Ramping Constraints and Scarcity Pricing

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Agenda

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Background

Current Scarcity Pricing Mechanism

- Currently, the ISO determines whether scarcity pricing will be applied through an ex post assessment.
  - This assessment determines whether it would have been possible to meet system requirements without the load reduction provided by SCRs and EDRP participants.
  - If it would not have been possible to do so, scarcity pricing is applied.
  - If it would have been possible to do so, scarcity pricing does not apply.

Moving Scarcity Pricing into the Dispatch

- If scarcity pricing is applied, the prices are changed after the dispatch.
  - But the dispatch is consistent with the original prices.
  - Consequently, scarcity prices may be inconsistent with real-time schedules.
- To address this, the ISO is proposing to move scarcity pricing into the dispatch.
- This will ensure that in scarcity conditions, prices are consistent with the dispatch, which will have several benefits, including:
  - Ensuring that market participants have a financial incentive to follow the ISO's dispatch instructions.
  - Avoiding losses or windfall gains that the current approach can yield.

Scarcity Reserve Requirement

- The ISO proposes to accomplish this by defining a scarcity reserve requirement. Scarcity pricing would apply if the ISO cannot meet that scarcity reserve requirement in the dispatch.
  - The scarcity reserve requirement in a given area would equal the estimated impact on load in that area of SCRs and EDRP participants plus the operating reserve requirement.
  - The scarcity reserve demand curve would be priced at $500/MWh, which is consistent with payments made to SCRs and EDRP participants to avoid operating reserve shortages.

The Problem with the ISO's Proposal

Ramping Constraints and OR Supply

- The amount that any given resource is allowed to contribute to operating reserve requirements is appropriately limited by its ramp rate. Consequently:
  - The amount that any given resource can contribute towards meeting the 10-minute reserve requirement is limited to the amount it can ramp in 10 minutes.
  - The amount that any given resource can contribute towards meeting the 30-minute reserve requirement is limited to the amount it can ramp in 30 minutes.

Ramping Constraints and Scarcity Reserve

- The problem with the scarcity pricing proposal arises because the ISO is proposing to apply similar limits to the amount each resource is permitted to contribute to the scarcity reserve requirement.
- The amount each resource could contribute to that requirement could not exceed:
  - The amount it can ramp in 30 minutes, if SCRs and EDRP participants were activated to protect 30-minute reserves.
  - The amount it can ramp in 10 minutes, if SCRs and EDRP participants were activated to protect 10-minute reserves.

Effective Increase in OR Requirement

- As a result, the ISO's proposal will effectively convert the scarcity reserve requirement into an increased 10-minute or 30-minute reserve requirement.
  - The increased requirement would apply to the area in which SCRs and EDRP participants were activated, and would be equal to the anticipated impact of demand response on load in that area.
  - The demand curve price of this increased operating reserve requirement would be $500/MW-hr., the proposed scarcity reserve demand curve price.
- In contrast, the current scarcity pricing procedure does not produce increased operating reserve requirements.

Lack of Need for Increased OR Requirement

- There has been no demonstration of any need for additional 10-minute or 30-minute reserves after demand response has been activated.
  - If it was necessary for the ISO to ensure that it could respond within 10 or 30 minutes if all SCRs and EDRP participants were to stop providing demand response instantaneously, then this increase might be justified.
  - But the ISO has not claimed the need to increase operating reserve requirements to that level, or to implement any change to the revised requirements that will go into effect in November.

Consequences of the ISO's Approach

- As the examples to follow will show, implementing an unnecessary increase in operating reserve requirements during SCR/EDRP activation will have several adverse effects, including:
  - Permitting scarcity pricing to apply in some cases when demand response was not needed to meet system needs.
  - Producing an inefficient dispatch.

Inconsistency with Scarcity Pricing Objectives

- It would be inconsistent with the objective for scarcity pricing given in the 2014 State of the Market Report.
  - That report explained its support for Comprehensive Scarcity Pricing by stating:

    "It is important for … Scarcity Pricing to allow demand response to set prices only when it is needed to meet system needs."
  - The ISO's proposal, as currently constituted, will not meet that objective.

Proposed Modifications

- Fortunately, as the examples to follow will show, with relatively minor changes, the ISO's proposal can meet these objectives.
- These modifications would:
  - Ensure that scarcity pricing does not apply when demand response is not needed to meet system needs.
  - Ensure that scarcity pricing applies when demand response is necessary to meet system needs.
- And they would avoid inefficient dispatches.

Example 1:
Demand Response Is Not Needed to Meet System Needs

Assumptions

- For this example, assume the following:
  - There are two generators, A and B.
    - Each has 500 MW of capacity.
    - Each can ramp at 5 MW/minute, so each can provide 150 MW of 30-minute reserve.
    - Each has a minimum generation level of zero.
    - Gen. A's incremental energy cost is $50/MWh.
    - Gen. B's incremental energy cost is $300/MWh.
  - There is a 100 MW 30-Minute reserve requirement, with a $100/MW-hr. demand curve price.
  - SCRs and EDRP participants are activated throughout the system to protect 30-minute reserves.
  - They reduce system load by 200 MW, from 850 MW to 750 MW.

Dispatch without Demand Response

- Without any demand response, it would have been possible to meet all system needs.
  - The 1000 MW of capacity online can produce 850 MW of energy while providing 100 MW of 30-minute reserve, as the following table shows.
- Therefore, scarcity pricing should not apply.

Resource	Capacity (MW)	Max 30-Min. Res. Schedule (MW-hr)	Energy Offer ($/MWh)	Schedule	
				Energy (MWh)	30-Min. Reserve (MW-hr)
Gen. A	500	150	50	500	-
Gen. B	500	150	300	350	100
Total				**850**	**100**

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Dispatch Under the ISO's Proposal

- Since demand response reduces load in this example by 100 MW, the ISO would define a 100 + 100 = 200 MW scarcity reserve requirement.
  - But Gen. B's ramp limits prevent it from providing more than 150 MW of 30-minute reserve.
  - Therefore, the ISO would not count more than 150 MW of Gen. B's capacity toward the scarcity reserve requirement.

Redispatch Resulting from the ISO's Proposal

- This would lead RTD to dispatch Gen. A down by 50 MW.
  - That permits some of its capacity to count towards the scarcity reserve requirement, thereby avoiding a scarcity reserve shortage.
  - Gen. B would be dispatched up by 50 MW to offset the energy that Gen. A no longer produces.
  - The marginal cost of this redispatch, $300/MWh – $50/MWh = $250/MWh, is less than the scarcity reserves demand curve price of $500.

Settlement Under the ISO's Proposal

- The settlement that results is shown below.
  - The price of both 30-minute reserve and scarcity reserve is $250/MWh, since the marginal cost of meeting the scarcity reserve requirement is the cost of the redispatch.
  - The energy price is $300/MWh.
  - The redispatch has increased bid production cost by $250/MWh × 50 MWh = $12,500.

					Schedule				Revenue			
Resource	Capacity (MW)	Max 30-Min. Res. Schedule (MW-hr)	Energy Offer ($/MWh)	Demand Curve Price ($/MW-hr)	Energy (MWh)	30-Min. Reserve (MW-hr)	Scarcity Reserve (MW-hr)	Bid Production Cost ($)	Energy (MWh)	30-Min. Reserve (MW-hr)	Scarcity Reserve (MW-hr)	Margin ($)
Gen. A	500	150	50		450	-	50	22,500	135,000	-	12,500	125,000
Gen. B	500	150	300		300	100	50	90,000	90,000	25,000	12,500	37,500
30-Min. Res. DC				100		-		-				
Scarcity Res. DC				500			-	-				
Total					**750**	**100**	**100**	**112,500**	**225,000**	**25,000**	**25,000**	**162,500**

Inefficiency of the ISO's Proposal

- This is inefficient.
  - The purpose of incorporating a scarcity reserve requirement in RTD is to ensure that prices reflect scarcity when it exists, not to increase the cost at which system needs are met.
  - The ISO's proposal does this because of the limits it imposes on the amount of capacity provided by generators like Gen. A that is considered when assessing whether the scarcity reserve requirement is met.
- Minor changes will eliminate this problem.

Proposed Modification to the ISO's Approach

- Modify the ISO's approach as follows.
  - Permit all capacity on each generator to count towards scarcity reserve requirements.
  - Define the scarcity reserve requirement as the sum of:
    - The estimated impact on demand of SCRs and EDRP participants, and
    - The 30-minute reserve requirement.

Dispatch Under the Proposed Modification

- Consequently, all 350 MW of Gen. B's capacity that is not used to generate energy would count towards the scarcity reserve requirement.
  - The scarcity reserve requirement is 200 MW, including both the 100 MW 30-minute reserve requirement and the 100 MW of demand response.
  - Since Gen. B has more than enough capacity to meet this requirement, scarcity pricing is not applied.
  - This shows that this approach doesn't apply scarcity pricing when demand response wasn't necessary to meet system needs.

					Schedule				Revenue			
Resource	Capacity (MW)	Max 30-Min. Res. Schedule (MW-hr)	Energy Offer ($/MWh)	Demand Curve Price ($/MW-hr)	Energy (MWh)	30-Min. Reserve (MW-hr)	Scarcity Reserve (MW-hr)	Bid Production Cost ($)	Energy (MWh)	30-Min. Reserve (MW-hr)	Scarcity Reserve (MW-hr)	Margin ($)
Gen. A	500	150	50		500	-	-	25,000	150,000	-	-	125,000
Gen. B	500	150	300		250	100	100	75,000	75,000	-	-	-
30-Min. Res. DC				100		-		-				
Scarcity Res. DC				500			-	-				
Total					**750**	**100**	**100**	**100,000**	**225,000**	**-**	**-**	**125,000**

Example 2:
Demand Response Is Needed to Meet System Needs

Assumptions

- For this example:
  - SCRs and EDRP participants are assumed to have reduced system load by 175 MW, from 925 MW to 750 MW.
  - Otherwise, make the same assumptions as in Example 1.

Dispatch without Demand Response

- In this case, it would not have been possible to meet all system needs if there had not been any demand response.
  - It would now require 1025 MW of capacity to meet those needs, rather than 950 MW as in Example 1.
  - Consequently, if not for the demand response, there would have been a 30-minute reserve shortage, as shown below.
- Therefore, scarcity pricing should apply.

Resource	Capacity (MW)	Max 30-Min. Res. Schedule (MW-hr)	Energy Offer ($/MWh)	Demand Curve Price ($/MW-hr)	Schedule: Energy (MWh)	Schedule: 30-Min. Reserve (MW-hr)
Gen. A	500	150	50		500	-
Gen. B	500	150	300		425	75
30-Min. Res. DC				100		25
Total					**925**	**100**

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Dispatch Under the ISO's Proposal

- In this example, demand response lowers load in this example by 175 MW, so the ISO would define a 175 + 100 = 275 MW scarcity reserve requirement.
  - Once more, Gen. B's ramp limits prevent it from providing more than 150 MW of 30-minute reserve.
  - Therefore, the ISO would not count more than 150 MW of Gen. B's capacity toward the scarcity reserve requirement.

Redispatch Under the ISO's Proposal

- This would lead RTD to dispatch Gen. A down by 100 MW—50 MW more than in Example 1.
  - That permits 100 MW of its capacity to count towards the scarcity reserve requirement, although that is not sufficient to avoid a scarcity reserve shortage.
  - Gen. B would be dispatched up by 100 MW to offset the energy that Gen. A no longer produces.

Settlement Under the ISO's Proposal

- The settlement that results is shown below.
  - The price of 30-minute reserve and scarcity reserve is \$500/MWh, reflecting scarcity.
  - The energy price is \$550/MWh, as Gen. A would meet additional load, which would exacerbate the shortage.
  - The redispatch has increased bid production cost by \$250/MWh × 100 MWh = \$25,000.

Resource	Capacity (MW)	Max 30-Min. Res. Schedule (MW-hr)	Energy Offer (\$/MWh)	Demand Curve Price (\$/MW-hr)	Schedule: Energy (MWh)	Schedule: 30-Min. Reserve (MW-hr)	Schedule: Scarcity Reserve (MW-hr)	Bid Production Cost (\$)	Revenue: Energy (MWh)	Revenue: 30-Min. Reserve (MW-hr)	Revenue: Scarcity Reserve (MW-hr)	Margin (\$)
Gen. A	500	150	50		400	-	100	20,000	220,000	-	50,000	250,000
Gen. B	500	150	300		350	100	50	105,000	192,500	50,000	25,000	162,500
30-Min. Res. DC				100		-		-				
Scarcity Res. DC				500			25	12,500				
Total					**750**	**100**	**175**	**137,500**	**412,500**	**50,000**	**75,000**	**412,500**

- This is even less efficient than Example 1.

Dispatch Under the Proposed Modification

- Under the proposed modification to the ISO's approach:
  - The scarcity reserve requirement is 275 MW, as it includes both the 100 MW 30-minute reserve requirement and the 175 MW impact of demand response.
  - Gen. B's capacity is not sufficient to meet this requirement, so scarcity pricing is applied.
    - The energy price is $800/MWh (not $550/MWh) and the 30-minute and scarcity reserves prices are $500/MWh.
  - Consequently, scarcity pricing is applied when demand response is needed to meet system needs, without requiring inefficient redispatch.

					Schedule				Revenue			
Resource	**Capacity (MW)**	**Max 30-Min. Res. Schedule (MW-hr)**	**Energy Offer ($/MWh)**	**Demand Curve Price ($/MW-hr)**	**Energy (MWh)**	**30-Min. Reserve (MW-hr)**	**Scarcity Reserve (MW-hr)**	**Bid Production Cost ($)**	**Energy (MWh)**	**30-Min. Reserve (MW-hr)**	**Scarcity Reserve (MW-hr)**	**Margin ($)**
Gen. A	500	150	50		500	-	-	25,000	400,000	-	-	375,000
Gen. B	500	150	300		250	100	150	75,000	200,000	50,000	75,000	250,000
30-Min. Res. DC				100		-		-				
Scarcity Res. DC				500			25	12,500				
Total					**750**	**100**	**175**	**112,500**	**600,000**	**50,000**	**75,000**	**625,000**

Foregoing 30-Minute Reserves

- One concern that has been raised about this proposed modification is that it might induce the ISO to forego purchases of NYCA 30-minute reserves in order to meet the scarcity reserve requirement.
  - But reserve that is "provided" by the NYCA 30-minute reserve demand curve only counts towards the NYCA 30-minute reserve requirement, not the scarcity reserve requirement.
  - So it will not be possible to avoid scarcity reserve shortages by incurring 30-minute reserve shortages.

Conclusion

Benefits of the Proposed Modification

- With the modifications described above, the ISO's proposal will:
  - Meet the scarcity pricing objective stated in the 2014 State of the Market report.
    - The $500/MWh minimum payment for SCR/EDRP sets the price when, and only when, demand response is needed.
  - Avoid the inefficiency that results from unnecessary increases in operating reserve requirements.
  - Settle using real-time schedules and prices that are consistent with each other.
    - This provides a financial incentive for market participants to submit bids and offers that reflect actual costs and to follow dispatch instructions.
  - Without causing violations of operating reserve requirements.