Electric Resource Adequacy:

It's not an issue of Operating Reserves

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Why the concern? – Overview of the presentation

Recent events, reports and proposals have put “resource adequacy” in the news

- California 2000 – resources became adequate when DOE issued “must offer” order
- 2003 Blackout – transmission operating & maintenance
- California ISO 2005 – belt & suspenders
- LICAP, SW Connecticut

Is resource adequacy a public good?

- In particular, can free riding be avoided? If I build a plant for my future needs, can I keep you from using it?

What does resource adequacy insure against? What good is it?

- Are there private-goods approaches that work as well?

What is a Resource Adequacy Requirement (RAR)?

An RAR:

- Is a condition placed on a Load Serving Entity's (LSE's) use of the grid that requires the LSE to demonstrate that a certain amount of physical generating capacity exists
- Is exclusive – two LSEs cannot same credit for the same increment of capacity
- Is based on an administrative determination of the LSE's use of the system in the future, not its specific use at any time

Not all US system operators enforce RARs

- ISO-NE, NYISO and PJM do but MISO does not
- California did not in the past but may in the future
- RARs may also be mandated by state regulators but it is not clear how they will be enforced

Meaning of "Adequacy" in a reliability context

NERC defines are two components of reliability

- Security: "ability to withstand sudden disturbances"
  - Short-term or delivery reliability
  - Common-language meaning of "reliability"
- Adequacy: "ability to supply demand and energy"
  - Long-term or planning reliability

A concern with resource adequacy, especially in a competitive environment, is a concern that *price will not call forth supply*

- RAR requirements are not the same as call options and are distinct from price caps
- If supply is available but expensive, resources are adequate – adequacy is an engineering rather than economic concept

FERC's 3 Justifications for an RAR

1. Generation investment may not respond promptly to spot prices, creating shortages (price will not call forth supply)

- At present, more a conjecture than an observation from history.

2. Energy price caps will prevent prices from rising high enough to stimulate generation investment.

- Not a statement about electricity markets, it's a statement about regulation

3. Without a mandate, some load-serving entities will not invest in new generation and will "free ride" on others' surpluses.

- System operator cannot preferentially serve loads that paid for new generation. The inequity makes adequacy a public good.

Source: Standard Market Design (SMD) NOPR ¶460-473

Operators use operating reserve to ensure security; resource adequacy refers to *planning* reserves

Operating reserves additional capability above demand available to meet load excursions or cover for sudden outages

Operating levels are closely related to physical reliability (security)

- A shortage of operating reserve can lead to system insecurity and cascading blackouts if a plant trips or load spikes.

The purpose of an RAR is to avoid physical shortage

- Economic shortage occurs when physical capacity exists but customers are not willing to pay its asking price; physical shortage occurs when no matter what price is offered, supply is not available.

Physical supply, compared to the (expected) system peak, yields the planning reserve margin

Planning reserves are **not the same** as operating reserves

Planning reserves are not the same as operating reserves

Planning reserves represent the potential to generate energy but not necessarily operational generators

Planning reserves themselves are not actually used for anything

- Unlike operating reserves, they do not stand by for dispatch
- Specific units are not scheduled out of planning reserves, planning reserves are an undifferentiated mass of capacity

Just as security is contrasted with adequacy, operating reserves may be contrasted with planning reserves

- Security is unquestionably a public good; whether adequacy is, has been questioned

Resource *In*adequacy leads to controlled, not cascading, shortages

Blackout avoidance is not a direct benefit of planning reserves

- System security is provided by operating reserves
- E.g., resource adequacy had nothing to do with 2003 blackout

If there is a shortage of physical capacity the operator will either shed load, or there will be a shortage of operating reserve

- A rational operator will not schedule, with fair warning an operating reserve shortage
- A planning reserve shortage leads to the rationing of energy whether by price or by fiat

For example, in 2003 California responded to capacity shortages (economic not physical!) by rolling blackouts over an extended period of time

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The time-frame of inadequacy events is much different from that of insecurity events

Because the operator cannot select nonpayers to curtail in real time, some assert that command-and-control is the only way to ensure capacity adequacy

One proposed market mechanism is “priority service”, but it requires that low priority or uninsured customers be identified for curtailment

Even if an initial shortage event is unanticipated or if the loads that failed to arrange for their needs cannot be identified immediately, a shortage of planning reserves is long-lived

- Free riders to be identified can be identified during the shortage

The lack of active metering is a system design choice

- Remote-shutoff and current-limiting meters are available but generally not installed

Analogy: Water meters in Sacramento

Will administrative mechanisms lead to an economically efficient level of resource adequacy?

Two flaws of the historic approach (capacity markets)

- Reliance on a (non-economic) estimate of capacity requirements and an administrative penalty value
- "Bang-bang" spot pricing of capacity tickets

"Demand curve" approaches (NYISO, ISO-NE) substitute a continuous formula for the bang-bang spot market

- "Demand curves" still involve arbitrary decisions about the appropriate reserve margin and the residual cost of capacity
- They can remove incentives to efficient operations depending on the approach taken to "net energy revenues"

The role of an ISO biases it to overstate capacity requirements

Counterargument: economic efficiency not an appropriate metric

Note on price forecasting

In the long run, no difference between price cap + RAR and uncapped price regime

"Long-run" forecasts assume that markets reach equilibrium

- Total revenue expected from new plant equals its cost

Energy prices that cover the costs of entrants may be unacceptably high

- FERC recognized that one role of an RAR is to counteract energy price caps

A "capacity spot price" should exactly balance the impacts of a price cap

Therefore, for forecasting market revenues and overall expected consumer cost, one can forecast uncapped "all-in" prices

- Note the equivalence only holds in the long run (expectations)

