Forward Capacity Auctions and Electricity Market Design

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Agenda

- Objective and basic structure
- Descending-clock auction
- Treatment of zones, interconnectors, renewables
- Other auctions for renewables
- Conclusion: Rationale for capacity auctions

Forward Capacity Auctions: Objectives and Basic Structure

Objective

- The objective of a forward capacity auction is to assure an adequate quantity of reliable generating capacity
  - Efficient investment in new generating resources
  - Maintaining current generating capabilities
  - Attaining goals for renewables / reducing GHG emissions
  - Reliably meeting peak demand
  - Addressing the missing-money problem
  - Doing all of the above efficiently (minimizing cost)

Basic Structure

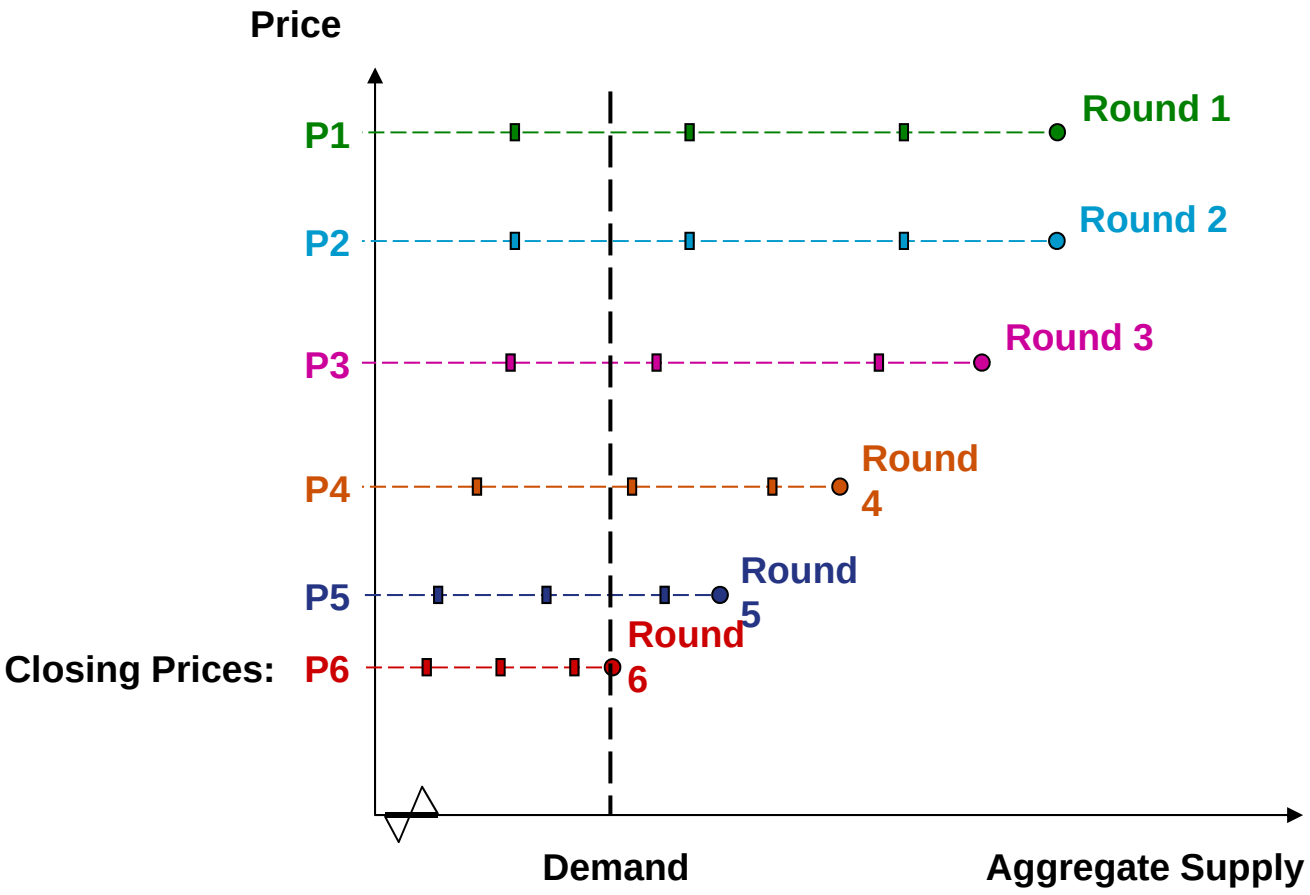
- Auction occurs 3+ years ahead of commitment period, so that auction provides price signal for new capacity investment
- Descending clock auction
- Duration of auction is less than a week
- Bidding occurs on a resource-by-resource basis
- Demand curve reflects the incremental value of additional capacity (so that amount of buffer procured depends on cost)
- Auction may account for interconnectors and multiple zones
- Auction may account for lumpy nature of investment
- Performance incentives so that capacity obligations are met during shortage events

Mechanics of a Descending Clock Auction

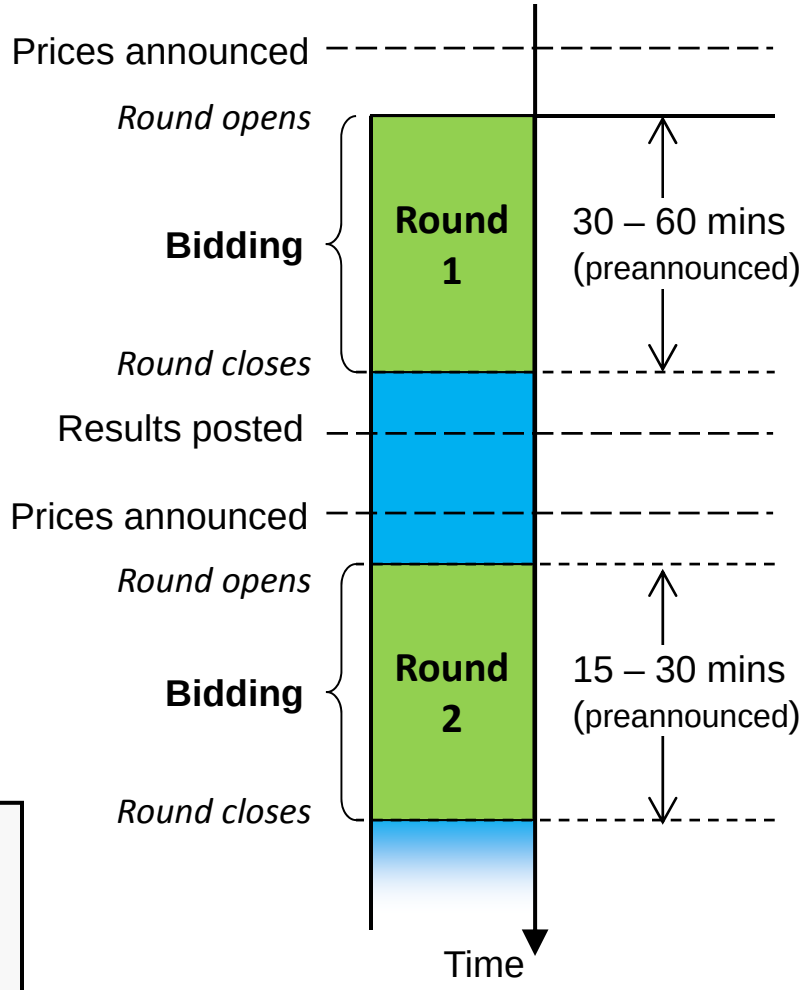
Key Features of a Descending Clock Auction

- Dynamic rather than static
  - The auctioneer iteratively names prices and bidders respond with quantities. Bidders receive feedback on the level of aggregate supply after every round
- Discrete auction rounds
  - Time to adjust bidding strategy as auction progresses
- Activity rule
  - Bidders cannot increase supply as prices decrease
- Closing rule
  - Auction closes when Aggregate Supply $\leq$ Demand
- Uniform-price rather than pay-as-bid
  - All successful bidders (in a zone) are paid the same price

Descending Clock Auction



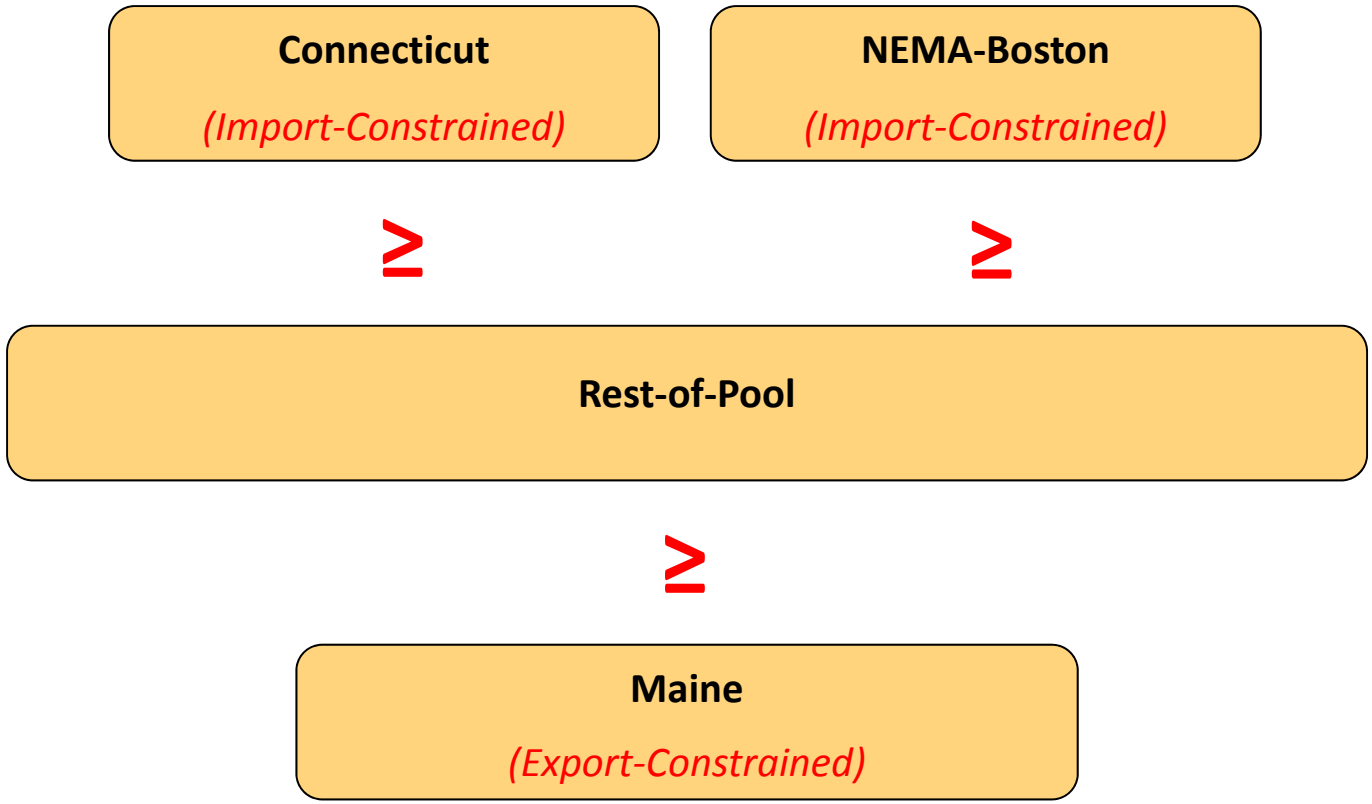
Clock Auction Process



	Submit bids	Receive info about demand
■	✓	✗
■	✗	✓

Treatment of Zones, Interconnectors and Renewables

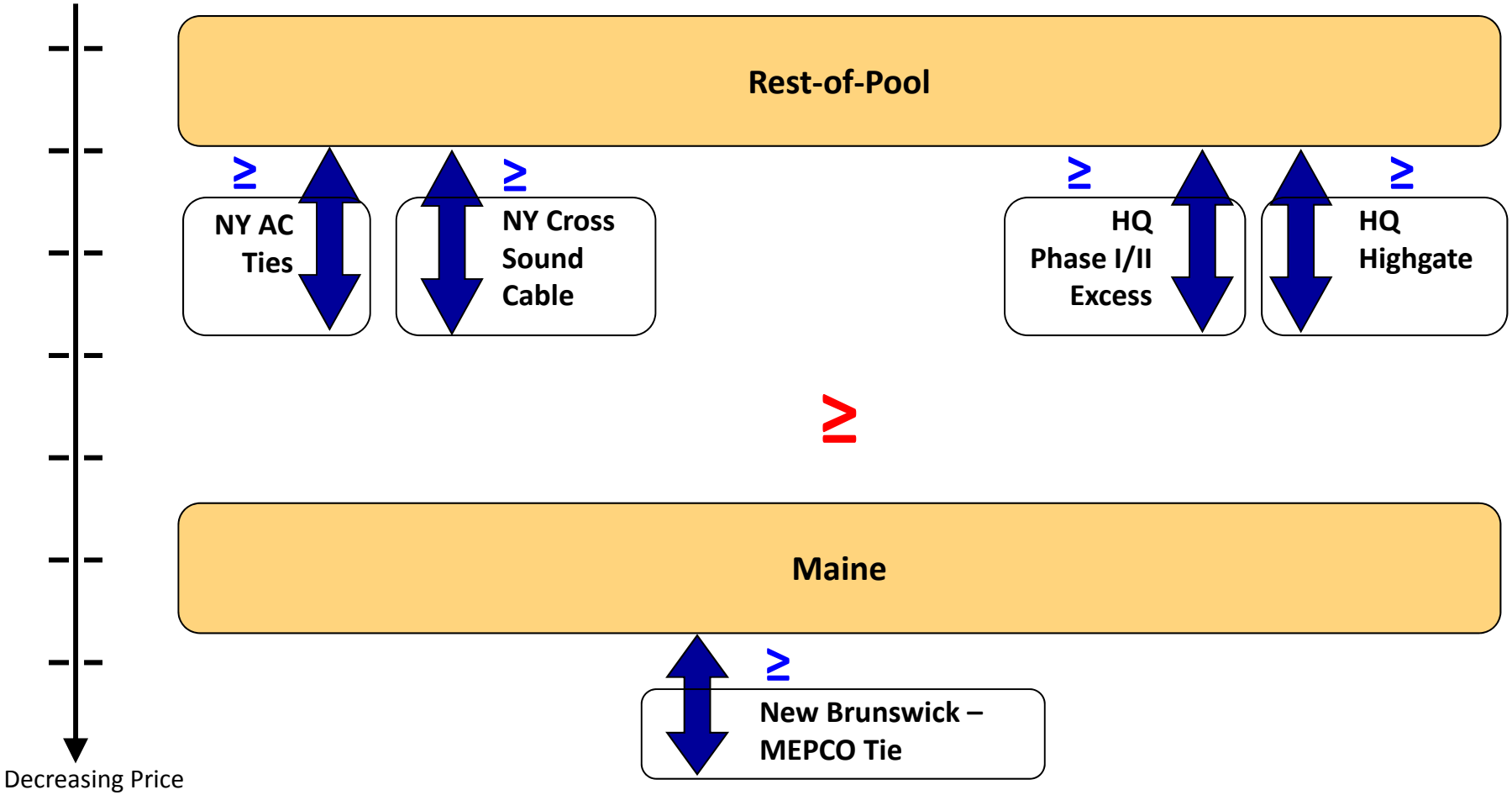
Possible Nested Capacity Zone Configuration



Treatment of Nested Capacity Zones

- An import-constrained zone can clear at a higher price (capacity is limited by resources located within the zone + the transmission capacity into the zone)
- An export-constrained zone can clear at a lower price (capacity is enhanced by resources located within the zone that cannot be exported)

Possible Interconnector Configuration



Treatment of Interconnectors

- An import-constrained zone can clear at a higher price (capacity is limited by resources located within the zone + the transmission capacity into the zone)
- An export-constrained zone can clear at a lower price (capacity is enhanced by resources located within the zone that cannot be exported)
- One possible treatment of an interconnector is the same as an export-constrained zone (i.e. price can be no higher than the price at the location to which it connects, but it can be lower due to competition for the limited transmission capacity of the interconnector

Treatment of Renewables

- In principle, renewable resources can be treated largely the same as thermal resources in a forward capacity auction
- (Alternatively, their contribution can be subtracted from the requirement, as a load reduction)
- The nameplate MW must be discounted in order to reflect availability at the time of shortage events (e.g. a wind energy resource might only be counted as 25% of its nameplate MW)
- Performance incentives are important so that capacity obligations are met during shortage events
- Some issues arise to the extent that some renewables are likely to be correlated in their unavailability (clouds / darkness affect all solar resources; calm affects all wind resources)

Other Auctions for Renewables

Offshore Wind Energy (Atlantic coast of US)

- Offshore wind energy has enormous potential to help the US reduce its greenhouse gas emissions, develop domestic clean energy resources, and provide cost-competitive electricity to key coastal regions
- The Offshore Wind Innovation and Demonstration initiative set a goal of 10 GW of offshore wind deployment by year 2020 and 54 GW of offshore wind deployment by year 2030
- The Atlantic coast of the US has strong, steady winds
- Equally importantly, the ocean is reasonably shallow for fairly long distances from the coast, vastly simplifying the engineering of offshore wind energy

Offshore Wind Energy (Atlantic coast of US)

- At current cost levels, development of offshore wind energy is economical only with PPAs or other incentives / subsidies
- Once sufficient incentives or subsidies are offered, there may be multiple companies interested in the same lease area
- In the event of competitive interest, the US Bureau of Ocean Energy (BOEM) runs an ascending clock auction
- Four auctions have been completed to date:
  - Rhode Island / Massachusetts (July 2013)
  - Virginia (September 2013)
  - Maryland (August 2014)
  - Massachusetts (January 2015)
- The program is ongoing

Conclusion: Rationale for Capacity Auctions

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- A centralized auction is not the only approach for assuring an adequate quantity of reliable generating capacity
- For example, France has established a decentralized capacity obligation mechanism:
  - Obligations will be assigned to suppliers based on the actual consumption of their customers during peak periods
  - To meet its obligation, a supplier will have to secure capacity certificates, either by certifying the capacities it operates (generation or demand-side capacities) or by purchasing certificates from players that hold them
- To a first approximation, using an auction or a decentralized market mechanism for capacity obligations are equivalent
- However an auction offers several advantages … .

Conclusion: Rationale for Capacity Auctions

- Reducing transaction costs is one key advantage of a capacity auction over a decentralized mechanism
- Decentralized broker markets tend to be subject to transaction fees of several percentage points. An analogy is municipal and corporate bond markets in the US, where markets are thin and commissions are high
- By contrast, the process cost of an efficiently operated auction tends to be a small fraction of one percent of the transaction value
- As an example, this is the principal reason why most major governments organize their primary government securities market as an auction, rather than through brokers

Conclusion: Rationale for Capacity Auctions

- Improved information aggregation is another key advantage of a capacity auction over a decentralized mechanism
- Decentralized broker markets tend to be relatively opaque in the information provided, especially when the market is thin. The brokers find this information asymmetry to be beneficial. When reporting requirements are present, parties go to great lengths to avoid them
- By contrast, a centralized auction generates a clearing price which is the best aggregation of the available information
- Moreover, a descending clock auction also generates useful measures of aggregate supply after each round, which are useful in leading to the best available clearing price

Conclusion: Rationale for Capacity Auctions

- In addition, we have seen that centralized auctions can neatly accommodate import-constrained and export-constrained zones (arising from limited transmission capacity)
- These are problematic to handle within a decentralized mechanism, as multiple generating resources and multiple suppliers may benefit from the same transmission line