PJM Capacity Market Workshop Session #3:

Forward Clean Energy Market

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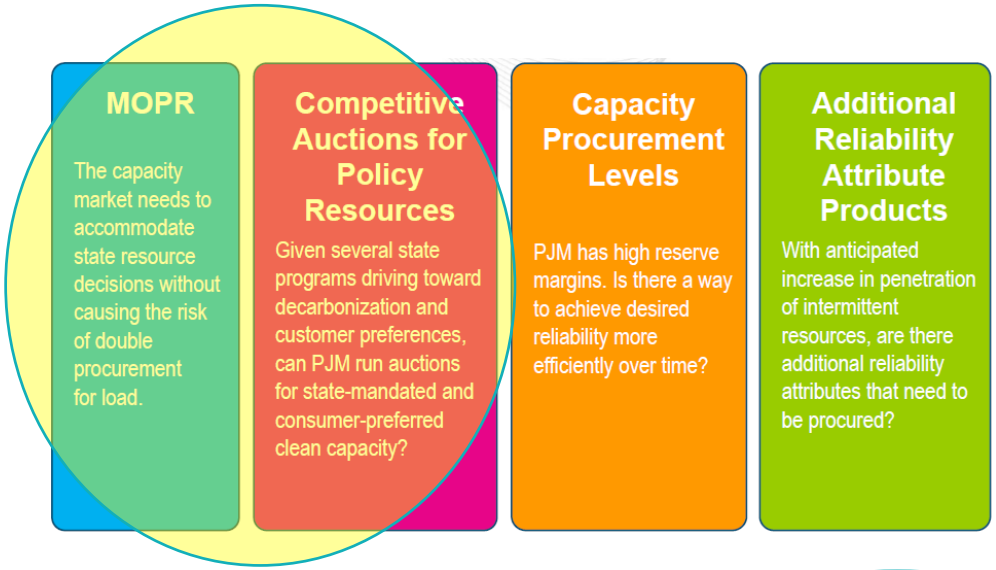
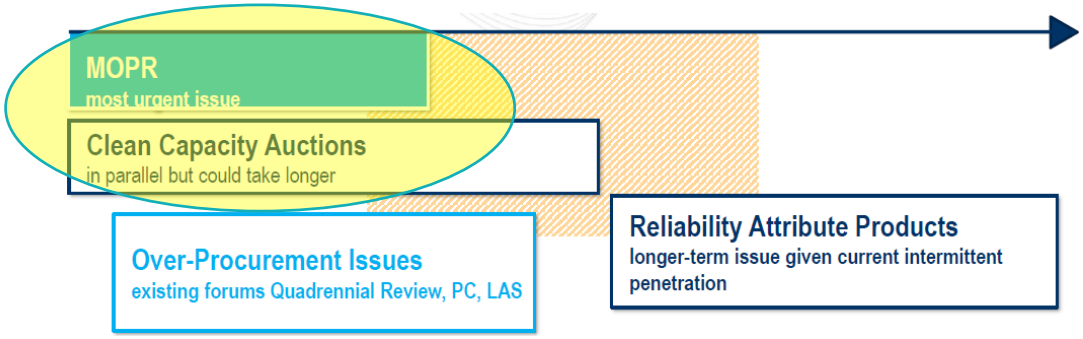
March 12, 2021

State clean-electricity standards ***are*** U.S. climate policy

- 30 states have a binding renewable portfolio standard that legally oblige (some part of) the power business to (buy or sell) a certain percentage of their electricity from qualifying, usually zero-carbon resources.
  - In PJM, 11 of the 14 jurisdictions and many cities/municipalities have set goals or standards
- We observe that goals are accelerating in many regions
- In-state preferences and technology carve-outs have resulted in an increasingly inefficient patchwork of policies

Where are our efforts focused in today's discussion?

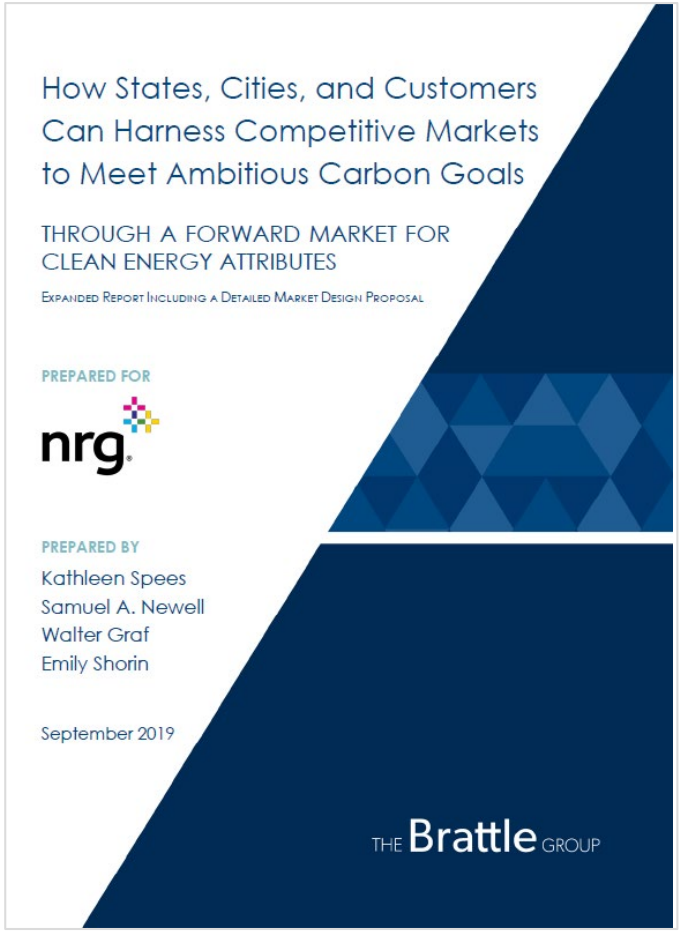




A Market-Based Model: Forward Clean Energy Market

Forward Clean Energy Market

- This concept grew out of the ISO-NE's "Integrating Markets & Public Policy" (IMAPP) process
- Adapted and further defined by Brattle Group for NRG
- Evolution and variations continue with ICCM
- A good idea whose time has come?



https://www.brattle.com/news-and-knowledge/publications/how-states-cities-and-customers-can-harness-competitive-markets-to-meet-ambitious-carbon-goals-through-a-forward-market-for-clean-energy-attributes-expanded-report

Decarbonizing via a growing trade in clean energy

- A Forward Clean Energy Market is a trade in Clean Energy Attribute Credits ("CEAC")
  - 3-year forward annual auction
  - Uniform product definition where 1 unit = 1 MWh of production of clean energy
  - Can be enhanced by making them "dynamic," tied to the marginal emissions prevailing during the time of a CEAC's creation
- Demand bid expressed by a volume-and-price bid, anchored around:
  - the state's clean-energy procurement requirement and
  - the state's reference price
    - *e.g.*, social cost of carbon or a legislative price cap, *etc*.
- Multiple states' participation + voluntary actors (cities & customers) allow for the market to scale up.

Policy Benefits of a FCEM

- RTO-operated, state demand-determined design can…
  - Address existing conflict among state goals and wholesale markets
  - Achieve and exceed state goals
  - Maintain compatibility among jurisdictional matters

- Direct line of sight to new clean energy investment to meet statutory goals
  - Achieve faster and cheaper decarbonization than alternatives through sloped demand curve + banking provisions prior to binding compliance requirement

- Less risk for consumers vs. long-term, *ad hoc* contracting

Policy Benefits of a FCEM (cont.)

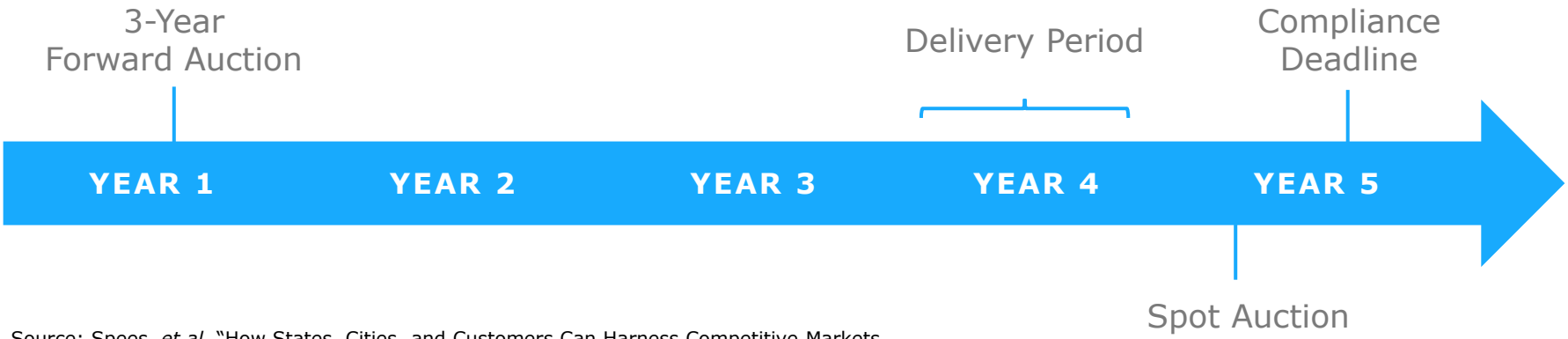
- Strength in numbers – distribution of risk to many buyers/sellers; avoids lumpiness.
  - State policies less dependent on individual project non-performance; projects not as subject to counterparty bankruptcy
  - Easier platform for smaller buyers (*e.g.*, munis and/or corporations) from which to buy
- A more level playing field between existing and new resources who provide the same product (*e.g.*, zero-carbon energy)
- Sends a stronger signal to developers to site projects where energy & capacity are most valuable

Questions?

Appendix

Auction Timing

- An annual auction, 3 years forward
  - Spot auction before compliance period to allow trade for residuals
  - Banking permitted to encourage early adoption/smoother pricing/project formation
  - Borrows from (and complementary with) existing capacity auctions



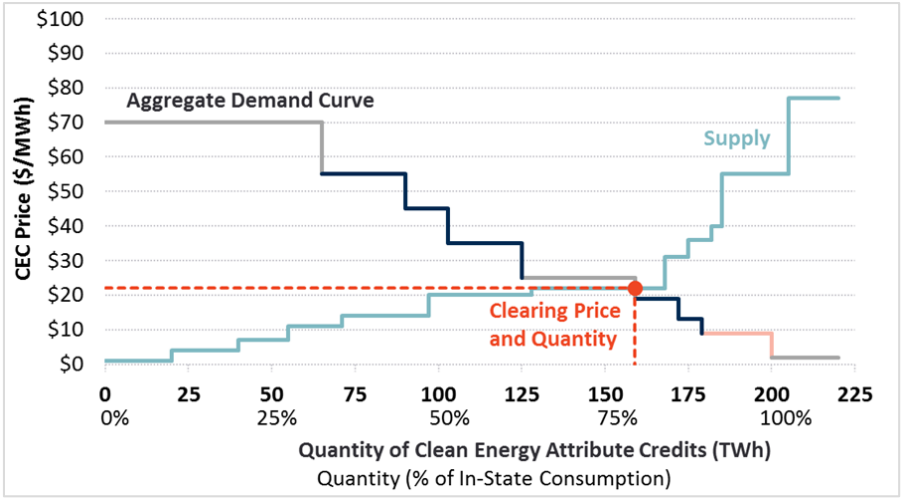
Source: Spees, *et al*. "How States, Cities, and Customers Can Harness Competitive Markets to Meet Ambitious Carbon Goals." September 2019.

- 7-year "price lock" for new resources

Clearing the Market

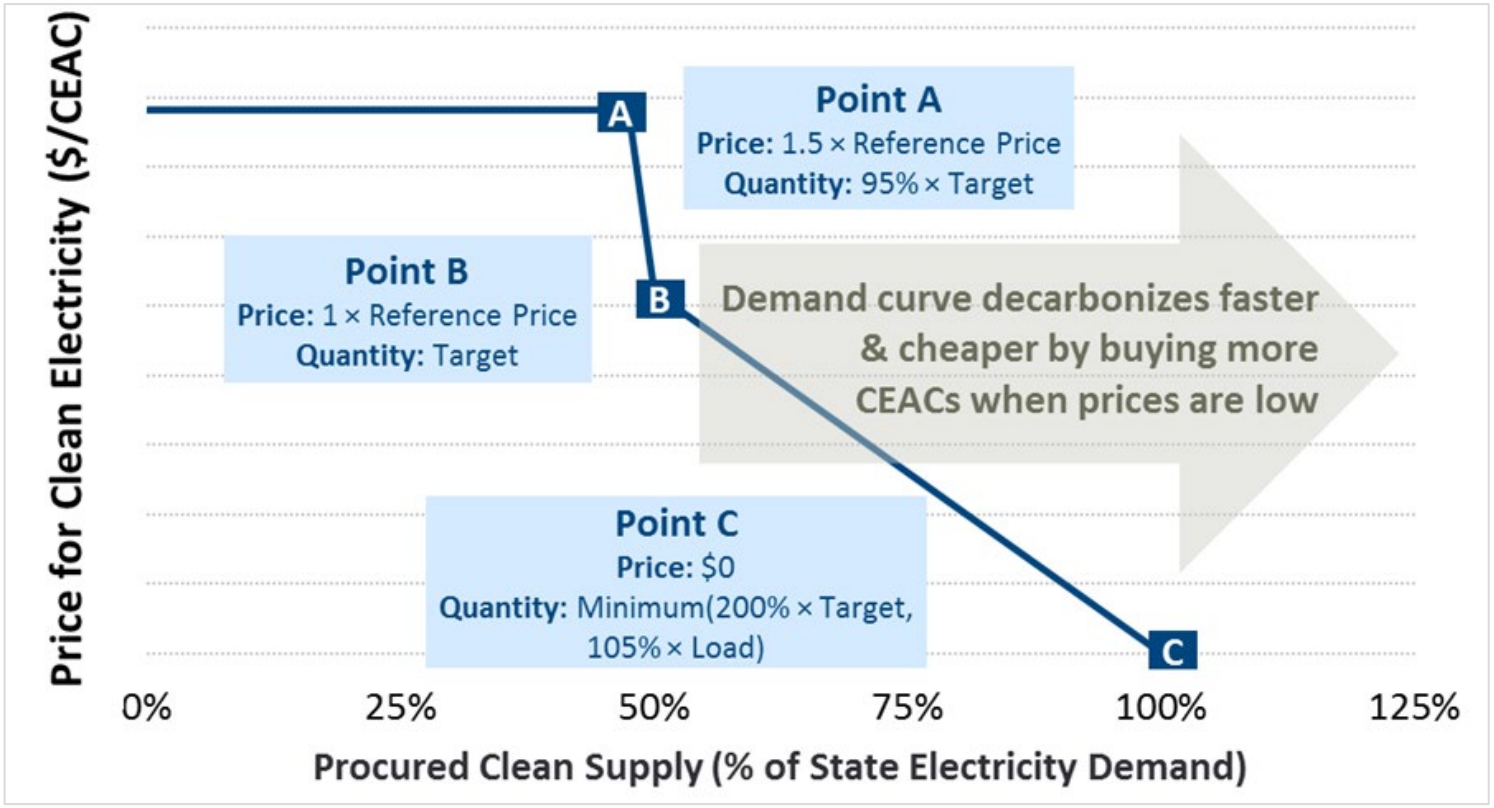
- Different buyers all have a different willingness to pay.

- A central market accommodates these and ensures that those willing to pay more are not simply paying more for less—but *getting more* because of that willingness to pay.



Source: Spees, *et al*. "How States, Cities, and Customers Can Harness Competitive Markets to Meet Ambitious Carbon Goals." September 2019.

Illustrative sloped demand curve & reference price

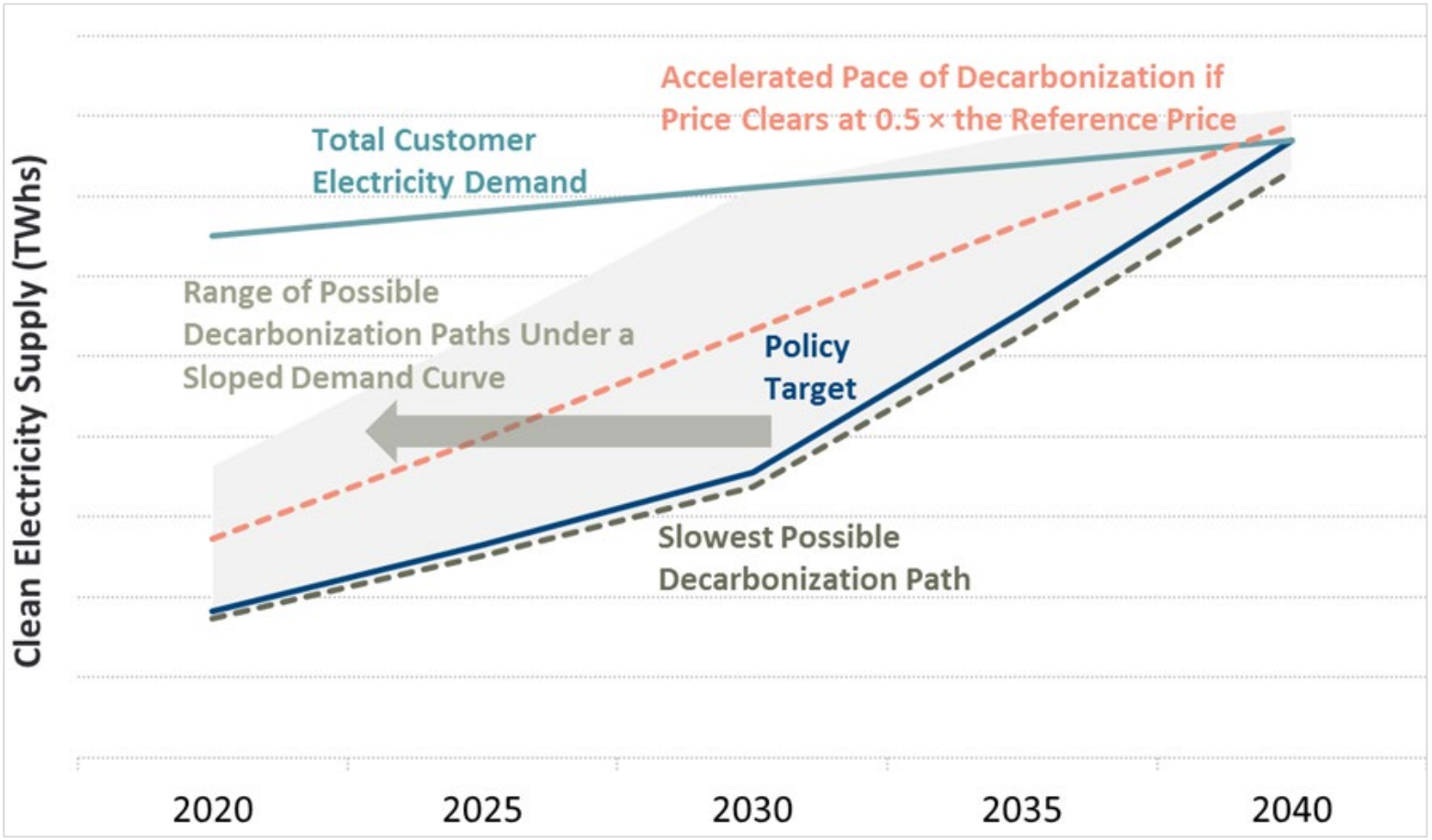


Year	Social Cost of Carbon *($/ton)*
2020	$47.25
2025	$51.75
2030	$56.25
2035	$61.87
2040	$67.49
2045	$71.99
2050	$77.62

Source: Spees, *et al*. "How States, Cities, and Customers Can Harness Competitive Markets to Meet Ambitious Carbon Goals." September 2019.

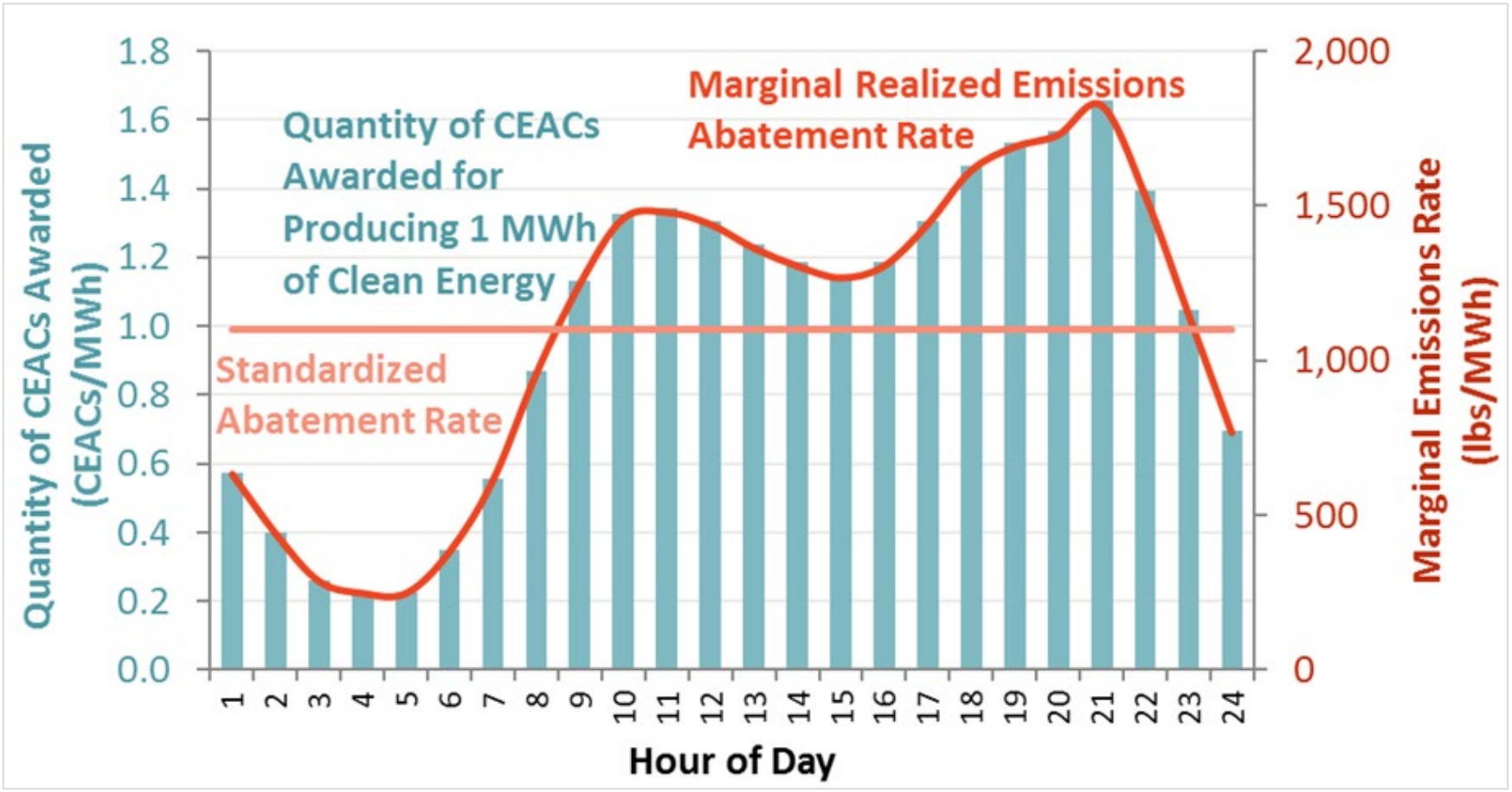
Source: Interagency Working Group on Social Cost of Carbon (updated 2016, revd for 2019 real dollars).

Cleaner, Faster, Cheaper



Source: Spees, *et al*. "How States, Cities, and Customers Can Harness Competitive Markets to Meet Ambitious Carbon Goals." September 2019.

One (complicating but positive) enhancement



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