



**RAP**

Energy solutions  
for a changing world

# Demand Response in Wholesale and Retail Markets:

## Where are we headed?

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**The Regulatory Assistance Project**

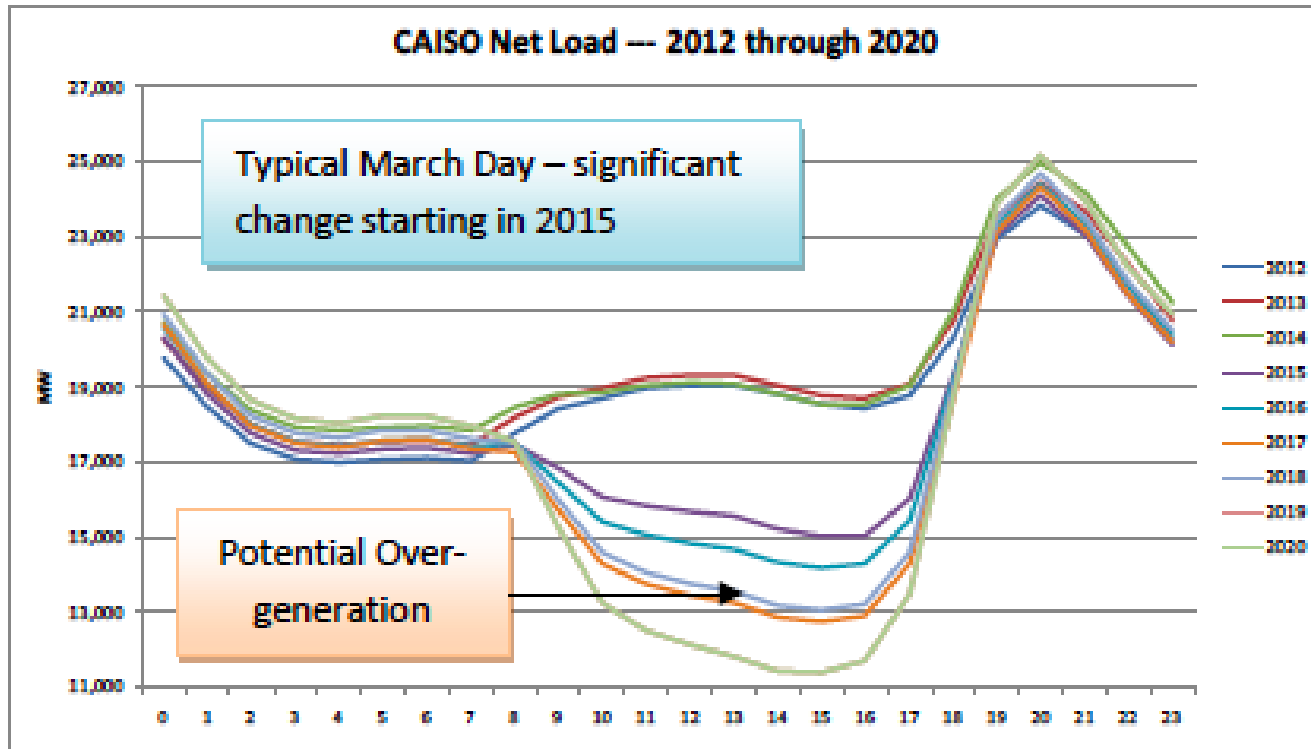
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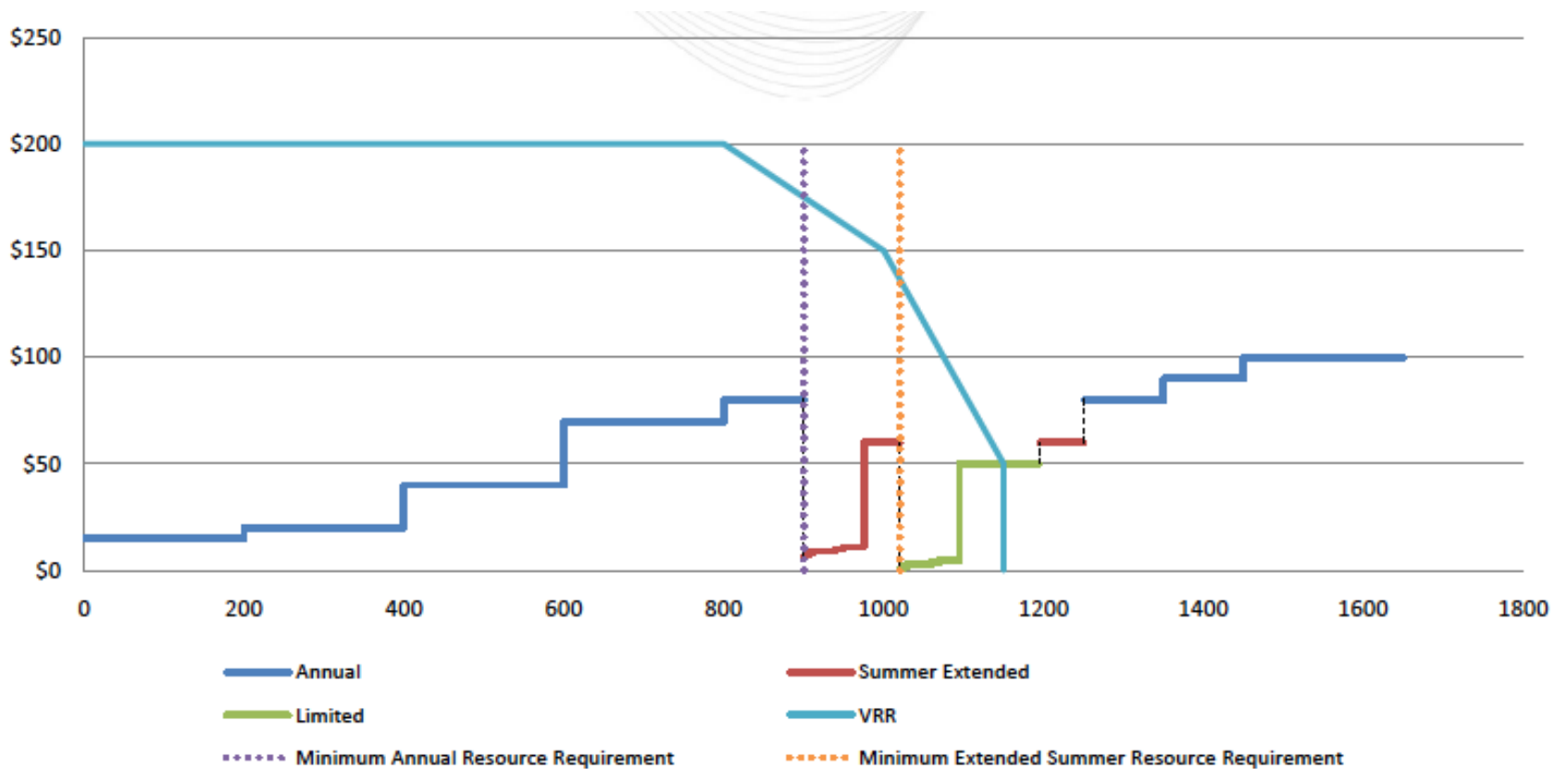
# Markets: where are we headed?

- Wholesale markets: renewables integration
  - DR as flexible resource: capacity markets, services markets, dispatchability, scarcity pricing in energy and services markets
  - DR as daily resource: DR + end-use energy storage + “technology”
  - “Due discrimination”: FERC Order 1000, tiered auctions, capabilities, public policy

# Growth of PV in CAISO

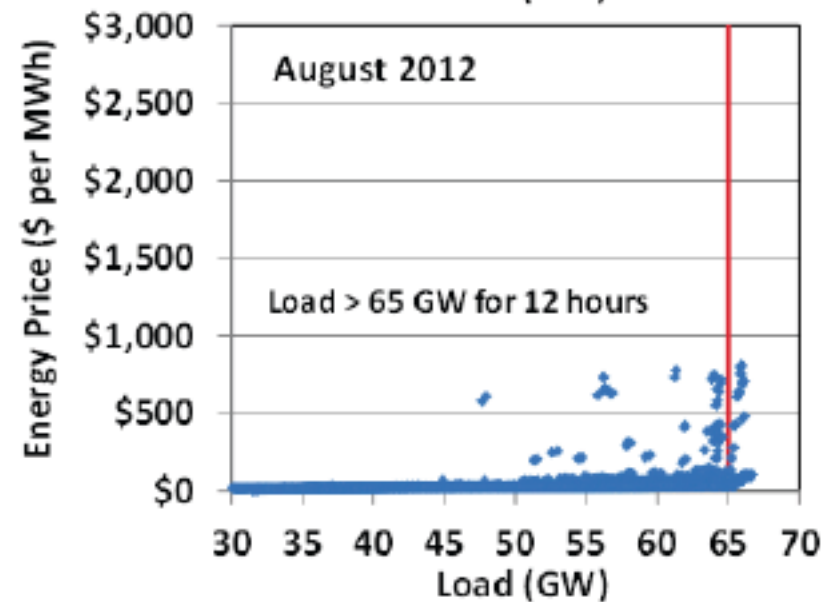
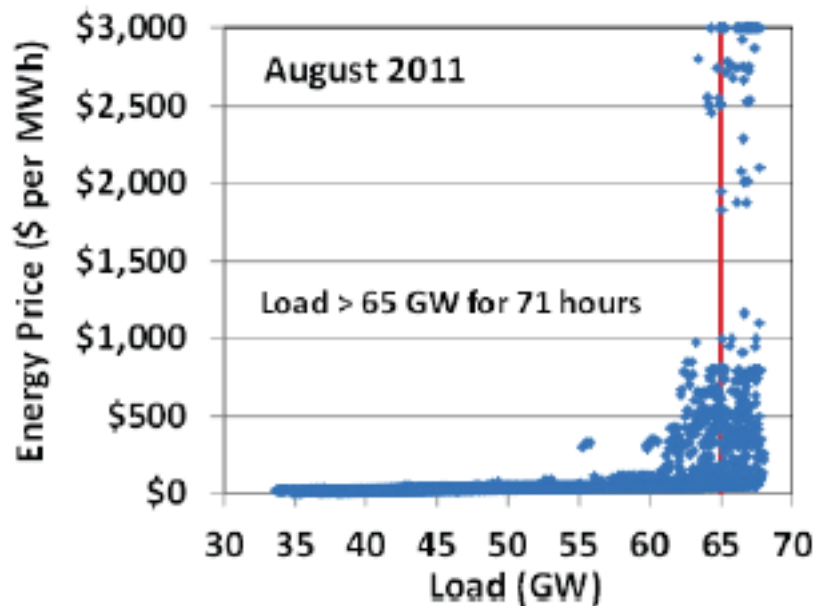


# Increased demand flexibility through 'smart' grid investments is a cost-effective alternative to curtailing low-carbon sources



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

# Impact of improved scarcity pricing (ERCOT)

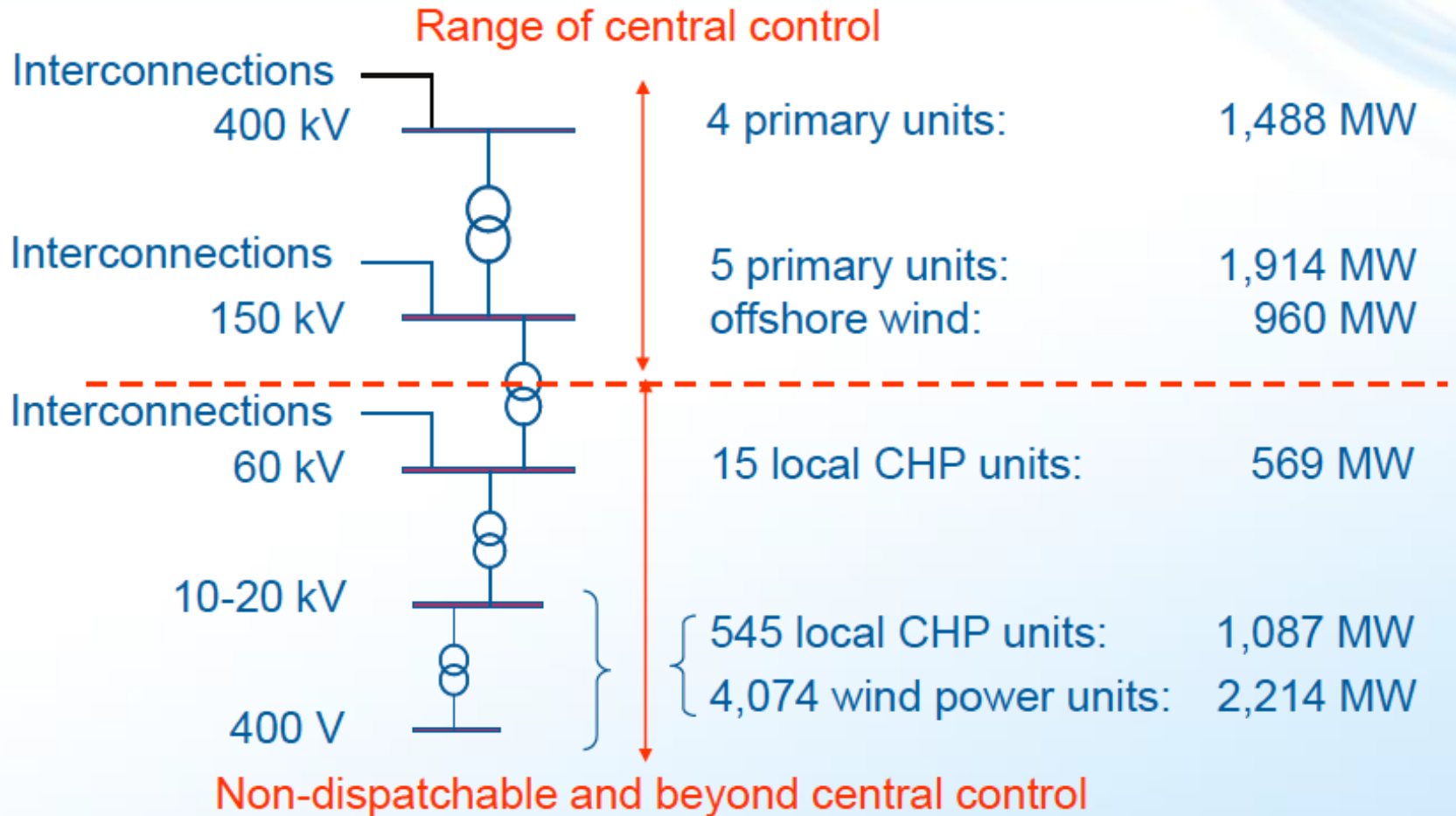


Source: Potomac Economics, "ERCOT 2012 State of the Market Report", June 2013

# Markets: where are we headed?

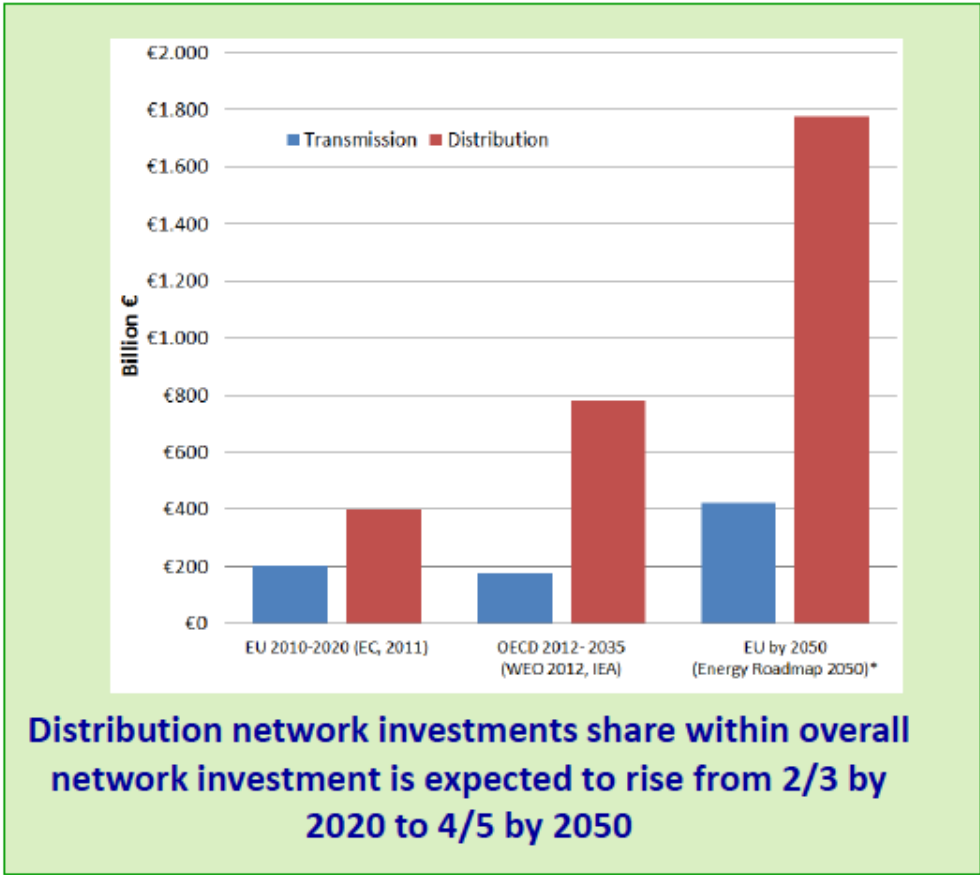
- Retail markets: multiple challenges, multiple opportunities
  - Integration of distributed generation on distribution system
  - Facilitation of “DR + end-use energy storage” as a wholesale system resource: wires charges, distribution system impacts
  - Customer value proposition: dynamic pricing vs. payment for services, automation, equity

# Denmark: a snapshot of the future?



Source: Energinet.dk

# Where the rubber meets the road....

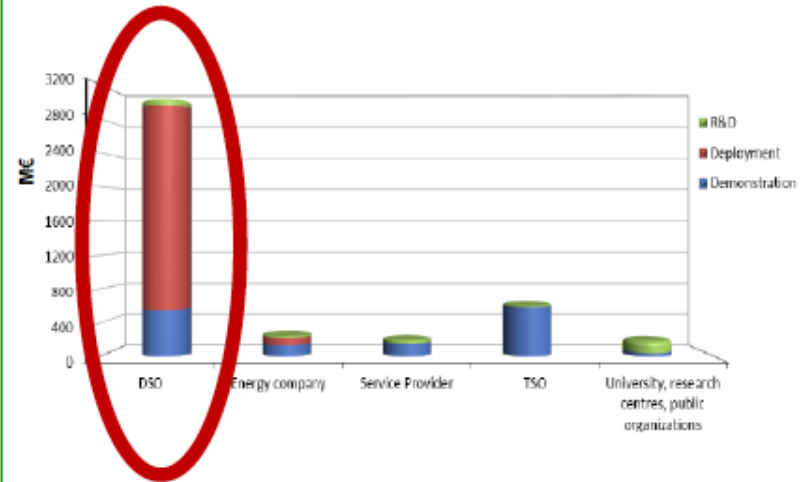


**Distribution network investments share within overall network investment is expected to rise from 2/3 by 2020 to 4/5 by 2050**

*\*upper range values considered*

Source: Gunnar Lorenz, Eurelectric

## Main investors in Smart Grids pilots are DSOs

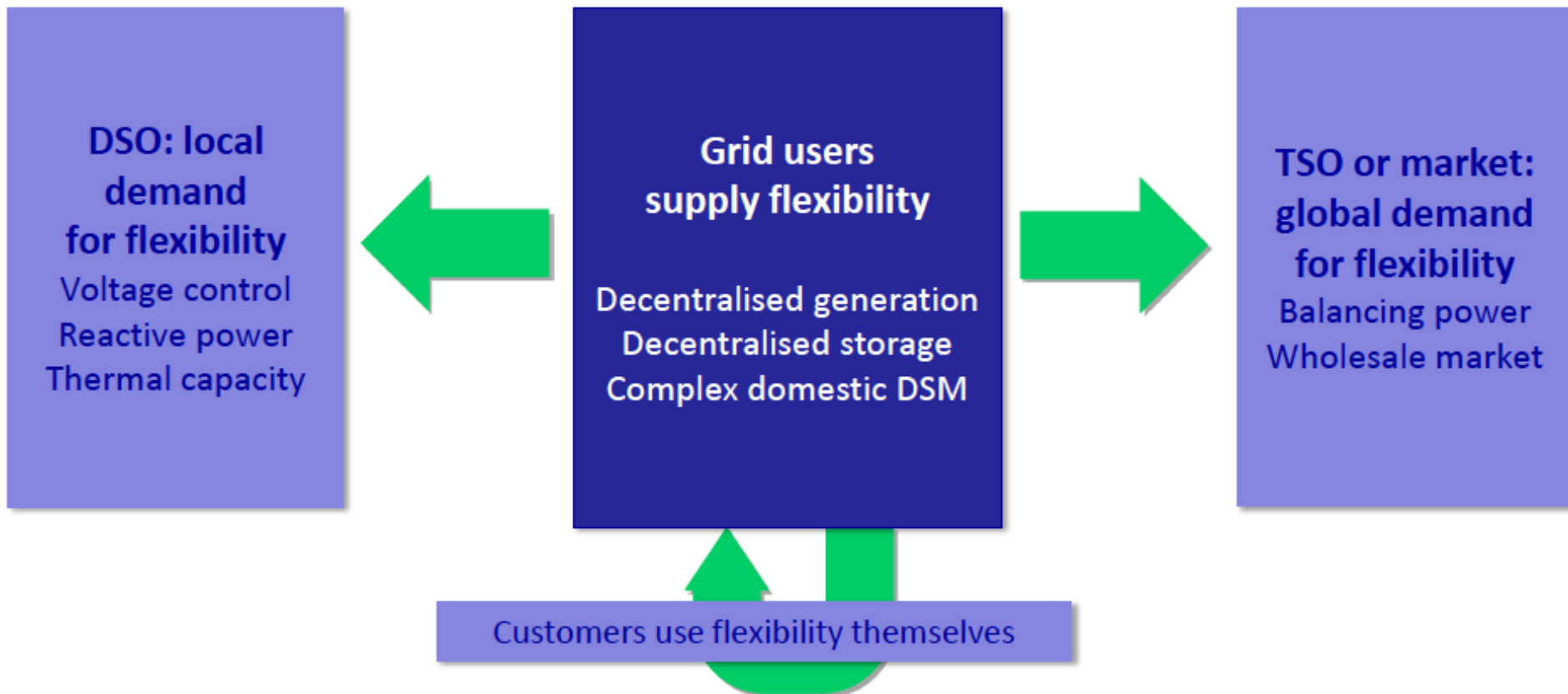




# Markets: where are we headed?

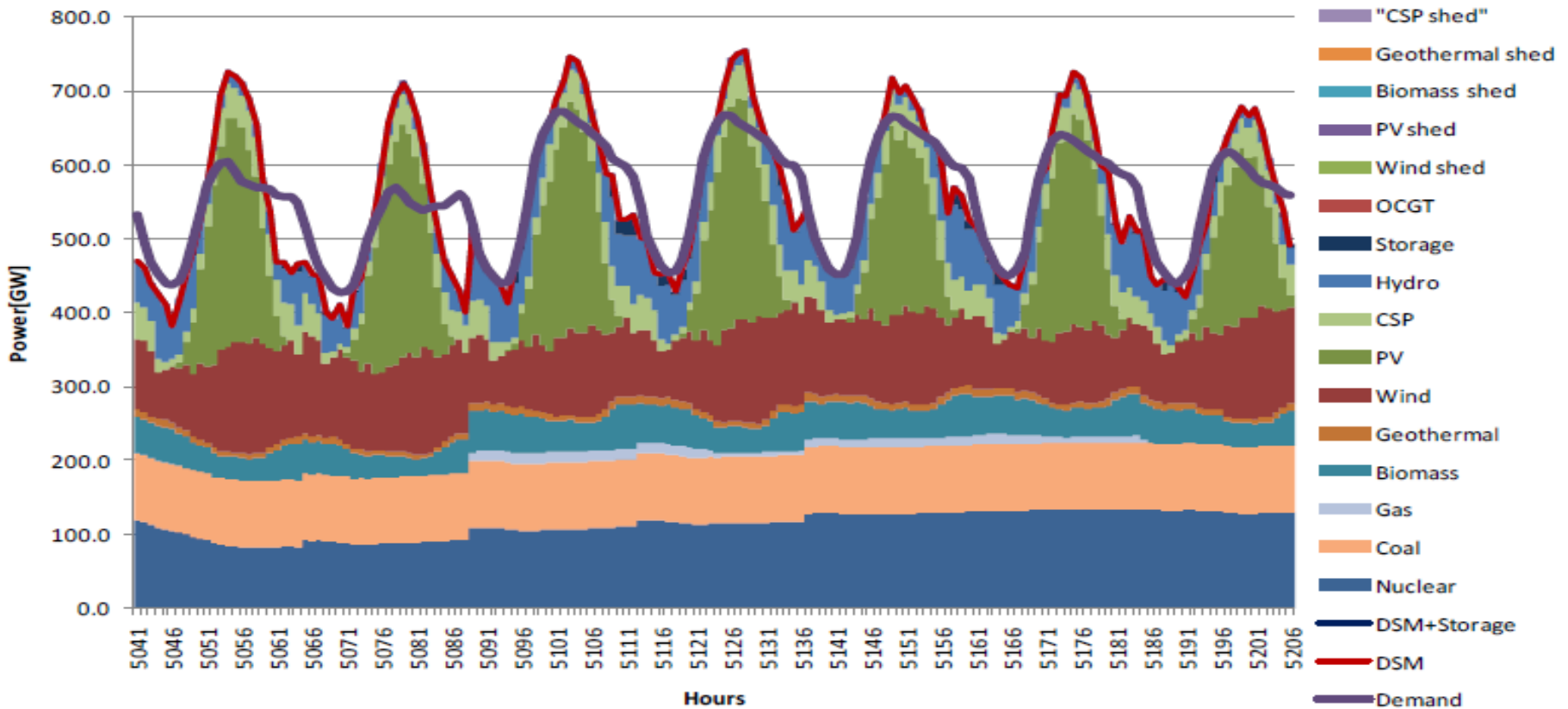
- Wholesale vs. retail markets:
  - Competition between TSOs and DSOs for DR services
  - Who is willing to pay, how much, and in what form? Market access for 3<sup>rd</sup> party providers
  - Cooperation across the largest feasible geographic footprint – argues for giving the lead to TSOs, establishing a protocol with member DSOs

# Coordination will be key to unlocking critical flexibility



Source: Gunnar Lorenz, Eurelectric

# Responsive demand – in *both directions* - is a cost-effective solution to both curtailment and excessive price volatility



End-use energy storage is feasible, low-cost and widely available

## 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

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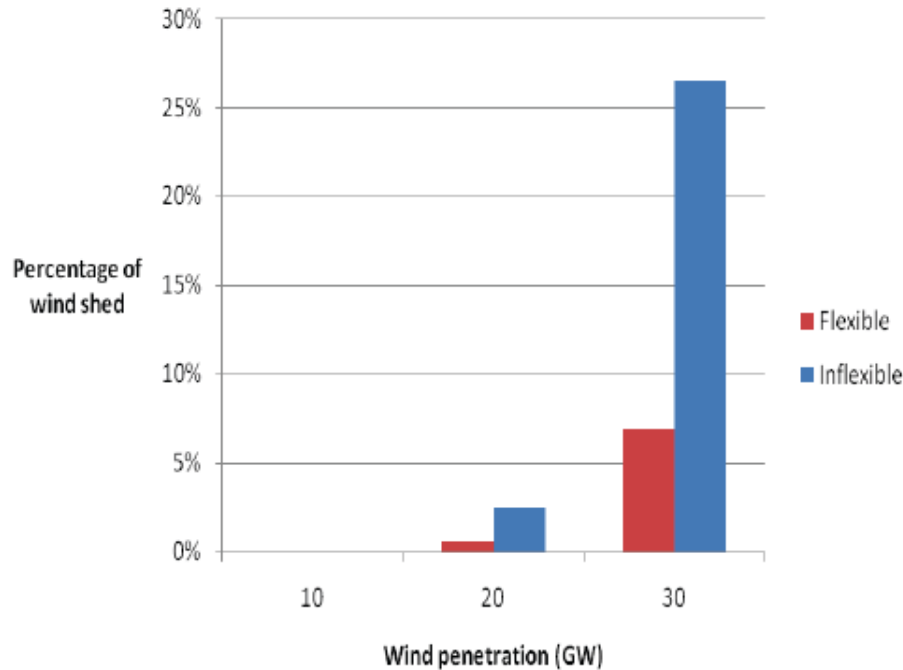
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# The forward value of flexible resources



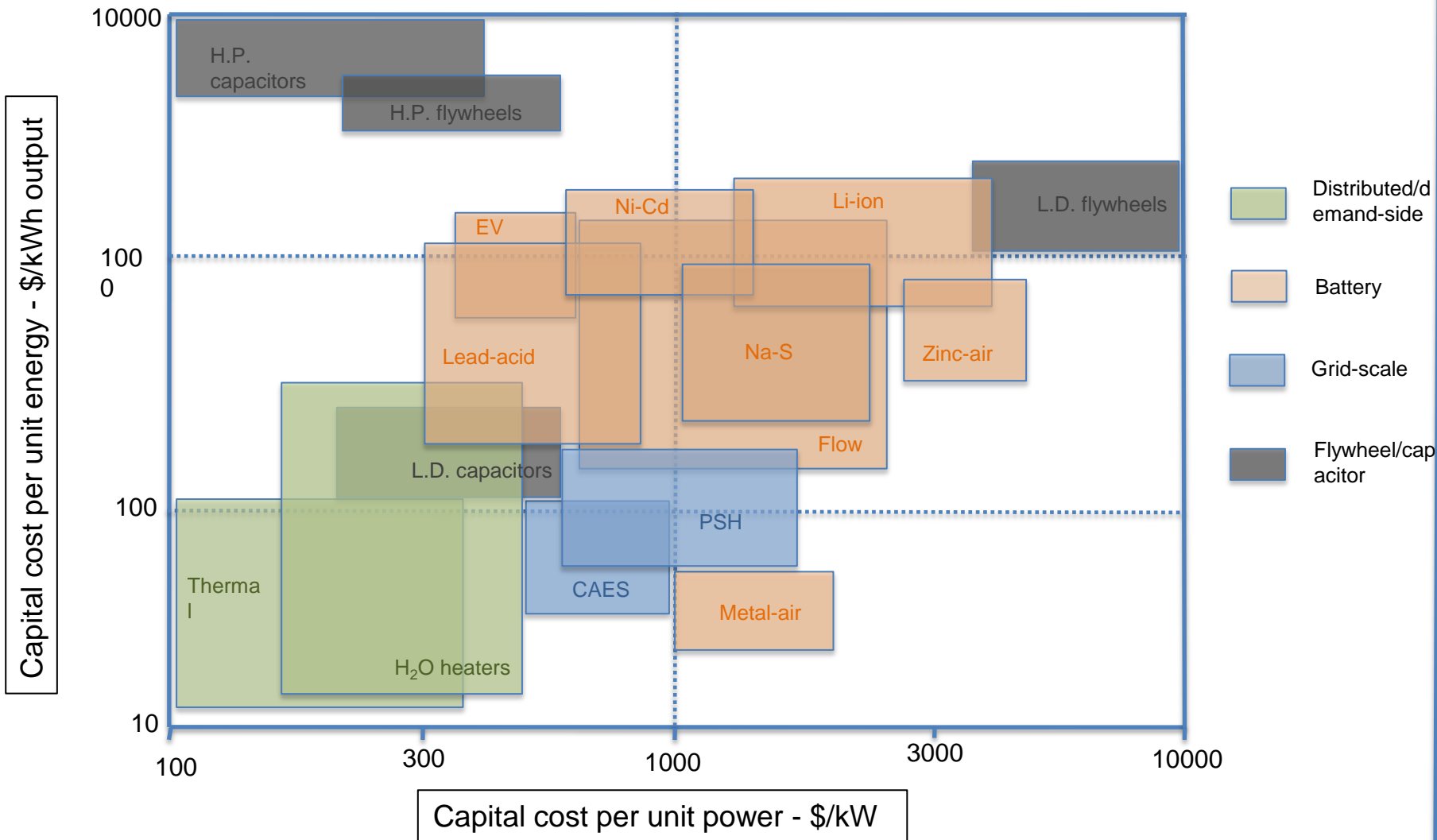
*Number of hours with zero or negative prices*

High Generation Flexibility	Low Generation Flexibility
200	>1500

*leading to increased base-load & peak generation investment risks...  
...while providing significant opportunities for **demand response, storage, flexible generation, .....***

Source: Energy Futures Laboratory, Imperial College London

# Cost per Unit of Performance for Various Energy Storage Options



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