Beyond Capacity Markets

Ensuring Reliability in Competitive Wholesale Power Markets Under the New Resource Paradigm

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An old debate heats up again

From the UK (Electricity Market Reform) to Germany (Energiewende) to Texas (???), it’s a hot topic: “Das Stichwort…heißt Kapazitätsmarkte” (“The key word...is capacity markets”)

Chancellor Angela Merkel, 23 May 2012

How do we design markets to ensure reliability:
- without undermining competitive markets?
- without locking in all the “wrong” resources?
- without prohibitively high RES integration costs?
- Reliability has always had two dimensions:
  - *Resource adequacy* – are there enough *firm resources* to meet system peak demand?
  - *System security* – are the *right resources* deployed to balance supply and demand at least cost?
- These always functioned at different timescales – resource adequacy at investment timescales, system security at operational timescales
- Capacity markets were investment incentives designed for that world, i.e., a world where investment problems = resource adequacy problems
A traditional view of the resource challenge
That world is disappearing, faster in some places than in others, and in some places it’s already gone.

Variable, low-marginal-cost renewable production now represents a significant share of production in markets like ERCOT.

This has transformative implications for least-cost reliability planning.

The essence of the shift is revealed through forecasts of net demand: gross demand minus demand effectively served by low-marginal-cost, uncontrollable supply.
Net demand presents a fundamentally different picture
Where you stand depends on where you sit
Capacity markets: the “fax machine” of the power industry

- *Capacity* markets worked for awhile; now, as renewables have grown, it’s become apparent that protecting the *quantity* of firm resources is no longer enough
- Even in 2005 PJM tried (unsuccessfully) to address the need for resource *capabilities*, not just *capacity*
- Now ISO-NE is facing reliability issues *despite* surplus capacity and is proposing to do just that
- The rise of low-marginal-cost variable resources poses a different investment challenge:
  - The right quantity of capacity is now a contingent metric - *how much* depends on *what kind*
Fixing one problem...making the other one worse

- Capacity markets actually work at cross purposes with the need to increase system flexibility
  - Long-term value of capacity is highlighted, implicitly devaluing other resource attributes
  - Capacity is a more visible, tangible commodity
  - They favor least cost (i.e., least flexible) firm capacity

- Energy-only markets may also militate against resource flexibility by systemically undervaluing it

- If we don’t expand flexibility consumers will pay the price – in higher operating costs, unnecessary investment in back-up generation, and ultimately reduced reliability
What lies “beyond capacity markets”?

- Two basic forms of market-based long-term investment incentives are appropriate to the new supply paradigm:
  - Apportioned forward capacity mechanism
  - Enhanced forward services mechanisms
- Based on net demand forecasts and analysis of the incremental value of critical services
- By shifting investment to flexibility and assessing demand for and paying for flexibility on a system basis these designs expedite the integration of variable renewables into the balancing market
Enhanced forward services markets

- Long-term auctions for selected non-energy services; a representative example:
  - 10-minute spinning reserves
  - 10-minute non-spinning reserves
  - 30 minute operating reserves
  - non-reserve ramping capability
  - frequent short-cycling capability
- Energy storage service can be incorporated
- Demand-side competes wherever qualified
- Suited to regions preferring to allow energy-only markets to work with minimal intervention
Apportioned forward capacity markets

- Subdivide capacity market into tranches based on resource capabilities (supply- and demand-side)
- Sequence procurement – most flexible (short-cycling) resources first (incl. storage), flexible (ramping) resources next, inflexible resources last
- Incentives to invest in traditional balancing services (e.g., operating reserves) can be part of capacity mechanism or auctioned separately
- Pays all firm resources for market value of firm capacity...*but pays more for resources that possess other reliability attributes, less for those that don’t*
Apportioned forward capacity markets
Apportioned forward capacity markets

[Diagram of Multiple Clearing Price Auction (c)]

- Bids
- Price
- Gigawatts
- Q1, Q2, Q3

Energy solutions for a changing world
Market design alternatives

Decision Framework

Variable renewables market share?
- Low
  - Deterministic methodology with recent experience
    - Rate of growth?
      - High
        - Plan for more complex methodology
      - Low
        - Monitor trends in variable renewable production
    - Capacity mechanism?
      - Yes
        - Apportioned forward capacity mechanism*
      - No
        - Simple capacity mechanism + enhanced services markets
  - High
    - Probabilistic methodology with production model
      - Capacity mechanism?
        - Yes
          - Apportioned forward capacity mechanism*
        - No
          - Enhanced services market mechanisms

*Traditional ancillary services can be addressed via long-term ancillary services auctions rather than via the capacity mechanism.
About RAP

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- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

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