California ISO
Shaping a Renewed Future

Bidding for Capacity Products in Spot Markets

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Outline

- Introduction and Overview of Spot Market Capacity Products
- Types of cost: direct and opportunity
- ***Appropriateness of offer price for spot market capacity hinges on whether there are marginal costs for that capacity***
- Foregone energy sales *within* CAISO market are opportunity costs covered by the capacity price
- Foregone energy sales in other markets (outside, RT v. DA) are opportunity costs that can be captured with demand bids
- Including opportunity cost in bids can introduce market inefficiency compared to using other existing mechanisms
- Direct costs of providing spot market capacity are not clear

Overview of Spot Capacity Products

- Ability to change energy output within a specified time
- Can be procured
  - By committing generation resources
  - By moving an online generator (up or down) to an output level where they can provide more energy change within timeframe
  - Or from offline generators that can start up quickly enough
- CAISO is currently developing:
  - Flexible Ramping Product to procure 5-Minute Capacity in a period so it can be used to provide energy in a future period
  - Corrective Capacity to reduce flows across a transmission constraint post contingency within 30-Minutes
- CPUC and CAISO are also working together to develop forward procurement of flexible ramping capacity

Determining the Value of Capacity (1 of 2)

- Value of a MW of capacity is the amount energy production costs do not have to increase because that MW was able to help meet the capacity requirement
- Equivalent to the Shadow Value on the capacity constraint
  - The amount energy costs would decrease from a reduction in the capacity constraint.

G1 provides 50 MW of capacity and 50 MW of energy

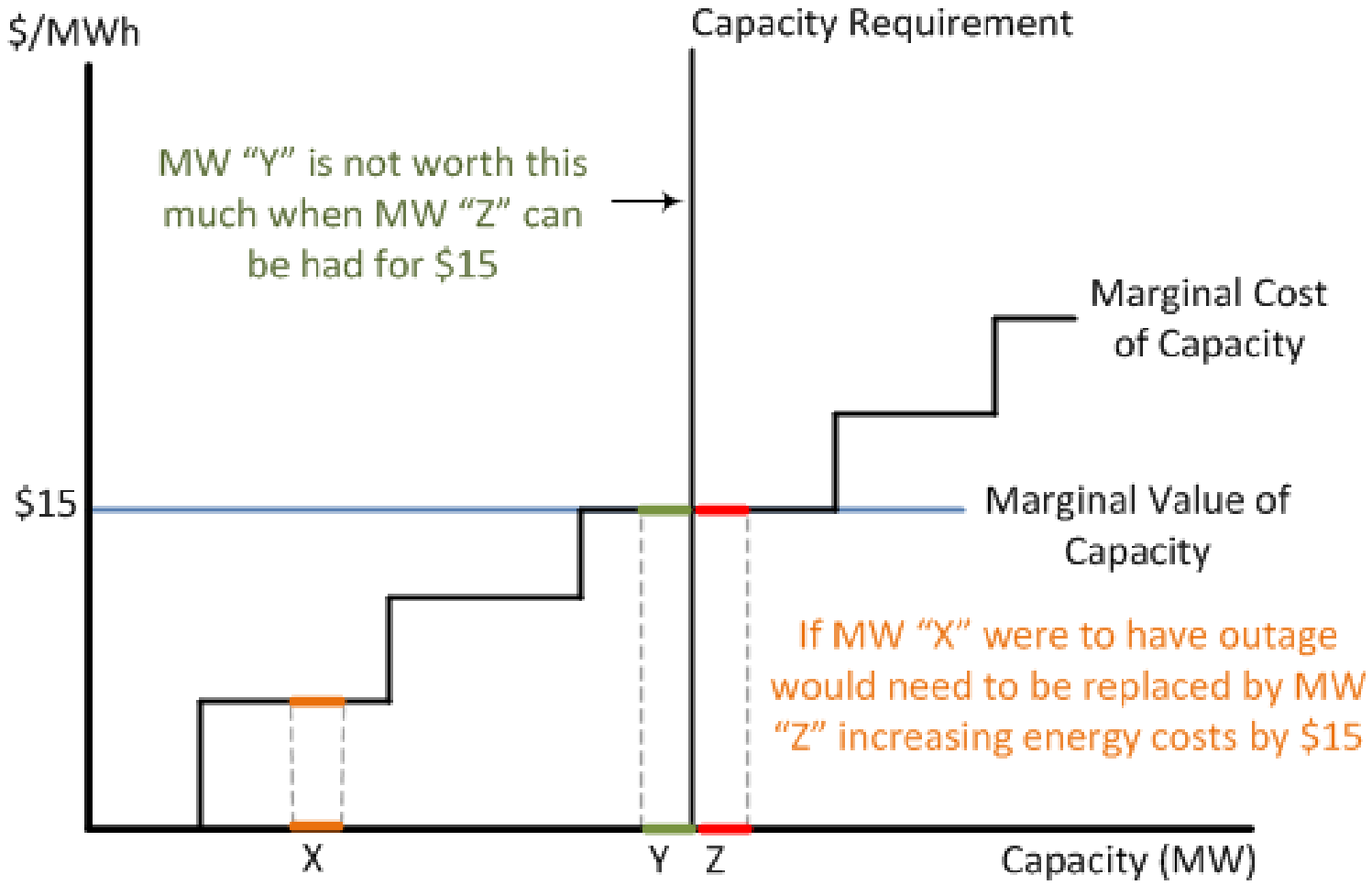
Energy Bid = $35

LMP = $50

If G1 provides 1 MW less of capacity it can produce more energy at a cost ($35) below market price ($50)

- Net savings = $50 - $35 = $15 = Capacity Price

Determining the Value of Capacity (2 of 2)



Opportunity Cost of Within Market Unsold Energy

- G1
  - MC = Energy Bid = $35
  - LMP = $50
  - Energy Profit = LMP - MC = $50 - $35 = $15

- The $15 that G1 could earn by selling energy is its opportunity cost of providing capacity

- G1 must receive $15 from the capacity market in order to be willing to provide capacity

Accounting for Opportunity Cost of Another Market in Energy Bid

- Generation resource G2 has:
  - MC = $35
  - Expected Price Other Market = $38
  - Energy Bid = $38
    - to account for expected opportunity cost of other market
- LMP = $39
  - Energy Profit = LMP - MC = $39 - $35 = **$4**
  - Capacity Profit = LMP - Energy Bid = $39 - $38 = **$1**
- If procured for energy, opportunity cost of other market is covered
- If procured for capacity, loss of $3 profit opportunity
  - Perceived low in-market opportunity cost because of higher energy bid price to account for opportunity cost of other market

Accounting for Opportunity Cost of Other Markets with Capacity Bid

- Generation resource G2 has:
  - MC = $35
  - Expected Price Other Market = $38
  - Energy Bid = $38
  - Capacity Bid = $3 (Opp. Costs of other market = $38 - $35)

- LMP = $39
  - Profit if Energy = LMP - MC = $39 - $35 = $4
  - Profit if Capacity = LMP - En Bid + Cap Bid = $39 - $38 + $3 = $4

- Can cover opportunity cost in both markets with capacity offer

- There are other existing market instruments for covering this opportunity cost

Using Export Bid to Represent Opportunity Cost of Outside Market

- G2 can submit an export bid of $38 equal to the price of other market
- Consider the case without congestion:
  - Energy Bid = $35 = MC
  - Export Bid = $38 = P^{other}
- LMP = $39
  - Profit if Energy = LMP - MC = $39 - $35 = $4
  - Profit if Capacity = LMP - Energy Bid = $39 - $35 = $4
  - Export Profit = $0 - *export does not clear market*
- LMP = $37
  - Profit if Energy = LMP - MC = $37 - $35 = $2
  - Profit if Capacity = LMP - Energy Bid = $37 - $35 = $2
  - Export Profit = P^{other} - MP = $38 - $37 = $1
  - Total Profit = $3 = same as selling energy in other market
- Can cover opportunity costs of both markets with export bid

Demand Bids vs. Capacity Bids

- Demand bid method (either export or virtual) has stronger incentive to only submit when resource believes the opportunity cost is real
  - If benefit from other market does not materialize, resource may lose money on export or virtual demand bid
- With demand bids generator does not risk CAISO market profits
- Demand bid *cannot* be used to exercise market power in capacity
  - Interties are considered competitive markets
- Capacity bid *can* be used to exercise market power in capacity
  - Local constraints
- Existing LMPM for energy can be altered to accommodate corrective constraints
- If separate capacity bids are used, new market power mitigation for capacity products would need to be developed

Direct Costs of Capacity

- Non-Energy costs to provide capacity may affect whether a capacity bid separate from energy bid is appropriate and what the range of expected competitive offer prices might be

- Direct costs may include:
  - Scheduling Costs (per-bid fee, GMC)
  - Staffing Costs (when no energy schedules)
  - Operations and Maintenance
  - Others?

- Not clear to what extent these costs exist, are marginal, and aren't presumed to be covered by forward capacity contracts or infra-marginal rents in the spot market

Thank you for your time