Capacity Auction Reforms

Overview of Prompt Capacity Market

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Capacity Auction Reforms (CAR)

WMPP ID: 184

Earliest Target Effective Date: Q2-Q3 2026

- The CAR project includes a change in auction timing, where a prompt auction held shortly before the start of the Capacity Commitment Period (CCP) would replace the Forward Capacity Auction that has been used to date
- Today's discussion provides a high-level overview of how the prompt market may work, and provides further details on several key prompt topic areas

Topics Discussed Today

- High-level overview of prompt capacity market
- Auction overview and mechanics
- Treatment of capacity that is not yet in-service
- Competitive capacity offer prices in a prompt market
- Capacity market price formation in a prompt market

Anticipated Capacity Market Reforms under CAR

- The ISO plans to make three sets of foundational changes to its capacity market for the Capacity Commitment Period (CCP) that begins in June 2028
  - Change the auction timing from 3+ years forward to prompt
  - Move from an annual auction that procures capacity for a 12-month period to seasonal auctions
  - Introduce accreditation reforms to better align how much capacity a resource can sell with its contributions to resource adequacy
- Each of these changes is a significant body of work in and of itself

Objectives of the CAR-PD Phase of Work

- Facilitate change to a prompt auction, including necessary updates to auction processes and administration to make such an auction framework function effectively
- Where possible, simplify and streamline auction processes and procedures for the ISO and Market Participants
- Focus design work on changes that are necessary to develop a functional prompt design or that are needed to create a foundation upon which CAR-SA proposal can be built
- Using these objectives to guide the CAR-PD work will allow the ISO to complete this first phase of design work in 2025, thereby allowing the time necessary to complete CAR-SA by late 2026

Today's Discussion Focuses on the Prompt Design Overview and Some Key Design Elements and Concepts

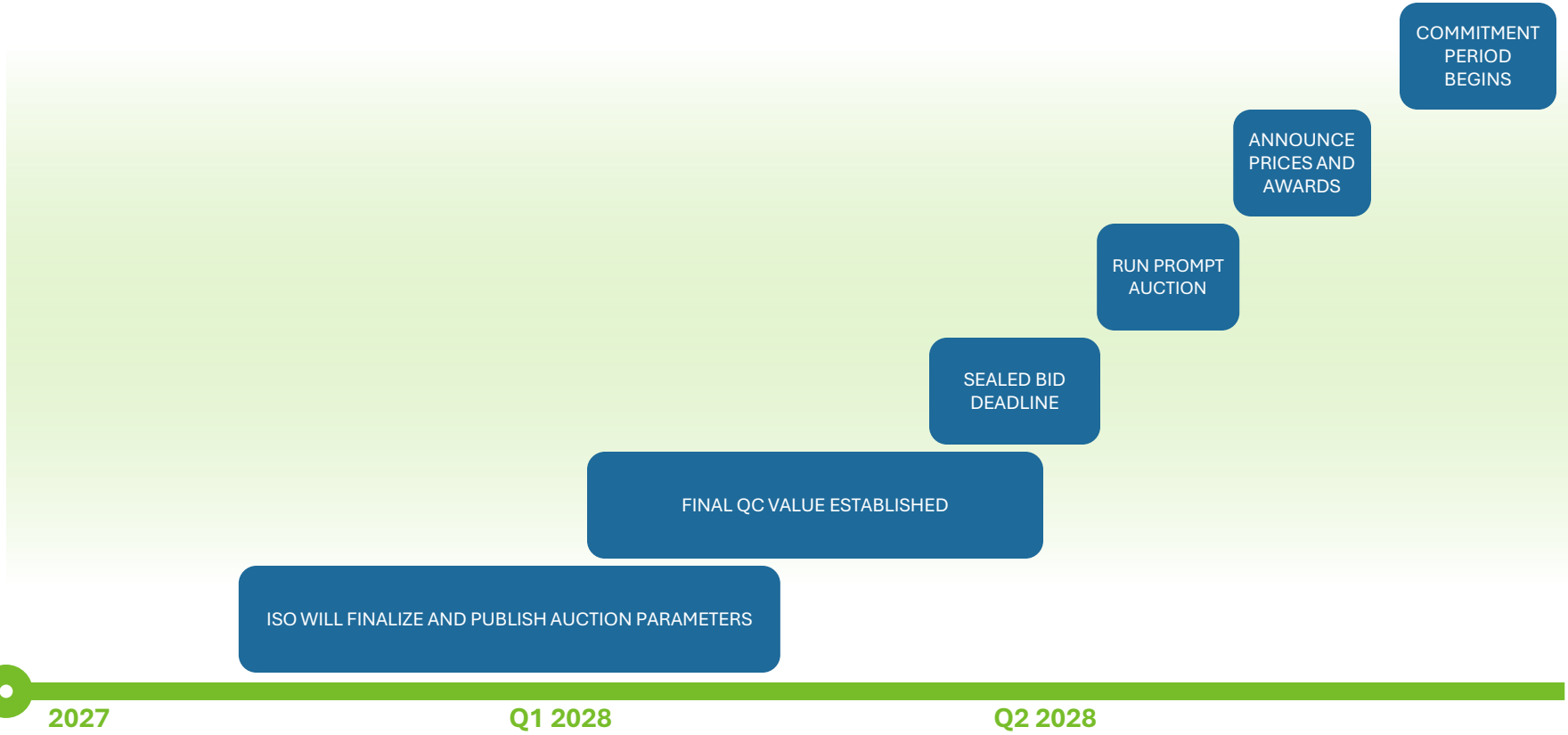
- All material discussed today represents the ISO's current thinking, where design elements may evolve as work progresses
  - If the ISO proposes changes to the design, it will inform stakeholders
- The discussion today aims to give stakeholders a 'big picture' sense of how the prompt design may work, and offers the ISO's thinking on some key design elements
- The ISO appreciates stakeholder interest in digging into design details, but in many cases, these details are still being worked out and the ISO will endeavor to answer such questions and share design details as soon as practical

HIGH-LEVEL OVERVIEW OF PROMPT CAPACITY MARKET

Activity Schedule: Current Thinking on Dates/Deadlines for Prompt Auction

- Capacity Commitment Period Begins: June 1, 2028
- Run the prompt annual auction: April/May, 2028
- Sealed bid deadline: March/April, 2028
- Final Qualified Capacity (QC) values established: Early 2028
- Prior to sealed bid submission, the ISO will finalize and publish auction parameters, including those related to:
  - The capacity zones to be modeled
  - The auction demand curves
  - The offer price below which resources are not subject to seller-side mitigation review (the sealed bid equivalent of today's Dynamic Delist Bid Threshold (DDBT)). Note: this offer price and mitigation review will be discussed in more detail beginning at the April MC

Activity Schedule: Current Thinking on Dates/Deadlines Prompt Auction



Processes Preceding the Auction to Specify Capacity Demand

- The development of the capacity demand curves will use several processes that are similar to today:
  - Demand curves will continue to be derived based on capacity's Marginal Reliability Impact (MRI) value
  - Net CONE will be used to translate MRI values to capacity prices
  - The ISO will continue to study the need to define import- and export-constrained capacity zones in the auction
- Under prompt, these processes will be conducted closer to the start of the CCP to leverage the most up-to-date information about capacity demand

Processes Preceding the Auction to Specify Capacity Supply

- The auction will continue to require that the ISO determine how much capacity resources can sell
  - Anticipate broader changes with the seasonal and accreditation reforms as part of the CAR-SA design and filing
- Key difference: To sell capacity in the prompt auction, resources must demonstrate that they have achieved in-service operation *(more on this later in deck)*

Processes Preceding the Auction to Specify Capacity Offer Prices

- Before the auction is run, the ISO will collect all offers for qualified resources, reflecting the minimum price at which they would sell capacity
- The IMM will review cost workbooks associated with offers above the equivalent of the DDBT to gauge whether they may represent an attempt to exercise market power
- Similar to today, the resource's offer price may be modified if the offer price represents an attempt at economic withholding
- The ISO will discuss details of mitigation review beginning in April

The Auction Will Use Supply Offers and the Demand Curve to Determine Capacity Awards and Prices

- Anticipate that the sealed bid auction will be run in the April/May timeline for the CCP set to start on June 1
  - More on the sealed bid format later in the deck
- As today, the ISO will determine the cost-effective set of capacity awards and capacity clearing prices using the set of supply offers and demand curves
- Shortly after the auction is complete, the ISO will notify Market Participants of the auction outcome

Settlements and Pay-for-Performance

- Resources that are awarded a CSO are paid the market clearing price for each unit of capacity sold
- Such resources have a financial ‘share of system’ obligation against which their performance is measured during Capacity Scarcity Conditions during the CCP
- There will continue to be annual and monthly stop-loss limits that cap the non-performance charges that resources with a CSO may incur, where these are not expected to materially change under CAR-PD

Reconfiguration Auctions

- Under the current forward construct, the ISO runs three Annual Reconfiguration Auctions (ARAs) that provide capacity suppliers with opportunities to update their capacity position ahead of the CCP
- With the move to a prompt auction, there is less time between when the primary auction is run and the start of the CCP, eliminating the need for such ARAs
  - The prompt auction is likely to be no earlier than the last of these auctions, ARA3
- Under a prompt auction, there will continue to be Monthly Reconfiguration Auctions (MRAs) that provide the ability to buy and sell CSO MW for each month of the CCP

AUCTION OVERVIEW AND MECHANICS

The Prompt Auction will use a Sealed Bid Format

- This change was first noted as ‘in scope’ in the August 2024 NEPOOL Markets Committee Presentation (slide 32)
- Benefits of current descending clock auction (DCA) format, where offers and bids are collected over series of rounds, are reduced with move to a prompt auction, where participating resources have already made entry decisions
- For more information on the differences and tradeoffs between a DCA and sealed bid auction, see the ISO’s 2016 discussion paper and presentation to stakeholders on this topic

What Does a Move to a Sealed Bid Format Mean?

- Rather than collecting offers during a series of rounds, ‘final and best’ offers will be submitted to the ISO ahead of the auction
- The ISO will use these offers to determine capacity awards and clearing prices using the market clearing engine in a manner comparable to today
  - In other words, the auction format is a mechanism by which offers are collected, but it does not change the process or rules used to determine auction clearing outcomes
- Some auction parameters may effectively remain the same, but require terminology updates to reflect the change in auction format
  - E.g., the Auction Starting Price may be changed to the ‘Maximum Offer Price’, or a comparable term

All Resources Submit Priced Supply Offers (PSOs)

- CAR-Prompt replaces the delist bid framework that was used for existing resources
- However, the logic is largely unchanged – in each case, the price represents the minimum value at which the resource would willingly accept a CSO
- With deactivations occurring outside of the capacity market, will no longer have retirement or permanent delist bids, or the PSO equivalent

A Number of Features Are Not Materially Changing with the Move to Prompt

- Resources will continue to be able to offer their capacity in multiple price/quantity pairs, and submit non-rationable offers
- Intermittent Power Resources (IPRs) will continue to be able of sell different quantities of capacity in the summer and winter
  - Anticipate that this process will change with the seasonal and accreditation reforms
- Composite offers will continue to be permitted
  - Anticipate that this process will change with the seasonal and accreditation reforms
- Resources that do not submit a price for their capacity in the auction will be treated as a price-taker (willing to sell capacity at any price)

TREATMENT OF CAPACITY THAT IS NOT YET IN-SERVICE

A Prompt Auction Helps Address Concerns with Phantom Entry

- Phantom entry occurs when a new resource sells capacity for a future commitment period, but then is not able to provide capacity when the CCP begins
- Phantom entry has several adverse effects on market efficiency and system reliability:
  - Suppresses capacity prices because phantom resources sell capacity (thereby reducing the clearing price) but then cannot deliver on their obligation
  - Reduces system reliability in the short term by awarding position to capacity that is not available in place of other resources that could improve the region's reliability
  - Reduces market efficiency and system reliability in the long-term by creating a misalignment between the (higher) reliability value that capacity prices and the (lower) price that is paid to capacity; this can reduce the likelihood that new resources enter and existing resources continue to operate
- As outlined in the Analysis Group report, the concern with phantom entry in New England is material (see pages 24 through 30)

All Resources Will Need to Operate Before Selling Capacity in a Prompt Auction

- The move to a prompt auction that is run shortly before the start of the commitment period requires changes to the process by which ‘new’ projects that have not previously sold capacity participate in the auction
- The ISO is proposing that resources will have to demonstrate that they are in-service ahead of the auction before they can sell capacity
- This approach will most effectively and directly address the concerns with phantom capacity relating to market and reliability outcomes

The ISO Will Develop Rules to Maximize Resources' Ability to Demonstrate Being In-Service

- While the ISO is still working on the design details, it aims to provide as much opportunity for new resources to demonstrate being in-service as possible, including:
  - Allowing resources that are not yet commercial to complete the qualification process
  - Setting the in-service demonstration deadline as close to the running of the prompt auction as possible
  - Holding the prompt auction as close to the start of the CCP as possible

Opportunities Available to Resources That Miss the In-Service Deadline

- Resources that miss this deadline to participate in the annual auction can still earn capacity revenues by performing during Capacity Scarcity Conditions
- As part of CAR-SA, the move to a seasonal auction will also give resources more opportunities to demonstrate that they are in-service
  - E.g., if a resource misses the deadline by a month, the next in-service deadline for a seasonal auction will occur in five months, rather than 11 months
- The ISO is also assessing if there are other ways in which it can facilitate additional participation from resources that become in-service after the deadline

COMPETITIVE OFFER PRICES IN A PROMPT MARKET

Background and Context: Offer and Price Formation

- Stakeholders have raised questions and shared observations related to:
  i. How a move to prompt may impact what costs are included in competitive offer prices, and
  ii. How this change could affect capacity clearing prices
- This section discusses (i), and the next section considers (ii)
- Today's discussion is intended to share information about how the ISO thinks about these questions at a conceptual level
- More discussion of how this thinking impacts the proposed design, including the mitigation process, will follow in the coming months

Competitive Capacity Offer Price Formation

- Under either a forward or a prompt auction, a resource's competitive capacity offer price should consider the incremental costs associated with taking on a CSO
- In other words, the resource should consider what costs it would not incur (and revenues not received) if it did not take on a CSO – i.e., avoidable costs
- This logic is consistent with economic theory, and earlier ISO statements on competitive offer price formation
  - See, for example, the IMM testimony on competitive bids included in the Pay-for-Performance filing (pages 57 and 58)
- This concept can be illustrated with a simple example (*next*)

Example Assumptions

- Imagine that Resource A has low unavoidable going forward costs, and therefore expects to operate (in the same manner) for the upcoming CCP, regardless of whether it acquires a CSO
- To determine its competitive capacity offer price, Resource A should consider the costs associated with taking on a CSO, which may primarily relate to its Pay-for-Performance revenues
- Let's assume that Resource A has the following expectations regarding the potential for Capacity Scarcity Conditions (CSCs) for the CCP

Expected Number of CSC Hours	10
Expected Balancing Ratio	0.72
Expected Performance During CSC Hours	0.8
Performance Payment Rate (PPR)	$5,000 / MWh

Developing the Cases for Comparison

- To calculate Resource A's competitive offer price, we compare its expected revenues under two cases:
  - Case 1: Resource A sells capacity at its competitive offer price, O^C
  - Case 2: Resource A does not sell capacity
- We then solve for the value of O^C that ensures that the resource is no worse off from selling capacity
- To do so, we plug in the inputs from earlier to get the capacity revenues (R^1 and R^2) for each case *(next)*
- More details walking through these calculations are provided in the appendix

Deriving the Competitive Offer Price

- Case 1: $R^1 = O^C + (0.8 – 0.72) \times 10 \times \$5{,}000$
- Case 2: $R^2 = 0.8 \times 10 \times \$5{,}000$
- To derive the competitive offer price, we set R^1 equal to R^2 and solve for O^C
- At this capacity price, Resource A earns equal revenues whether it takes on a CSO or not
- Thus, at any capacity price greater than O^C, Resource A would prefer to sells its capacity

Deriving the Competitive Offer Price (con't)

Rearranging the terms and solving for O^C yields the following:

- $O^C = 0.72 \times 10h \times \$5{,}000 / MWh = \$36{,}000 / MW = \$3/kW\text{-}m$
- Terms that are included in both R^1 and R^2 cancel each other out and therefore do not impact O^C
  - Intuition: These costs (or, in this case, revenues) are not impacted by whether Resource A sells capacity, and therefore do not factor into its competitive offer price
- Interpretation: By taking on a CSO, Resource A gives up the opportunity to earn an additional $3/kW-m in capacity performance payments

Extending the Logic to Other Costs

- Costs that are incurred that would be avoided if the resource did not take on a CSO should be included in the resource's competitive offer price
- However, this logic does not extend to costs that would still be incurred even if the resource did not sell capacity
- For example, imagine that Resource A is considering whether it should also include property taxes ($24,000 per year) in its competitive offer
- We'll again apply the Case 1 and Case 2 logic to derive the competitive offer price for Resource A

Deriving the Competitive Offer Price with Costs That Would Not Be Avoided

- Regardless of whether Resource sells capacity, it will face the same property taxes
- Resource A now includes its property taxes in both cases
- Case 1: $R^1 = O^C + (0.8 – 0.72) \times 10 \times \$5{,}000 - \$24{,}000$
- Case 2: $R^2 = 0.8 \times 10 \times \$5{,}000 - \$24{,}000$
- We again set R1 and R2 equal and solve for O^C

Deriving the Competitive Offer Price with Costs that Would Not Be Avoided (con't)

- Because the property taxes are included in both cases, they cancel out and we end up with the same value of OC
- $O^C = 0.72 \times 10 \times \$5{,}000 = \$3/kW\text{-}m$
- Because property taxes would not be avoided if Resource A does not sell capacity, its competitive offer price should not include this component of its total costs

What If Resource A Increased Its Offer to Account for these Unavoidable Costs (Property Taxes)?

- This question can be answered by comparing its next revenues when it offers competitively ($3/kW-m) to when it instead increases its offer above this value
- In this example, we assume it inflates its offer to $5/kW-m
  - The $2/kW-m increase in its offer corresponds with the $24,000/year property taxes
- We also assume that the capacity clearing price falls between $3/kW-m and $5/kW-m
  - If the capacity price falls below $3/kW-m or above $5/kW-m, Resource A's revenues are not impacted by its decision to inflate its offer price

Comparison of Resource A's Net Revenues

- Competitive Offer: $48,000 + (0.8 – 0.72) × 10 × $5,000 - $24,000 = $28,000
- Inflated Offer: 0.8 × 10 × $5,000 - $24,000 = $16,000
- When Resource A inflated its offer price to include costs it cannot avoid, it no longer sells capacity
- This results in its net revenues decreasing, as it still incurs the costs associated with the property taxes
- Resource A therefore maximizes its net revenues by offering its capacity at its competitive offer price

Competitive Offer Prices under a Prompt Auction

While this logic is applicable regardless of auction timing, there are several ways in which the costs (and revenues) in Cases 1 and 2 could change depending on the auction timing, including:

- If costs that would be avoided if the resource does not obtain a CSO are different under a prompt auction
  - E.g., a new resource would incur investment costs before taking on a CSO in prompt that may not yet be incurred under a forward auction
  - This could result in lower competitive offer prices for such resources in a prompt timeline (if the resource makes the investment)
- Resource may have better information about expected market conditions, including the opportunity costs of taking on a CSO under Pay-for-Performance, in a prompt market

Key Takeaways on Competitive Offers under a Prompt Market

- A resource's competitive capacity offer price considers the incremental costs associated with taking on a CSO
- Costs that cannot be avoided should not be included in a competitive offer price, as their inclusion is not consistent with profit-maximizing behavior
- The move to a prompt may result in some resources offering their capacity at lower prices, but as we'll discuss in the next section, this is not expected to result in lower clearing prices

CAPACITY MARKET PRICE FORMATION IN A PROMPT MARKET

Capacity Price Formation in a Prompt Market

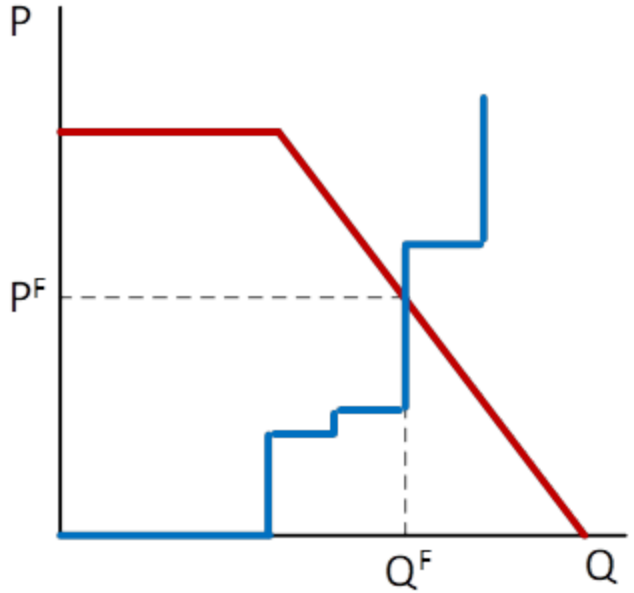
- This module discusses how resources make investment decisions, how they may be impacted by auction timing, and what this means for expected capacity prices
- Considers the investment decision of a potential new resource B under both a forward and prompt auction
  - Example generalizes to all types of investment that could be avoided if the resource does not sell capacity
- Illustrates why we would not expect capacity prices to be lower under prompt, as resources will only make investment decisions if they expect to recover the costs associated with those investments

Capacity Market Pricing Fundamentals

- Generally, the capacity clearing price is set at the intersection of the capacity supply and demand curves
  - The allowance of non-rationable (lumpy) supply offers means this property may not always precisely hold, but general logic outlined in this section will continue to hold
- The demand curve is derived using capacity's MRI-based reliability value
- The supply curve is determined by competitively priced supply offers
- These fundamentals hold under either a prompt or forward market

Capacity Market Pricing Fundamentals (con't)

- An example of the competitive clearing price is shown in the figure to the right where P^F, the capacity clearing price, and Q^F, the clearing quantity, are based on the intersection of the forward supply and demand curves*



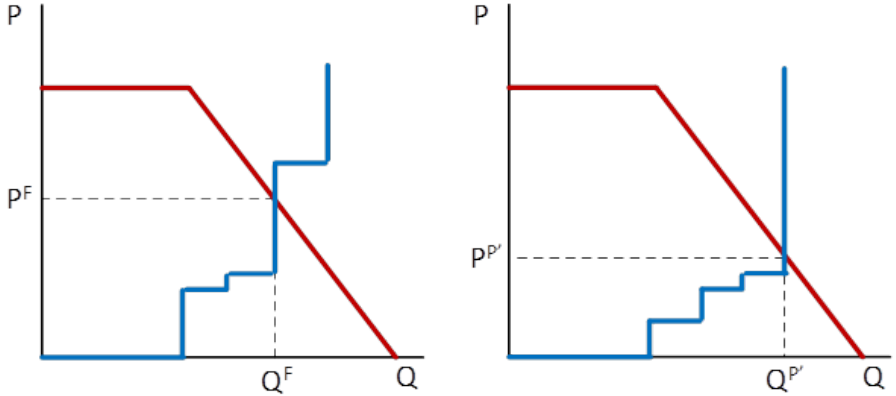
* Demand curve represented as linear for simplicity of examples in this presentation

Clearing Prices After Moving to a Prompt Auction

- The methodology to derive the capacity demand curve will continue from that used under the forward construct where demand is derived using the MRI value of capacity
- As explained in the previous section, the methodology to derive competitively priced supply offers is also unchanged, though there may be instances where a resource's competitive offer price is reduced with the move to a prompt auction
- Based on this, there is a concern that the move to a prompt market could reduce capacity clearing prices if it leads the entire supply curve to shift down

Clearing Prices After Moving to a Prompt Auction (con't)

- Illustrate the concern, where the entire supply shifts down under prompt (as shown on right) and this results in a lower capacity clearing price and higher cleared quantity



- Next: Discuss why the move to prompt is unlikely to decrease the clearing price from P^F to $P^{P'}$

Assumptions Required for Prices to Decrease Under Prompt Are Unlikely to Hold

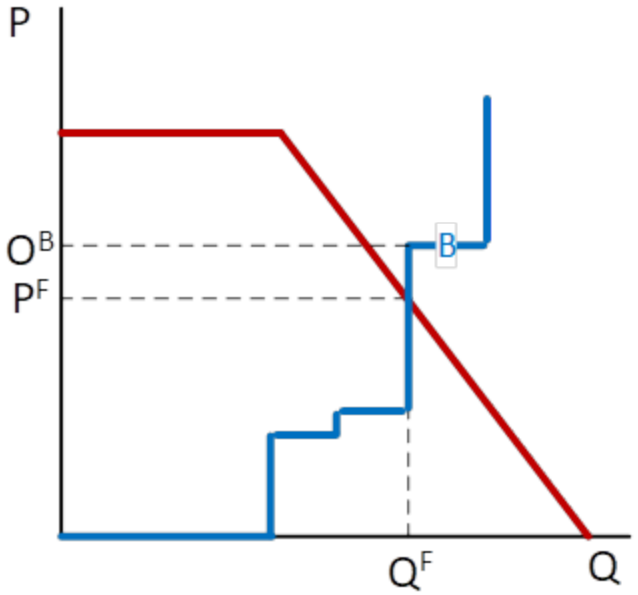
- In this example, the decrease in the clearing price occurs because the prompt auction awards more CSO MW than the forward auction ($Q^{P'} > Q^{F}$)
- This result requires that there is at least one resource that
  i. Does not sell capacity under forward, and
  ii. Sells capacity under prompt
- Satisfying both (i) and (ii) appears inconsistent with profit-maximizing behavior, as explained using an example with new resource B (*next*)

Participation of Resource B in a Forward Auction

- If resource B has yet to be built and sells capacity, it must then incur the investment costs to be built
- These investment costs would be avoided (and resource B would not be built) if it does not sell capacity
- It therefore requires capacity market compensation of at least O^B to 'break even' and willingly choose to be built
- For this condition to hold, it requires that $O^B > P^F$

Participation of Resource B in a Forward Auction (con't)

- Consider the case where resource B satisfies condition (i), meaning $O^B > P^F$
- This means resource B does not sell capacity in the forward market
- Because it does not expect to recover its investment costs, it does not move forward with the project

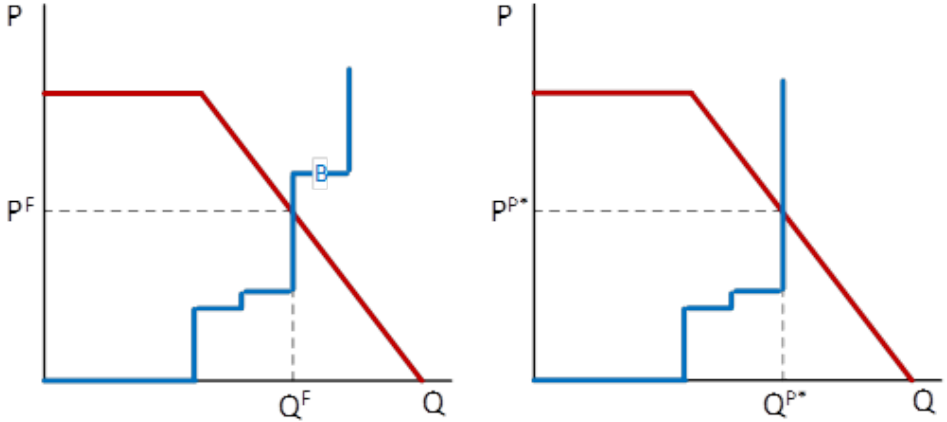


Participation of Resource B in a Prompt Auction

- Let's now consider resource B's options in a prompt auction
- In this setting, it has to make its investment decision before the auction is run
  - If it chooses to invest, these costs have been incurred at the time of the auction and as a result, its competitive offer in a prompt auction may be relatively low
  - If it chooses not to invest, it does not offer capacity into the auction since it is not in-service for the CCP
- If it expects that the auction clearing price will be lower than its 'all in' break-even price (but higher than its competitive offer price if it does move forward), should it invest?
- No. It would not incur investment costs ahead of the auction that did not expect to recover in the auction

Because Resource B Does Not Participate in the Prompt Auction, the Capacity Clearing Price is Equivalent to Under a Forward Auction

- As a result, it would not be included in the supply curve
- This means condition (ii) does not hold, and the prompt clearing price is therefore equivalent to the forward clearing price



Generalizing this Price Equivalency Between Forward and Prompt Auctions

- Resources that are considering investment costs will only incur those costs if they expect to recover them via the markets, whether those markets are forward or prompt
- This is true for potential new resources (such as resource B) and for existing resources considering investment decisions that are related to their capacity market participation, including cases where the existing resource is considering deactivating
- We would therefore expect similar quantities of capacity to be sold in a forward or prompt market, producing comparable capacity prices

The Role of Price Expectations in Investment Decisions Under Prompt

- With a prompt auction, the participant is more likely to make investment decisions before the capacity price is known
- In cases where the investment decision is made based on an expectation of capacity prices that differ from actual prices, this can result in the prompt auction producing a higher or lower capacity price than under the forward auction
  - The prompt auction will produce a higher price (and less cleared capacity) if participant expects a lower capacity price than is realized
  - The prompt auction will produce a lower price (and more cleared capacity) if participant expects a higher capacity price than is realized
- We would not expect this to result in systematically higher or lower capacity prices

Key Takeaways on Price Formation in a Prompt Market

- Instances where a resource's competitive offer price is reduced with a move to a prompt auction are unlikely to reduce the capacity clearing price
- Resources that are considering investment costs will only incur those costs if they expect to recover them via the markets
- We will generally expect similar quantities of capacity to be sold in a forward or prompt market, producing comparable prices
- Participants may be more likely to make an investment decision before the capacity price is determined under prompt because this decision is made based on expected prices
  - This can result in more or less capacity clearing than under forward, which can result in price differences when expected and realized prices differ

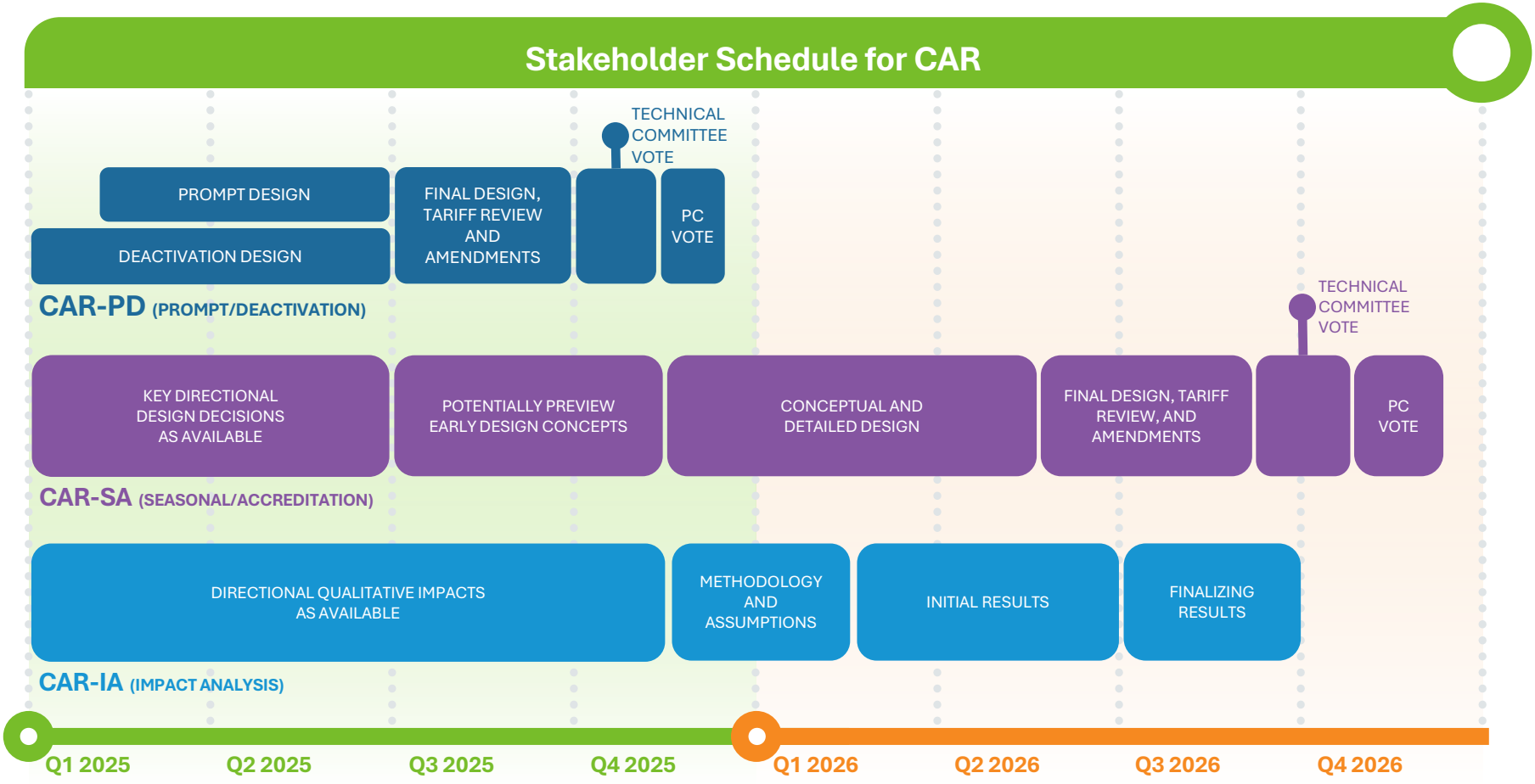
Conclusion and Next Steps

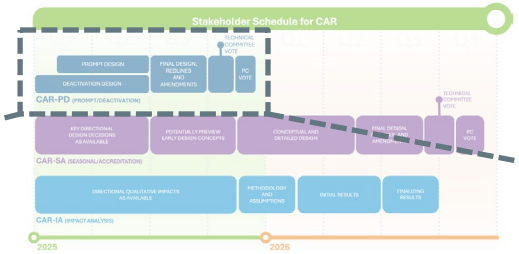
- This presentation reviewed the framework of CAR-Prompt topics: price- and offer-formation, non-commercial participation, the auction structure, and current thinking on the activity schedule and deadlines
  - Additional details will be delivered as we get deeper into design discussions
  - In April, the ISO expects to cover the framework of CAR-Prompt design related to: Resource Qualification, Capacity Interconnection Service, Market Power and Mitigation, and the RAA/ICR process
- Please reach out to James Woods (Jwoods@iso-ne.com) with any feedback following this meeting by March 21, 2025

Questions

STAKEHOLDER SCHEDULE

Stakeholder Schedule for CAR





Stakeholder Schedule for CAR

PROMPT DESIGN

DEACTIVATION DESIGN

FINAL DESIGN, TARIFF REVIEW AND AMENDMENTS

TECHNICAL COMMITTEE VOTE

PC VOTE

CAR-PD (PROMPT/DEACTIVATION)

PROVIDE QUESTIONS AND FEEDBACK ON DESIGN

CONCEPTUAL AMENDMENTS

PRESENT AMENDMENTS

Stakeholder Activity

PRESENT DESIGN & RESPOND TO FEEDBACK

PROVIDE QUESTIONS AND FEEDBACK ON AMENDMENTS

ISO Activity

Q1 2025 | **Q2 2025** | **Q3 2025** | **Q4 2025**

CAR-Deactivation Topic Schedule

The list below provides a projection of when committee discussions will begin on topics related to the deactivation framework:

Deactivation Topic	Projected Start of Committee Discussions
Introduction and notification timeframe	January 2025
Additional design details on notifications and information release	February 2025
Reliability reviews	March 2025
Market power evaluation framework	March 2025
Market power evaluations follow-up	April 2025

CAR-Prompt Topic Schedule

The list below provides a preliminary projection of when committee discussions will begin on the following CAR-Prompt topics:

Prompt Topic	Projected Start of Committee Discussions
Price Formation and Offer Formation	March 2025
Non-Commercial Participation	March 2025
Auction Design and Structure	March 2025
Activity Schedule	March 2025
Resource Qualification Criteria and Process	April 2025
Capacity Interconnection Service	April 2025
Market Power and Mitigation	April 2025
RAA/ ICR Process	April 2025

APPENDIX: DERIVATION OF REVENUES AND COMPETITIVE OFFER PRICE

Calculation of R^1

- R^1 represents the total capacity revenues received if Resource A sells capacity at its offer price of O^C
- The revenue will include three components:
  - The forward capacity payment associated with the sale of capacity: O^C
  - The expected payment associated with energy and ancillary services provided during CSCs: $0.8 \times 10 \times \$5{,}000$
  - The expected charge associated with the share-of-system obligation during CSCs: $0.72 \times 10 \times \$5{,}000$
- Putting the pieces together yields the following:

$$R^1 = O^C + (0.8 - 0.72) \times 10 \times \$5{,}000$$

Calculation of R^2

- R^2 represents the total capacity revenues received if Resource A does not sell capacity
- The revenue will now only include a single component, since it does not receive a forward capacity payment or incur an expected charge associated with a forward position:
  - The expected payment associated with energy and ancillary services provided during CSCs: 0.8 × 10 × $5,000
- This yields the following revenue:

$$R^2 = 0.8 \times 10 \times \$5{,}000$$

Derivation of O^C

- $R^1 = O^C + (0.8 – 0.72) \times 10 \times \$5{,}000$
- $R^2 = 0.8 \times 10 \times \$5{,}000$
- Setting R1 and R2 equal:
- $O^C + (0.8 – 0.72) \times 10 \times \$5{,}000 = 0.8 \times 10 \times \$5{,}000$
- Rearranging and solving for OC yields:
- $O^C = \cancel{0.8 \times 10 \times \$5{,}000} – [(\cancel{0.8} – 0.72) \times 10 \times \$5{,}000]$
- $O^C = 0.72 \times 10 \times \$5{,}000$

Derivation of O^C (con't)

- O^C = 0.72 × 10 hours/year × $5,000/MW-hour = $36,000/MW-year
- Converting to a kW-m price
- O^C = $36,000/MW-year × [1 year / 12 months] × [1 MW / 1,000 kW] = $3/kW-m