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

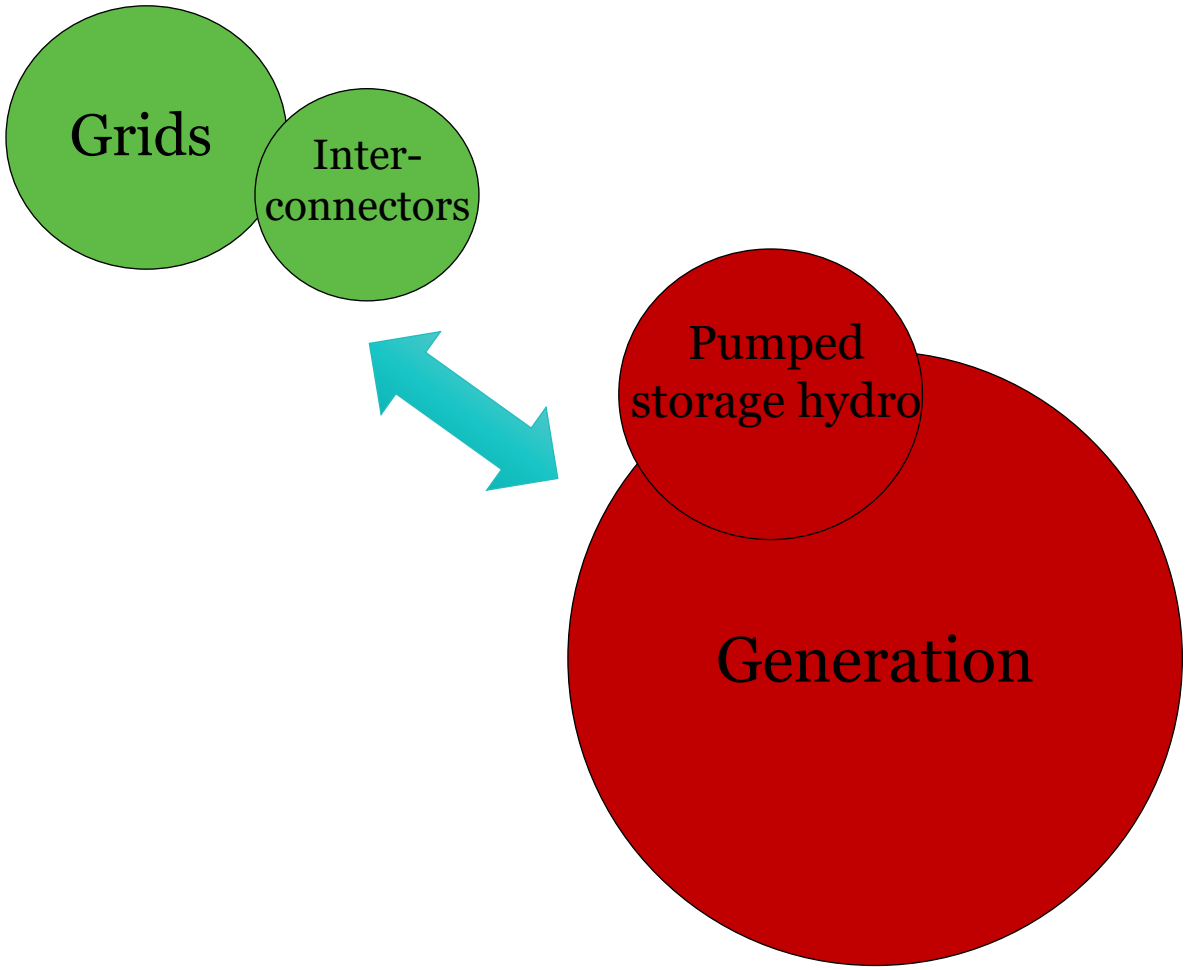
mhogan@raponline.org
raponline.org

Expected benefits of optimization

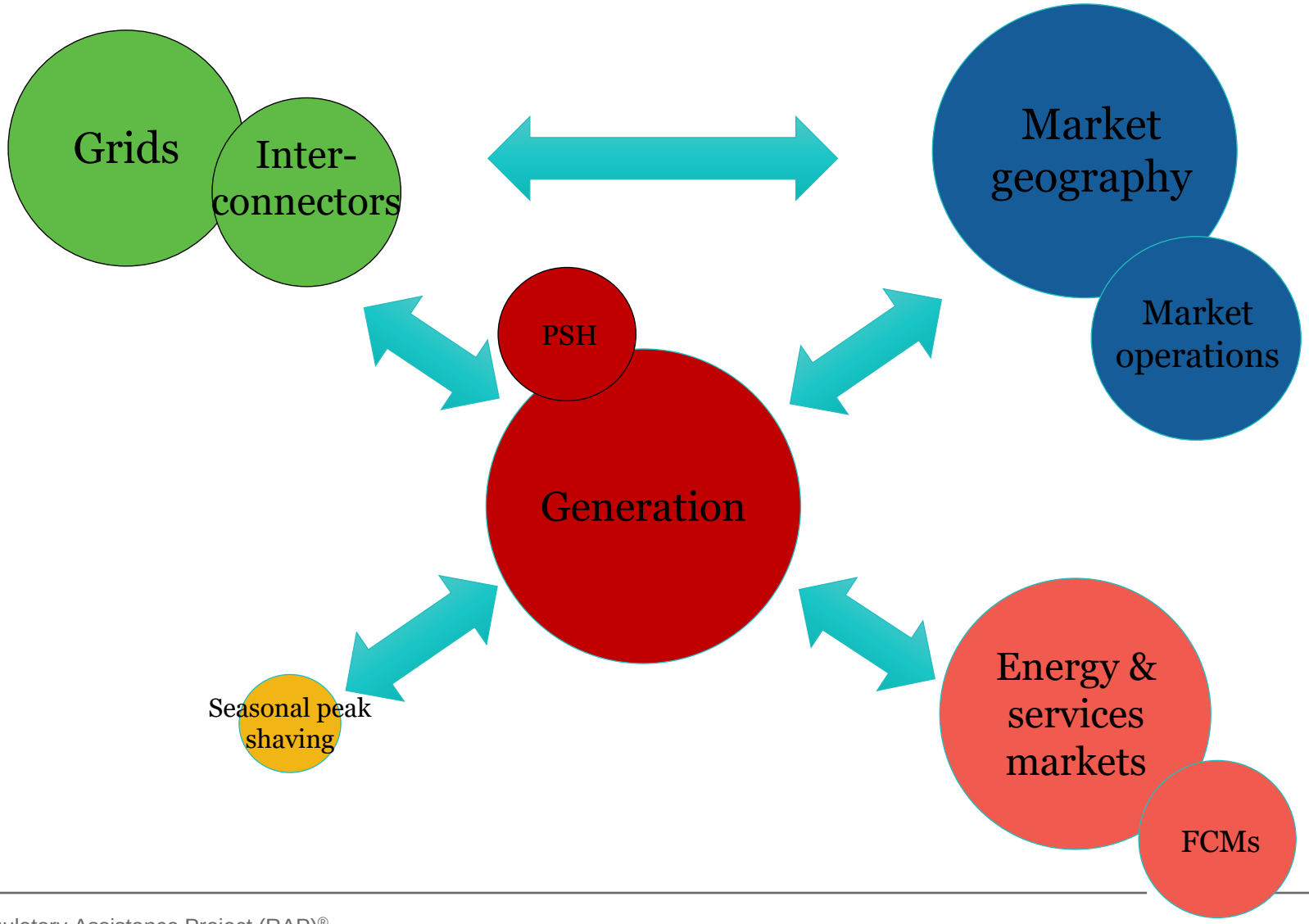
- Operational cost efficiency
- System flexibility
- Investment cost efficiency

But optimizing what? Based on what information?

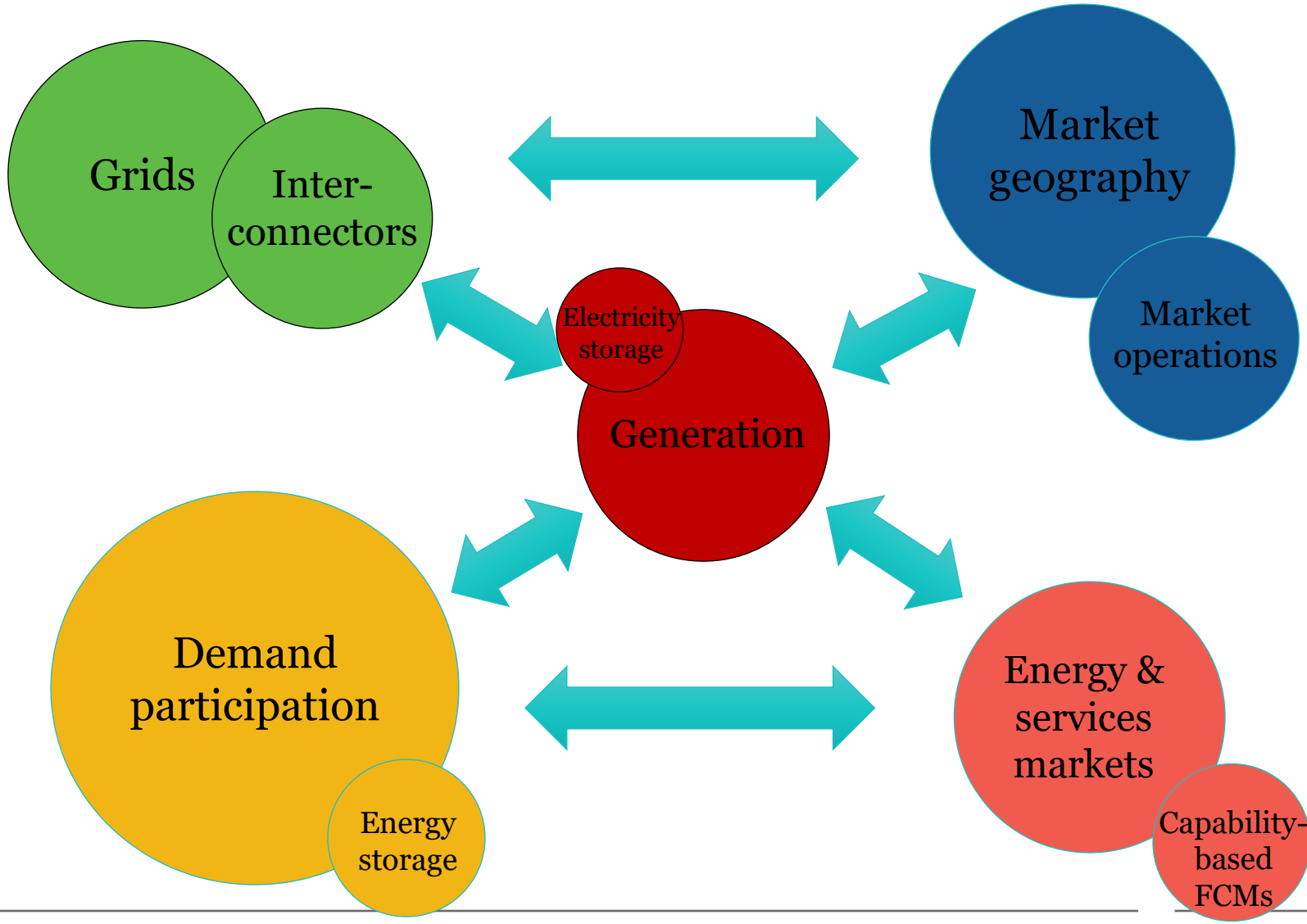
Traditional monopoly optimization field



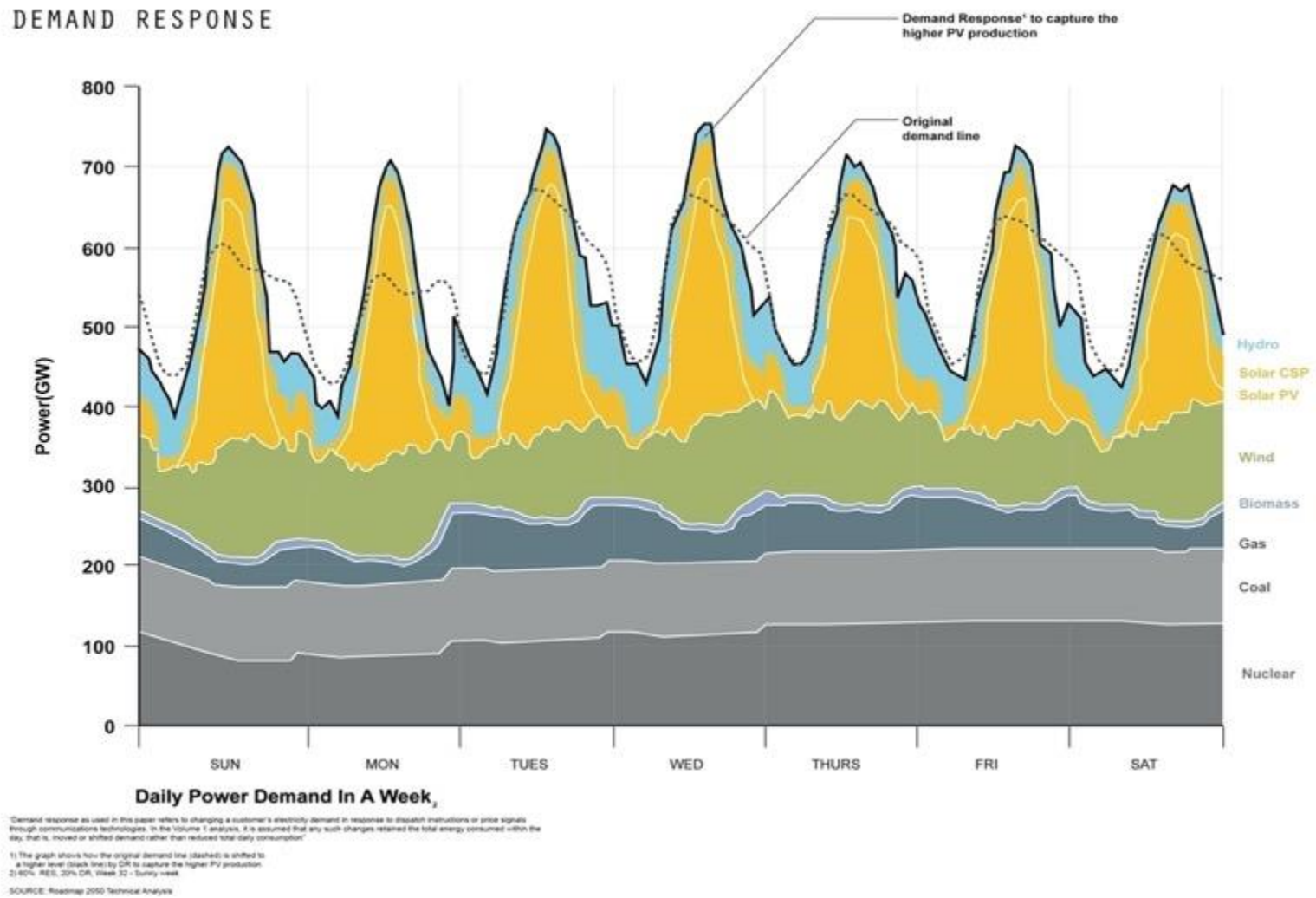
Supply-side ISO/RTO optimization field



Bottom-up 360° optimization field

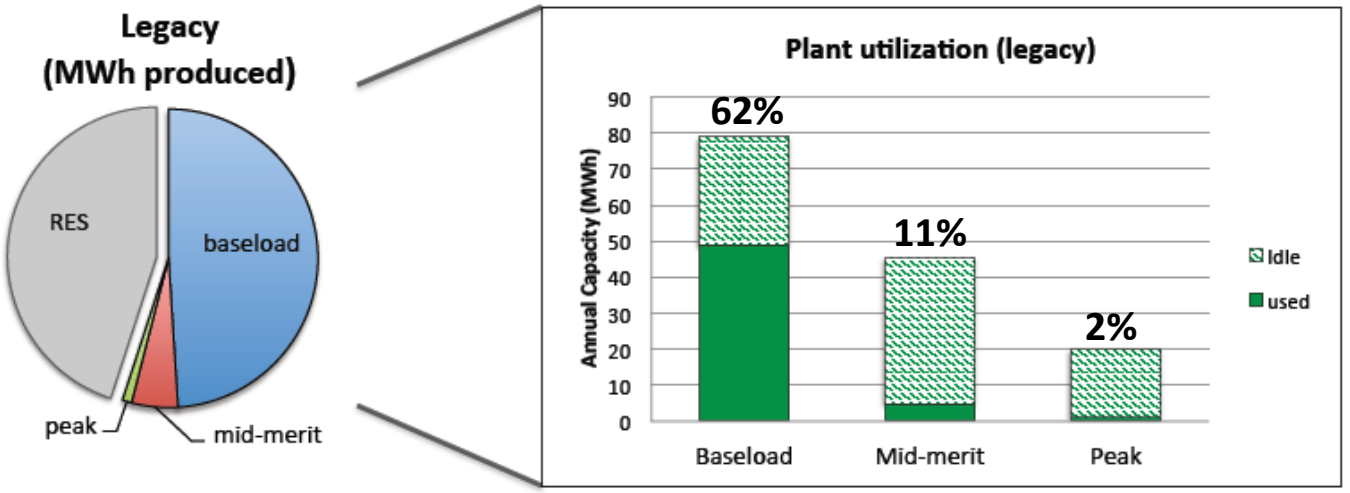


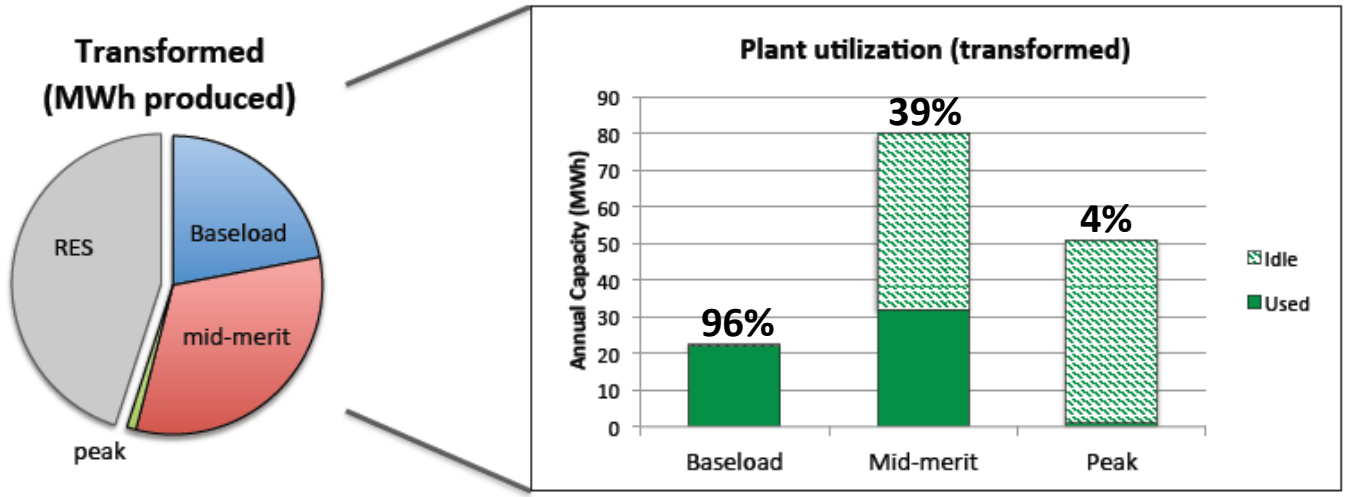
Summer week, 35% annual variable RES



Source: McKinsey & Co., Imperial College London, ECF, *Roadmap 2050: A practical guide to a prosperous, low-carbon Europe* (2010)

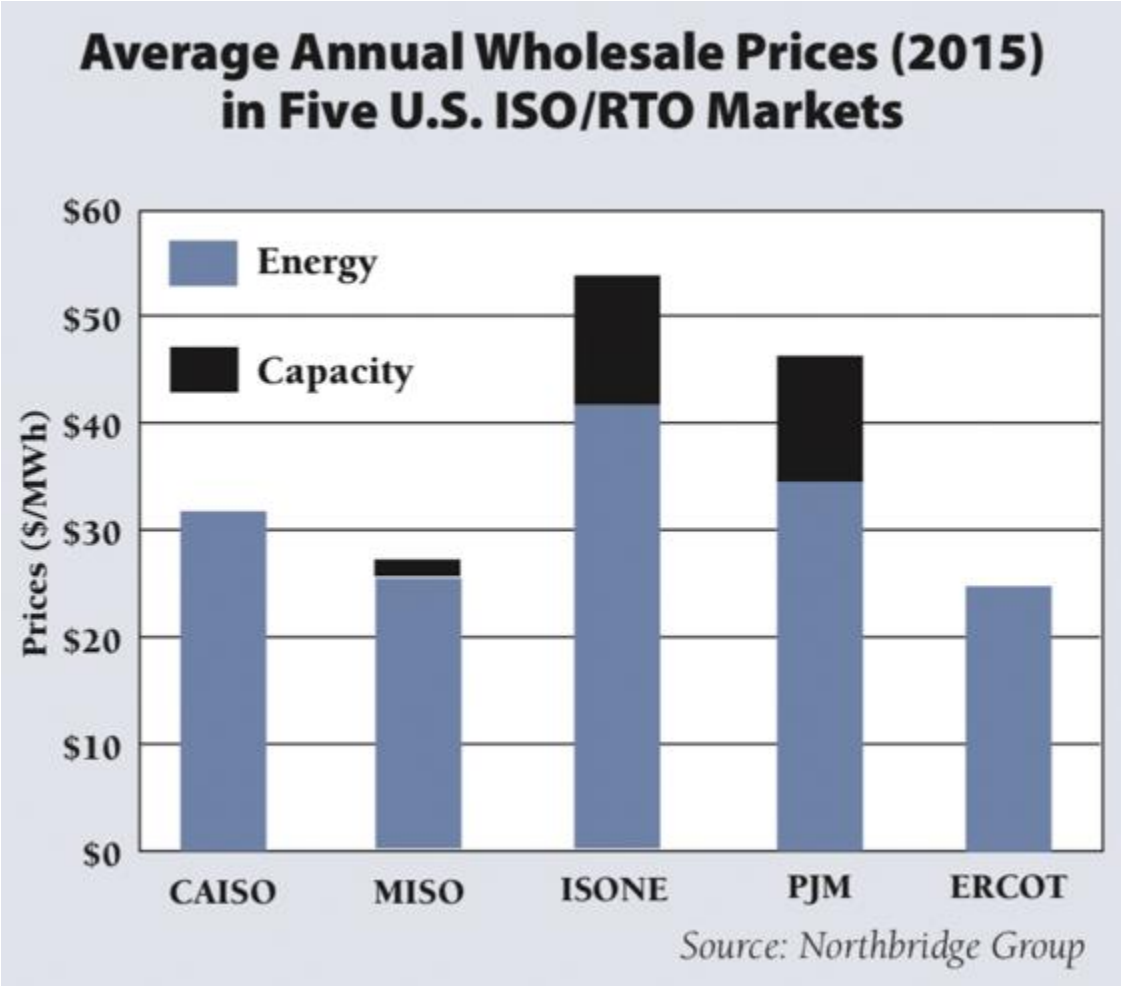
“How much?” depends on “what kind?”



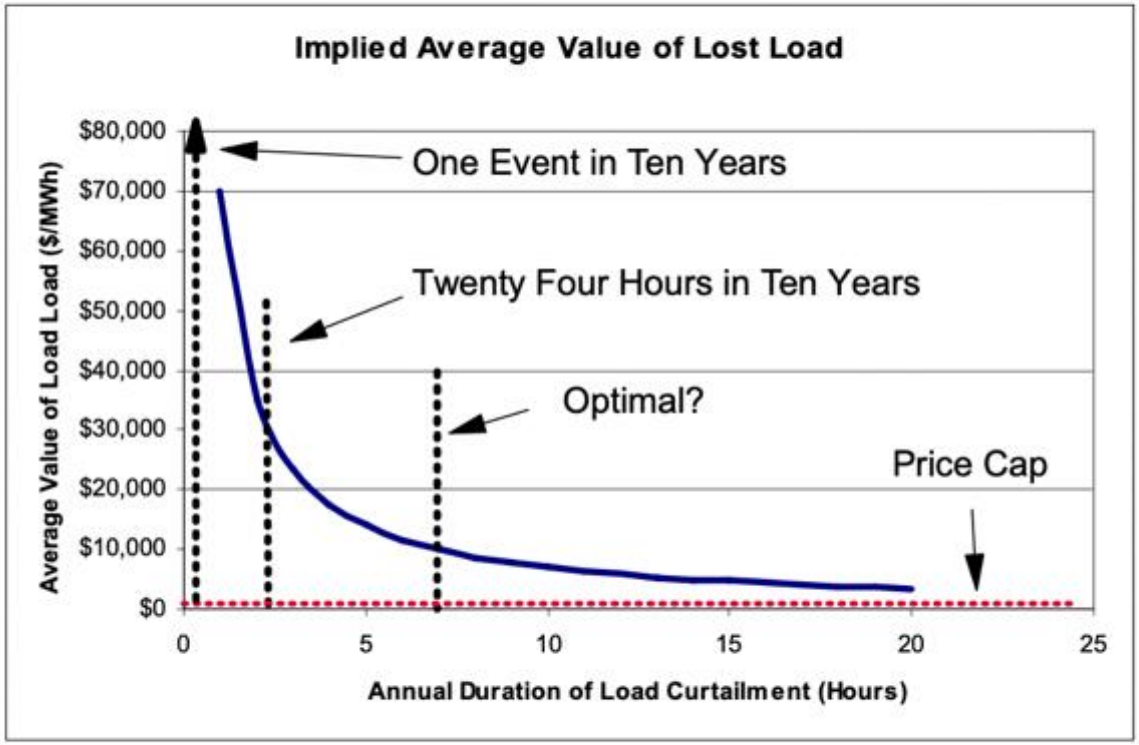


Source: Adapted from *The Power of Transformation* (IEA, 2014)

Limits of operational optimization?



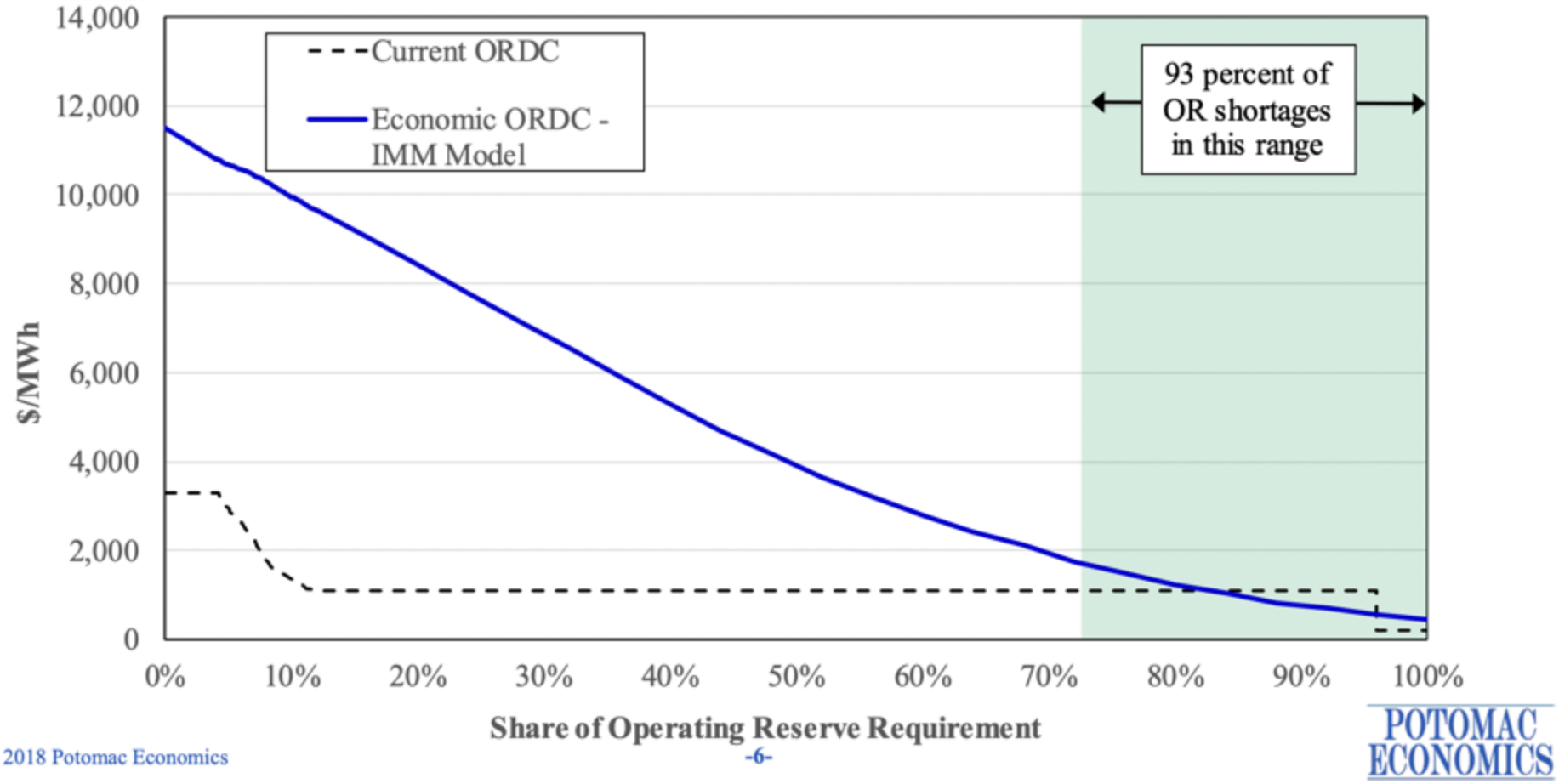
Reliability Standard and Market Disconnect



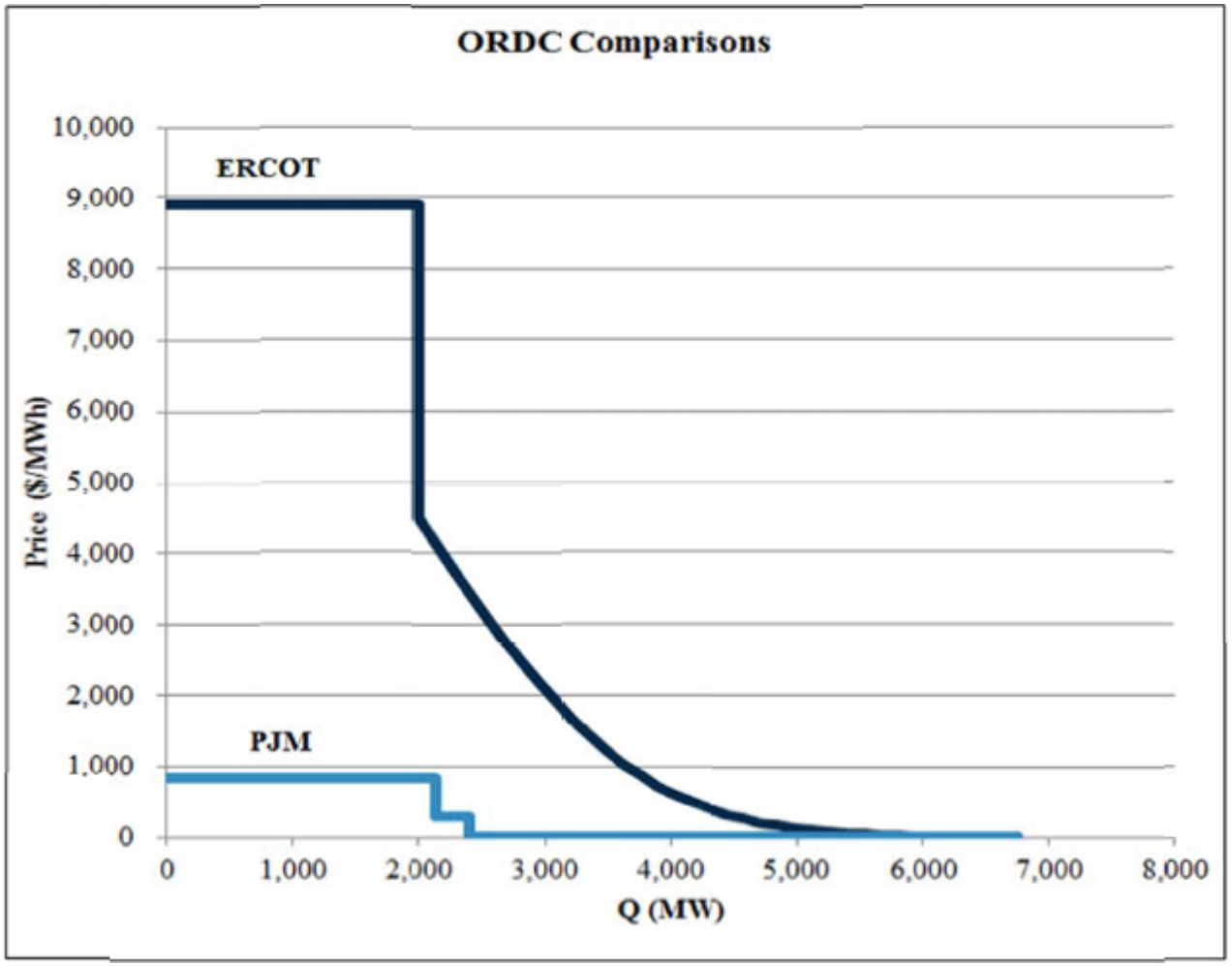
Peaker fixed charge at $65,000/MW-yr.

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

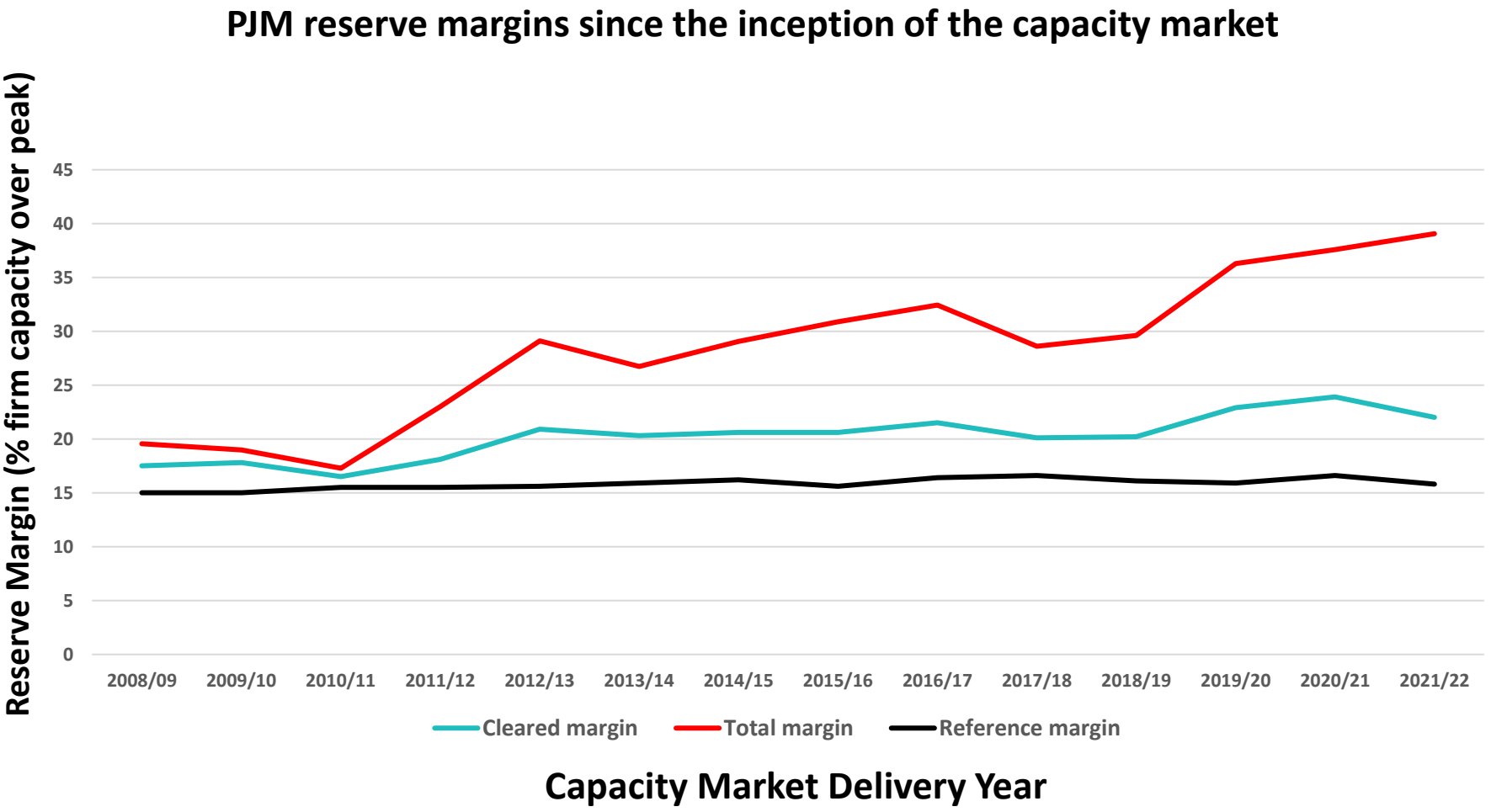
MISO Operating Reserve Demand Curve (scarcity pricing function)



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


ORDC Comparisons
ERCOT
PJM
Price ($/MWh)
Q (MW)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000

Garbage in…*a lot* of garbage out



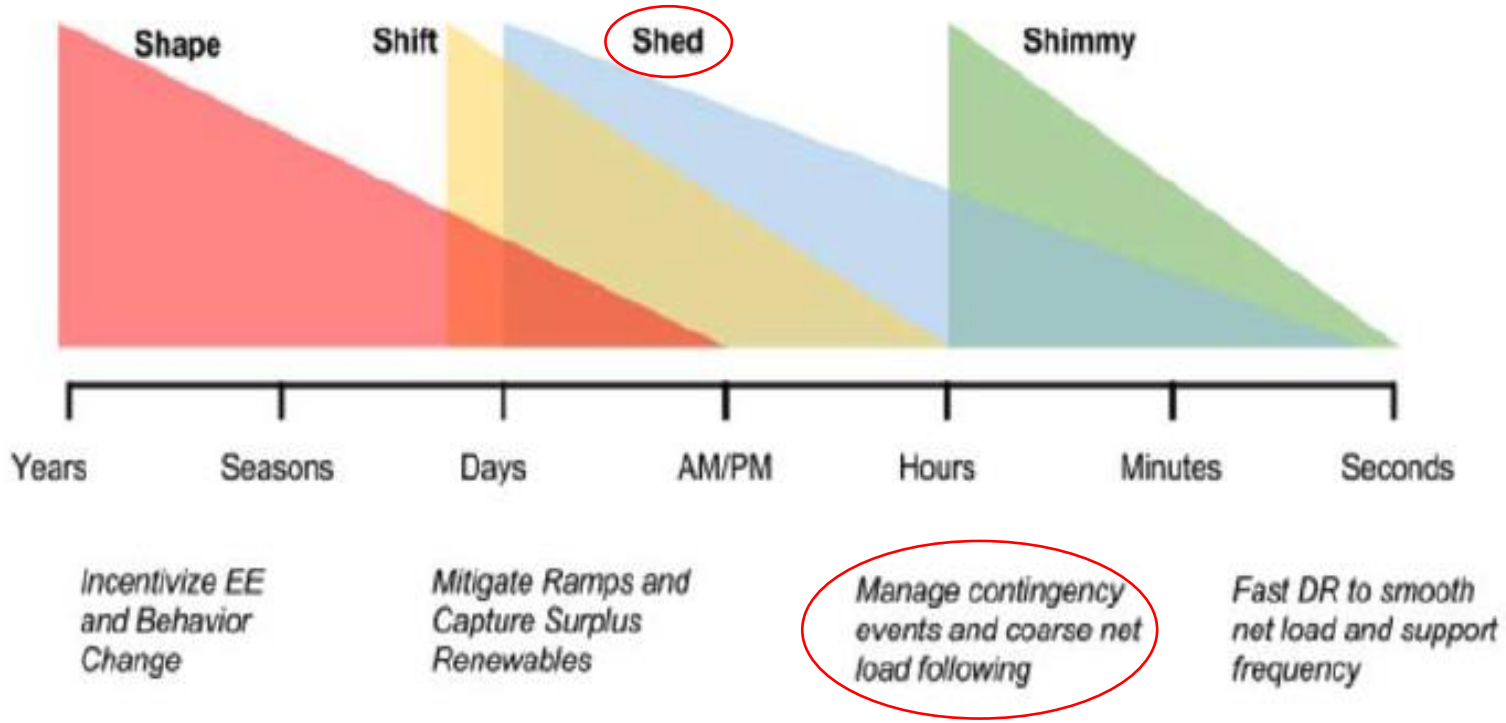
Source: Published data from PJM, NERC

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

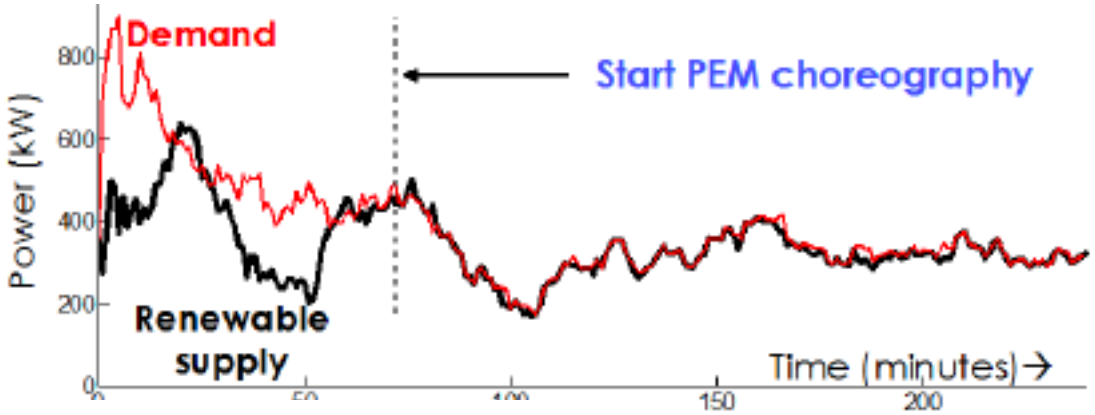
Source: Adapted from Brattle Group

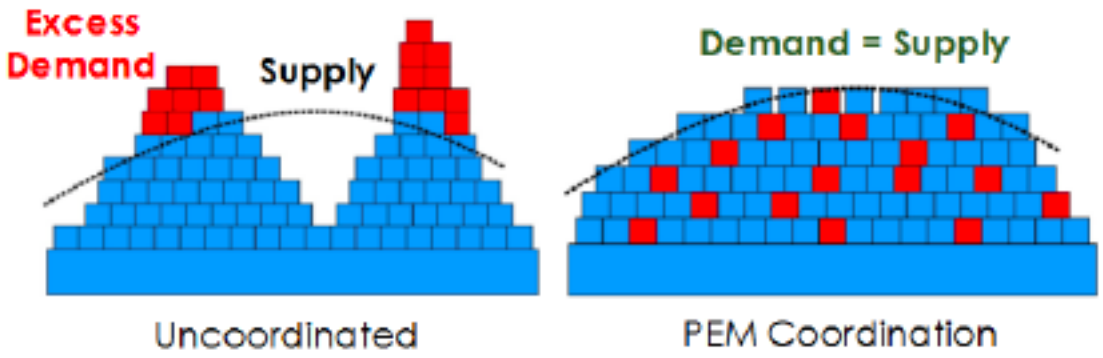
“Capacity” blocks most valuable DR potential



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

Innovation: 3rd party access is essential





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

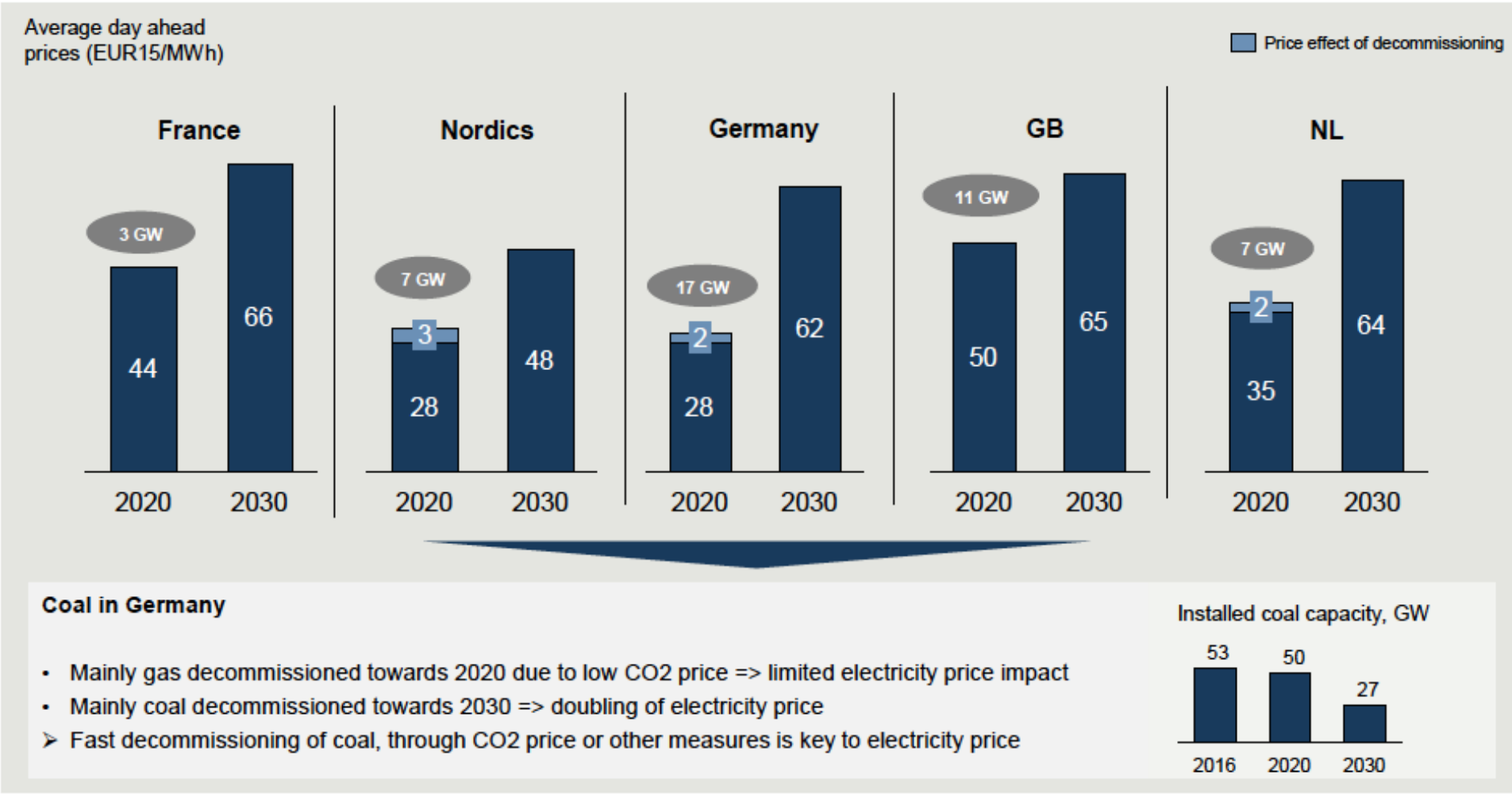
The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

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

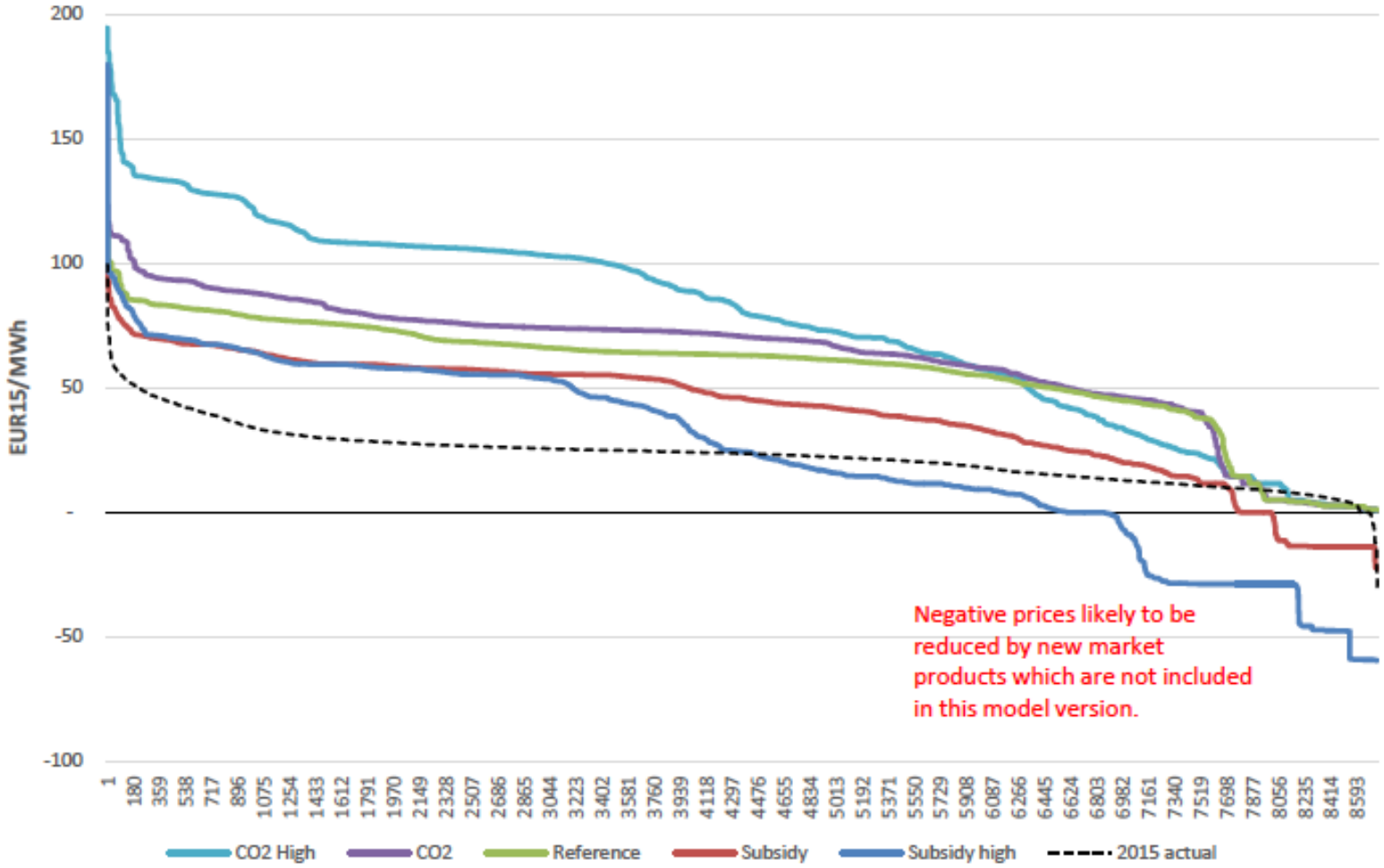
Sunapee, New Hampshire
United States

mhogan@raponline.org
raponline.org

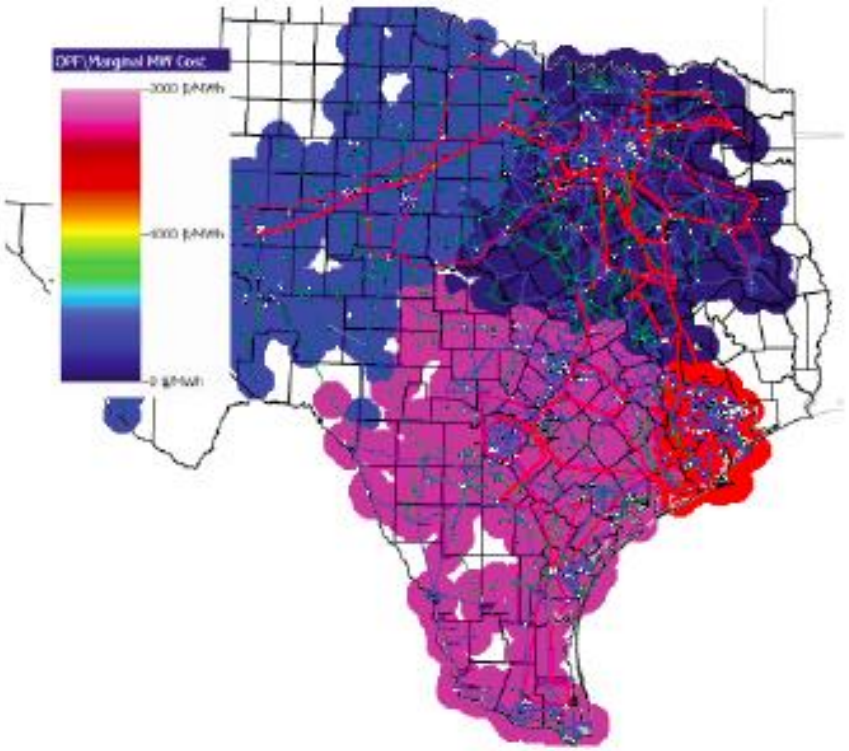


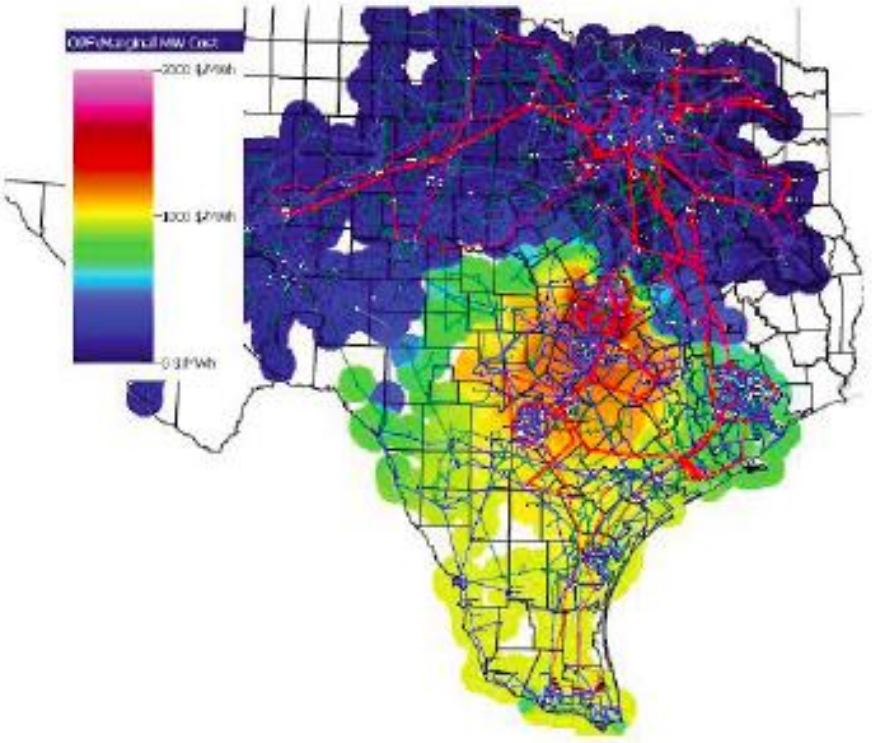
Source: DONG Energy/Orsted

Price duration curves with 70% RES

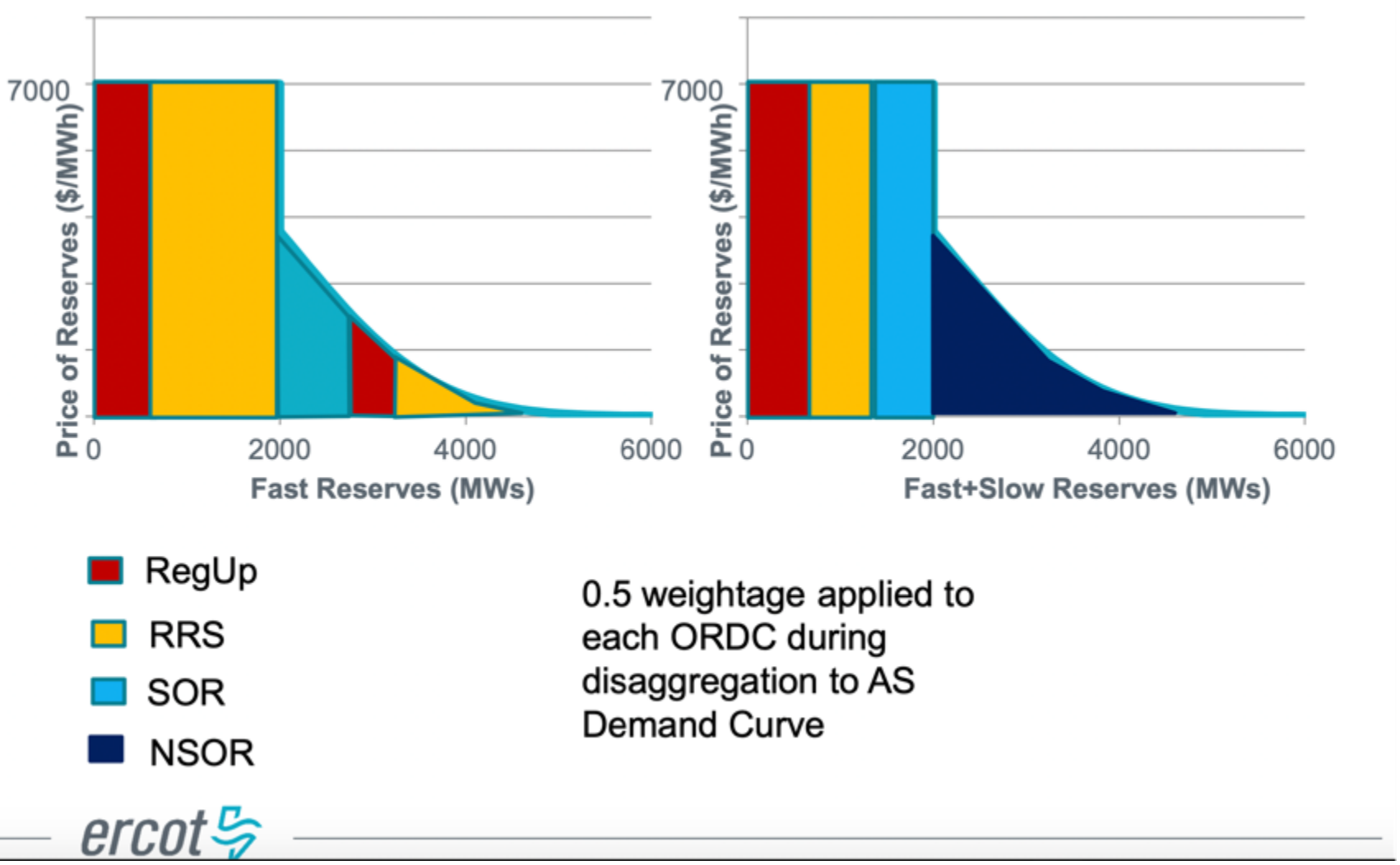


Source: DONG Energy/Orsted



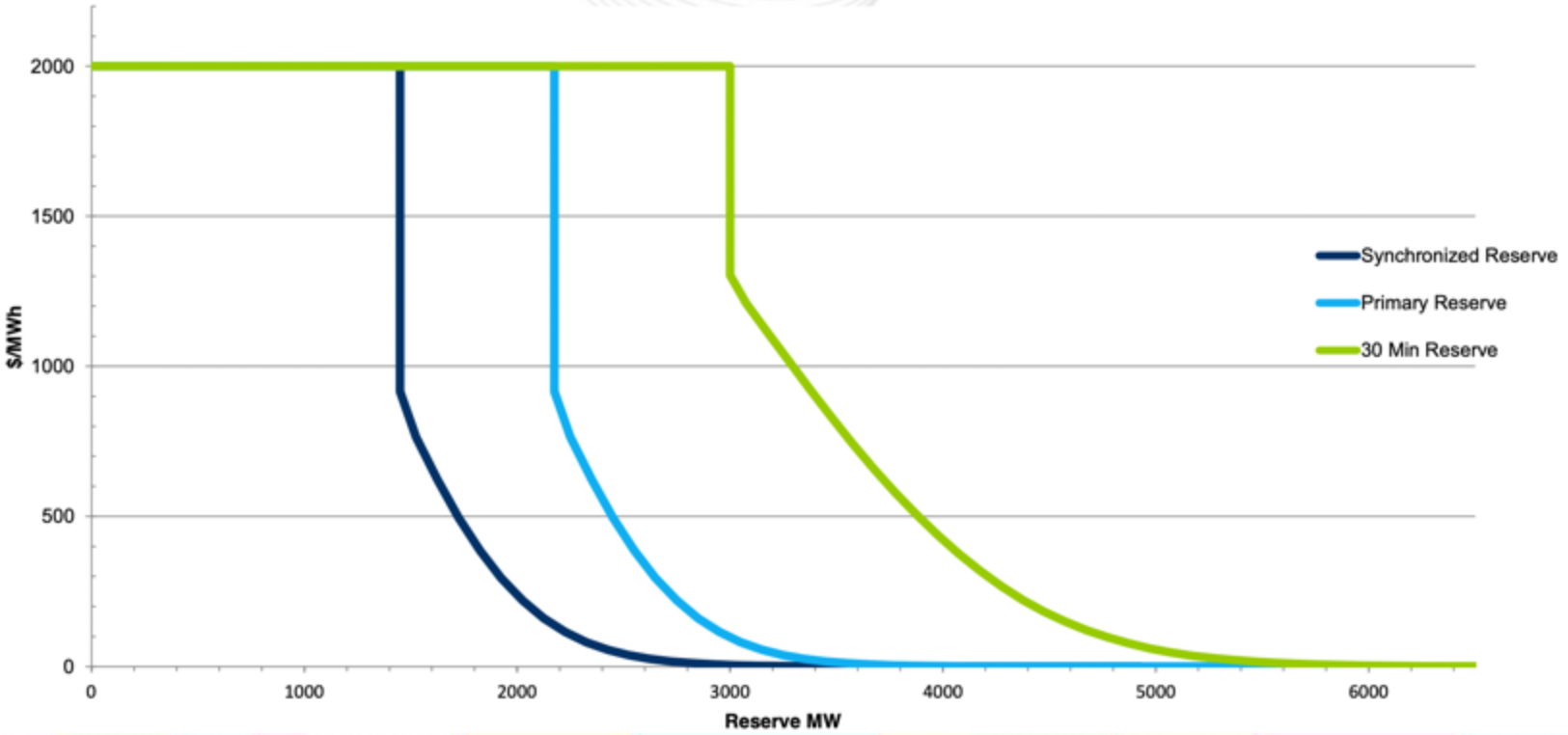


Source: Hogan, W. & Pope, S. for FTI Consulting & ERCOT

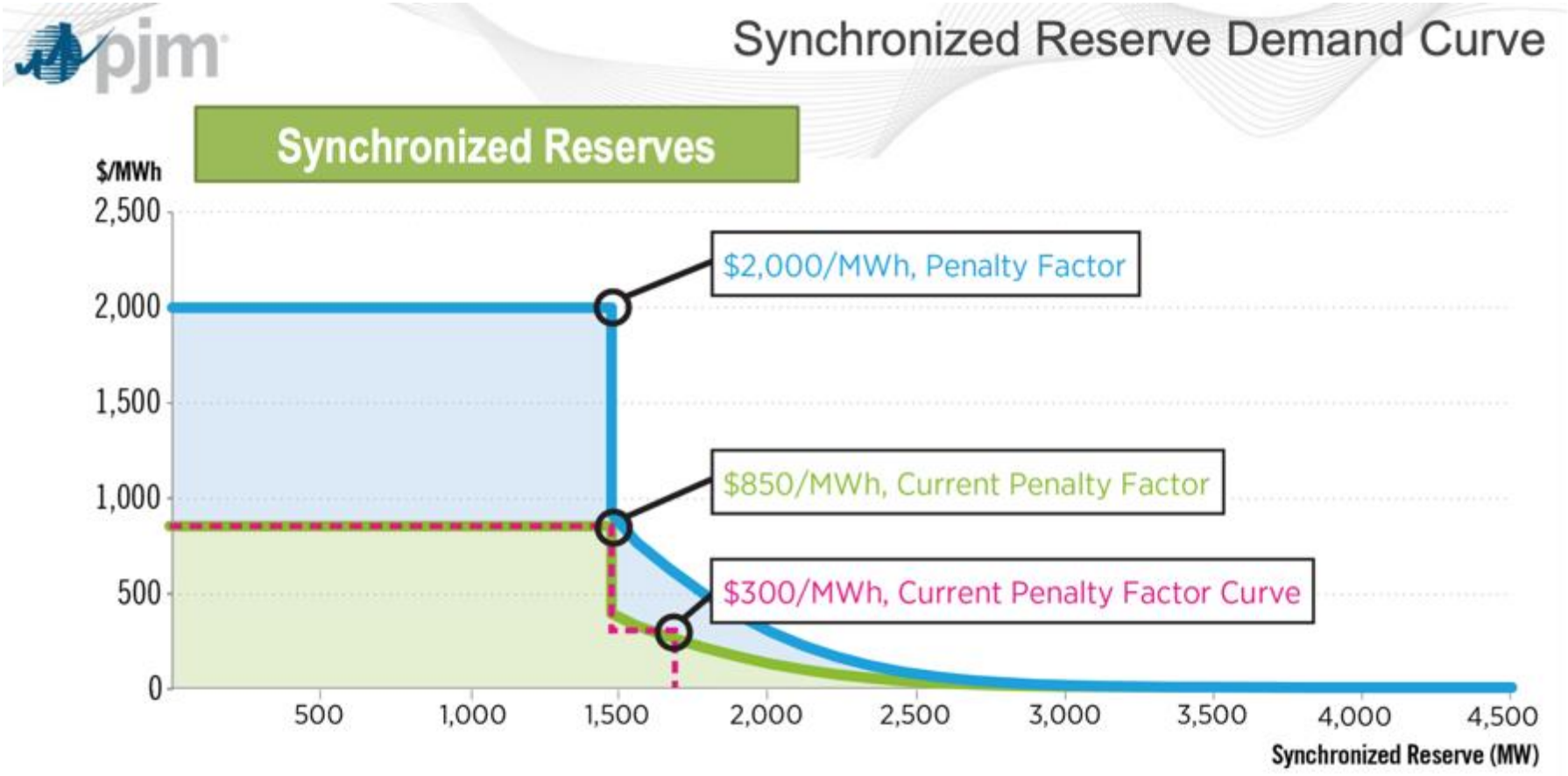


Source: ERCOT, Scarcity pricing using ORDC for reserves

Reserve Product ORDC Comparison



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



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