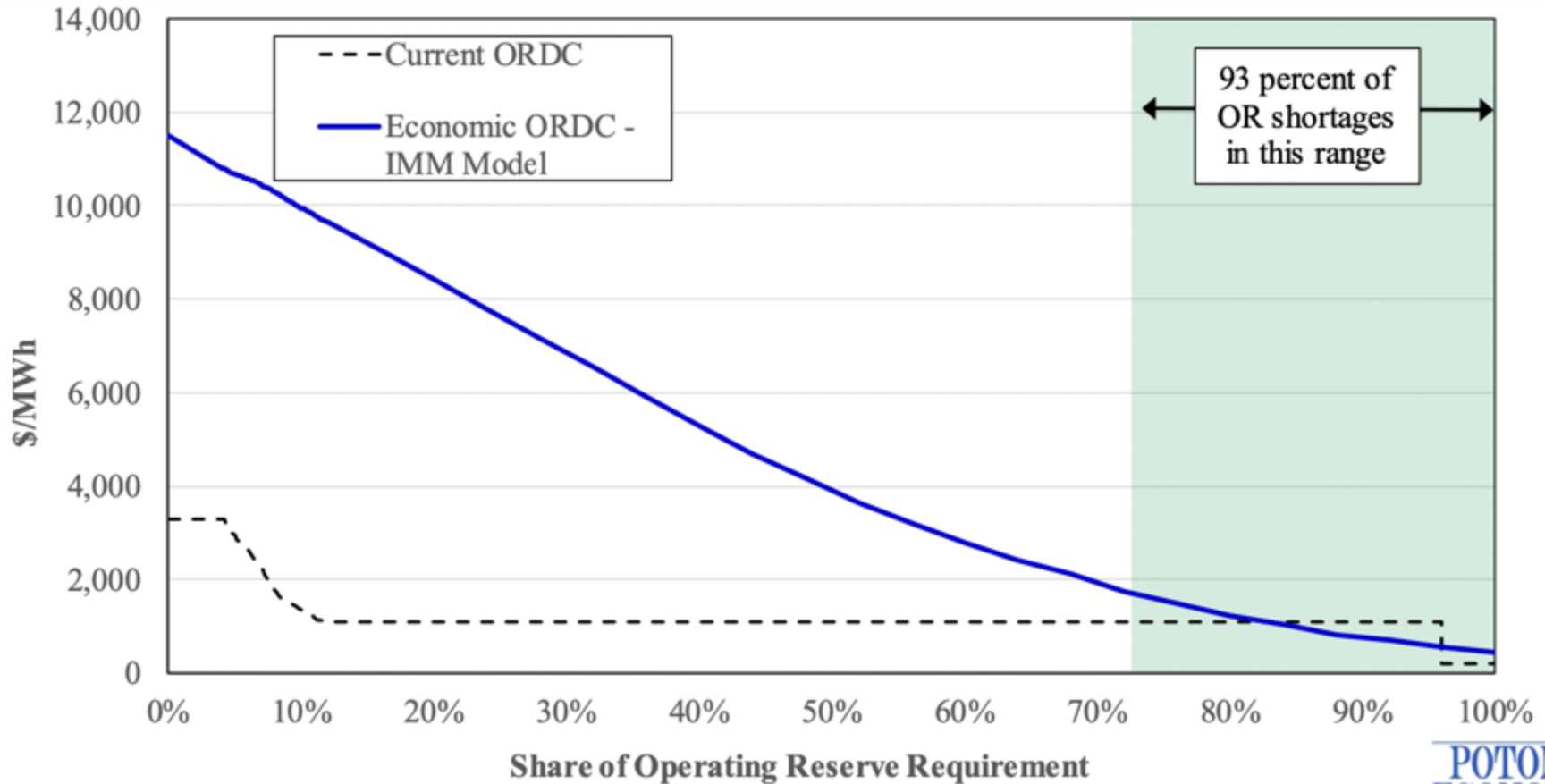
Reliability Standard and Market Disconnect



Peaker fixed charge at \$65,000/MW-yr.

Source: Hogan, W., *Electricity Resource Adequacy* (2007)

MISO Operating Reserve Demand Curve (scarcity pricing function)

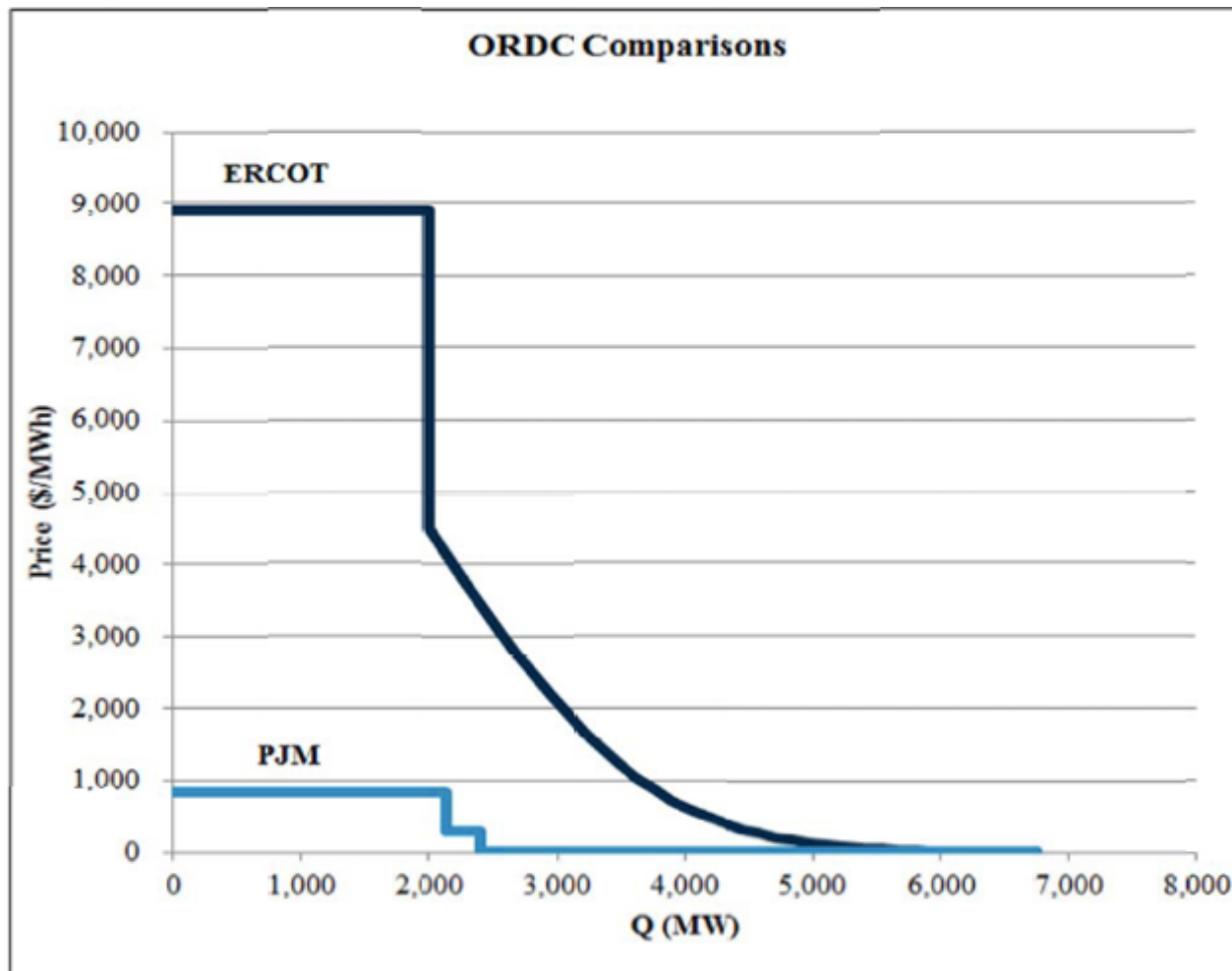


© 2018 Potomac Economics

-6-

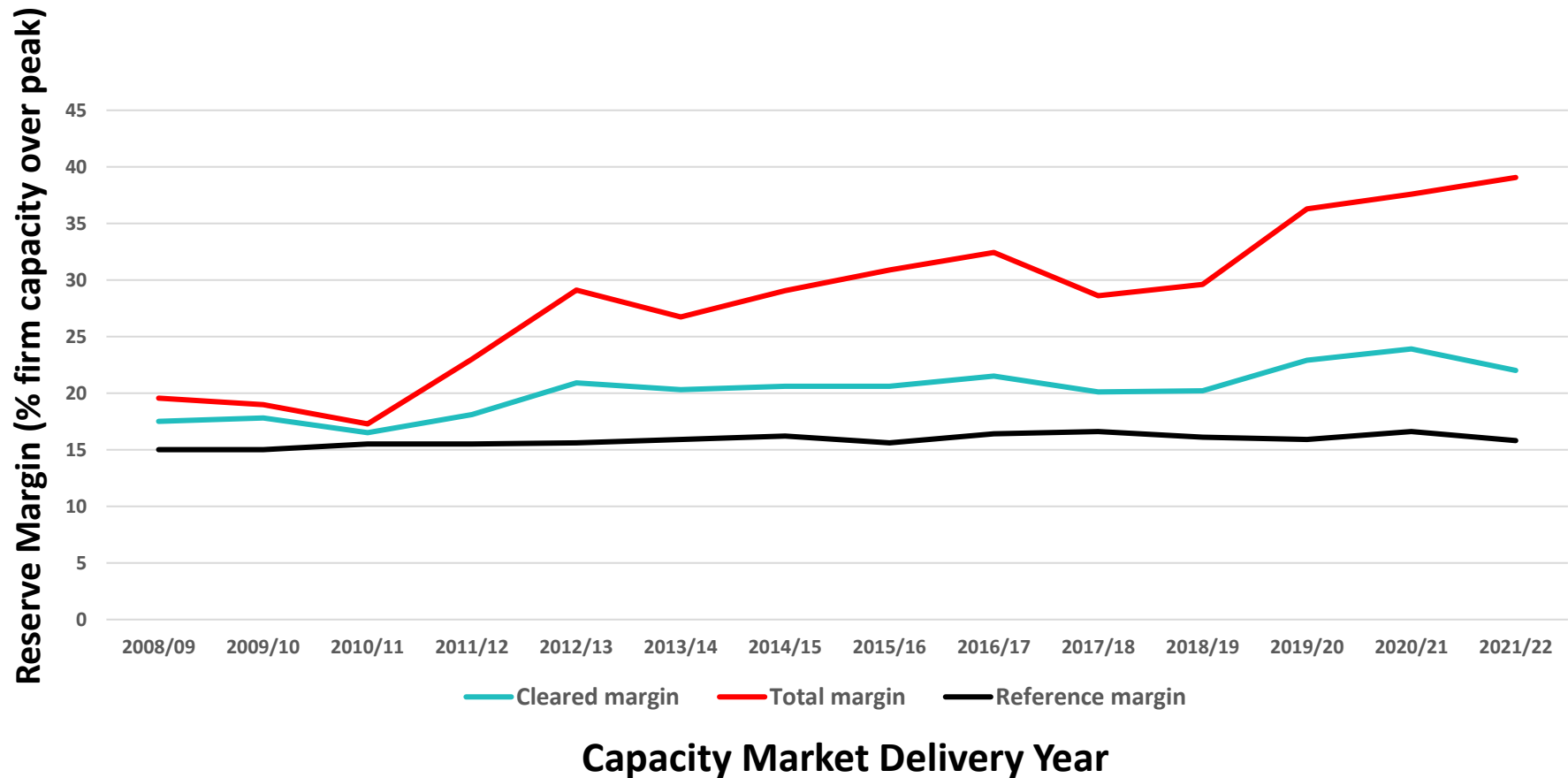
POTOMAC
ECONOMICS

Source: Potomac Economics, *Resilience and emerging issues in wholesale electricity markets* (2018)



Garbage in...*a lot of* garbage out

PJM reserve margins since the inception of the capacity market



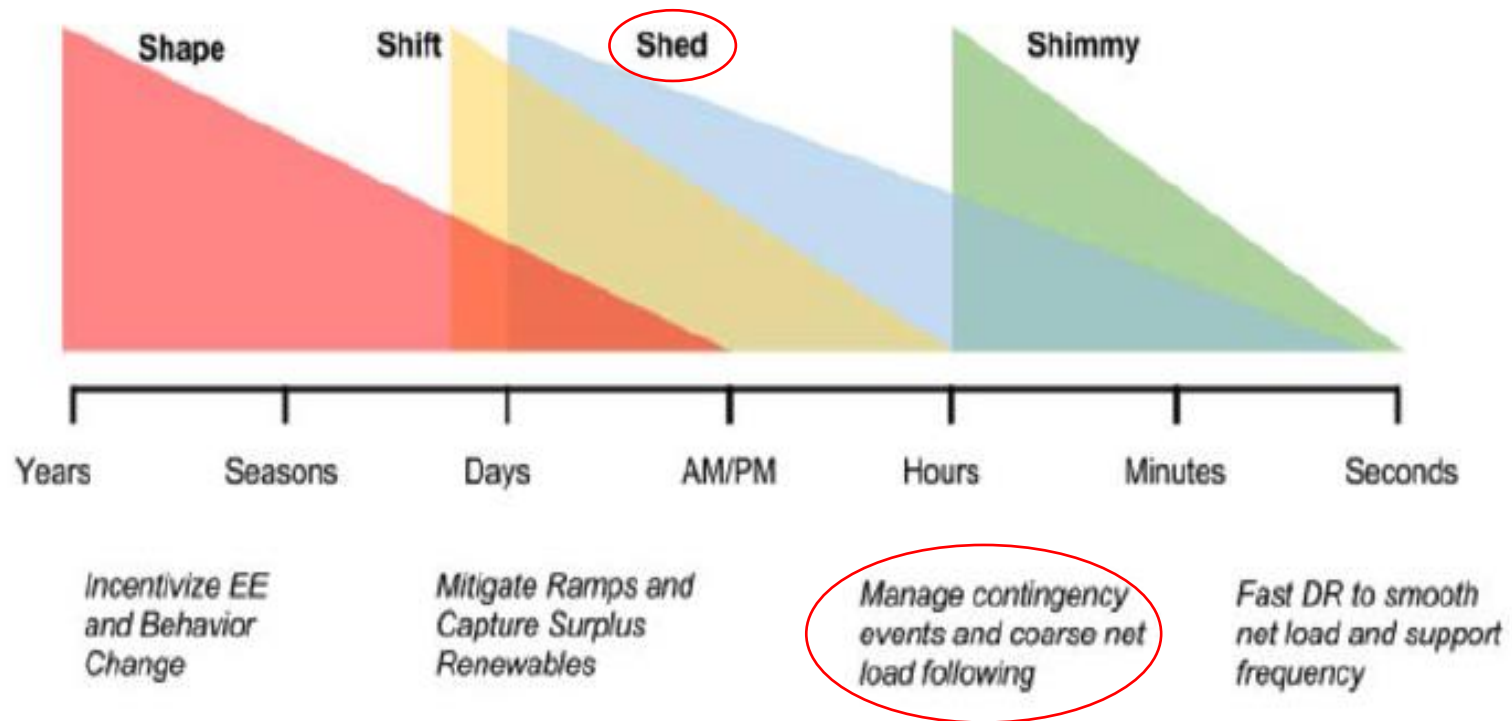
Source: Published data from PJM, NERC

The real costs in marginal cost pricing

System Resource	Full Marginal Cost (€/MWh)
Generation capacity	20-250
Imports	20-1,000
Secondary (operating) reserves	250-5,000
Emergency generation	500
Primary (regulation) reserves	500-9,000
30-minute responsive back-up	1,400
30-minute controllable demand response	2,400
10-minute controllable demand response	2,600
10-minute responsive back-up	3,700
Emergency load-shedding	9,000

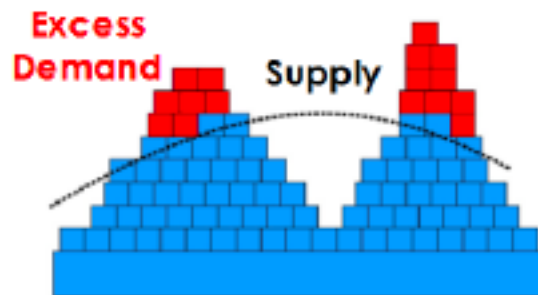
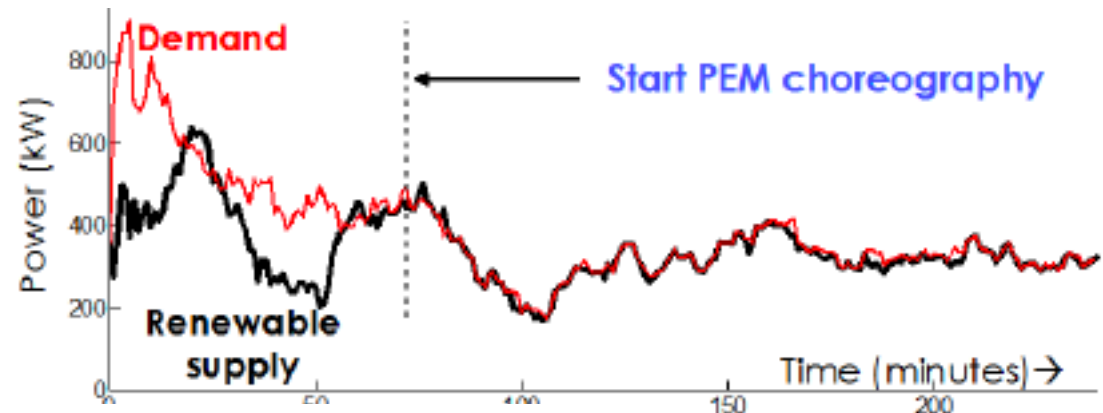
Source: Adapted from Brattle Group

“Capacity” blocks most valuable DR potential

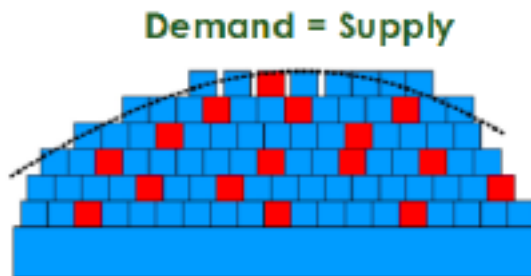


Source: 2015 California Demand Response Potential Study, LBNL, November 2016

Innovation: 3rd party access is essential



Uncoordinated



PEM Coordination

Conclusions:

- Centralized, top-down, operating-cost-based optimization might have worked well in 1980
- As we move toward zero-carbon electricity, distributed, bottom-up, price-based optimization will be required
- Optimization without good energy price formation creates false precision and the illusion of expected benefits

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



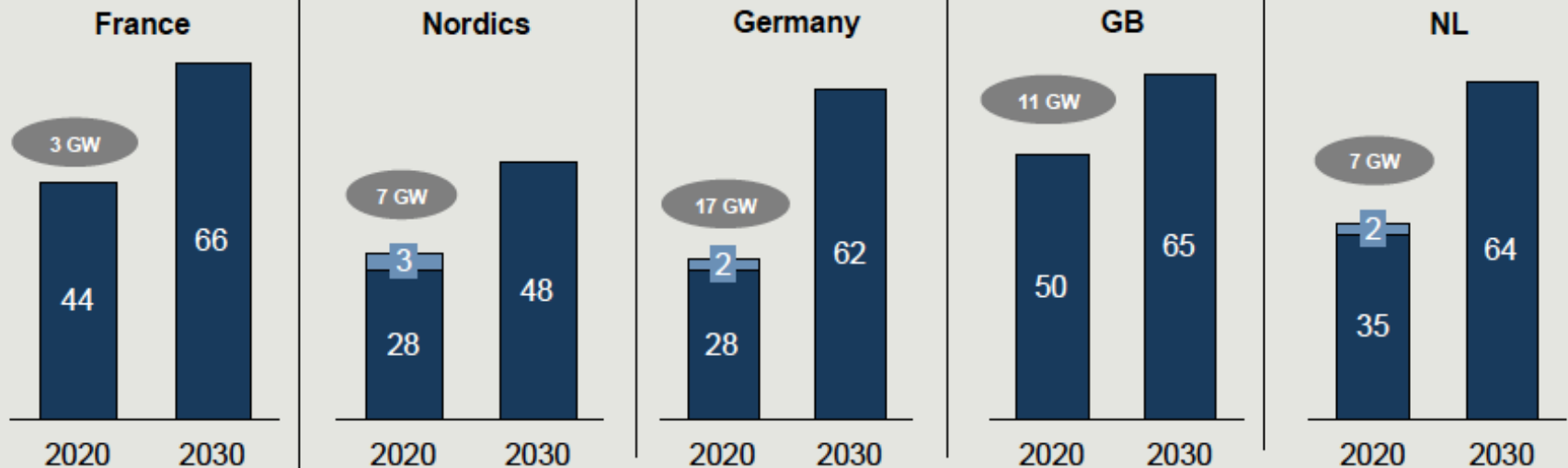
Michael Hogan
Senior Advisor
The Regulatory Assistance Project (RAP)[®]

Sunapee, New Hampshire
United States

mhogan@raponline.org
raponline.org

Average day ahead
prices (EUR15/MWh)

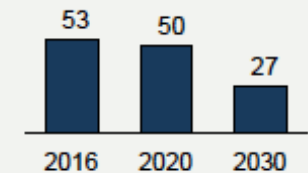
Price effect of decommissioning



Coal in Germany

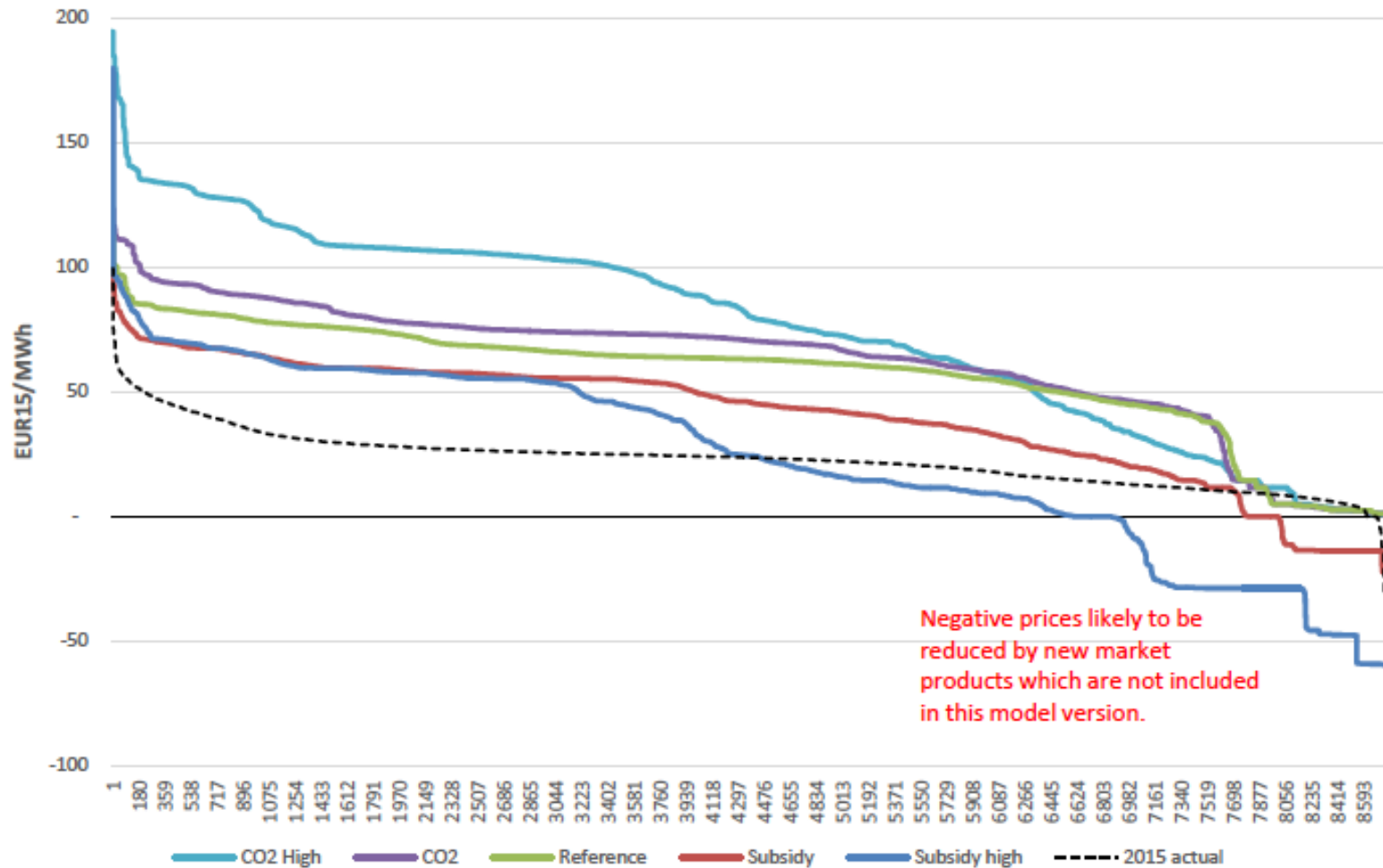
- Mainly gas decommissioned towards 2020 due to low CO2 price => limited electricity price impact
- Mainly coal decommissioned towards 2030 => doubling of electricity price
- Fast decommissioning of coal, through CO2 price or other measures is key to electricity price

Installed coal capacity, GW

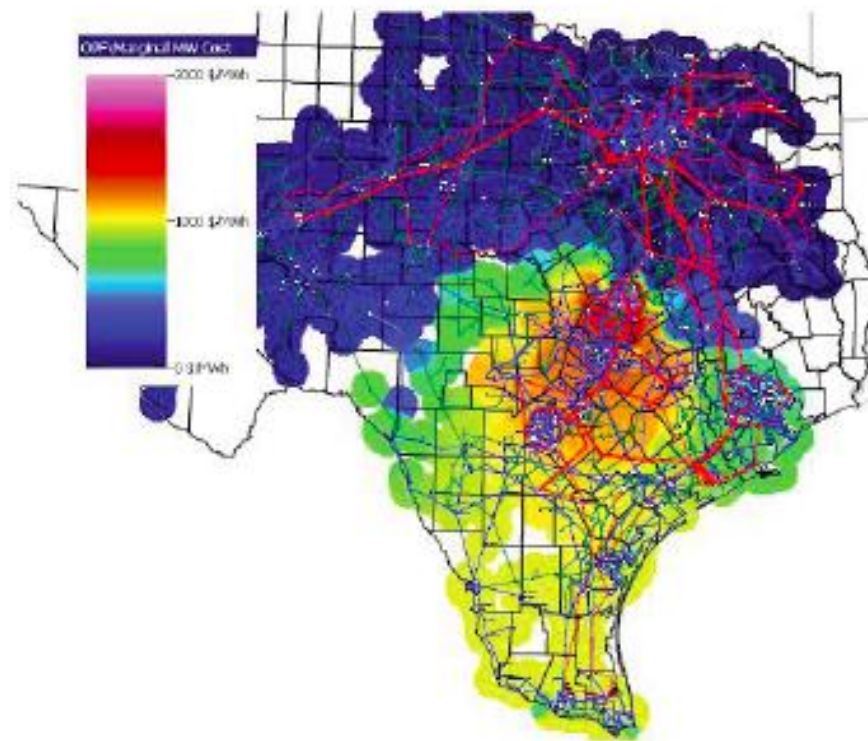
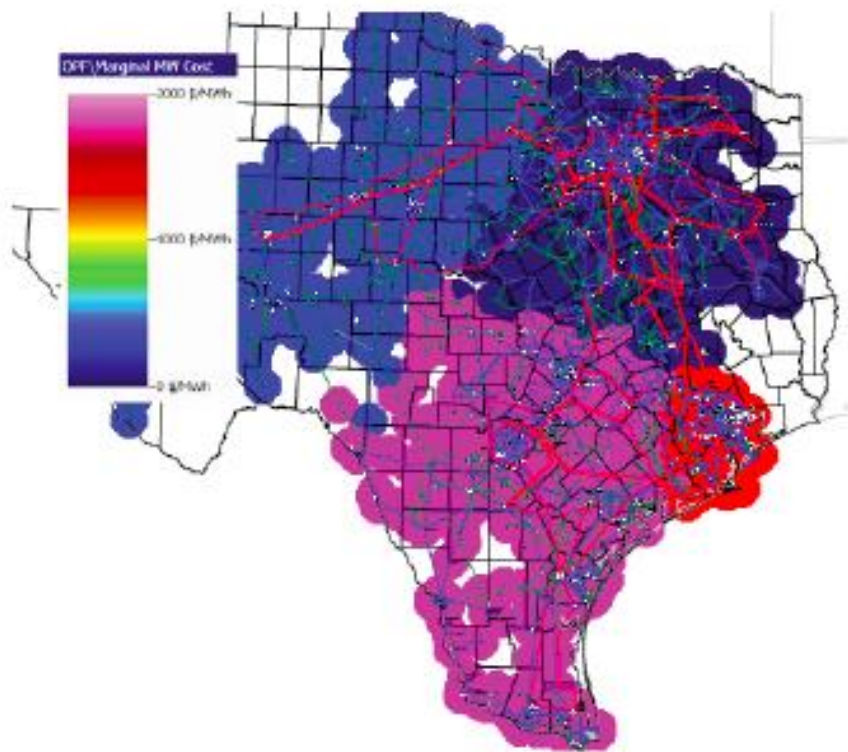


Source: DONG Energy/Orsted

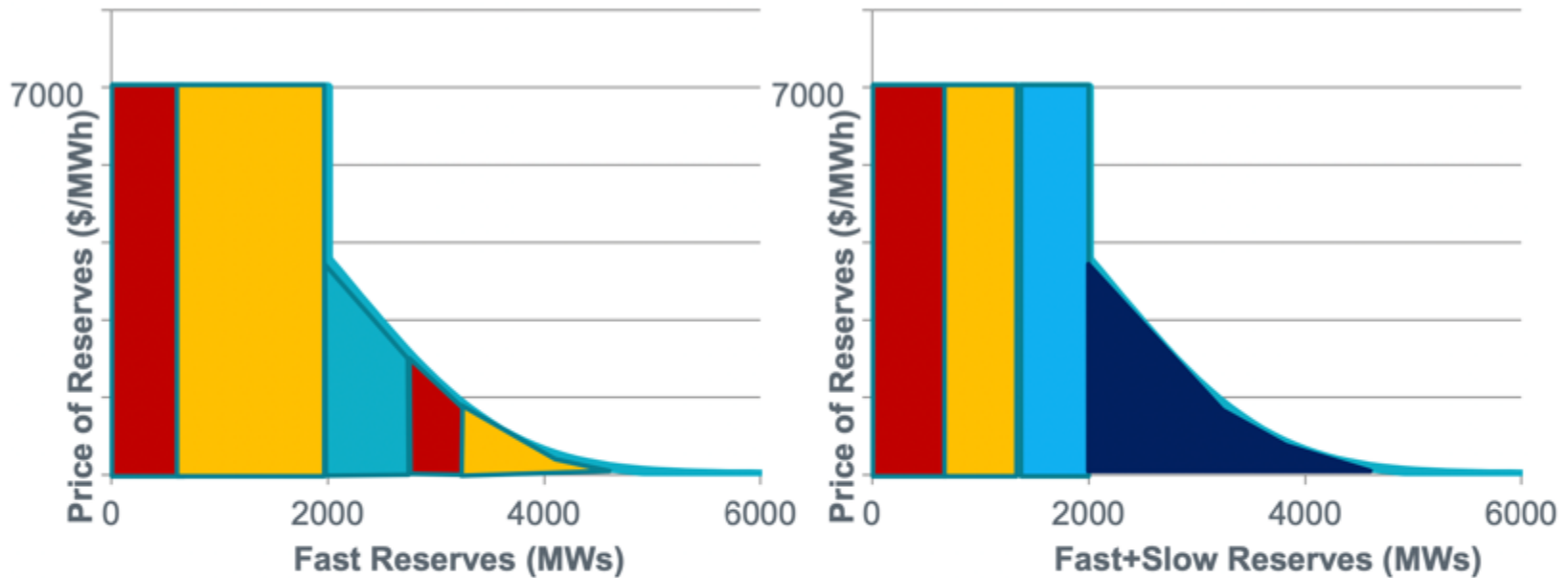
Price duration curves with 70% RES



Source: DONG Energy/Orsted



Source: Hogan, W. & Pope, S. for FTI Consulting & ERCOT



- RegUp
- RRS
- SOR
- NSOR

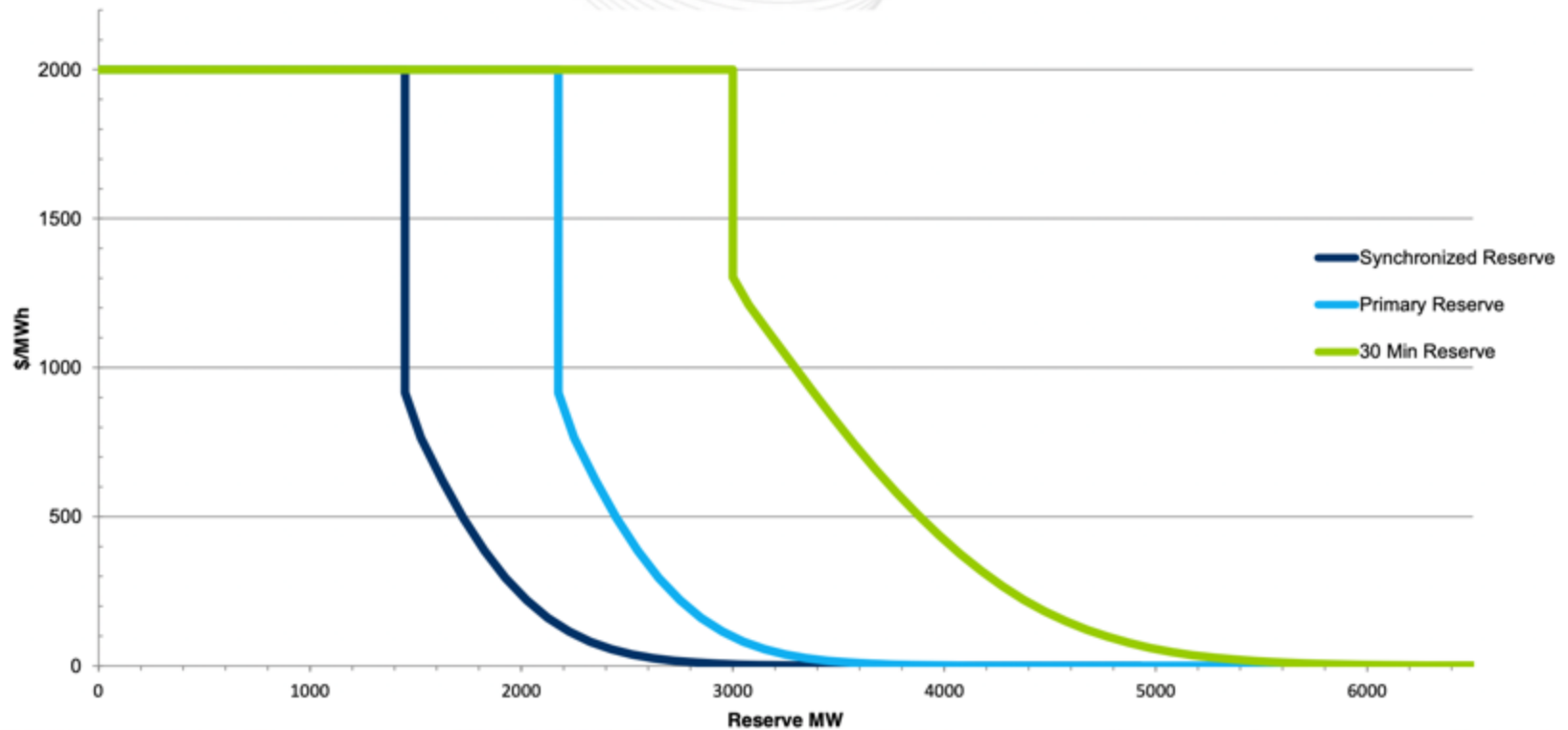
0.5 weightage applied to
each ORDC during
disaggregation to AS
Demand Curve



Source: ERCOT, Scarcity pricing using ORDC for reserves



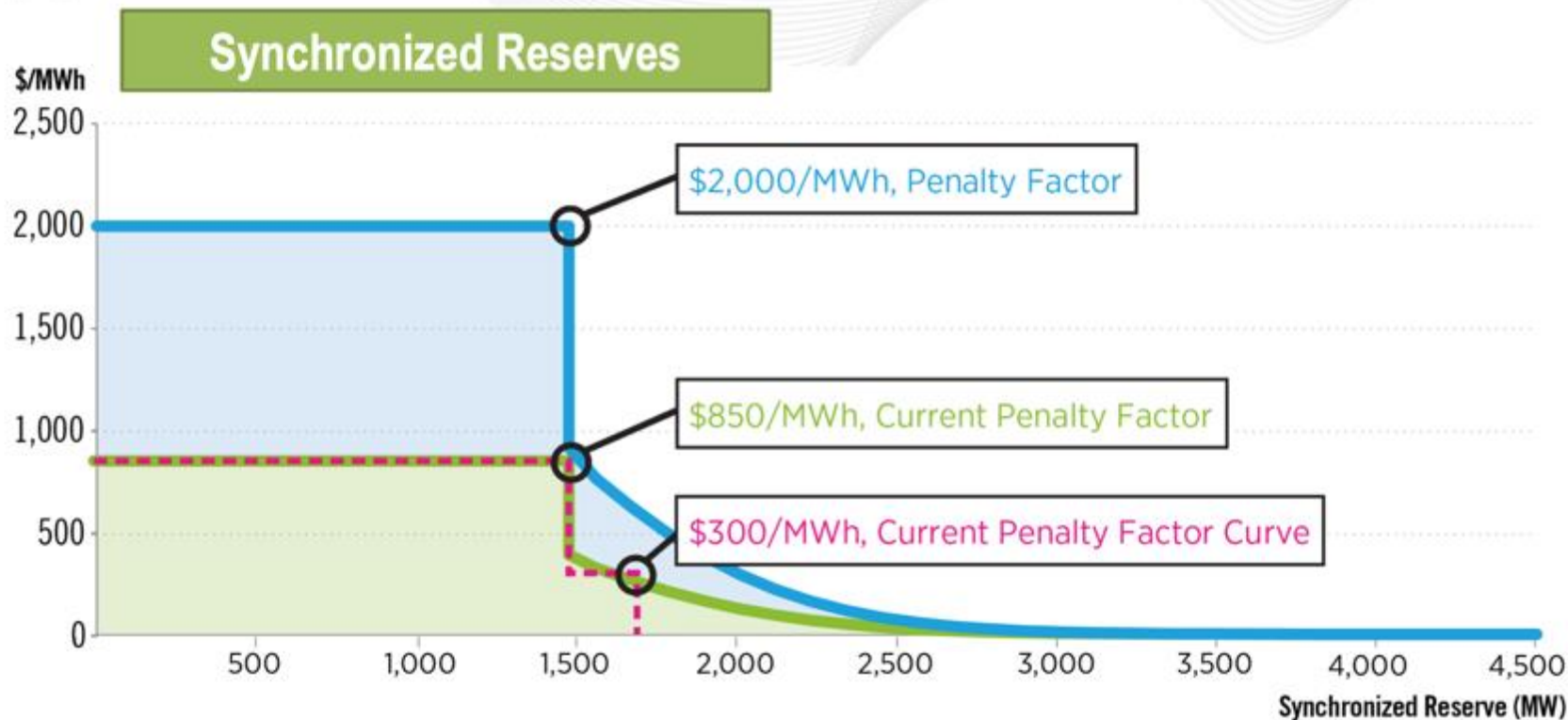
Reserve Product ORDC Comparison



Source: PJM, *Proposed reserve market enhancements*
(2018)



Synchronized Reserve Demand Curve



Source: PJM, *Use of penalty factor for the ORDC* (2019)