WESTERN ENERGY MARKETS

Bid Cost Recovery Payments: Educational Review

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This presentation is an educational briefing on Bid Cost Recovery (BCR) payments.

- Topics
  - Background: What are BCR payments?
  - Motivation: What issues related to BCR arise in electricity markets?
  - Rationale: Why are BCR payments included in electricity market designs?
- Q&A with Governing Body and Stakeholders
- Appendix: Could single-part offers simplify BCR payments?

Overview of the main points of this presentation:

TOPIC	TAKEAWAY
What is BCR	➢ *BCR payments generally ensure that suppliers scheduled in electricity markets recover their offer costs* ➢ *BCR concepts are well established in US markets* ➢ *Rules may be updated to address new resource types and market design changes*
Market issues related to BCR	➢ *Market designs need to address the potential for BCR payments to be increased by the exercise of market power and for unintended BCR payments* ➢ *BCR costs are recovered through unhedgable uplift charges that can sometimes be large*
Rationale for BCR	➢ *<u>Critical for least-cost dispatch and system reliability</u>* • *Supports incentive for resource operators to make cost-based offers (because these will be profit-maximizing)* • *Ensures resource operators will not lose money from following dispatch instructions*

What are BCR payments?

- *BCR payments are generally intended to ensure that supply resources scheduled in electricity markets recover their offer costs after accounting for the locational marginal price (LMP) and ancillary services revenue they are paid*
  - All resources that are not self-scheduled are generally eligible
  - BCR is paid for market schedules and for schedules set to maintain reliability (e.g., reliability unit commitment)
- The motivating idea for BCR is that operators of supply resources should not lose money from following system operator dispatch instructions

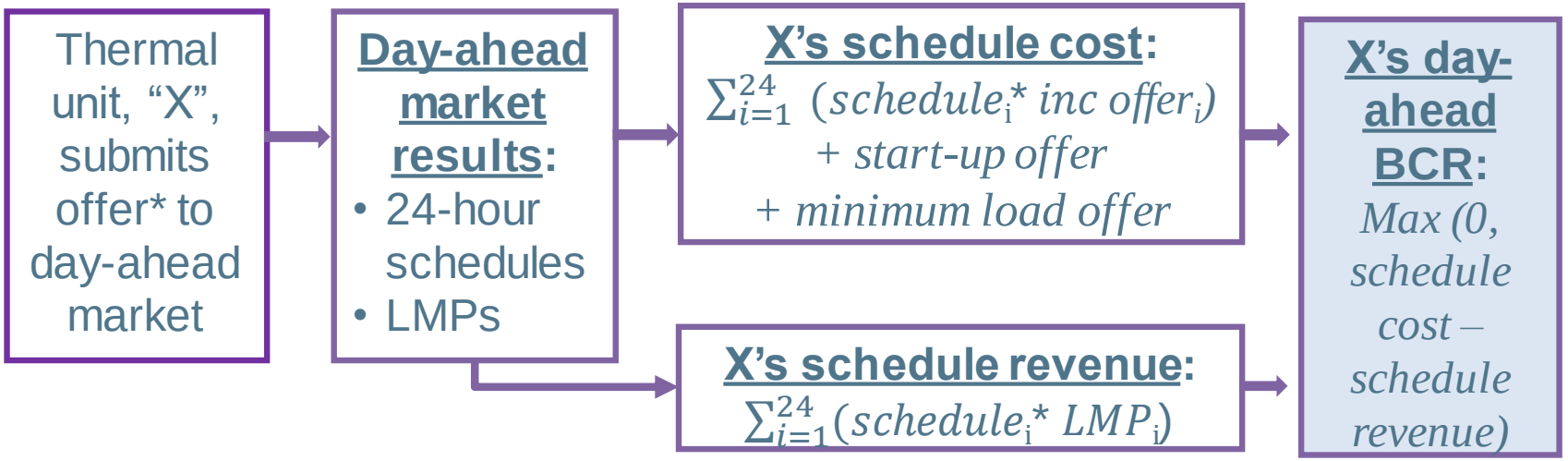
The conceptual basis for BCR is established; rules are similar across markets and are updated for new resource types or market design changes.

- All centrally dispatched U.S. markets have BCR
  - Needed for day-ahead markets with unit commitment and commitment costs, such as EDAM
  - Also occurs when resources are dispatched out of merit for reliability or committed in real time
- Rules for BCR calculations, eligibility for BCR, and the dispatch circumstances when it is paid differ somewhat:
  - Across U.S. electricity markets
  - Over the markets run by a single system operator
- BCR rules can change:
  - To address operating characteristics of new types of resources
  - Due to design changes affecting schedules, costs or revenues

BCR calculation formulas are specific to the market (or reliability run) in which a resource is scheduled.

- Calculation is performed across the time period (hours or intervals) covered by the market
- Values used in the calculation depend on the market

Example of Day-ahead BCR Calculation



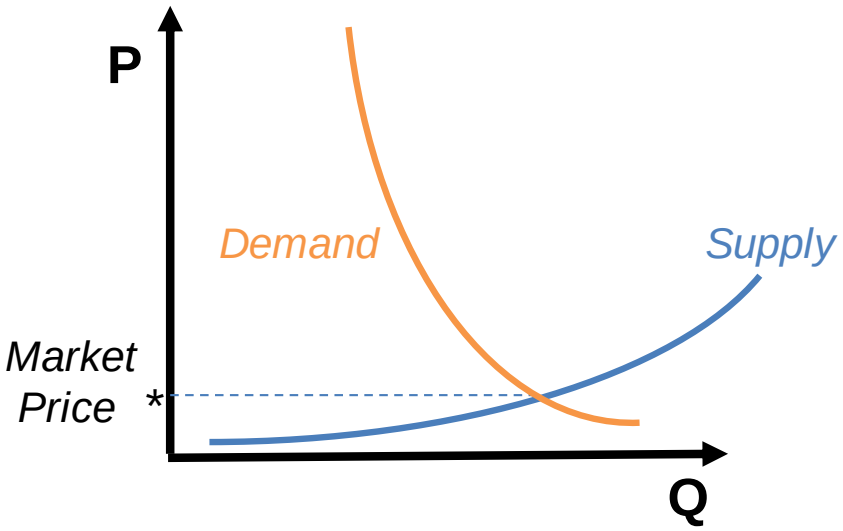
*Ancillary services omitted from example for simplicity.

What issues related to BCR arise in electricity markets?

- BCR has been vulnerable to the exercise of market power and unintended payments in some markets
  - Start-up and minimum load (i.e., no-load) offers can be mitigated prior to unit commitment; they are also mitigated after the fact, particularly for resources committed for reliability
  - Rules for defining eligibility for BCR must be carefully designed
- BCR costs are recovered through unhedgable uplift charges to loads and virtual market participants
  - Charges are not related to any market clearing prices and cannot be avoided by responding to price signals
  - Can be substantial if system conditions require extensive out of market actions by system operators
  - Highest BCR occurs on days with high gas prices and especially if real-time commitments turn out to be unnecessary

Why are BCR payments included in electricity market designs?

- In classroom economics:
  - Market clearing prices are determined by the intersection of supply and demand curves
  - Sellers are paid the market clearing price for their output
  - End of story; no potential BCR payments to suppliers



BCR payments are made to maintain the efficient incentives of textbook economics in the more complicated context of electricity markets, to the extent possible.

- Bids and offers to electricity markets consist of many parameters to communicate the actual costs and operating characteristics of resources
- System reliability requirements are imposed in clearing of electricity markets; market clearing simultaneously determines schedules spanning multiple time periods
- System operators can require the out-of-market operation of resources to maintain reliability
- Multi-settlement systems introduce additional considerations

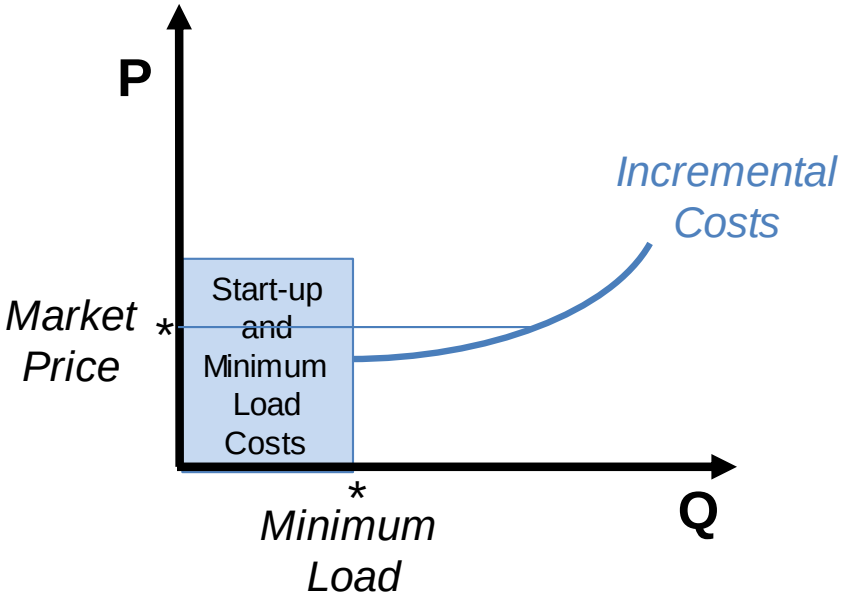
BCR payments can occur because offers for electricity supply resources can consist of more than just offers for incremental energy.

- Offers can include multiple dollar-denominated values
  - Incremental energy offer ($/MWh); can increase with the level of output
  - Commitment cost offers:
    - Cost to start-up unit ($/start)
    - Cost of operating at minimum load ($/MWh)
  - Offers for ancillary services ($MWh)
- They can also include non-price parameters
  - Examples: minimum load (MW), state-of-charge limit (MW), and ramp rates (MW/minute)
  - Rules can restrict the frequency with which some offer parameters can be changed for several reasons, including limiting possibilities for the exercise of market power

Because of the multiple parts of electricity supply offers, market clearing prices for energy are not always enough to ensure that suppliers cover their costs, bringing about the need for BCR.

- A well-known example is that thermal unit start-up costs and minimum load costs lead to resource supply curves that do not smoothly increase with output

Illustrative Thermal Unit Commitment Costs and Incremental Costs



BCR payments can also occur because of system reliability requirements.

- Reliability requirements (e.g., for reserves) interact with unit operating constraints (e.g., state of charge or minimum run time) in the unit commitment and dispatch optimization run to simultaneously determine schedules over multiple hours or intervals
  - ➡ BCR might be needed for a unit optimally scheduled at its minimum load to meet an operating reserve constraint
- Reliability constraints imposed outside of the least-cost commitment and dispatch also result in BCR
  - ➡ A unit might be committed out of merit to meet an unmodeled constraint, such as a requirement for voltage support

A final reason for BCR payments can be to compensate resources* for costs they incur because they cannot operate according to their day-ahead schedules due to following system operator directions.

- Operators may order a schedule change to maintain reliability, even if the change is inconsistent with a supplier's real-time offer and/or day-ahead schedule
- For example, a supplier might be instructed out of merit to inject less than scheduled to avoid overloading a transmission constraint that is not modeled in the market in real time
- Suppliers may incur costs from following system operator real-time dispatch instructions that are not covered by market revenue (i.e., payments for energy and AS)

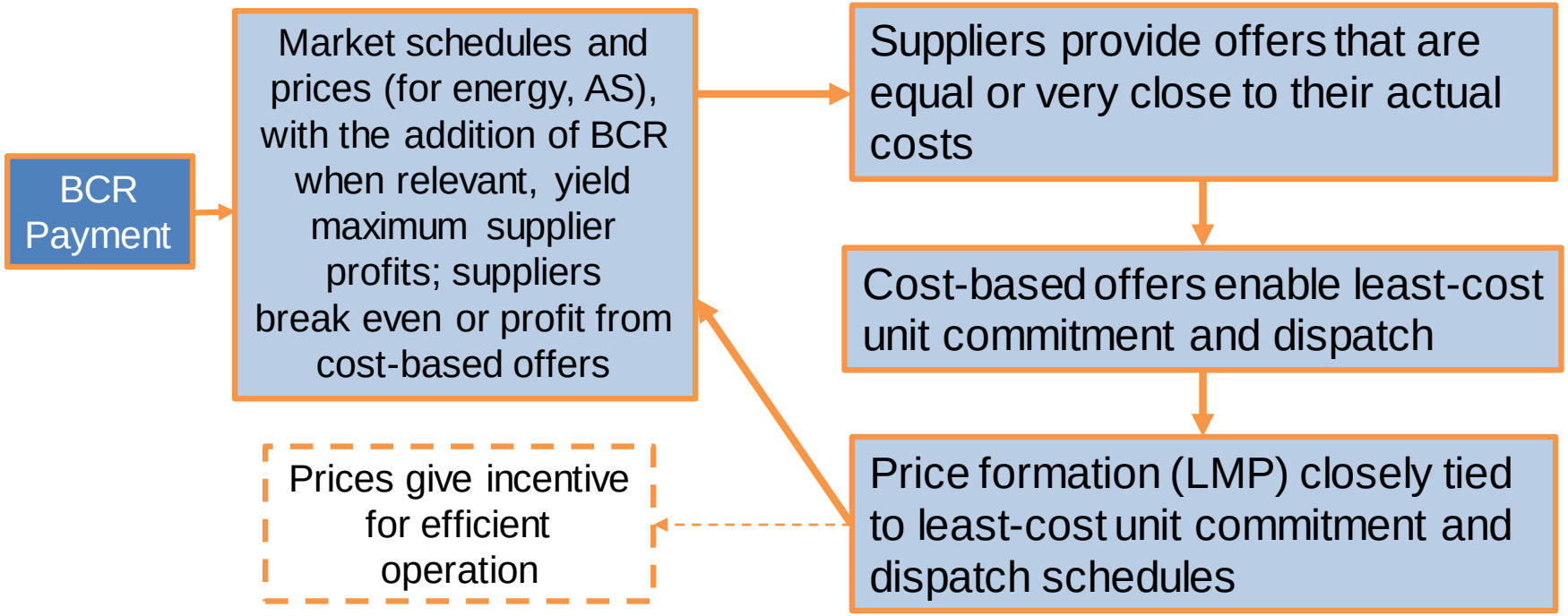
*The discussion here applies, analogously, to load as well as to supply.

BCR is paid to make suppliers whole for following system operator real-time dispatch instructions.

- In regions with day-ahead markets, suppliers pay the real-time price for shortfalls in their real-time injections, compared with their day-ahead financial schedules, even when the shortfalls are due to following dispatch instructions
- The BCR payment is made to provide the supplier with the assurance that it will not lose money by following dispatch instructions, i.e., to align the resource operator's incentives with a system reliability need
- BCR is not intended to compensate suppliers for operational difficulties preventing them from meeting their day-ahead schedule

BCR is needed to support efficient bidding incentives and least-cost dispatch, which are central goals in designing electricity markets.

Objective: Competitive market providing reliable electricity supply* at the lowest cost possible



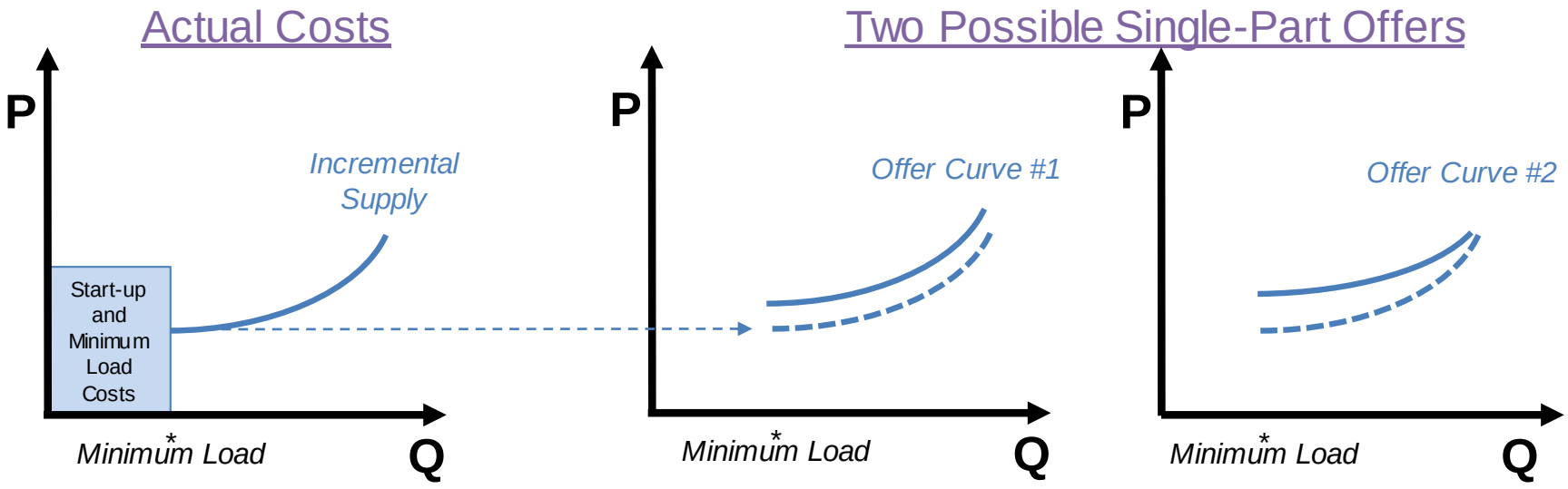
*The concepts here apply, analogously, to load.

APPENDIX

Could Single-Part Offers Simplify BCR Payments?

It is sometimes suggested that elimination of the start-up and minimum load components of offers could simplify the clearing of electricity markets.

- Single-Part Offers: A frequently discussed approach would be for suppliers to include their start-up and minimum load costs in their offer for incremental energy
- The offer curve would have only horizontal or upward sloping sections, reducing the need for BCR



Three-part offers have become state-of-art for unit commitment because single-part offers do not support efficient electricity market outcomes.

- Single-part offers would be less closely tied to actual costs
  - Suppliers must guess how to recover all of their commitment and dispatch costs through a single offer
  - To form their offer, suppliers would likely forecast their schedules
- Leads to inefficient dispatch and prices
  - Offers distorted by possibly incorrect supplier forecasts
  - If actual conditions are different than expected, suppliers may have an incentive to depart from commitment instructions
  - Clearing prices set by offers that include non-variable costs
  - Inefficiently high price signal given for incremental supply (imports, demand response) and charged for incremental load (exports, real-time injections less than schedules)