



Clearing Price Impact Election Model

REVISED

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Clearing Price Impact Election Model Goals

- Accommodate state actions
- Limit price suppression
- Mitigate potential changes in participant bidding behavior that could cause the “race to the bottom”
- Avoid interaction of subsidized resources relative to the VRR curve, which is highly sensitive to small changes
- Avoid load from “paying twice” for capacity which would be the result if subsidized resources are MOPR’d and therefore don’t/can’t clear the auction

Note - Definition of “subsidized” resources to be determined

Concerns with Other Proposals

- Common concern with the PJM and NRG proposals
  - Both impose the impacts of subsidized resources on the VRR curve which can be highly sensitive to small changes resulting in large clearing price shifts
  - The market design and not the resource owner's decision determines whether a resource clears the market (PJM) or has its cleared MW reduced (NRG)
- PJM Two-Tier Pricing Proposal
  - The marginal resource that sets the clearing price is eventually eliminated from the clearing process and does not receive a capacity obligation
  - Therefore, the resource owner that believes they may be the marginal resource will adjust the offer price lower to avoid being the marginal resource and setting the clearing price and ultimately not receiving a capacity obligation
    - e.g., A resource owner that believes it could be the marginal resource at, say an offer price of $100, will most likely reduce the offer price to, say, $97 knowing that the market will clear higher than that and therefore will receive a clearing price greater than $97.
      - This outcome is much preferred over not clearing and receiving $0.00 and the lower price may only have a minor impact on the resource's overall return

Concerns with Other Proposals

- NRG Two-Tier Pricing Proposal
  - In this proposal, the cleared quantity of MW are reduced pro-rata to accommodate the subsidized resources
  - This proposal could work well in ISONE which does not have the concept of ICAP/UCAP
  - However, in PJM where the market is cleared using UCAP, resource owners will adjust their EFORd in an effort to offer more MW than otherwise knowing that the cleared amount will be reduced for the quantity offered
  - This increases the amount of capacity being offered into the market and therefore has downward pressure on clearing prices.

LS Power's Clearing Price Impact Election Model mitigates all these concerns

Advantages of the Clearing Price Impact Election Model

- Allows the non-subsidized resource owner, not the market design, to determine if they want to continue to clear in spite of a subsidized resource impacting the competitive market
- Protects the market against bidding behavior that would result in price suppression
  - Eliminates resources from:
    - Bidding down a price in an attempt to avoid being the price setting resource but not clear (PJM), or
    - Offering additional MW to mitigate the reduction in cleared MW (NRG)
- Limits price suppression from subsidized resources through the use of a weighted average clearing price as opposed to the VRR curve, which is nearly vertical
  - 1,000 MW movement on the VRR curve in RTO represents a $25+/MW-Day impact in pricing
  - Using a weighted average approach results in a 1,000 MW resource having a less than 1% impact on the pricing in RTO

Advantages of the Clearing Price Impact Election Model

- Has built-in mechanisms to
  - Prevent large impacts to the clearing price by a large amount of subsidized resources being accommodated in the market either at one time or cumulatively over time
  - Prevent the final clearing price from being greater than Competitive Clearing Price from the BRA
- Results in a competitive market clearing price for load
  - Load will never pay more than the total system competitive clearing cost when subsidized resources are re-introduced to the supply curve
  - Load will never pay less than the total system competitive clearing cost as a disincentive to state actions that are implemented for the purpose of lowering capacity prices
- Provides a good compromise between generators and load in accommodating subsidized resources

Clearing Price Impact Election Characteristics

- Multi-step clearing process using portions of both PJM's and NRG's proposal
- Step 1 – BRA is cleared using competitive offers for subsidized and non-subsidized resources
- Step 2 – Iterative Process by PJM after the BRA clears to allow subsidized resources that did not clear the BRA the ability to obtain a capacity obligation
  - Determines the "Subsidized Clearing Price"
    - Does not change total cost to load resulting from the BRA clearing
    - Reduces payments to generators
- Offers those non-subsidized resources that elected the "Clearing Price Impact Election" prior to the BRA AND cleared the BRA the ability to continue to clear when subsidized resources are re-introduced in the Iterative Process and the Subsidized Clearing Price falls below the Competitive Clearing Price
- All resources that did NOT clear the BRA, regardless of whether or not they elected the Clearing Price Impact Election prior to the BRA, are no longer considered in the process and are ineligible to receive a capacity obligation
- ***The final quantity (MW) of resources that obtain a capacity obligation from this process can never fall below the quantity (MW) of resources that cleared in the BRA***

Clearing Price Impact Factor

- Resources have the ability to make an election prior to the BRA to continue to clear if the clearing price is impacted by a subsidized resource in the Iterative Process by electing the Clearing Price Impact Election
- The key determinant in whether an owner elects the Clearing Price Impact Election or not is the Clearing Price Impact Factor
  - This is the potential reduction of the Competitive Clearing Price when subsidized resources are re-introduced to the supply curve
- To determine the Clearing Price Impact Factor, prior to the BRA, PJM calculates and posts for each affected LDA the Clearing Price Impact Factor (%) as follows:
  - PJM determines the quantity of subsidized resources and the total quantity of resources in the LDA prior to the auction
  - The clearing price impact factor is the quantity of subsidized resources divided by the total quantity of resources expressed as a %
  - Example:
    - Assume an LDA with total capacity of 25,000 MW
    - Assume there are 1,000 MW of subsidized resources in the LDA
    - The preliminary clearing price impact factor = 1,000/25,000 = 4%

Clearing Price Impact Factor

- While the exact shift in the Competitive Clearing Price will not be known until the entire process is completed, the Clearing Price Impact Factor is a good proxy for how much it could move and should be close the maximum it could shift.
- Resource owners also have the ability to estimate the Clearing Price Impact Factor on their own by reviewing the VRR curve and determining the quantity that would clear at a certain clearing price. Using this quantity along with the quantity of subsidized resources, the resource owner can determine the Competitive Price Impact Factor
- Resource owners also have the ability to run sensitivities around the Competitive Price Impact Factor by selecting, from the VRR curve, several different price/quantity pairs and calculating the Competitive Price Impact Factor for each pair.
- Resources make the election at the same time as the competitive offer price is submitted in the BRA
- The posting of the preliminary Clearing Price Impact Factor and the ability of the owners to perform their own analysis/sensitivities should provide owners with sufficient information to make the decision of whether to stay in and continue to clear (electing the Clearing Price Impact Election) or to not stay in and not clear (does not elect the Clearing Price Impact Election)

Clearing Price Impact Factor

- This process also has a built-in mechanism for mitigating the extreme case of when, relative to the total installed capacity in an LDA, a large amount of subsidized resources are introduced, whether in a given year or over the course of several years.
- As more and more and more subsidized resources are introduced, the Competitive Clearing Price increases, approaching the subsidized resource's reference price.
  - For the Competitive Price Impact Factor to be 50%, 50% of the resources in the LDA are subsidized and the LDA would most likely clear at the subsidized resource's reference price – substantially higher than normal
  - Therefore the shift in the Competitive Clearing Price is starting from a much higher clearing price, mitigating the increased concentration of subsidized resources.

- See example on next page

Clearing Price Impact Factor

- By way of example:
  - Using the earlier example of a 1,000 MW of subsidized resources in a 25,000 MW LDA yielded the Competitive Price Factor of 4%
  - Now assume the quantity of subsidize resources increased to 12,500 MW (50% Competitive Clearing Price Impact Factor).
  - Although the Capacity Price Impact Factor is 50%, the clearing price in the LDA would be at the reference price.
  - Assume the reference price is something around Net CONE of ~$360 (and one has to assume it would be much higher for a nuclear resource) and the BRA clears at this reference price; $360.
  - The impact to the Competitive Clearing Price would be a shift from $360 to $180 therefore mitigating the impact.
  - Higher concentration of subsidized resources, yields higher clearing prices, thereby mitigating the impact of large quantities of subsidized resources

Step 1 - BRA Clearing

- Similar to PJM's Second Step
- There are no changes to the BRA "Must Offer" requirements or obligations
- The BRA is cleared using competitive offer prices
  - Non-subsidized resources offer into the BRA at their competitive offer price as they do today in accordance with tariff requirements
  - Subsidized resources are offered into the BRA at the PJM reference price (the subsidized resource mitigated offer price)
- The BRA determines:
  - The "Competitive Clearing Price"
  - The "population" of resources that are eligible to receive a capacity obligation, and
  - The total system "Competitive Clearing Cost" to load
    - This cost is fixed and will not change
    - Load will never pay more than this cost when subsidized resources are re-introduced in the Iterative Process

Step 1 - BRA Clearing (continued)

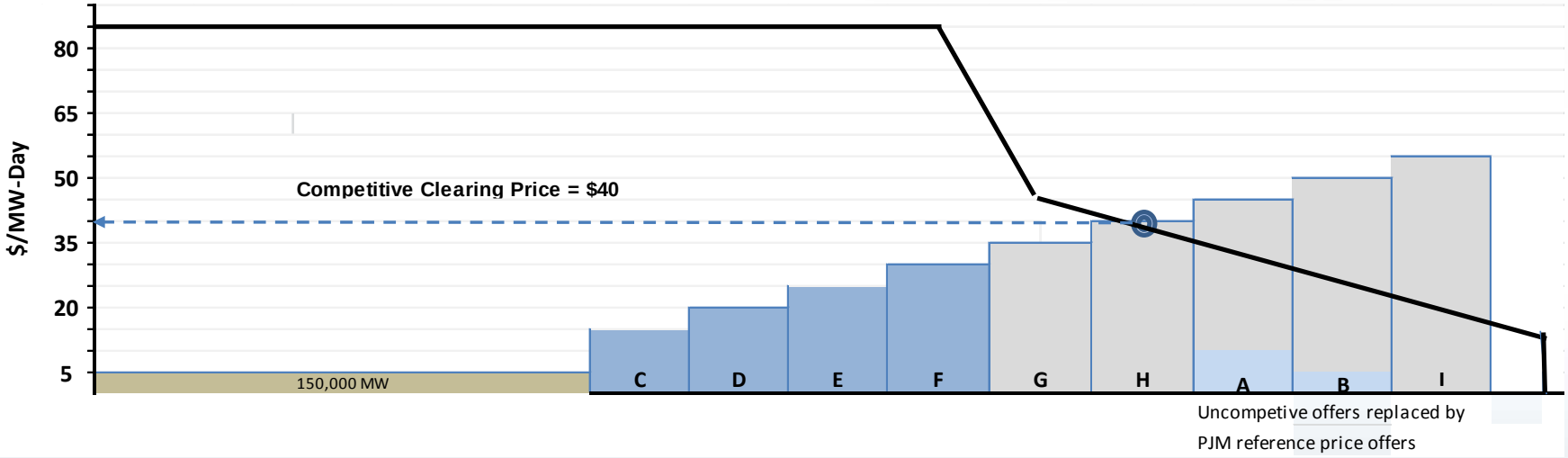
- Note that the "population" of resources that are eligible to receive a capacity obligation after completion of the Iterative Process are only:
  - Those resources that cleared the BRA, and
  - Subsidized resources that have an unmitigated offer price below the Competitive Clearing Price
  - Resources that did not clear the BRA are out of the process and ignored
- Once the BRA clears, PJM calculates the total system "Competitive Clearing Cost" to load
  - Total BRA cleared MW x the Competitive Clearing Price x 365 days
    - This cost is fixed and will not change
    - Load will never pay more than this cost when subsidized resources are re-introduced in the Iterative Process
- See example on next couple of pages

Step 1 - BRA Clearing Example

- Using PJM's example – clear the BRA
  - Resources C thru H are non-subsidized resources offering in at their competitive offer price
  - Resources A and B are subsidized resources offering in at the PJM reference price
  - Resource H is the marginal resource setting the clearing price at $40/MW-Day – this is the Competitive Clearing Price
    - Resources C through H would be eligible to receive a capacity obligation
    - Non-subsidized resources that did not clear are eliminated from the process
    - Subsidized resources (such as A & B below) that did not clear the BRA will be re-introduced in the Iterative Process provided their un-mitigated offer price is below $40

Step 1 - BRA Clearing Example (continued)

- PJM then determines total "competitive system clearing cost" from the cleared BRA (using PJM's example)
  - Assume price takers of 150,000 MW to the left of resource C and assume resources C through H are each 1,000 MW
  - Total competitive system clearing cost = (150,000 MW + 6,000 MW) x $40/MW-Day x 365 days = $2,277.6 million
  - This cost is fixed throughout the remainder of the process and load will not pay any more or any less than this



Step 2 - Iterative Process

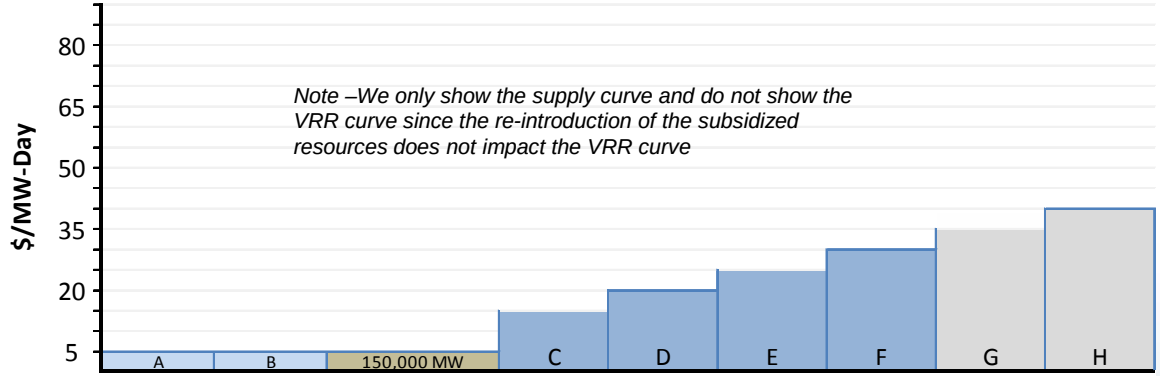
- PJM then re-introduces to the supply stack those subsidized resources that did not clear the BRA to the extent their unmitigated offer price is below the competitive clearing price
  - This determines the “subsidized clearing price”; and
  - Increases the quantity of resources eligible for a capacity obligation

- The “subsidized clearing price” is determined by dividing the total system competitive cost from Step 1 by the increased quantity

- See example on next page

Step 2 - Iterative Process Example

- Assume resources A & B are each 1,000 MW with unmitigated offer prices below $40/MW-Day and therefore re-introduced in the supply curve
  - This increases the quantity of eligible resources to 158,000 MW (the 156,000 MW cleared in the BRA + 2,000 MW of A & B re-introduced in the process)
- Subsidized clearing price is
  - (Total system competitive cost from Step 1)/(capacity cleared in BRA + re-introduced subsidized resources)/365 days
  - Subsidized Clearing Price = $2,277.6 million / (156,000 MW + 2,000 MW) / 365 days = $39.49/MW-Day



Uncompetitive Offers re-introduced in the BRA cleared supply curve

Step 2 - Iterative Process, continued

- PJM continues the Iterative Process by evaluating those resources that cleared the BRA and have competitive offers between the subsidized clearing price (e.g. $39.49/MW-Day) and the competitive clearing price (e.g. $40/MW-Day) to determine the final cleared resources and final clearing price
- Non-subsidized resources that cleared the BRA and elected the "Clearing Price Impact Election" would continue to clear
- Non-subsidized resources that cleared the BRA and did not elect the "Clearing Price Impact" would not necessarily clear and the clearing price would be adjusted upward to account for removing the resource from the supply stack

Step 2 - Iterative Process, continued

- If no non-subsidized resources elected the Clearing Price Impact election then the Iterative Process begins with the resource having the highest offer price between the competitive clearing price and the subsidized clearing price
  - The highest-priced resource that cleared is removed from the supply stack and a new, higher subsidized clearing price is calculated by subtracting the resource's capacity from the cleared quantity
  - The next highest-priced resource that cleared is then removed from the supply stack and a new, higher subsidized clearing price is calculated
  - This process continues until there is equilibrium between the subsidized clearing price and the quantity of resources that cleared at the subsidized clearing price

THE FINAL SUBSIDIZED CLEARING PRICE CAN EQUAL BUT NEVER EXCEED THE COMPETITIVE CLEARING PRICE

Step 2 - Iterative Process, continued

- Non-subsidized resources that cleared the BRA and elected the “Clearing Price Impact” would continue to clear
- Some of the non-subsidized resources that cleared the BRA and did not elect the “Clearing Price Impact” would not clear and the clearing price would be adjusted upward to account for removing the resource from the supply stack
- If no non-subsidized resources elected the Clearing Price Impact election, then there is nothing to iterate and the final clearing price is the subsidized clearing price
- Example on next page

Step 2 - Iterative Process, continued

- Example
  - Assume resources C, D, E, F, G, and H did NOT elect the Clearing Price Impact election
  - Assume their offer prices are the following:

Resource	Offer Price	MW
C	$39.40	1000
D	$39.50	1000
E	$39.70	1000
F	$39.80	1000
G	$39.90	1000
H	$40.00	1000

- Resource H is first removed from the supply stack as it is the price setting resource at $40/MW-Day. A new subsidized clearing price is then calculated:
  - $2,277.6 million / (156,000 MW + 2,000 MW **– 1,000 MW**) / 365 days = $39.75
- Next, resource G is removed from the supply stack and a new subsidized clearing price is calculated:
  - $2,277.6 million / (157,000 MW – 1,000 MW) / 365 days = $40.00
- Iteration process is ended since resources F thru C all clear as their offer prices are less than $40.00 and the final clearing price is $40.00
  - If Resource G had elected the Clearing Price Impact then it would have cleared. Unlike the other proposals, it was the resource owner's decision and not the market design that resulted in Resource G not clearing.

FRR Reliability Requirement

- The CCPPSTF includes Design Component 5 –

  Reliability Requirement: whereas today we have IRM (and the FPR) as our reliability requirement target, going forward should these calculations continued to be utilized, or something else?

- Although LS Power did not include this in the matrix and it is not necessarily tied to this proposal, it affords stakeholders the opportunity to correct a design flaw that has existed from the onset of RPM that provides a "free ride" for certain participants
- FRR entities are only required to meet their load plus the Installed Reserve Margin (IRM – typically in the ~16% range) that is used to calculate the Forecast Pool Requirement
- RPM has been clearing, and load has been paying for, IRMs in the 20%+ range
- FRR entities are part of the pool and enjoy the benefits of the increased IRMs ("lean on the pool") while not contributing to the cost of the increased IRMs

FRR Reliability Requirement

- Therefore, the FRR reliability requirement should change from using the IRM that is currently used to calculate the FPR to the greater of the IRM currently used to calculate the FPR or the three year rolling average RPM final IRMs for the previous three BRAs.
- This will ensure that FRR entities that are part of and enjoy the benefits of the larger pool are compatible in their requirements with the larger pool.
- By way of example
  - The IRM used by FRR entities for the 2020/2021 BRA is 16.6% while the the 2020/2021 BRA cleared with IRM of 23.3%
  - FRR entities were only required to meet the 16.6% while enjoying the increased reliability while the rest of the pool is paying for the increased reliability
  - Under this proposal, FRR entities would have had to meet an IRM of 20.6% for the 2020/2021 BRA
    - Average of: 19.7% (2017/2018), 19.8% (2018/2019), and 22.4% (2019/2020)

Contact Information

- LS Power is interested in working with others to develop consensus around a proposal that mitigates the impact of subsidized resources while accommodating subsidized resources
- We believe this proposal mitigates the impact and eliminates bidder behavior changes that could defeat the intention of market changes but are open to consider all options
- We are also available to discuss further and solicit feedback in the form or questions, comments, concerns, criticism and, of course, support
- Contact the following with any and all feedback at your convenience:

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