Achieving reliability and system flexibility at least-cost in a decarbonised power system

ERRA webinar: Modelling Electricity Generation & Transmission Systems’ Adequacy
1 Clean Energy for All Europeans legislative framework
CE4All Package & Resource Adequacy

- Monitoring security of supply: EU-wide assessment + optional national assessment
- Identify and remove obstacles and prioritise energy market reforms
- In case of residual risks:
  - Can a strategic reserve resolve the issue?
  - Market-wide capacity mechanism as last-resort solution
CRMs – current status

What market reforms?
Multiple complementary levers

- Grids
- ICs
- Generators
- Market geography
- Market operations
- Energy & services markets
- Demand response
- Storage
Appropriate pricing of energy services

![Graph showing energy and demand curves](image)

- Average VoLL
- Marginal cost supply curve
- Energy plus reserves demand (2)

\[ P_3 = 800 \]

Price (€/MWh) vs Quantity (MW)
Administrative shortage pricing to ensure demand for reliability is priced...

...creating volume & price risks that drive bilateral contracting (e.g., ~95% of energy consumed in ERCOT is under bilateral contracts)

New role for responsive demand

will now need to shape, not just shave, demand

Moving from a world where we forecast load and schedule generation, to a world where we forecast generation and schedule load
Tariffs that reward flexibility
Price-responsive DR in ERCOT

System-Level Total DR Tradedate - 13AUG2019
near_cp_day/high_price_day

HE-17 DR Reduce: 3,385 MW
Max Int DR Reduce: 3,463 MW
ESIIDs Reduce: 294,107
NOIEs Reduce: 32
What about CRMs?
A note of caution
What’s wrong with CRMs?

• They’re the tail that soon wags the dog
• Lead to structural over-procurement
• Lock-in of energy price suppression, undercutting smart demand and DERs
• Not well suited to differentiating value of capacity based on operational attributes
• By design they constrain participation and in so doing raise costs
The cumulative cost of the first three auctions is around €7.9 bln

Source: Forum Energii, Capacity market for review | Analysis of the results of three auctions
Polish CRM - Resources

Figure 4: Contracted capacity by fuel type

Source: Forum Energii, Capacity market for review | Analysis of the results of three auctions
Creeping over-procurement - PJM

PJM Reserve Margin Expansion since adoption of capacity market

Source: PJM data, compiled by J. Chen, Nicholas Institute for Environmental Policy Solutions, Duke University.
Creeping over-procurement - GB

Loss of load expectation (LoLE)

Note - LoLE for years 2017/18 onwards too small to register on chart

Source: RAP graph based on National Grid data
Conclusions

• Well functioning energy and ancillary services markets is the best way to achieve reliability at least cost
• Key: prices reveal true value of energy
• Consider all available levers
• Experience with CRMs: over-procurement, carbon lock-in and excessive costs for consumers
Resources

- Market reform options for a reliable, cost-efficient and decarbonised Italian power system
- Hitting the Mark on Missing Money: How to Ensure Reliability at Least Cost to Consumers
- Regional resource adequacy assessments: The key to ensuring security of supply at a reasonable cost
- ENTSO-E public consultation on ERRAA: Response to questions
- Capacity market review in Great Britain: Response to the call for evidence
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
Demand response is cheap

Cost-benefit ratios of different flexibility options

Note: DSI = demand-side integration; IC = interconnection.

In ERCOT the summer peak is the most important period. The first five years of results show recent scarcity of reserves and higher reserve prices.

Source: Resmi Surendran, ERCOT, EUCI Presentation, Updated 8/31/2019. The ORDC is illustrative. See also (Hogan & Pope, 2017)

Source: W. Hogan, Electricity market design and green energy, March 13, 2020