

ESR Participation Model: Energy Level Monitoring

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Agenda

- Background
- Objectives
- Energy Level Monitoring
 - NYISO-monitored energy level
 - Self-monitored energy level
 - Ancillary Services considerations
- Ancillary Services Scheduling Examples
- Timeline

Previous Discussions

Date	Working Group	Discussion points
08-04-16	Market Issues Working Group (MIWG)	Initial discussion on alternatives for Energy Storage in the NYISO markets
09-29-16	MIWG	Market Design ideas discussion
11-29-16	MIWG	Presentation providing more detail on the Market Design that the NYISO will pursue
05-05-17	MIWG	Presentation addressing the proposed modeling enhancements as the cornerstone of the Energy Storage Integration phase
07-19-17	MIWG	Presentation delving into the eligibility criteria and RT scheduling logic for Energy Storage Resources (“ESRs”).
08-25-17	MIWG	Discussion on the Settlements logic for ESRs.
10-03-17	MIWG	Day-Ahead scheduling logic and Mitigation framework
11-02-17	MIWG	Aggregations in the ESR model
12-20-17	MIWG	Market Design Concept Proposal Summary
02-21-18	MIWG	Ancillary Services Treatment in the ESR Participation Model

Background

On February 15, 2018, FERC issued Order No. 841, directing “each RTO/ISO to revise its tariff to establish a participation model consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, facilitates their participation in the RTO/ISO markets.”¹

Tariff revisions must:

- 1) “ensure that a resource using the participation model for electric storage resources is eligible to provide all capacity, energy, and ancillary services that it is technically capable of providing in the RTO/ISO markets;
- 2) “ensure that a resource using the participation model for electric storage resources can be dispatched and can set the wholesale market clearing price as both a wholesale seller and wholesale buyer consistent with existing market rules that govern when a resource can set the wholesale price;
- 3) “account for the physical and operational characteristics of electric storage resources through bidding parameters or other means; and
- 4) “establish a minimum size requirement for participation in the RTO/ISO markets that does not exceed 100 kW.”²

1. Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, Order No. 841, 162 FERC ¶ 61,127, at P3 (Feb. 15, 2018) (“Order No. 841”) as amended by the Feb. 28, 2018 Errata Notice (“Order No. 841 Errata”).
2. Order No. 841 Errata at P 4.



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Background

- **In 2017, the NYISO developed a concept for a participation model that would enable ESRs to offer their full capabilities into the NYISO's wholesale Energy, Capacity, and Ancillary Services markets.**
 - The NYISO is currently reviewing its ESR market design concept to ensure compliance with FERC Order No. 841 directives.
- **In 2018, the NYISO will complete the market design of the ESR participation model.**
 - FERC Order No. 841 requires the NYISO to file tariff revisions on or before December 3, 2018.
 - Implementation of the tariff revisions is required on or before December 3, 2019.
- **Market design elements that are outside the scope of FERC Order No. 841 compliance will not be part of the initial ESR participation model:**
 - The NYISO will not file tariff revisions in 2018 to address storage aggregations or dual participation.
 - Rules for dual participation and aggregations of all resource types are being developed as part of the DER Participation Model.

Objectives

- Review FERC Order No. 841 energy level monitoring directives.
- Discuss the NYISO's energy level monitoring proposal for the ESR participation model.
- Provide examples to illustrate how the NYISO proposes to manage energy level constraints for ESRs when supplying Operating Reserves, Regulation and Energy.
 - Requested by stakeholders at the February 21st, 2018 MIWG.

Energy Level Monitoring

- FERC Order No. 841 states that “resources using the participation model for electric storage resources must have the ability to self-manage their state of charge”³ and goes on to clarify that:

“Providing this flexibility will allow resource owners/operators to ensure their own Minimum and Maximum States of Charge are not violated, which will help prevent excessive wear and tear on the resource and help maintain its technical capabilities to provide services in the RTO/ISO markets.”⁴
- In accordance with this directive, the NYISO proposes that ESRs be allowed to participate in one of two modes:
 1. NYISO-monitored energy level
 2. Self-monitored energy level

3. Order No. 841 Errata at P 252.

4. Order No. 841 Errata at P 252.

NYISO-monitored Energy Level

- **ESRs will be eligible to request that the NYISO monitor their energy level constraints.**
 - The NYISO will ensure that ESRs which opt in to NYISO energy level monitoring receive physically feasible schedules.
 - For example: once an ESR reaches its Upper Storage Limit, it will not be scheduled to withdraw more energy regardless of its bid.
- **The NYISO's Energy Level Monitoring proposal will prevent ESRs from receiving a physically infeasible schedule throughout the dispatch day. The proposal will not, however, permit ESRs to specify an energy level they wish to have at the end of a dispatch increment (the "ending energy level").**
 - The ability to specify an ending energy level will allow an ESR to manage its energy level throughout the dispatch day.
 - The NYISO is considering a future market enhancement that would permit ESRs to submit ending energy levels.

NYISO-monitored Energy Level

- The NYISO will monitor the following operating characteristics for ESRs that opt-in to NYISO-monitored energy level:
 1. **Beginning Energy Level (MWh)**
 - Beginning Energy Level 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.
 - FERC Order No. 841 refers to this characteristic as “State of Charge,” and the NYISO intends to use the Commission’s definition.*
 2. **Upper Storage Limit (%)**
 - Upper Storage Limit 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).
 - FERC Order No. 841 refers to this characteristic as “Maximum State of Charge,” and the NYISO intends to use the Commission’s definition.*
 3. **Lower Storage Limit (%)**
 - Lower Storage Limit 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).
 - FERC Order No. 841 refers to this characteristic as “Minimum State of Charge,” and the NYISO intends to use the Commission’s definition.*

* The Commission’s definition of these, and other, Operational Characteristics are available in the chart accompanying paragraph 236 of the Order No. 841 Errata.

Self-monitored Energy Level

- The NYISO will not consider the following operating characteristics for purposes of scheduling ESRs that opt-out of NYISO-monitored energy level:
 1. Beginning Energy Level
 2. Upper Storage Limit
 3. Lower Storage Limit
- Self-monitoring ESR's will be responsible for managing their energy level constraints through their offers.
- It will be possible for self-monitoring ESRs to receive physically infeasible schedules.
- The NYISO is considering how to determine eligibility for make-whole payments for self-monitored resources.

Energy Level Considerations for Ancillary Services

- **ESRs will not be scheduled to provide Ancillary Services in excess of their physical capabilities.**
 - An ESR with a UOL of 5 MW could not be scheduled to provide 5 MW of Energy and 2 MW of Reserve during the same market interval.
- **Regulation:**
 - Regulation awards will be assumed to have a neutral impact on a resource's energy level during the awarded market interval.
 - For example: if an ESR is awarded 1 MW of Regulation, the NYISO's market software will neither add nor subtract any energy from the ESR's forecasted energy level for the subsequent market interval.
- **Operating Reserves:**
 - Consistent with NPCC rules, the NYISO will ensure that ESR's receiving Operating Reserve awards have the capability to maintain a Reserve activation for at least one hour.⁵
 - ESRs will be required to meet all applicable NERC, NPCC, and NYSRC rules to provide Operating Reserves.
- **ESRs will be responsible for managing their energy level so that they are able to honor their schedules and/or paying any applicable penalties if they fail to do so.**

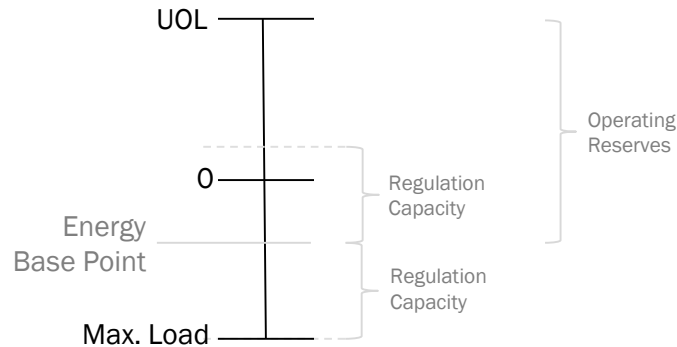
5. On March 29th, the NYISO filed its proposed tariff revisions addressing the provision of Spinning Reserves by Inverter-Based Energy Storage Resources. Additional information can be found in docket [ER18-1231-000](#).

Ancillary Services Scheduling Examples

Ancillary Service Awards

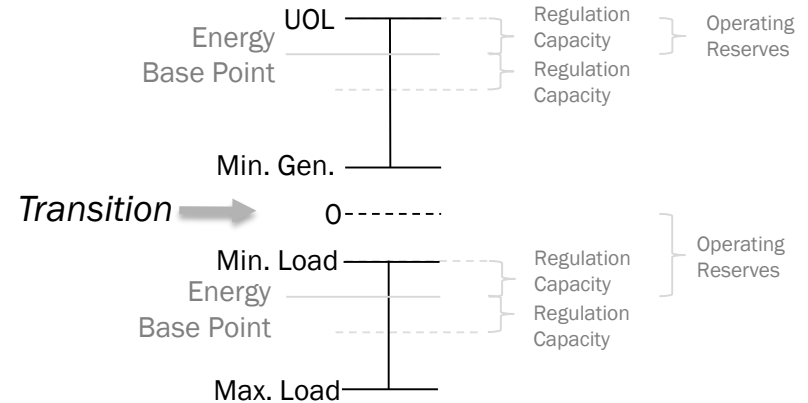
Example 1:

ESR without transition constraints



Example 2:

ESR with transition constraints



* The Regulation Capacity and Operating Reserve brackets represent the maximum award that an ESR could receive for a given Energy Base Point. They do not represent distinct awards for a single interval.

Simplified DA Scheduling Example 1: ESR Without Transition Constraints

- Only the first five hours of an operating day are considered for this example (HB 0 – HB 4).

<i>ESR Parameters</i>		
Storage Capability	10	MWh
UOL	5	MW
Max. Load	5.2	MW
Min. Generation	0	MW
Min. Load	0	MW
Transition Time	0	Hrs

- The NYISO assumes that Regulation awards will be deployed equally in the positive and negative directions and will not impact an ESR's energy level during the scheduled interval.
- Energy awards will affect energy level forecasts for subsequent intervals.
- ESRs will not be scheduled to provide more energy and ancillary services than their storage capabilities physically allow.

<i>Hour</i>	<i>Energy Level (Top of the hour)</i>	<i>Energy</i>	<i>Regulation</i>	<i>Operating Reserve</i>
	<i>MWh</i>	<i>MW</i>	<i>MW</i>	<i>MW</i>
HB 0	9	0	1	0
HB 1	9	-1	0	0
HB 2	10	5	0	0
HB 3	5	-1	3	1
HB 4	6	3	0	1

Simplified DA Scheduling Example 2: ESR with Transition Constraints

- Only the first five hours of an operating day are considered for this example (HB 0 - HB 4).

<i>ESR Parameters</i>		
Storage Capability	10	MWh
UOL	5	MW
Max. Load	5.2	MW
Min. Generation	1	MW
Min. Load	1	MW
Transition Time	1	Hrs

- The ESR is scheduled according to its single-state capabilities.
- Storage capabilities are being fully utilized during each hour.
- Idle schedule during HB 2 is necessary for the resource to transition from a withdrawing state to an injecting state.

<i>Hour</i>	<i>Energy Level (Top of the hour)</i>	<i>Energy</i>	<i>Regulation</i>	<i>Operating Reserve</i>
	<i>MWh</i>	<i>MW</i>	<i>MW</i>	<i>MW</i>
HB 0	5	-4	1	0
HB 1	9	-1	0	0
HB 2	10	0	0	0
HB 3	10	3	0	2
HB 4	7	3	2	0

Timeline

- **April 24, 2018:**
 - Begin discussing Capacity market provisions for ESRs.
- **May – August 2018:**
 - Continue discussions at MIWG on key topics:
 - Settlements rules
 - Capacity market participation
 - DA and RT market prototyping efforts
 - FERC Order No. 841 Implications
 - Mitigation rules
 - Credit implications
 - Consumer impact analysis
- **June-September 2018**
 - Draft Tariff language and share with stakeholders.
- **September-November 2018**
 - Prepare and finalize FERC Order No. 841 compliance filing.

Questions?

We are here to help.

The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits 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 policy makers, stakeholders and investors in the power system



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