Resource Adequacy and US Capacity Markets

Matching policies to goals

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UC Davis and NBER

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- Line between energy and capacity was always blurry.
- This boundary is now completely fuzzy — one of the most contested boundaries in electricity policy these days.

Two paradigms, and one thing they have in common

- Energy-only — resources earn for services actually delivered. Higher price caps, scarcity pricing, sometimes mandatory contracting. *Texas, Australia, Germany, New Zealand.*
- Capacity markets — pay separately for the *potential* to supply, on top of energy. *Eastern US.*
- The key design question is whether you pay for the commodity, or also for the option on the commodity — and, if the latter, who buys it and how standardised it is.

The thing they have in common: in *both* systems, the great majority of actual investment is underwritten by long-term contracts, vertical integration, or regulated cost recovery. The formal adequacy mechanism is the smaller part of the answer.

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6. There *would* be a framework for compensating units subject to local market-power mitigation.

How a resource adequacy obligation works, generically

- Forecast the need. A system peak — annual, seasonal, monthly — projected a month, a year, or several years ahead.
- Require someone to procure against it. Each retailer, or the system operator on their behalf, must hold certified firm capacity covering its share of that peak, plus a reserve margin.
  - Which means somebody must first rule on what counts, and for how much.
- Hope it turns up. Or pay it to turn up. The obligation is written over resources that *could* supply; whether they do is a separate question.
  - Is the product "on demand," or merely "expected"?

The planning paradigm under strain

Points of disillusion from the US experience

- One-year streams of hedging or capacity payments do not finance investments.
  - Even if they are locked in three years in advance.
  - Vertical integration and/or hedging is still necessary, RA contracts can crowd out other hedging.

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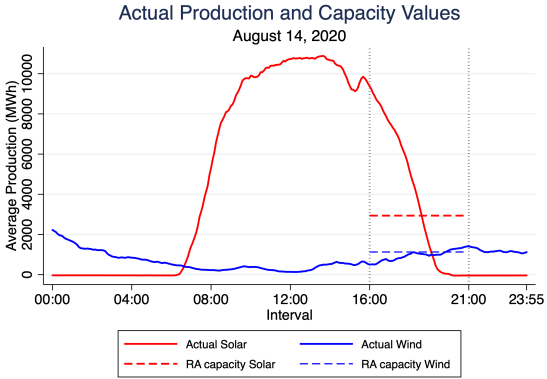
- There is as much market power in capacity obligations as in energy markets, arguably more.
- Firm capacity correlates only loosely with delivered reliability.
- More volatile energy prices have become necessary to operate a system dominated by renewables, storage, and demand response.

The counting problem, and what it attracts

- Before anyone can discharge an obligation, somebody must *rate* what counts: how many "firm" MW is a wind farm, a solar farm, a four-hour battery, a demand-response programme, a gas plant that breaks down?
- The standard answers — capacity factors, ELCC — look at historical output over a chosen window.
- Complex, opaque, consequential, and therefore extremely vulnerable to lobbying. The rating formula becomes the policy.
- The only reliable way to measure the reliability contribution of a resource is to measure its output in the moment.
  - This is exactly what spot energy prices are designed to do.

What strain looks like: California



The day of the rotating outages. What wind and solar were rated at through the 16:00–21:00 net peak, against what they delivered.

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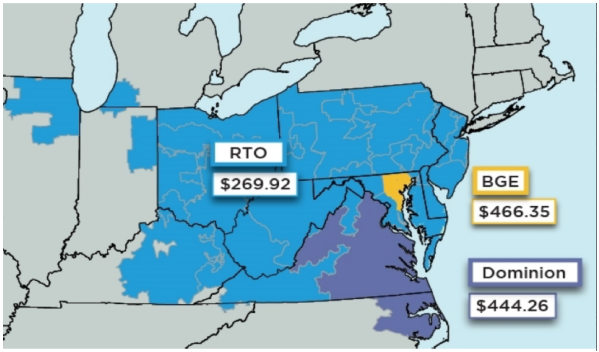
What strain looks like: PJM

- Capacity prices clear at roughly ten times their 2022 level.
- Constrained zones clear far above the rest of the pool.
- The capacity market is facing its first test of whether its version of scarcity prices can spur investment.



And then the politics arrives

States threaten to leave PJM without expanded role in grid operator

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The bridge: pay for performance, not for existence

- Two ways to strengthen the link between reliability and revenue:
  - raise energy price caps — more revenue from delivering; or
  - impose strong ex-post penalties on capacity that fails to show up. ISO-NE charges upwards of $5,000/MWh for non-performance during scarcity.
- Mechanically these are nearly the same thing — the penalty is a high energy price applied only to supply. Politically they are very different, which is the point.
- And it dissolves the counting problem: you no longer need a formula for what a battery is "worth" if you pay it for what it actually delivered.

What stronger performance incentives buy you

- An incentive to avoid forced outages *when it matters*, and to secure fuel before it matters.
- An incentive for storage to walk into a tight evening with a full charge.
- A counterweight to lobbying over crediting formulas — performance is measured, not negotiated.
- Flexible and resilient resources earn more, without anyone having to define "flexible" in a rulebook.

Summary

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- Higher and more volatile hourly energy prices are likely to be both more common and more efficient.
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  - Higher spot prices are necessary for efficient operations — it is not just about investment any more.
  - Will still, increasingly, depend on healthy long-term contracting between suppliers and retailers.
- Important benefits to basing more revenue on ex-post performance, via either energy or capacity performance revenue.
  - Stronger incentives for availability in critical periods that are increasingly hard to predict in advance.
  - Relaxes the need for precise ratings of each capacity type, by rewarding realised reliability contributions instead.

“Reliability” is at least three different problems

Type	Area affected	Frequency	Duration
Distribution fault / storm	Local	1–2 per year	Hours
Cascading transmission failure	States, countries	Once in 10–20 years	Days
Generation supply shortfall	Parts of cities	1 in 10 years (goal)	1–4 peak hours

- Outage *statistics* are overwhelmingly the first row.
- Policy *attention* is overwhelmingly the third row.
- Only the third row has anything to do with markets versus planning.

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Is Reliability a Public Good?

- The system must balance continuously; markets clear discretely. A small shortfall does not shrink service, it collapses it.
- We ration randomly, regardless of whose fault the shortfall is.
- So a retailer who bought enough cannot deliver a better product than one who didn't — reliability can't be monetised at the retail level.
- That is a real public-good problem, and it can justify a mandate.
  - But are there other solutions? We don't have to pool consequences.
  - We *can* assign blame to suppliers who are short. Either by providing different reliability or through ex-post penalties.

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Steady (or low, or high) prices are not a public good

- Physical rationing is an externality: my shortfall blacks out your hospital.
- A high price is not. I cannot free ride on your high price, but I can choose to hedge against it if I want.
- Suppressing the price does not remove the scarcity. It removes the response to the scarcity, and moves the cost somewhere less visible.

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