

A Regional Policy Attribute Market

OPTIONS FOR ENABLING STATES AND CONSUMERS TO REFLECT POLICY REQUIREMENTS WITHIN THE PJM REGIONAL MARKETPLACE

PRESENTED BY

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The general concept for a regional policy attribute market

Buyers

Submit target clean energy procurement volumes

States

Customers

Retailers

Public Power

Cities



Regional Policy Attribute Market

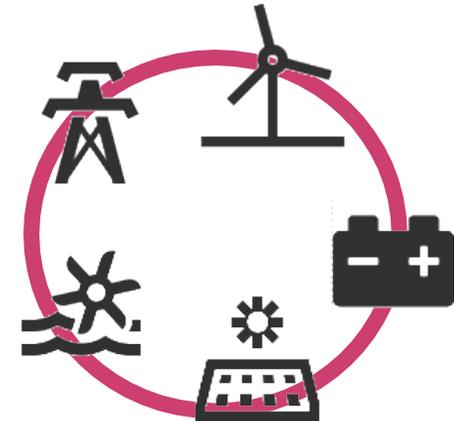
Platform for large-scale, regional clean energy attribute procurement

- **Three-year forward auction (immediately before or integrated with capacity market)**
- **Multi-year commitments for new resources (one year for existing)**
- **Competitive format drives innovation and cost reductions**

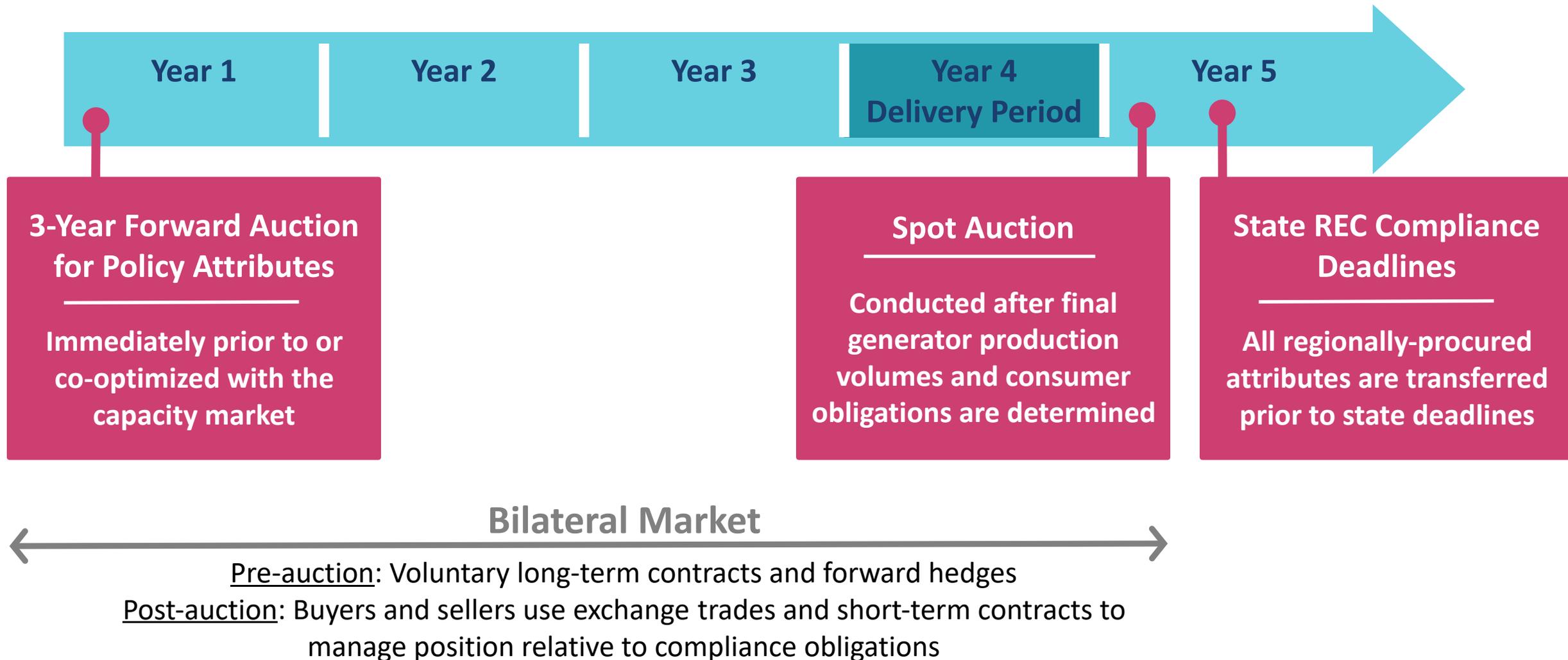


Procured Attributes

Regional scale unlocks benefits of regional coordination and competition (infeasible for one state in isolation)



Timeline of a regional clean attribute procurement market



Three high-level options (many variations)

1. Current RPM with Clean Capacity Constraints

2. Forward Clean Energy Market (FCEM)

3. Integrated Clean Capacity Market (ICCM)

How do customers express demand for clean supply?

Clean capacity requirements (UCAP MW)

Clean energy attribute bids (MWh of attributes)

Clean energy (MWh of attributes)
+
Option: Clean capacity (UCAP MW)

Who runs the market?

PJM

Options: 1) PJM
or
2) State-selected entity (e.g. similar to RGGI)

Options: 1) PJM
or
2) State-selected entity (under multi-state FRR)

For detail see: [Report on FCEM](#) (Appendices A-H)

For detail see: [Report on ICCM](#) (Appendix C)

Design elements: OPSI guidance on design and variations

Design Element	OPSI Preferred Design (per OPSI Letters)	Design Variations and Implementation Details
Product Definition	<ul style="list-style-type: none"> • Products should align market outcomes with policy requirements 	<ul style="list-style-type: none"> • States can opt in to listing selected state-defined • Identify new regionally-defined products (e.g. REC, CEAC, GHG-abatement product, clean capacity)
Demand Participation	<ul style="list-style-type: none"> • Voluntary buy bids, buyer-pays model • All types of buyers accommodated (state agencies, utilities, cities, competitive retailers, public power, end use consumers) • State programs, policies, and self-supply enabled 	<ul style="list-style-type: none"> • How to accommodate buyers that are not current PJM market participants • Mechanics of bidding, credit requirements, settlements, bilaterals & attribute transfers
Supply Participation	<ul style="list-style-type: none"> • States will continue to determine eligibility criteria for their own products 	<ul style="list-style-type: none"> • Eligibility requirements for new regionally-defined products • Multi-year price lock-in eligibility and term (e.g. 7-15 years) • Mechanics of offering for multiple products, bilaterals, penalties for non-delivery & settlements
Auction Clearing	<ul style="list-style-type: none"> • Competitive, least-cost procurement 	<ul style="list-style-type: none"> • Mechanics of optimized auction clearing with multiple products and multi-year commitments • Integration or alignment with RPM • Reconfiguration and spot auction processes
Monitoring and Mitigation	<ul style="list-style-type: none"> • Best practice monitoring and mitigation 	<ul style="list-style-type: none"> • Mechanics of any defined processes and reports; reporting and enforcement processes

Forward Auction Clearing

Optimized clearing in a multi-product auction

- ✧ Adapt the same math utilized in RPM today to achieve optimized market clearing across multiple products in the regional market platform
- ✧ Common features across all designs:
 - Societal-benefit maximization to select cleared resources
 - Marginal-cost-based pricing (every product can clear at a different price, but products with large overlaps in eligible resource mix will tend to clear at the same or similar price)
 - Resources eligible to sell multiple products clear in the most profitable bundle of attributes (never earning less than their total offer price)
 - Buyers procure the most valuable products at the lowest combined cost (never paying more than their bid price)
- ✧ Other particulars of the auction clearing mechanism will depend on the chosen products and whether the attribute market is integrated with RPM

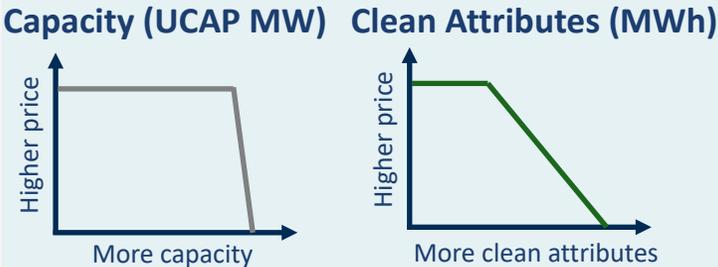
ICCM example illustrates extending RPM auction clearing in a multi-product market (capacity and clean attributes)

BIDS

CO-OPTIMIZED AUCTION CLEARING

CLEARING RESULTS

Demand



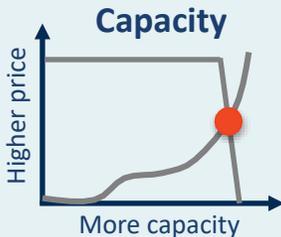
Supply Offers

- Total annual resource cost (\$)
- Capacity quantity (UCAP MW)
- Clean attribute quantity (MWh)

Similar to Current PJM Capacity Market Clearing

- **Objective function:** Maximize social surplus (area under demand curves minus cleared resource cost)
- **Cleared resources:** Least cost resources for meeting capacity & clean energy demand
- **Price setting:** Marginal cost of meeting incremental demand

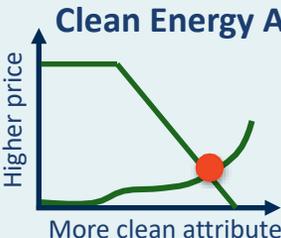
Clearing Prices



Cleared Resources



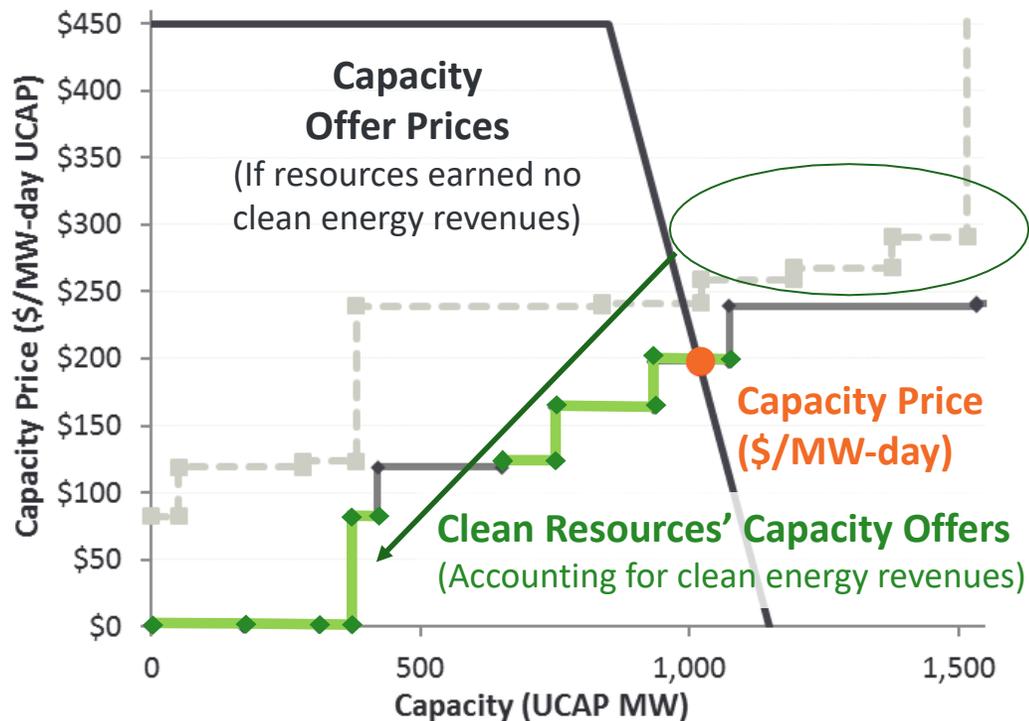
Clean Energy Attribute



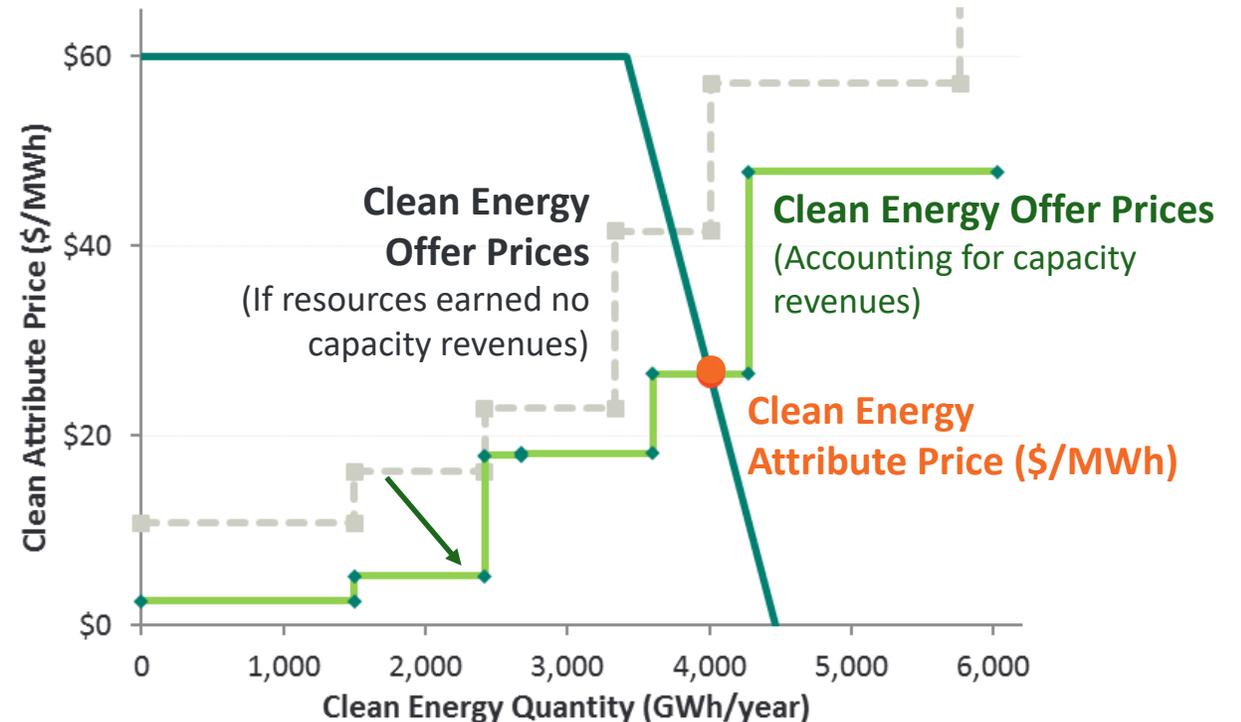
How are prices set in ICCM?

Co-optimized price formation reflects marginal cost of each product.

Capacity Clearing



Clean Energy Attribute Clearing



Note: Simplified example is not intended to reflect PJM. Clearing model available upon request.

How can sellers offer in ICCM?

Sellers can offer up to three types of offers: capacity-only, attribute-only, or capacity+attribute. Examples of typical fossil and clean resource offers:

	Gas Plant	Solar Resource
Installed Capacity	100 MW ICAP	100 MW ICAP
Qualified Offer Quantity	Capacity: 95 MW UCAP Attributes: n/a (not eligible)	Capacity: 42 MW UCAP Attributes: 131 GWh RECs
Offer Price	\$200/MW-day UCAP Same as current capacity market offer structure.	\$80/kW-year ICAP One total revenue requirement to sell two products; resource will clear if total revenues from selling both products exceeds the offer price.

ICAP = Installed capacity, or maximum/nameplate rating

UCAP = Unforced capacity, or de-rated value contributing to capacity market reliability needs

Attributes = any REC, ZEC, or CEAC product that the resource is eligible to sell

Demand Participation

What will attract demand into the marketplace?

Suggest: Focus on
what states &
consumers want to
buy

Attractive product listing:

- ⌘ Establish market platform able to support multiple products, tracked by PJM-EIS
- ⌘ State-defined attributes (states can opt in)
- ⌘ Newly-defined regional products that aim to serve voluntary demand, support innovation, and any future federal policies
- ⌘ Mechanisms to list new and refine product listings over time, so as to support emerging buyer demand

Options for customizing buyer demand bids:

- ⌘ Specifying maximum price and volume (price-quantity pairs, or sloping demand curve)
- ⌘ Specifying which products can fill the demand bid
- ⌘ Expressing demand for new resources only
- ⌘ Expressing demand for multi-year commitments (imposes additional credit requirements)

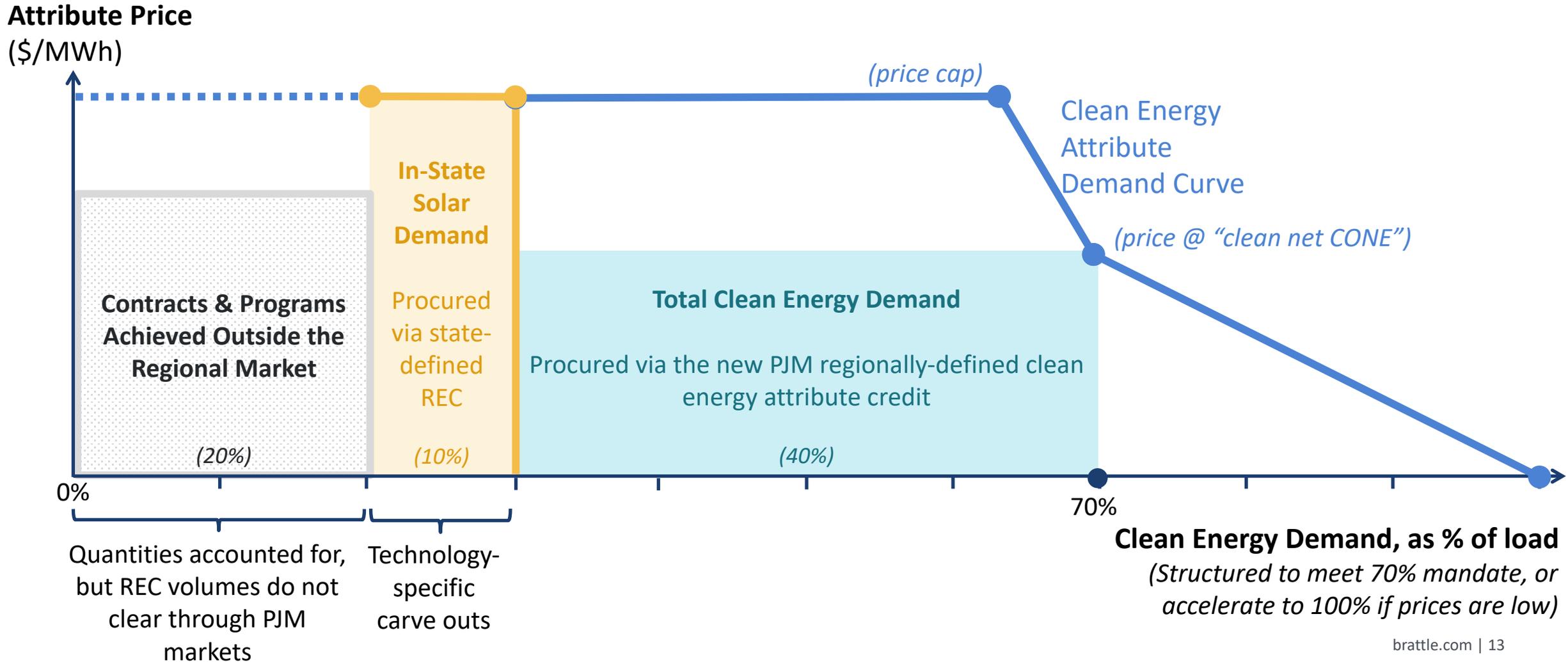
Minimizing buyer transaction costs and barriers to entry:

- ⌘ Supporting state regulatory integration (e.g. supporting development of demand parameters, REC submissions processes, enabling retail switching)
- ⌘ Straightforward participation models for all types of buyers

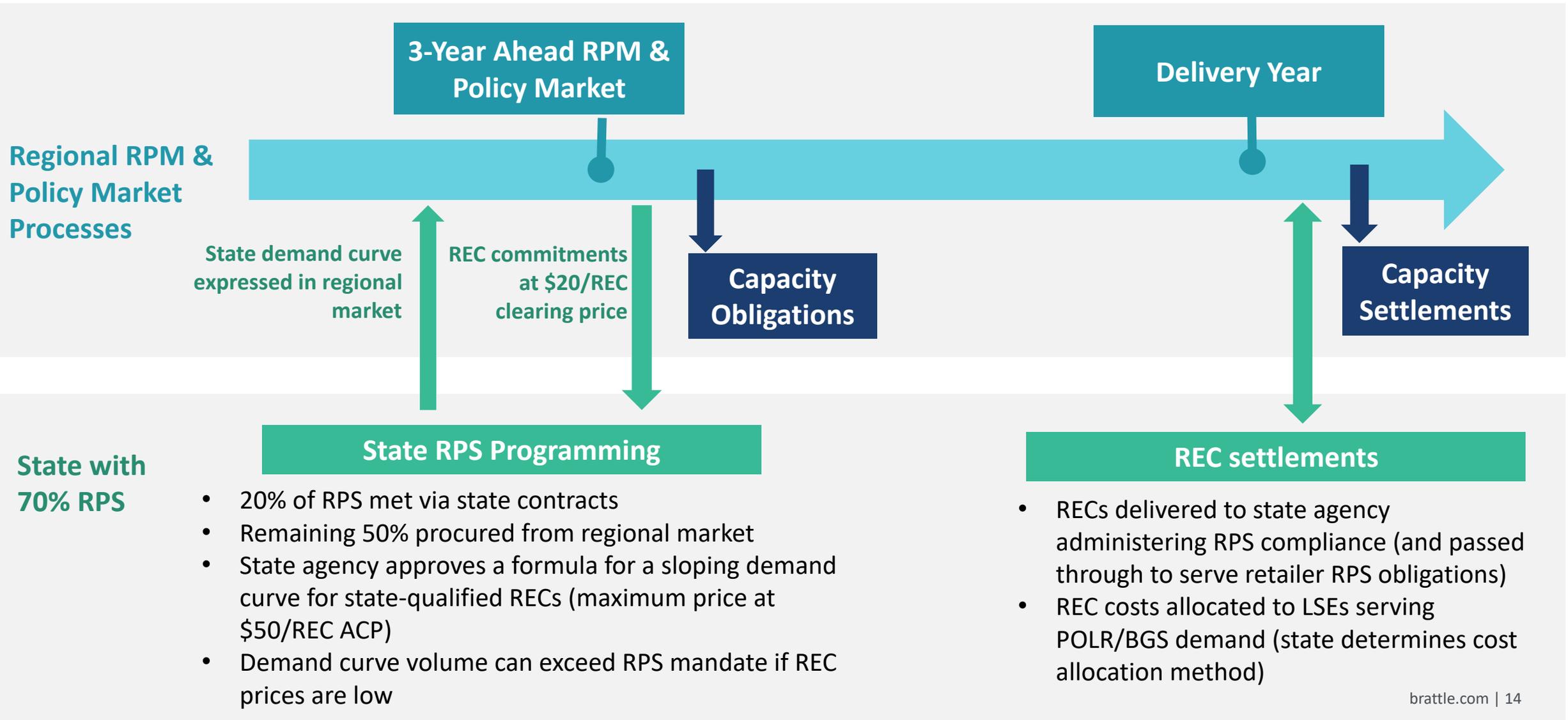
What demand participation models need to be considered?

	State-authorized demand bids	Voluntary LSE demand bids	Non-LSE voluntary demand bids
What types of entities might submit the demand bid?	<ul style="list-style-type: none"> • State agency • PJM (using state-dictated formula) • Distribution utility (under state-authorized participation) 	<ul style="list-style-type: none"> • Retailer subject to state RPS or serving voluntary end use demand • Public power or integrated utility engaged in resource planning 	<ul style="list-style-type: none"> • Local governments • End use consumers • NGOs
Payment obligation	Payment obligation follows the state-specified customer group (not the LSE)	Payment obligation assigned to the LSE (not the end use customer)	Payment obligation to voluntary buyer
Credit requirements	n/a (guarantee to pay is derived through settlement authority)	Credit requirements sufficient to cover buyer-specified max price & term	Credit requirements sufficient to cover buyer-specified max price & term
Attribute transfers	Attributes transfer to state-designated entity prior to compliance deadline	Transferred to LSE	Transferred to voluntary buyer

Example: State-authorized demand bid structure to meet a 70% clean energy requirement



Example: State uses policy market to meet RPS for POLR/BGS/non-shopping customers (additional examples in appendix)



Takeaways

Takeaways for clean attribute design

- 🌀 **OPSI Guidance:** Provides overall framework for design objectives and procurement format, including the requirement that the design should fully support many types of state, LSE, and non-LSE buyers
- 🌀 **Product Definition:** Recommend a flexible platform that can support multiple state-defined and regionally-defined products (RECs, CEACs, and clean capacity). Platform will maximize benefits of trade by attracting large volumes of voluntary demand
- 🌀 **Procurement Format** (RPM constraints, FCEM, ICCM): Full integration with RPM is most economically efficient and able support all of the products under discussion, but may have pragmatic governance and implementation challenges
- 🌀 **Flexibility to Innovate:** Recommend to maintain flexibility to offer policy support, regulatory integration, and innovative products to consumers and policymakers

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Dr. Kathleen Spees is a Principal at The Brattle Group with expertise in designing and analyzing wholesale electric markets and carbon policies. Dr. Spees has worked with market operators, transmission system operators, and regulators in more than a dozen jurisdictions globally to improve their market designs for capacity investments, scarcity and surplus event pricing, ancillary services, wind integration, and market seams. She has worked with U.S. and international regulators to design and evaluate policy alternatives for achieving resource adequacy, storage integration, carbon reduction, and other policy goals. For private clients, Dr. Spees provides strategic guidance, expert testimony, and analytical support in the context of regulatory proceedings, business decisions, investment due diligence, and litigation. Her work spans matters of carbon policy, environmental regulations, demand response, virtual trading, transmission rights, ancillary services, plant retirements, merchant transmission, renewables integration, hedging, and storage.

Dr. Spees earned her PhD in Engineering and Public Policy within the Carnegie Mellon Electricity Industry Center and her MS in Electrical and Computer Engineering from Carnegie Mellon University. She earned her BS in Physics and Mechanical Engineering from Iowa State University.

Appendix

Demand participation examples

Question: How might differently-situated states and buyers utilize a regional market for policy resources?

Caveat: Illustrative examples are for discussion only – anticipate that each participating state would need to engage in a more fulsome exercise to examine interactions with planning, retail choice, and RPS structures.

Examples:

1. State with no policies
2. Utility engaged in integrated planning
3. State uses regional policy market to serve RPS of POLR/BGS customers
4. State allowing competitive retailers to use the regional market on a voluntary basis
5. Many states/customers use the regional market to procure many different categories of clean attributes

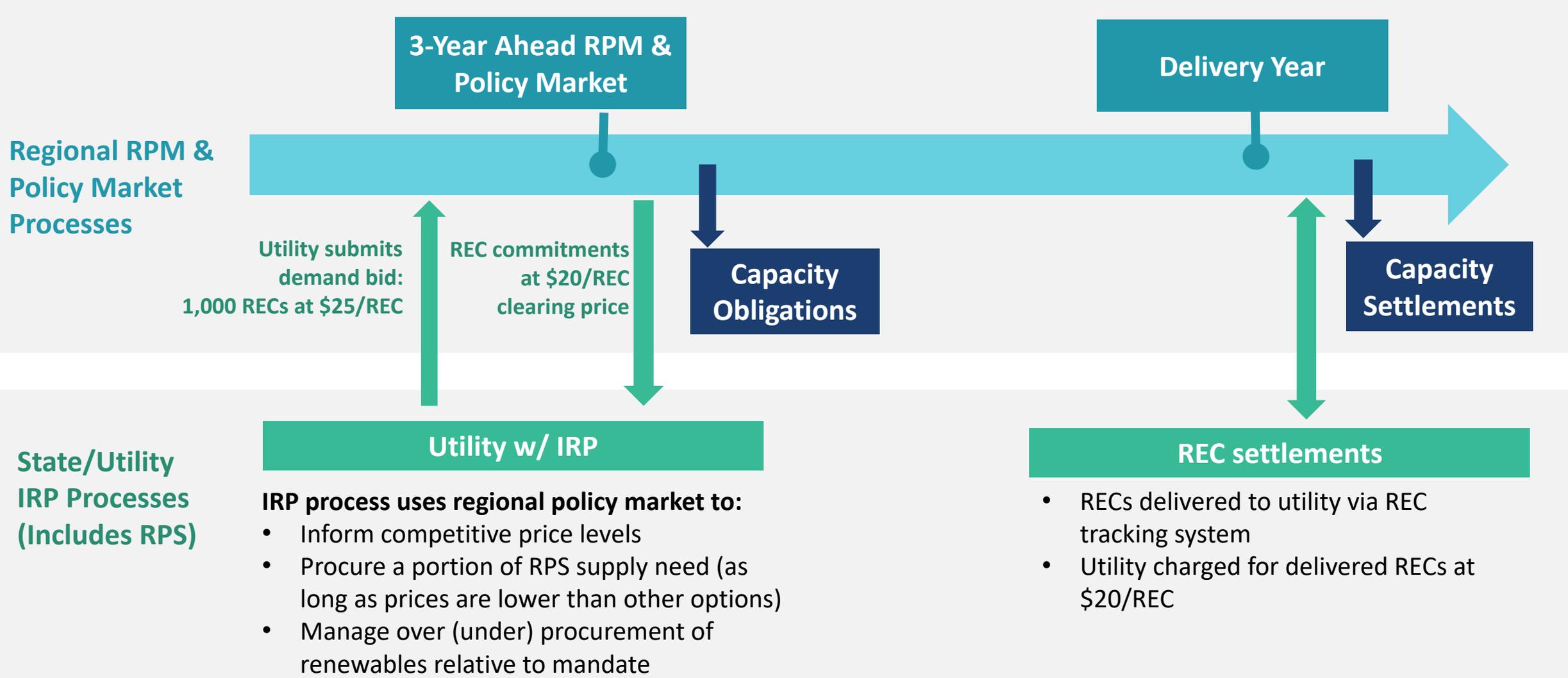
Example 1: State with no policies



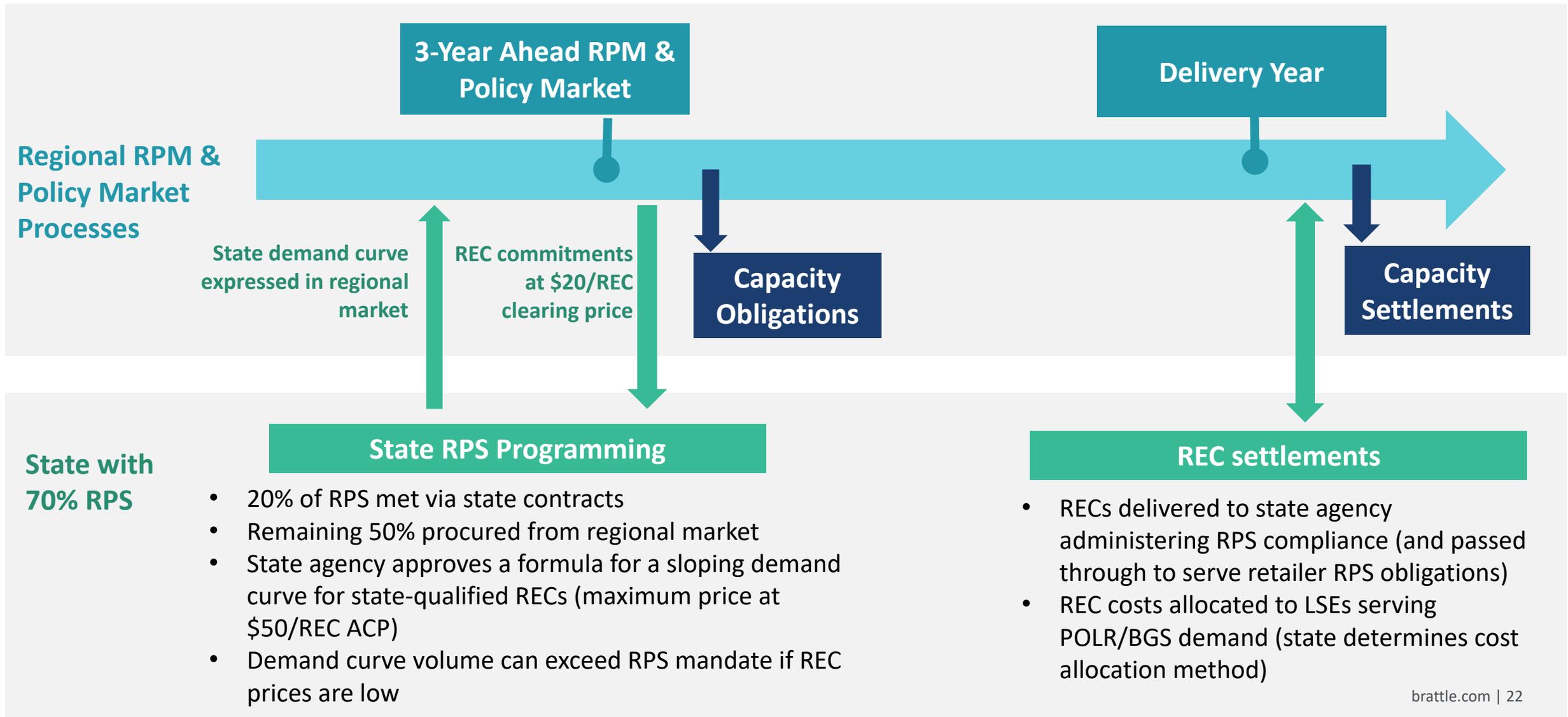
Policy market impacts on non-participating states:

- No change to processes compared to status quo
- FRR remains an option
- Capacity and energy prices may be somewhat lower than under status quo (especially if the policy market is used to accelerate clean resource deployment)

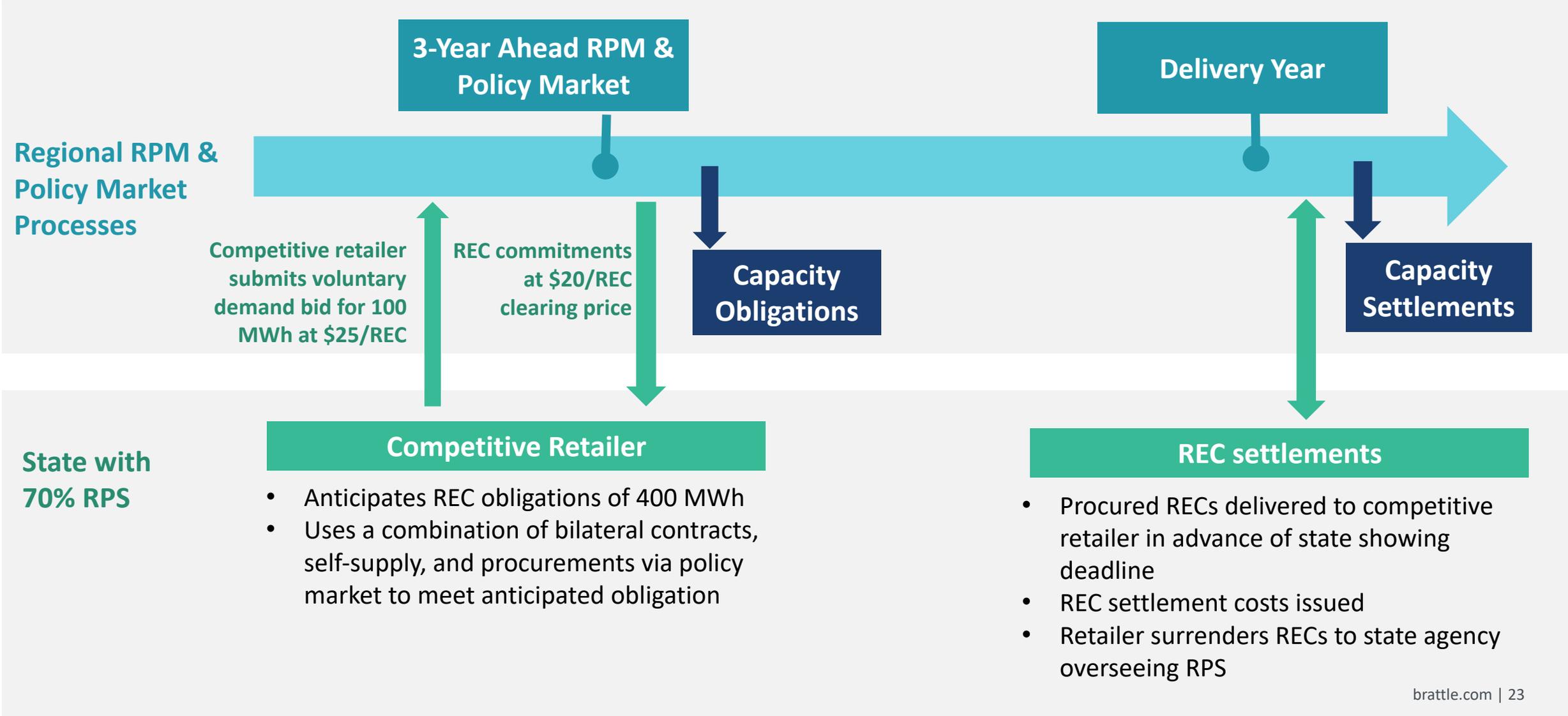
Example 2: Utility engaged in integrated planning



Example 3: State uses policy market to meet RPS for POLR/BGS/non-shopping customers



Example 4: State allows competitive retailers to utilize regional policy market on a voluntary basis



Example 5: Many states/customers use the regional market to procure multiple different categories of clean attributes

