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Capacity Markets in Action:

Challenges from the Purchaser's Point of View

Harvard Electricity Policy Group
Forty-Eighth Plenary Session

The Missing Money

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- In an average year, some peaking generation will only run a few hours a year.
- For most commodities, infrequent utilization/purchase of a resource/product may be a signal that the resource/product is not needed.
- Electricity is different: we must keep the lights on, so must hold onto some infrequently utilized resources.
- In today's energy markets:
  - If a generator does not run, it does not get paid
  - ISOs need a way to repay this "missing money" to keep enough generation on hand.

How to Recover the Missing Money

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- **Scarcity Pricing Only:** To ensure that sufficient investment is made in supply, a market can be designed such that during those infrequent periods of unusually high demand, prices are also permitted to go unusually high.

- **Capacity Market:** To combat market power concerns, the energy price is mitigated and generally assumed to only cover short-term variable costs, and a second revenue stream via a capacity construct is developed to cover long-term fixed costs.

- **Hybrid:** This approach combines a capacity construct with relaxed energy market mitigation and/or limited administrative price setting.

Previous Capacity Market Approach

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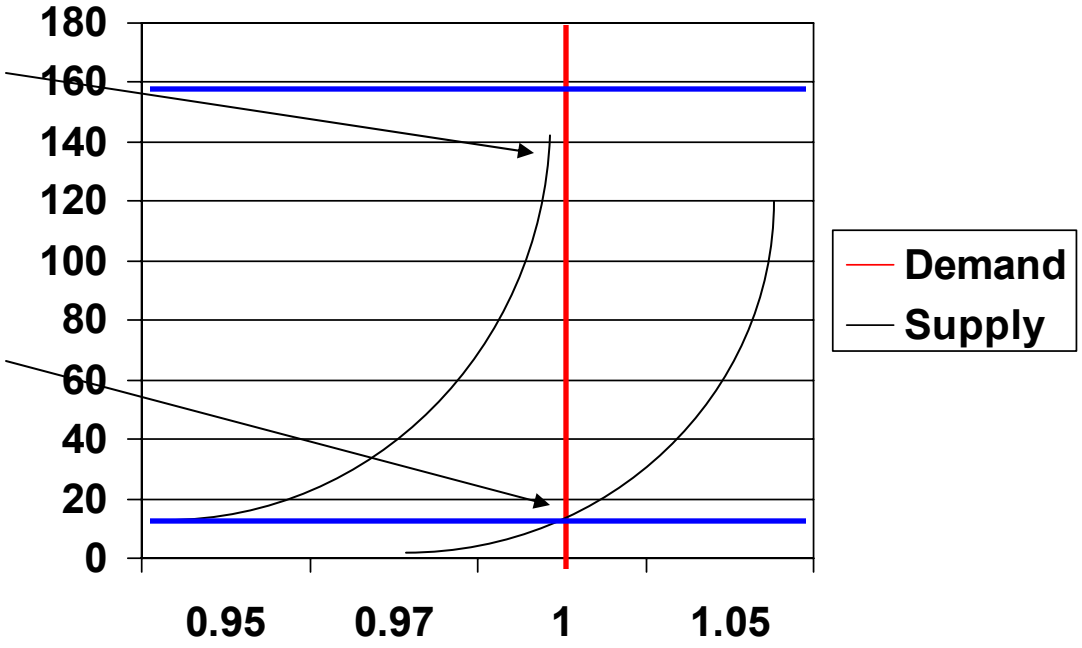
- Unforced Capacity (UCAP) market
  - Generators assigned an Unforced Capacity value based on the generator's forced outage rate
  - ISO's goal was to procure enough unforced capacity to meet the expected load forecast plus a sufficient Installed Reserve Margin (IRM) to ensure a loss of load probability less than one in ten years.
- Loads must procure sufficient capacity to cover unforced capacity obligation or pay deficiency charge
  - Capacity could be acquired through:
    - Bilateral contracts
    - Auctions (loads needed only procure the delta between their requirement and bilateral contracts)

Previous Capacity Market Issues

- Auctions resulted in very low ($5/mw-day) or very high clearing prices ($160/mw-day) with little in between

Case 1: Capacity less than Installed Reserve Margin: Capacity Clears at Deficiency Rate

Case 2: Capacity greater than Installed Reserve Margin: Capacity Clears very low



Previous Capacity Markets

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- Areas of success:
  - Purchasers could easily fulfill obligations through long term bilateral contracts
  - Multiple options to make up for capacity requirements beyond bilateral contracts
    - Monthly, multi-monthly, and daily auctions
- Areas of failure:
  - Price volatility increases **long term investment risk**
  - RTO wide clearing price results in low price for capacity, but does not recognize **localized capacity shortages**
  - Low prices have caused high marginal cost units in areas like New Jersey and Southeastern Mass to retire, requiring expensive out of market **Reliability Must Run (RMR)** contracts

Case Study: PJM's RPM Approach

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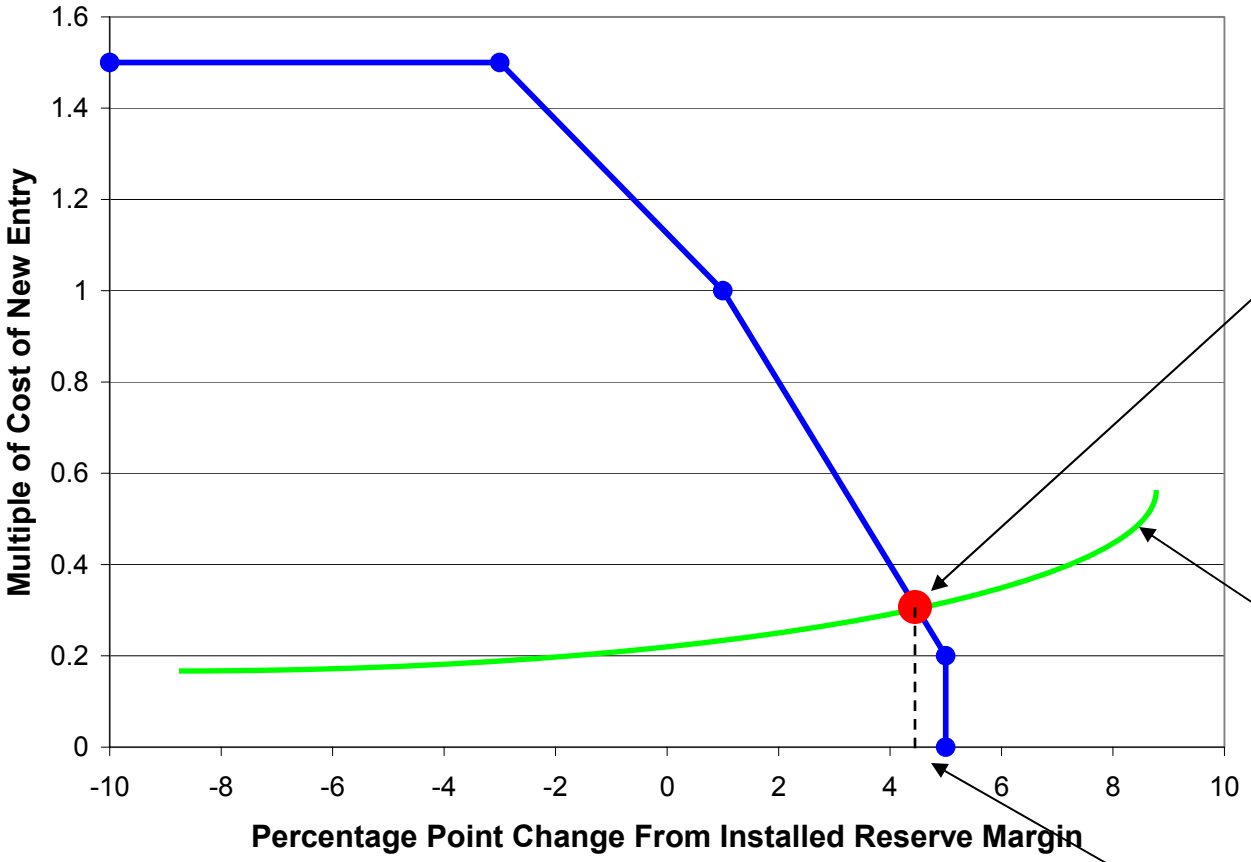
- Capacity acquired through annual, forward auctions
  - Centralized procurement
  - Auctions cleared based on resource offers, demand obligation, and reliability metrics
- Auctions contain a Variable Resource Requirement (aka "Demand Curve")
  - Values capacity above the installed reserve margin requirement
  - Sets clearing price at intersection with supply curve
- Locational clearing prices
  - Locational Deliverability Areas (LDAs) defined based on transmission import capability into local areas
  - Each LDA's clearing price may contain an adder over the system price, if additional capacity is needed in the LDA

PJM's Variable Resource Requirement



Clearing Price established By intersection of VRR and Supply curve

Supply Curve

Load required to purchase more than Installed Reserve Margin (104.5% in this case)

Issue: Obligation Uncertainty

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- Variable Resource Requirement:
  - Intended to value generation capacity above the Installed Reserve Margin
  - Under excess capacity situations, will result in entities incurring a capacity obligation greater than the published Installed Reserve Margin
  - Increased obligation can be up to 5%

- Increased obligation results in inability to accurately hedge capacity obligations
  - Entities that previously had sufficient generation to meet capacity obligations no longer have complete hedge

Issue: Forward Procurement

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- Three year forward auction provides:
  - Ability for new generation to offer into the market and be guaranteed a capacity price
  - Certainty for PJM that it will have sufficient installed capacity

- Forward auction also:
  - Limits ability for load serving entities to arrange bilateral capacity
  - Adds risk to generation owners to offer full amount of capacity into the market, which can result in a premium on the generator's offer

Issue: Locational Capacity

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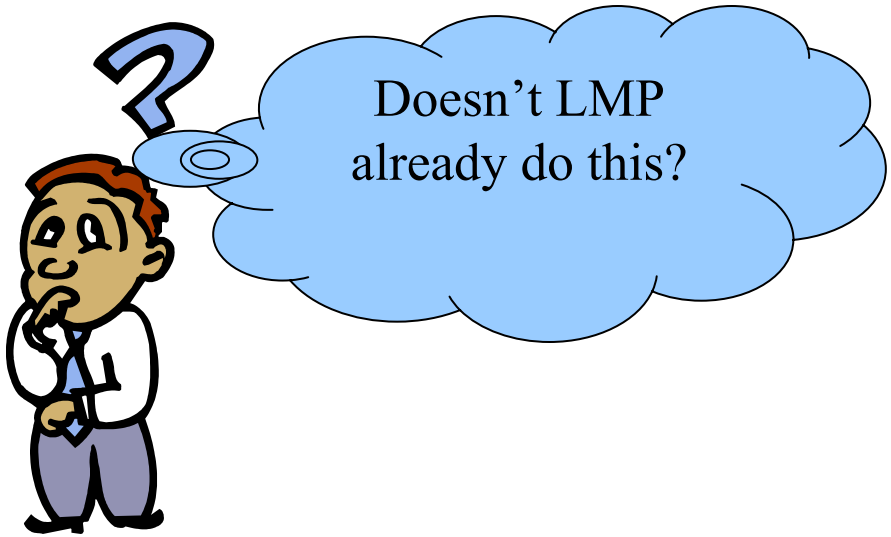
- Benefits:
  - Engineering reality of the electric grid is that generation can't all be built in the same place and transmission relied upon to deliver to any location.
  - Sends price signals to locate generators in the proper areas or build transmission into constrained areas



Issue: Locational Capacity (cont)

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- Drawbacks:
  - If a location is constrained, it will already be subject to higher LMP prices and higher capacity prices only serve to increase the costs to load in that area.
  - If the previous construct allowed obligation to be met with remote resources, entities that believed they had satisfied their obligation for the long-term may find that the resource they contracted with no longer satisfies the requirement.

Issue: Incentive or Windfall?

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RPM Results to Date:

	2007/2008		2008/2009	
LDA	**Resource Clearing Price [$/mw-day]**	**Net Load Price [$/mw-day]**	**Resource Clearing Price [$/mw-day]**	**Net Load Price [$/mw-day]**
Eastern MAAC	$197.67	$177.51	$148.80	$143.51
SW MAAC	$147.74	$140.16	$210.11	$180.58
RTO	$40.80	$40.80	$111.92	$111.92

2006/2007 Prices: less than $10

Issue: Incentive or Windfall?

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- Prices set based on the cost of new entry are intended to provide an incentive to new generation.
- Purchasers pay these costs regardless of whether any new generation is constructed.
- Can incentive price overcome other barriers to new construction:
  - Environmental restrictions
  - Local permitting issues
  - Forward price uncertainty

Issue: Transmission Infrastructure

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- The forward capacity markets are intended to help bolster transmission upgrades
  - PJM's RPM allows transmission upgrades to be offered into the market to increase the transmission capacity into constrained Locational Deliverability Areas
  - Locational price differences will help justify economic upgrades developed by PJM

- The key is that transmission planning still needs to occur on a longer horizon
  - RTO's cannot count on these capacity markets along to develop the system!
  - Can the capacity market be truly competitive with limited transmission capability?

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Questions?

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