Operating Characteristics of Energy Storage Resources

Preliminary guide to ESR parameters in the NYISO Energy and Ancillary Services markets

July 2018

Contents

Existing Parameters

Parameter[1]	Unit	Description	Registration[2]	Commitment[3]	Bid Screen[4]
Upper Operating Limit (UOL) ***Maximum Discharge Limit***	MW	Maximum power the ESR can supply. Upon Registration, the MP Administrator must provide the maximum Physical Upper Operating Limit of the ESR. While bidding, the MP Administrator must supply Emergency and Normal Upper Operating Limits that are less than or equal to the Physical Upper Operating Limit. ***Maximum Discharge Limit represents the maximum MW quantity that a resource using the participation model for electric storage resources can inject to the grid.***	Yes	No	Required
Minimum Generation ***Minimum Discharge Limit***	MW	Minimum power the ESR can supply. For a Continuous ESR, this can be a negative number representing the Maximum Withdrawal Limit. Upon Registration, the MP Administrator must provide the maximum Physical Minimum Generation of the unit. When bidding, the MP Administrator must supply a Minimum Generation value that is no less than the Physical Minimum Generation level. ***The minimum MW output level that a resource using the participation model for electric storage resources can inject onto the grid.***	Yes	No	Required
Minimum Run Time	Hours	Minimum time the ESR can inject energy. Taken as a consecutive interval. Honored only for the look-ahead horizon for the market interval offered into (e.g., 24 h for the DAM and 1 h for RT). ***Minimum Run Time represents the minimum amount of time that a resource using the participation model for electric storage resources is able to inject electric energy to the grid (e.g., one hour).***	Yes	Yes	N/A
Minimum Down Time	Hours	The minimum amount of time that the ESR, once stopped, must remain off or idle before being committed again. Honored only for the look-ahead horizon for the market interval offered into (e.g., 24 h for the DAM and 1 h for RT). If an ESR has a different Minimum Down Time when transitioning from withdrawal to injection than when transitioning from injection to withdrawal, the Market Administrator should submit whichever is most limiting.	Yes	Yes	N/A
Maximum Stops per Day	Whole Number	The maximum number of times that the ESR may be stopped and then started again in a single day. May be submitted either as a single value or as a time-varying curve dependent on how long the unit has been offline.	Yes	Yes	N/A
Start-up Notification Time and Start-Up Notification Time Curve	Hours	How far in advance the ESR needs to be made aware of its schedule in order to be prepared to operate at its bid Minimum Generation or Minimum Withdrawal Limit, whichever is greater.	Yes	Yes	N/A

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2. Registration parameters listed in this column may be changed upon request, subject to approval from the NYISO (~3 day process).
3. Registration parameters listed in this column may be changed by MP's at any time, and will be applied to the next open market interval.
4. For "Required" Bid Screen parameters, if no value is submitted at time of offer, the bid will not pass validation. N/A means the parameter is not available on the bid screen. If "Optional", the field may be left blank.

Parameter[1]	Unit	Description	Registration[2]	Commitment[3]	Bid Screen[4]
Start-up Cost	$	Amount of money needed to begin injecting energy from an offline state. Can be submitted as an incremental cost curve.	No	No	Required
Minimum Generation Cost	$	How much it costs for the ESR to remain at its bid Minimum Generation level. Is an hourly rate.	No	No	Required
Incremental Bid Curve	$/MWh	A series of monotonically increasing steps that indicate the quantities of Energy for a given price that an ESR is willing to supply to the NYISO. The NYISO proposes that ESRs utilize this mechanism to specify price points for both injecting and withdrawing energy. Hours for which the bid curve applies must be specified. For DAM bids, if an expiration date is not specified, the offer is assumed to be valid indefinitely.	No	No	Required
Market Choice	-	Market Administrator must select whether to offer into the DAM or RTM, or both.	No	No	Required
Unit Operation	-	Generators may operate in one of four modes: ISO-Committed Flexible, ISO-Committed Fixed, Self-Committed Flexible and Self-Committed Fixed. Details regarding the various bid modes may be found in Section 4 of the NYISO Services Tariff. If in NYISO-Monitored mode, ESR's must offer as ISO-committed Flexible.	No	No	Required
Response Rates *Charge Ramp Rate* *Discharge Ramp Rate*	MW/Min	How quickly the ESR can respond to dispatch instructions from the NYISO under various operating conditions. ***The speed at which a resource using the participation model for electric storage resources can move from zero output to its Maximum Charge Limit.*** ***The speed at which a resource using the participation model for electric storage resources can move from zero output to its Maximum Discharge Limit.***	Yes	No	No
Fuel Type		Typically used by traditional (fossil-fuel) generators. If no Fuel Type is provided, the NYISO evaluates the bid against the Reference Level for the Generator based on its primary Fuel Type.	No	No	Optional
Burdened Fuel Price	$/mmBtu	Typically used by traditional (fossil-fuel) generators. In-day per unit cost of fuel, including raw fuel price, taxes, and the adder as defined in the Reference Level Software User's Guide.[5]	No	No	Optional

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5. New York Indep. Sys. Operator, Inc., Reference Level Software User's Guide. Recovered from http://www.nyiso.com/public/webdocs/markets_operations/documents/Manuals_and_Guides/Guides/User_Guides/RLS_UG.pdf on Dec. 12, 2017.

New Parameters

Parameter[1]	Unit	Description	Registration[2]	Commitment[3]	Bid Screen[4]
Initial State of Charge[5] ***State of Charge***	Ratio	The ratio of the amount of energy currently stored to the amount of energy that could be stored at the beginning of the market interval. Estimated by the MP for the DAM, retrieved from the ESR's telemetry in RT. ***State of Charge represents the amount of energy stored in proportion to the limit on the amount of energy that can be stored, typically expressed as a percentage. It represents the forecasted starting State of Charge for the market interval being offered into.***	No	No	Required for DAM only
Upper Storage Limit[5] ***Maximum State of Charge***	MWh	Maximum energy the ESR is physically capable of storing. ***Maximum State of Charge represents a State of Charge value that should not be exceeded (i.e. gone above) when a resource using the participation model for electric storage resources is receiving electric energy from the grid (e.g. 95% State of Charge).***	Yes	No	N/A
Lower Storage Limit[5] ***Minimum State of Charge***	MWh	Minimum energy the ESR is physically capable of storing. ***Minimum State of Charge represents a State of Charge value that should not be exceeded (i.e. gone below) when a resource using the participation model for electric storage resources is injecting electric energy to the grid (e.g. 5% State of Charge).***	Yes	No	N/A
Roundtrip Efficiency[5]	Ratio	The ratio of energy that can be injected to the grid (in MWh) to energy that must be withdrawn (in MWh). Applied as a multiplier only to the withdrawing region of NYISO-Monitored ESRs.	Yes	No	N/A
Energy Level Mode	-	If "NYISO-Monitored" is selected, the NYISO will honor the ESR's Upper and Lower Storage Limits using the provided Initial State of Charge and Roundtrip Efficiency values. If "Self-Monitored" is selected, Upper Storage Limit, Lower Storage Limit, Roundtrip Efficiency, and State of Charge will not be considered by the market software.	No	No	Required
Continuous	Yes/No Flag	The Market Administrator should indicate "No" if the ESR is Non-Continuous (ie, does not have an infeasible operating region between Min Load and Min Gen). Min Load, Max Load, Startup Load Cost, Min Load Cost, Min Withdrawing Time and Max Withdrawing Time are parameters available only to Non-Continuous ESR.	Yes	No	N/A

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5. Parameter is only honored for ESRs that indicate "Yes" for NYISO-Monitored Flag.

Parameter[1]	Unit	Description	Registration[2]	Commitment[3]	Bid Screen[4]
Maximum Withdrawal Limit ***Maximum Charge Limit***	MW	Maximum power the ESR can withdraw. Must be a negative number. Not used for Continuous ESRs. Upon Registration, the MP Administrator must provide the Physical Maximum Withdrawal Limit of the unit. While bidding, the MP Administrator must supply a Normal Maximum Withdrawal Limit that is greater than or equal to the Physical Maximum Withdrawal Limit. ***Maximum Charge Limit represents the maximum MW quantity of electric energy that a resource using the participation model for electric storage resources can receive from the grid.***	Yes	No	Required
Minimum Withdrawal Limit ***Minimum Charge Limit***	MW	Minimum power the ESR can withdraw. Must be a negative number. Not used for Continuous ESRs. Upon Registration, the MP Administrator must provide the Physical Minimum Withdrawal Limit of the unit. When bidding, the MP Administrator must supply a Normal Minimum Withdrawal Limit that is no less than the Physical Minimum Withdrawal Limit. ***The minimum MW level that a resource using the participation model for electric storage resources can receive from the grid.***	Yes	No	Required
Minimum Withdrawing Time ***Minimum Charge Time***	Hours	Minimum duration for which the ESR can withdraw energy. Taken as a consecutive interval. Honored only for the look-ahead horizon for the market interval offered into (e.g. 24 h for the DAM and 1 h for RT). Not used for Continuous ESRs. ***Minimum Charge Time represents the shortest duration that a resource using the participation model for electric storage resources is able to be dispatched by the RTO/ISO to receive electric energy from the grid (e.g., one hour).***	Yes	Yes	N/A
Maximum Withdrawing Time ***Maximum Charge Time***	Hours	Maximum duration for which the ESR can withdraw energy. Taken as a consecutive interval. Honored only for the look-ahead horizon for the market interval offered into (e.g. 24 h for the DAM and 1 h for RT). Not used for Continuous ESRs. ***Maximum Charge Time represents the maximum duration that a resource using the participation model for electric storage resources is able to be dispatched by the RTO/ISO to receive electric energy from the grid (e.g.,four hours).***	Yes	Yes	N/A

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Parameter[1]	Unit	Description	Registration[2]	Commitment[3]	Bid Screen[4]
Maximum Run Time	Hours	Maximum time ESR can inject energy. Taken as a consecutive interval. Honored only for the look-ahead horizon for the market interval offered into (e.g. 24 h for the DAM and 1 h for RT). ***Maximum Run Time represents the maximum amount of time that a resource using the participation model for electric storage resources is able to inject electric energy to the grid (e.g., four hours).***	Yes	Yes	N/A
Start-up Withdrawal Cost	$	Amount of money needed to begin withdrawing energy from an offline state. Can be submitted as an incremental cost curve. Not used for Continuous ESRs.	No	No	Required
Minimum Withdrawal Cost	$	How much it costs to remain at the Minimum Withdrawal Limit level. Is an hourly rate. Not used for Continuous ESRs.	No	No	Required
Opportunity Cost	$/MW	Economic parameter that will be calculated by MMA. ESR's and other resources will be able to use this to override the value calculated by default by MMA. All submissions will be subject to Energy market mitigation.	No	No	Optional

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ESR Energy Level and Unit Operation Modes

DAM Offer		Permitted RTM Offers	
Energy Level Mode	**Unit Operation Mode**	**Energy Level Mode**	**Unit Operation Mode**
NYISO-Monitored	ISO-Committed Flex	NYISO-Monitored	ISO-Committed Flex
		Self-Monitored	ISO-Committed Flex Self-Committed Flex Self Committed Fixed*
Self-Monitored	ISO-Committed Flex	NYISO-Monitored	ISO-Committed Flex
		Self-Monitored	ISO-Committed Flex Self-Committed Flex Self Committed Fixed*
Self-Monitored	Self-Committed Flex	Self-Monitored	Self-Committed Flex Self Committed Fixed*
Self-Monitored	ISO-Committed Fixed**	Self-Monitored	Self-Committed Fixed
Self-Monitored	Self-Committed Fixed	Self-Monitored	Self-Committed Fixed
No DAM Offer		NYISO-Monitored	ISO-Committed Flex
		Self-Monitored	ISO-Committed Flex Self-Committed Flex Self Committed Fixed

*With approval from the NYISO

** Units may only bid as ISO-Committed Fixed if qualified by the NYISO