New York ISO
Independent System Operator

Constraint Specific Transmission Shortage Pricing: Updated Analysis and Proposal

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WebEx

Agenda

- Project Background
- Proposed Enhancements
- Next Steps
- Appendix
  - Current Transmission Constraint Pricing (TCP) Logic
  - Recap of 2019 Market Design Concept Proposal

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Project Background

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A Grid in Transition – The Plan

- **Carbon Pricing**
- **Comprehensive Mitigation Review**
- **DER Participation Model**
- **Energy Storage Participation Model**
- **Hybrid Storage Model**

Aligning Competitive Markets and New York State Clean Energy Objectives

- **Enhancing Energy & Shortage Pricing**
  - Ancillary Services Shortage Pricing
  - **Constraint Specific Transmission Shortage Pricing**
  - Enhanced Fast Start Pricing
- **Review Energy & Ancillary Services Product Design**
  - More Granular Operating Reserves
  - Reserve Enhancements for Constrained Areas
  - Reserves for Resource Flexibility

Valuing Resource & Grid Flexibility

- **Enhancements to Resource Adequacy Models**
- **Revise Resource Capacity Ratings to Reflect Reliability Contribution**
  - Expanding Capacity Eligibility
  - Tailored Availability Metric
- **Capacity Demand Curve Adjustments**

Improving Capacity Market Valuation

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Project Background

- **This project seeks to develop enhancements to the current transmission shortage pricing logic to better align the graduated transmission demand curve mechanism with the severity of transmission constraints**
  - The NYISO also intends to eliminate most occurrences of constraint relaxation by including pricing values for shortages that exceed applicable constraint reliability margin (CRM) value as part of the revised graduated transmission demand curve mechanism
- **Project Deliverable: Market Design Complete in Q4 2021**

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Proposed Enhancements

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Summary of the Proposal

- **The NYISO proposes to implement a revised approach to the current TCP logic consisting of the following components:**
  1. Establish a revised six-step transmission demand curve mechanism for facilities currently assigned a non-zero CRM value[1]
     - Each step corresponds to a specified percentage of CRM value. The final step will price all shortages in excess of the CRM
  2. Apply a non-zero CRM value to internal facilities currently assigned a zero value CRM, with a separate two-step transmission demand curve mechanism for such facilities
  3. Maintain the current single value $4,000 shadow price capping method for external interface facilities (zero value CRM) permitting the continued use of constraint relaxation for external interfaces

1. The NYISO typically uses a value of 20 MW for the CRM on its internal transmission facilities. A list of facilities using a different CRM value is posted on NYISO's public website: https://www.nyiso.com/documents/20142/2267995/Constraint_Reliability_Margin_CRM.pdf

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Proposal for Non-Zero CRM Value Facilities

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Rationale for the first three steps

- **The first three steps are proposed to be structured to facilitate reliance on as much efficient physical redispatch possible prior to utilizing relief provided by the transmission demand curve mechanism**
  - Constraint shadow cost represents the marginal cost of resolving a constraint and is assumed to be a proxy for the cost of physical redispatch
- **The steps in the transmission demand curve shall be graduated to help reduce unnecessary pricing volatility while reflecting an increasing constraint cost based on the severity of constraint**

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Rationale for the first three steps (cont'd)

- **The NYISO analyzed the historical binding RTD transmission constraints for non-zero CRM value facilities**
  - Study period for the analysis is March 2018 - March 2021
  - RTD constraints with Shadow Price of less than $0.04 per MWh are removed from the dataset
    - Only constraints with a Shadow Price greater than $0.04 per MWh are considered as active constraints (see MST Section 23.3.1.1.1.2)
  - Historic transmission constraint cost at various percentage level thresholds is calculated
    - Represents the historic cost associated with resolving the specified percentage value of transmission constraints
- **The table below summarizes the RTD transmission constraint cost at various percentage level thresholds for non-zero CRM value facilities**

Percentiles	90%	91%	95%	97%	98%	99%
Historic Constraint cost ($/MWh)	160	180	350*	350*	583	1175*

* These values correspond to the current steps of the graduated transmission demand curve mechanism

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Rationale for the first three steps (cont'd)

- **The NYISO is proposing to base the first three steps of the graduated transmission demand curve for non-zero value CRM facilities on >90 percentile of historic transmission constraint cost for these facilities**
  - These three steps will price flows corresponding to "0-20%", "20-40%" and "40-60%" of the applicable CRM value for the transmission facility
- **To provide a more graduated transmission demand curve, the NYISO proposes the following values for the first three steps:**
  - First step valued at $200/MWh (informed by 91 percentile of historic transmission constraint cost)
  - Second step valued at $350/MWh (95 percentile of historic transmission constraint cost)
  - Third step valued at $600/MWh (informed by 98 percentile of historic transmission constraint cost)

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Rationale for the first three steps (cont'd)

- **The proposed pricing values for first and third steps are same as the NYISO's 2019 proposal (see Appendix). The proposed value for second step has been revised based on the results of the updated data analysis**
  - The study period for calculating historic shadow cost is different from the analysis that informed the NYISO's 2019 proposal
    - The proposed value for the second step is $50/MWh higher than the NYISO's 2019 proposal
  - Although the proposed value for the third step is same as the NYISO's 2019 proposal, this value is now closer to the 98 percentile of historic transmission constraint cost for non-zero CRM value facilities, compared to the 99 percentile the value represented for the NYISO's 2019 proposal
    - The prior analysis did not include the RTD constraints where the transmission constraint cost was set by the current graduated Transmission Shortage Cost mechanism (i.e., Shadow Prices equal to $350/MWh, $1,175/MWh, and $4,000/MWh per MWh)

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Rationale for the first three steps (cont'd)

- **Supplemental analysis of base case constraints vs post-contingency constraints**
  - This analysis was requested by stakeholders to assess the appropriateness of the first three steps based on historic costs across base case and post-contingency constraints in non-zero value CRM facilities

	Percentage of constraints having historic constraint cost less than $600/MWh
Base Case Constraints	98.9%
Post-Contingency Constraints	97.6%

  - The results above show that the third step captures ~98 percentile of historic constraint costs across both types of thermal constraints supporting the NYISO's proposal to not differentiate pricing values by constraint type

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Rationale for the fourth step

- **The fourth step of the transmission demand curve is proposed to be $1,500 per MWh**
  - It is structured to assist with maintaining appropriate tradeoffs with meeting other market constraints, such as Operating Reserves
  - This step will price flows corresponding to “60-80%” of the applicable CRM value for the transmission facility
- **A simulation was used to determine the price level at which the economic dispatch would begin going short of SENY 30-minute reserves and converting that reserve to energy to solve the transmission overload on Leeds-PV line**
  - This occurred at a value of approximately $1,500 per MW considering an average shift factor of approximately 33% for SENY resources on the Leeds-PV constraint
- **The proposed pricing value for this step is same as the NYISO’s 2019 proposal**
  - No change is warranted from the earlier proposed value as the maximum $500/MWh shortage price value for SENY 30-minute reserves has not changed

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Rationale for the fifth step

- **The fifth step of the transmission demand curve is proposed to be $2,500 per MWh**
  - Value for the fifth step is designed to provide for a graduated price increase between the fourth and final (sixth) step
  - This step will price flows corresponding to “80-100%” of the applicable CRM value for the transmission facility
- **The proposed pricing value for this step is same as the NYISO’s 2019 proposal**
  - No change is warranted from the earlier proposed value as there has been no change proposed to the pricing values for the fourth and final steps

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Rationale for the final (sixth) step

- **The final (sixth) step of the transmission demand curve is proposed to be $4,000 per MWh**
  - The proposed final step would provide pricing of transmission shortages in excess of the applicable CRM value, thereby eliminating reliance on constraint relaxation for facilities assigned a non-zero CRM value
  - This value is designed to be sufficient to facilitate efficient re-dispatch of higher cost physical resources
    - For example, this pricing value would be sufficient to facilitate redispatch of a resource with a 25% shift factor and a cost of $1,000 per MWh
  - This step will price flows corresponding to ">100%" of the applicable CRM value for the transmission facility
- **The proposed pricing value for this step is same as the NYISO's 2019 proposal**
  - No change is warranted from the earlier proposed value as the assumptions regarding the derivation of this cost remain appropriate

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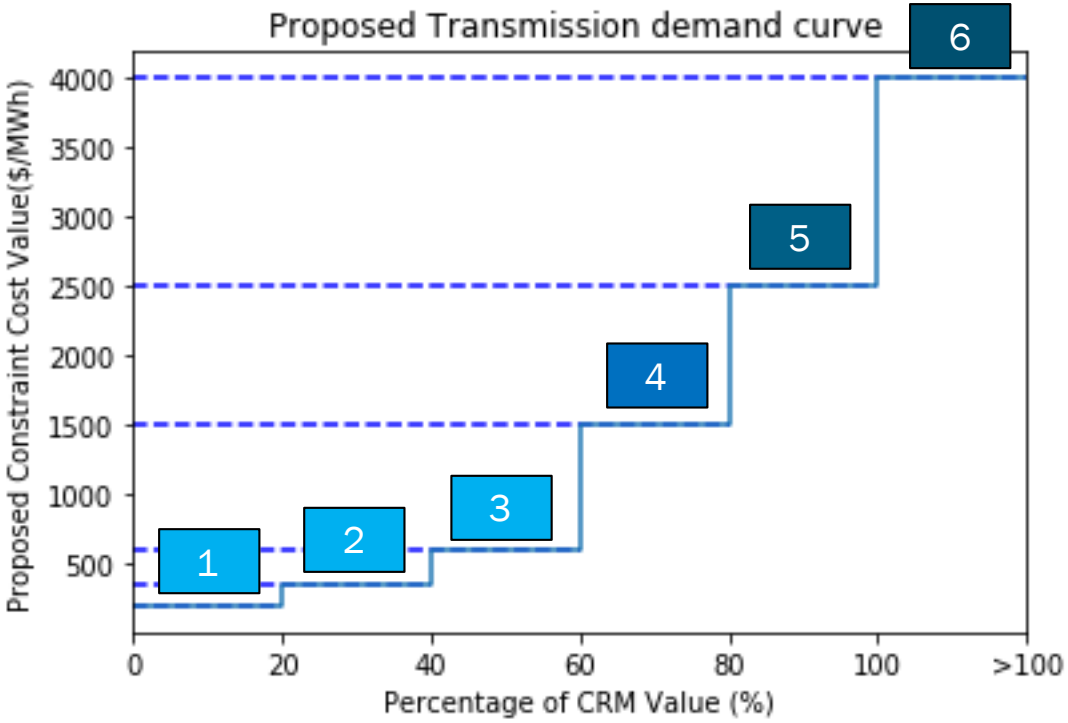
Proposal for Non-Zero CRM Value Facilities

- The NYISO is proposing following transmission demand curve for facilities currently assigned a non-zero value CRM:



1, 2, 3
- Steps 1, 2 & 3 are priced at $200, $350 and $600 per MWh, respectively
- These are based on historical constraint cost for these facilities (study period March 2018-March 2021)

4
- Step 4 is priced at $1,500 per MWh
- This step is based on appropriate tradeoff between transmission constraints and reserve products

5
- Step 5 is priced at $2,500 per MWh
- Provides transition step between Step 4 and 6

6
- Step 6 is priced at $4,000 per MWh
- Sufficient value to facilitate efficient re-dispatch of higher cost physical resources
- Applies to all shortages in excess of the applicable CRM value

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Proposal for Non-Zero CRM Value Facilities (cont'd)

- The proposed 6-step transmission demand curve structure for various non-zero CRM values is represented in the table below:

	Proposed Transmission Demand Curve steps											
CRM Value (MW)	Step 1 (MW)	Step 1 ($/MWh)	Step 2 (MW)	Step 2 ($/MWh)	Step 3 (MW)	Step 3 ($/MWh)	Step 4 (MW)	Step 4 ($/MWh)	Step 5 (MW)	Step 5 ($/MWh)	Step 6 (MW)	Step 6 ($/MWh)
10	<=2	$200	>2-4	$350	>4-6	$600	>6-8	$1,500	>8-10	$2,500	>10	$4,000
20	<=4	$200	>4-8	$350	>8-12	$600	>12-16	$1,500	>16-20	$2,500	>20	$4,000
30	<=6	$200	>6-12	$350	>12-18	$600	>18-24	$1,500	>24-30	$2,500	>30	$4,000
50	<=10	$200	>10-20	$350	>20-30	$600	>30-40	$1,500	>40-50	$2,500	>50	$4,000
60	<=12	$200	>12-24	$350	>24-36	$600	>36-48	$1,500	>48-60	$2,500	>60	$4,000
65	<=13	$200	>13-26	$350	>26-39	$600	>39-52	$1,500	>52-65	$2,500	>65	$4,000
100	<=20	$200	>20-40	$350	>40-60	$600	>60-80	$1,500	>80-100	$2,500	>100	$4,000

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Proposal for Internal Zero CRM Value Facilities

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Rationale for the proposed steps

- **The steps are proposed to be structured to facilitate reliance on as much efficient physical redispatch possible prior to utilizing relief provided by the transmission demand curve mechanism**
  - Constraint shadow cost represents the marginal cost of resolving a constraint and is assumed to be a proxy for the cost of physical redispatch
- **The NYISO analyzed the historical binding RTD transmission constraints for internal zero CRM value facilities**
  - Study period for the analysis is March 2018 - March 2021
  - RTD constraints with Shadow Price of less than $0.04 per MWh are removed from the dataset
    - Only constraints with a Shadow Price greater than $0.04 per MWh are considered as active constraints (see MST Section 23.3.1.1.1.2)
  - Transmission constraint cost at various percentage level thresholds is calculated
    - Represents the historic cost associated with resolving the specified percentage value of transmission constraints

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Rationale for the proposed steps (cont'd)

- The table below summarizes the RTD transmission constraint cost at various percentage level thresholds for internal zero CRM value facilities

Percentiles	90%	91%	95%	97%	98%	99%
Constraint cost ($/MWh)	51	53	72	102	129	217

- The NYISO is proposing following values for the two steps
  - First step valued at $100/MWh (informed by 97 percentile of historic transmission constraint cost)
    - This value remains the same as the NYISO's 2019 proposal
  - Second step valued at $250/MWh (informed by 99 percentile of historic transmission constraint cost)
    - As further described on the following slide, this value is different than the NYISO's 2019 proposal

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Rationale for the proposed steps (cont'd)

- **The proposed final step is informed by 99 percentile of historic transmission constraint cost, and would price transmission shortages beyond the minimal CRM value the NYISO proposed to apply to these facilities (i.e., 5 MW), thereby eliminating reliance on constraint relaxation for these facilities**
  - The proposed value is designed to facilitate reliance on as much efficient physical redispatch as possible prior to utilizing the final step that covers shortages beyond the proposed CRM value
  - The NYISO will continue to monitor and evaluate the pricing value of the final step based on operational experience in an effort to maintain alignment with the objective of facilitating efficient re-dispatch of higher cost physical resources providing relief on these facilities
- **The proposed pricing value for this step is different from NYISO's 2019 proposal**
  - The facilities covered by this component of the proposal accommodate flows out of export constraint pockets like generation complexes
  - Under the current TCP logic, these facilities do not utilize a transmission demand curve mechanism; the proposed enhancements would introduce the use of such a mechanism together with eliminating reliance on constraint relaxation for these facilities

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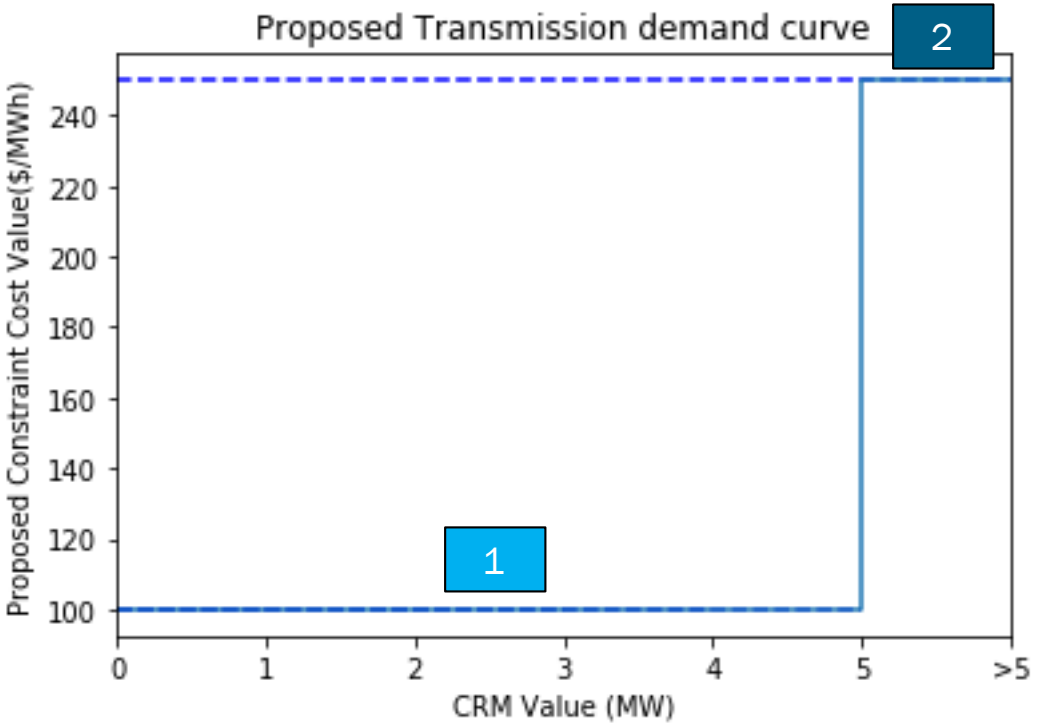
Proposal for Current Zero Value CRM Internal Facilities

- The NYISO proposes to apply a small non-zero CRM value (i.e., 5 MW) to internal facilities currently assigned a zero value CRM and apply the following transmission demand curve :



1

2

- Step 1 and 2 are priced at $100 and $250 per MWh, respectively
- These values are based on historical cost of solving the transmission constraints for these facilities (study period March 2018 – March 2021)
- Step 2 applies to all shortages in excess of the applicable CRM value

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Proposal for External Interfaces

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Proposal for External Interfaces

- **The NYISO will continue use of the current single value $4,000 per MW Shadow Price capping mechanism for external interfaces (i.e., the current pricing logic for facilities assigned a zero value CRM)**
- **Rationale for the proposal**
  - NERC rules require external interfaces to be scheduled to the same limit as the neighboring control areas. Due to the need to schedule to the same limit with external interfaces a CRM is not applied
- **The proposal is same as the NYISO's 2019 proposal**
  - No change is warranted from the earlier proposal

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Next Steps

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Next Steps

- **Q2/Q3 2021**
  - Continue discussions on the design proposal with stakeholders
- **Q3/Q4 2021**
  - Finalize design proposal
  - Develop associated tariff revisions
  - Present Consumer Impact Analysis
  - Seek stakeholder approval at BIC and MC

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Questions?

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Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policymakers, stakeholders and investors in the power system

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Appendix

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Current Transmission Constraint Pricing (TCP) Logic

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Current TCP Logic

- **The NYISO assigns a constraint reliability margin (CRM) to facilities and interfaces to help manage transmission modeling uncertainty.**
  - The CRM value represents a reduction to the otherwise applicable transmission facility rating or interface limit that is used to set the effective limit in the market software
  - A zero value CRM is applied to facilities that are generally located within a generation pocket, as well as external interfaces
- **The following limits on Shadow Prices are applied in instances of transmission shortages (implemented on June 20, 2017)**

Facility Type	Demand (MW)	Demand Curve Price ($/MWh)	Price Cap
Non-Zero CRM	Up to 5	$350	$4000
	>5 to 20	$1175	
Zero CRM	N/A	N/A	$4000

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Current TCP Logic

- For facilities with a non-zero value CRM, the software will seek redispatch at a shadow price up to $4,000 per MW, with consideration of the 20 MW of relief afforded by the two-step demand curve mechanism.
- For zero value CRM facilities, the software will seek redispatch at a shadow price up to $4,000 per MW, without consideration of any demand curve mechanism.
- For all facilities, in situations where insufficient resource/demand curve capacity is available to fully resolve a constraint, "relaxation" is applied
  - To determine the applicable shadow cost for the transmission constraint, the applicable limit for the facility is increased to a value equal to the flow that can be achieved on the constraint by the available resources (including the 20 MW of relief from the demand curve mechanism, if applicable), plus 0.2 MW

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Background – Progress so far

- The NYISO completed a study of the current transmission constraint pricing logic in September 2018.[1]
  - The study included a number of recommended considerations with respect to potential enhancements to the current TCP logic
- The NYISO presented a Market Design Concept Proposal in February 2019.[2]

1 Link to the Constraint Specific Transmission Shortage Pricing study:
https://www.nyiso.com/documents/20142/2549789/Constraint%20Specific%20Transmission%20Shortage%20Pricing%20-%20Paper_Final.pdf
2 Link to the Constraint Specific Transmission Shortage Pricing Market Design Concept Proposal:
https://www.nyiso.com/documents/20142/5020603/Constraint%20Specific%20Transmission%20Shortage%20Pricing%20_MDCP_021519.pdf

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Recap of 2019 Market Design Concept Proposal

Summary of the 2019 Proposal

- **The NYISO proposed to implement a revised approach to the current TCP logic consisting of the following components:**
  1. Establish a revised six-step transmission demand curve mechanism for facilities currently assigned a non-zero CRM value.
  2. Apply a non-zero CRM value to internal facilities currently assigned a zero value CRM, with a separate demand curve mechanism for such facilities.
  3. Maintain the current single value $4,000 shadow price capping method for external interface facilities (zero value CRM) permitting the continued use of constraint relaxation.

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Proposal for Non-Zero CRM Value Facilities

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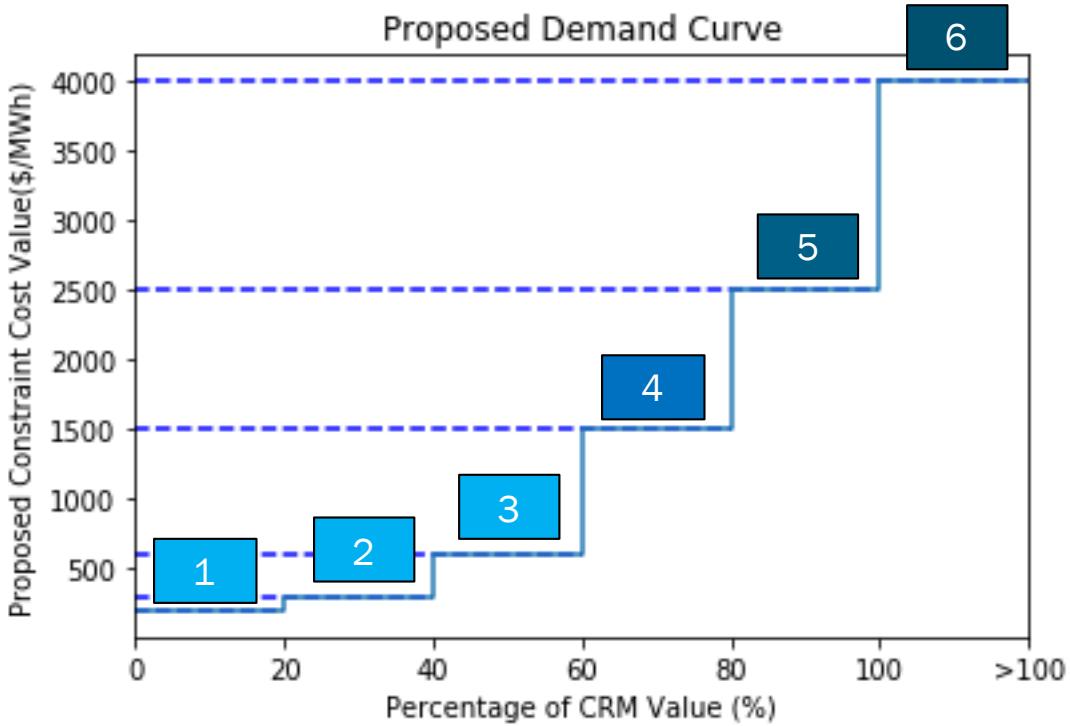

1, 2, 3
- Steps 1, 2 & 3 are priced at $200, $300 and $600 per MWh, respectively
- These are based on historical cost of solving the transmission system through physical re-dispatch (study period July 2017 – Feb 2018)

4
- Step 4 is priced at $1,500 per MWh
- This step is based on appropriate tradeoff between transmission constraints and reserve products

5
- Step 5 is priced at $2,500 per MWh
- Provides transition step between Step 4 and 6

6
- Step 6 is priced at $4,000 per MWh
- Sufficient value to facilitate efficient re-dispatch of higher cost physical resources
- Applies to all shortages in excess of the applicable CRM value

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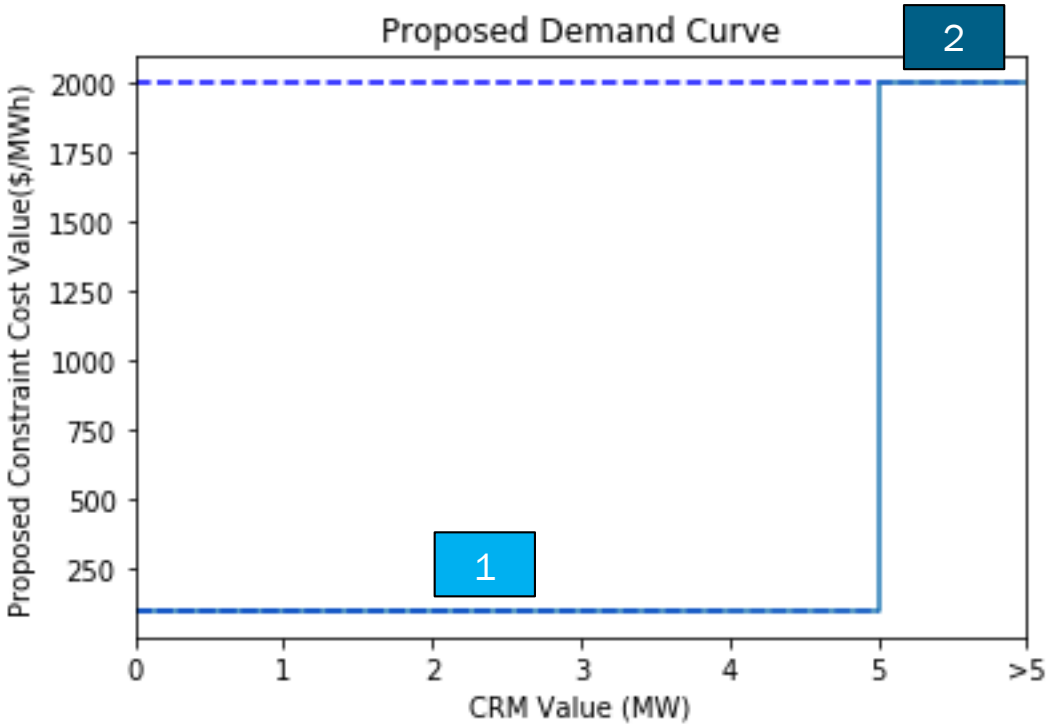
Proposal for Current Zero Value CRM Internal Facilities

- The NYISO proposed to apply a small non-zero CRM value (5 MW) to internal facilities currently assigned a zero value CRM and apply the following demand curve :



1

- Step 1 is priced at $100 per MWh
- This value is based on historical cost of solving the transmission constraints through physical re-dispatch in zero value CRM facilities (study period July 2017 – Feb 2018)

2

- Step 2 is priced at $2000 per MWh
- Sufficient value to facilitate efficient re-dispatch of higher cost physical resources

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