

May 1, 2019

**By Electronic Delivery**

Mr. Kurt D. Longo  
Director, Division of Electric Power Regulation – East  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, DC 20426

Re: *Response to April 1, 2019 Letter and Notification of Implementation Issues that Necessitate Additional Limited Compliance Tariff Revisions in Docket No. ER19-467-000*

Dear Director Longo:

The New York Independent System Operator, Inc. (“NYISO”) submits its responses to the questions in your April 1, 2019 letter (“April 1 Letter”) seeking additional information concerning the NYISO’s December 3, 2018, compliance filing in response to Order No. 841<sup>1</sup> in the above-referenced docket (“Compliance Filing”).<sup>2</sup> The NYISO’s responses to the questions in the April 1 Letter are set forth in Section I of this filing.<sup>3</sup>

In addition, please be advised that the NYISO has identified two issues with its planned implementation of the tariff revisions included in its Compliance Filing. The implementation issues are discussed in Section II. They involve the ability of electric storage facilities to participate in the NYISO-administered markets as Energy Limited Resources that are eligible to withdraw Energy in order to charge. Addressing the concerns that the NYISO has identified will necessitate three corrections to the tariff revisions included in the Compliance Filing. The corrections will ensure that the tariff accurately reflects the NYISO’s extremely limited ability to permit electric storage facilities to participate in its markets as Energy Limited Resources that are eligible to withdraw Energy. The NYISO is working diligently to develop the necessary tariff corrections and expects to file them before the end of the month (*i.e.*, in May 2019).

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<sup>1</sup> *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, Order No. 841, 162 FERC ¶ 61,127 (February 15, 2018), 83 Fed. Reg. 9580 (Mar. 6, 2018), Errata Notice (Feb. 28, 2018) (“Order No. 841”). All citations to Order No. 841 in this submission are to the revised order included with the February 28, 2018, errata notice.

<sup>2</sup> *New York Independent System Operator Inc.*, Compliance Filing and Request for Extension of Time of Effective Date, Docket No. ER19-467-000 (December 3, 2018) (“Compliance Filing”).

<sup>3</sup> Capitalized terms that are not otherwise defined in this submission or the Compliance Filing shall have the meaning specified in Section 2 of the NYISO Market Administration and Control Area Services Tariff (“Services Tariff”) and Section 1 of the Open Access Transmission Tariff (“OATT”).

The NYISO is not seeking any Commission or staff action in connection with its to-be-proposed tariff corrections at this time. The NYISO understands that filing the proposed corrections will constitute an amendment to the Compliance Filing. At the same time, because the proposed amendments address discrete implementation issues, the NYISO does not anticipate that addressing them will delay its requested effective date. The NYISO also notes that its to-be-filed corrections will not implicate the questions posed by the April 1 Letter and will likewise not require any changes to the NYISO's responses in Section I. Nevertheless, the NYISO regrets both that it did not identify these implementation issues until after the Compliance Filing was made and any inconvenience or delay that Commission staff may experience as a result.

## **I. Responses to the April 1 Letter's Questions**

### **Item 1 - Definition of Electric Storage Resource**

To identify the set of resources that are eligible to use the required participation models for electric storage resources, Order No. 841 revised section 35.38(b) of the Commission's regulations<sup>4</sup> to define an electric storage resource as "a resource capable of receiving electric energy from the grid and storing it for later injection of electric energy back to the grid."<sup>5</sup>

#### **Commission Question 1(a)**

*Please provide the rationale for including the phrase "at a specified location" in the definition of Energy Storage Resource. Would this definition prevent the aggregation of Energy Storage Resources?*

#### **NYISO Response**

The NYISO proposed in its Compliance Filing the definition of an "Energy Storage Resource."<sup>6</sup> The definition requires that an electric storage facility must receive and inject energy at the same location on the grid to qualify as an Energy Storage Resource.<sup>7</sup> The location requirement was included because, at the time of the filing, the NYISO did not have rules that would permit an aggregation of electric storage facilities at multiple, disparate locations to qualify and participate in the NYISO-administered markets as a single Energy Storage Resource.<sup>8</sup>

However, as previously described to the Commission, the NYISO has been working diligently with its stakeholders to develop aggregation rules as part of its initiative to create a

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<sup>4</sup> 18 C.F.R. § 35.28(b).

<sup>5</sup> Order No. 841, 162 FERC ¶ 61,127 at P 29.

<sup>6</sup> See Compliance Filing at pp 12-13.

<sup>7</sup> See Compliance Filing at pp 12-13. In particular, the definition of Energy Storage Resource describes such resources as "Generators that receive Energy from the grid *at a specified location*, and are capable of storing that Energy, for later injection back onto the grid *at the same location....*" *Id.* at p 13 (emphasis added).

<sup>8</sup> Consistent with the definition of Energy Storage Resource, electric storage facilities that are aggregated behind the same meter at the same point of interconnection may qualify and participate as a single Energy Storage Resource in the NYISO-administered markets.

new market design for Distributed Energy Resources (“DER”s).<sup>9</sup> To permit participation by aggregations of resources in the NYISO-administered markets, the NYISO and its stakeholders worked in the DER process to develop new or revised rules affecting interconnection, measurement and verification, bidding, scheduling, pricing, and other requirements.

The NYISO’s stakeholders recently approved tariff changes to implement the new market design for DERs, including aggregation requirements. The new aggregation requirements will allow for the aggregation of resources located at different interconnection points behind the same Transmission Node.<sup>10</sup> Once implemented, the aggregation rules developed for DER participation will be available for use by Energy Storage Resources and other resources. The NYISO expects to file the tariff revisions concerning the DER market rules, including the aggregation requirements, in the second quarter of 2019 after and contingent on authorization by the NYISO’s Board of Directors. The NYISO intends to implement the DER participation model rules by the end of 2021.

In addition, the aggregation of resources requires close coordination between the NYISO, the applicable Transmission Owner, and the aggregator to ensure system reliability and that the aggregator is providing the services for which it is being compensated. The NYISO has been working with New York utilities to create a set of business practices and procedures that ensures that the transmission and distribution grids are operated reliably while providing flexibility for aggregators to determine which resources within their aggregation should be used to respond to the NYISO’s and/or Transmission Owner’s dispatch instructions.<sup>11</sup>

## **Item 2 - Creation of a Participation Model for Electric Storage Resources**

Order No. 841 added section 35.28(g)(9)(i) to the Commission’s regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, facilitate their participation in the RTO/ISO markets.<sup>12</sup>

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<sup>9</sup> See Compliance Filing at p 55; see also *New York Independent System Operator, Inc.*, Request for Leave to Answer and Answer of New York Independent System Operator, Inc., Docket No. ER19-467-000 (February 22, 2019) (“NYISO February 2019 Answer”). The Commission explicitly determined not to take action in Order No. 841 concerning aggregations of distributed energy resources and opened a separate docket to explore separately reforms concerning such aggregations. Order No. 841 at P 5 (errata version). The NYISO believes that such requirements should be addressed through each region’s stakeholder process to accommodate each region’s unique market framework, system characteristics, and operational requirements.

<sup>10</sup> The NYISO has proposed to define “Transmission Node” as “a bus located inside the NYCA that is identified by the ISO to represent an electrical area to which individual DER may aggregate and at which LBMPs are calculated.”

<sup>11</sup> See, e.g., Draft DPS Communications and Coordination Manual; available at: <https://jointutilitiesofny.org/wp-content/uploads/2018/07/JU-DSP-Communications-and-Coordination-Manual-DRAFT-2.pdf>.

<sup>12</sup> Order No. 841 at P 51.

**Commission Question 2(a)(i)**

*Please explain and provide citations to the relevant proposed tariff language that demonstrate the following. To the extent NYISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

*i. How does NYISO's dispatch-only model account for the physical and operational characteristics of an Energy Storage Resource with, for example, a set minimum or maximum run time, or a set minimum or maximum charge time, as defined in Order No. 841? Please provide additional explanation, including a numerical example, of how Roundtrip Efficiency would ensure NYISO's scheduling efficiency of an Energy Storage Resource.*

**NYISO Response**

The NYISO's proposed dispatch-only model considers an Energy Storage Resource to be available for all hours in which it submits a Bid<sup>13</sup> and allows the resource to be dispatched in the full range between its maximum injection capability and maximum withdrawal capability, including to zero MW.<sup>14</sup> As detailed in the NYISO's response to Question 4(a) below, the NYISO's use of a dispatch-only model aligns with the characteristics of the advanced storage technologies that are being contemplated for future deployment in New York. These facilities are expected to be continuously dispatchable while they are participating in the NYISO-administered markets.

Charge time and run time parameters are intended to help a resource manage when it is scheduled to receive electric energy from the grid or to inject energy to the grid. The NYISO's dispatch-only model accounts for the characteristics associated with charge time and run time parameters through the Energy Storage Resource's registration parameters,<sup>15</sup> its offers, and in real-time, its six-second telemetry data.

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<sup>13</sup> An Energy Storage Resource's failure to submit a Bid when it is available to operate will be evaluated as possible Energy/Ancillary Service market physical withholding.

<sup>14</sup> As detailed in the NYISO's response to Question 4(e) below, requiring the NYISO's Security Constrained Unit Commitment ("SCUC"), Real-Time Commitment ("RTC"), and Real-Time Dispatch ("RTD") software to respect maximum run time and/or charge time parameters would impose a significant additional computational burden and would significantly delay the development of solutions and issuance of schedules to resources by the NYISO's commitment and dispatch software. Accordingly, as described in its compliance filing, the NYISO does not propose to use the Minimum Run Time, Maximum Run Time, Minimum Charge Time, or Maximum Charge Time parameters described by the Commission in Order No. 841. See Compliance Filing at p 20. The NYISO's participation model makes use of the other nine parameters identified by the Commission in Order No. 841, which parameters are applicable to the NYISO's participation model. See *id.* at pp 16-17, 24, 29-30.

<sup>15</sup> Registration parameters reflect the physical characteristics of a resource, and must be provided during the NYISO's registration process. See Compliance Filing at pp 15-17. As detailed in the NYISO's response to Question 2(a)(ii) below, registration parameters may be adjusted upon request to the NYISO. Market Participants may adjust biddable parameters when they submit their offers, as detailed in the ISO Procedures.

The NYISO's optimization software will use an Energy Storage Resource's registration and offer parameters to schedule the resource within its physical limits. Submitting a combination of financial Bids that accurately reflect an Energy Storage Resource's costs and physical limits (*e.g.*, Lower Operating Limit, Upper Operating Limit) will ensure that the resource's physical limits are respected, maximize the revenues paid to the resource, and improve the efficiency of the dispatch instructions produced by the NYISO's optimization.

An Energy Storage Resource may reflect through its offers an Upper Operating Limit and Lower Operating Limit that are consistent with its physical characteristics. Specifically, to receive energy from the grid, an Energy Storage Resource can offer negative MW values for both Lower Operating Limit (referred to as Maximum Charge Limit in Order No. 841) and Upper Operating Limit (referred to as Minimum Charge Limit in Order No. 841) for each hour that it wants to receive energy from the grid. Similarly, to inject energy to the grid, an Energy Storage Resource can offer positive MW values for both Lower Operating Limit (referred to as Minimum Discharge Limit in Order No. 841) and Upper Operating Limit (referred to as Maximum Discharge Limit in Order No. 841) for each hour that it wants to provide energy to the grid. When a resource is able to either receive energy from or inject energy to the grid for a particular hour, it can structure its offer to have a negative MW value for Lower Operating Limit (referred to as Maximum Charge Limit in Order No. 841) and positive MW value for Upper Operating Limit (referred to as Maximum Discharge Limit in Order No. 841).

An Energy Storage Resource may also choose to self-manage (offer as Self-Managed) or have the NYISO manage (offer as ISO-Managed) its state of charge.<sup>16</sup> For ISO-Managed resources, the NYISO optimizes all physical parameters, including their Energy Level, Roundtrip Efficiency, Upper Storage Limit, and Lower Storage Limit, across the entire look-ahead horizon.<sup>17</sup> The Roundtrip Efficiency parameter enables the NYISO to accurately track the state of charge for an ISO-Managed resource within its multi-interval optimization so that all provided schedules account for the roundtrip (injection to withdrawal) energy losses of the Energy Storage Resource.

Roundtrip Efficiency is defined as the ratio of energy that can be injected to the grid (in MWh) to energy that must be withdrawn (in MWh):

$$\text{Roundtrip Efficiency} = \frac{\text{Injection Energy (MWh)}}{\text{Withdrawal Energy (MWh)}}$$

Example: An ISO-managed Energy Storage Resource with an initial state of charge of zero MWh receives a withdrawal schedule of 10 MW for an hour in the Day-Ahead Market. This Energy Storage Resource also has a Roundtrip Efficiency of 80%.

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<sup>16</sup> For purposes of this submission, "ISO-Managed" refers to an Energy Storage Resources that chooses an ISO-Managed Energy Level, and "Self-Managed" refers to an Energy Storage Resource that chooses a Self-Managed Energy Level.

<sup>17</sup> The look-ahead horizons are 24 hours in the Day-Ahead Market, 2.5 hours in RTC, and 1 hour in RTD.

$$80\% = \frac{x \text{ MWh}}{10 \text{ MWh}}$$
$$x = 80\% * 10 \text{ MWh}$$
$$x = 8 \text{ MWh}$$

The resource can only inject 8 MWh the next hour. However, if the Roundtrip Efficiency were not considered, the resource could receive a schedule to inject 10 MWh. This would not be efficient for the resource and would leave the actual generation-load balance short 2 MWh.

When evaluating Self-Managed resources, the NYISO's Real-Time Commitment ("RTC") and Real-Time Dispatch ("RTD") software will not consider the Upper and Lower Storage Limits, Roundtrip Efficiency, or Energy Level within the optimization. To attain specific injection or withdrawal levels, Self-Managed resources may offer in the Self-Committed Fixed or Self-Committed Flexible unit operation modes.<sup>18</sup> Self-Committed Fixed resources are price takers at specific operating levels, while Self-Committed Flexible resources are price-takers at a fixed minimum operating point, above which they are evaluated as flexible resources.

In real-time, the NYISO will receive telemetry from all Energy Storage Resources, thus accounting for the current state of charge for both Self-Managed and ISO-Managed Energy Storage Resources. Consistent with the NYISO's treatment of other Generators, a pre-optimization step will enforce limits on RTC and RTD's ability to schedule Self-Managed resources. This will ensure that they are not scheduled outside of their physical limits for the next Real-Time Market interval. For this pre-optimization dispatch window calculation, the NYISO will consider a Self-Managed resource's Roundtrip Efficiency, Upper Storage Limit, Lower Storage Limit, Upper Operating Limit, Lower Operating Limit, Response Rates, and in addition, will consider real-time Energy Level as telemetered on a six-second basis to the NYISO. The RTD software will account for the Energy Level of all Energy Storage Resources, and will attempt to prevent the infeasible dispatch of Self-Managed Energy Storage Resources and thus supersedes the need for minimum and maximum charge or run time parameters.

**Commission Question 2(a)(ii)**

*ii. How does NYISO propose to allow an Energy Storage Resource to modify its Roundtrip Efficiency over time (e.g., across seasons or as the resource ages)?*

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<sup>18</sup> While operating as ISO-Managed, Energy Storage Resources must offer as ISO-Committed Flexible. Self-Managed Energy Storage Resources may offer in the Day-Ahead Market as ISO-Committed Flexible, ISO-Committed Fixed, Self-Committed Flexible, or Self-Committed Fixed. Self-Managed Energy Storage Resources are not permitted to select the ISO-Committed Fixed bid mode in its real-time Bids. See Compliance Filing at pp 27-28.

### **NYISO Response**

An Energy Storage Resource must provide its Roundtrip Efficiency as part of its registration with the NYISO. The Energy Storage Resource may subsequently seek to update this parameter at any time by submitting a request to the NYISO, including a justification for the change. The NYISO will then review and process the requested change.<sup>19</sup> The NYISO must review any requests to change registration parameters for consistency with the expectations for that technology. If the submitted values do not correspond with these expectations, the NYISO may request further information prior to approval.

### **Item 3 - Eligibility of Electric Storage Resources to Participate in the RTO/ISO Markets**

Order No. 841 added section 35.28(g)(9)(i)(A) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing 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, including services that the RTOs/ISOs do not procure through an organized market, such as blackstart, primary frequency response, and reactive power services.<sup>20</sup>

### **Commission Question 3(a)**

*Please explain and provide citations to the relevant proposed tariff language that demonstrate whether Energy Storage Resources would also be eligible to provide reactive power and black start services. Please explain why or why not. To the extent NYISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

### **NYISO Response**

Energy Storage Resources are a type of "Generator" under the NYISO tariffs. As such, Energy Storage Resources may be eligible to provide all cost-based Ancillary Services that can be provided by Generators (including Voltage Support Service and black start service), if the particular Energy Storage Resource is technically capable of providing the service, meets the applicable tariff requirements, and successfully demonstrates its ability to provide the service consistent with ISO Procedures.

The NYISO's requirements for Generators to provide Voltage Support Service are set forth in Section 15.2 of the Market Administration and Control Area Services Tariff ("Services Tariff"). Sections 15.2 and 15.2.1.1 of the Services Tariff establish that Generators with an

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<sup>19</sup> See Market Participant User's Guide at Section 4.5 (Version 10.1, December 17, 2018); available at: <https://www.nyiso.com/documents/20142/3625950/mpug.pdf/c6ca83ca-ee6b-e507-4580-0bf76cd1da1b>. The NYISO will update the user's guide to address the parameters applicable to Energy Storage Resources.

<sup>20</sup> Order No. 841 at P 76.

Automatic Voltage Regulator, synchronous-condensers, and Qualified Non-Generator Voltage Support Resources<sup>21</sup> may be eligible to provide Voltage Support Service if they satisfy certain reactive power testing requirements. In addition, Section 15.5 of the Services Tariff establishes the requirements to be considered for inclusion in the NYISO's or individual Transmission Owner's black start and system restoration plans of "generating units that are capable of starting without an outside electrical supply or are otherwise integral to the restoration of the New York State Transmission System after an outage."<sup>22</sup>

#### **Item 4 - Participation in the RTO/ISO Markets as Supply and Demand**

Order No. 841 added section 35.28(g)(9)(i)(B) to the Commission's regulations to require that each RTO/ISO have tariff provisions to 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 rules that govern the conditions under which a resource can set wholesale price.<sup>23</sup>

#### **Commission Question 4(a)**

*Please explain how NYISO's dispatch-only model will allow Energy Storage Resources to effectively reflect commitment costs in their bids, consistent with other Generators. Are there any circumstances that could preclude an Energy Storage Resource from effectively managing its capability to meet obligations through bidding? Please explain.*

#### **NYISO Response**

The NYISO's review of a conventional Generator's Day-Ahead and Real-Time Market Bids will generally include an evaluation of both its commitment and dispatch parameters. Commitment parameters include certain physical characteristics (*e.g.*, minimum run time) and costs (*e.g.*, start-up costs) that are required to bring a Resource to its minimum generation level for the evaluated interval. The dispatch parameters include the costs (and time, defined by response rate) necessary to bring a Resource to a particular unit of output. As detailed in the NYISO's response to Question 4(e), the NYISO will only consider an Energy Storage Resource's dispatch parameters.

All electric storage facilities in the NYISO's current interconnection queue are based on advanced battery technology. The NYISO understands based on discussions with its stakeholders and developers that the advanced storage technologies being contemplated for

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<sup>21</sup> A Qualified Non-Generator Voltage Support Resource is a resource that is neither a Generator nor a synchronous condenser but that is capable of providing the ISO with Reactive Power on a dynamic basis, that is energized and under the operational control of the ISO, or a Transmission Owner, that meets the resource-specific technical and testing criteria specified in the ISO Procedures, and that is ineligible to receive Reactive Power compensation other than as a Qualified Non-Generator Voltage Support Resource. Services Tariff Section 2.17.

<sup>22</sup> Services Tariff Section 15.5.

<sup>23</sup> Order No. 841 at P 142.

future deployment in New York as Energy Storage Resources, including the projects in the existing queue, will be continuously dispatchable whenever they are available. That is, unlike most existing, conventional Generators in New York, no start-up decision or minimum load, or related commitment costs, should be required for these resources to accurately represent their capabilities. Rather, when available, the electric storage facilities can respond in milliseconds without advance notice or start required to a dispatch instruction, and can idle at zero output. The NYISO, therefore, expects that an Energy Storage Resource can reflect and should be able to recover all of its incremental operating costs, including opportunity costs, when it is scheduled to operate.

The Real-Time Dispatch software will account for the Energy Level of all Energy Storage Resources, and will attempt to prevent the infeasible dispatch of Self-Managed Energy Storage Resources. In addition, as described in the NYISO's response to Questions 2(a)(i) above and 4(c) below, an Energy Storage Resource can effectively manage its capability through its offers.

#### **Commission Question 4(b)**

*Similarly, can Energy Storage Resources reflect opportunity costs in their bids, and if so, please explain how. Please explain how NYISO would calculate the reference level for an Energy Storage Resource that would be used as a comparison in its conduct and impact testing for economic withholding, and which commitment costs the reference level would include. For example, would the reference level include opportunity costs (e.g., start up or no load costs or forgone revenue from other commercial circumstances)?*

#### **NYISO Response**

In order to evaluate offers for economic withholding, the NYISO calculates reference levels for all Generators as an estimation of the short run marginal cost to produce energy. Reference Levels are used to evaluate economic offers for both conduct and impact against the NYISO's defined market power mitigation thresholds. Reference Levels for Energy Storage Resources will include opportunity costs and additional adders as appropriate. The opportunity cost is intended to reflect the revenue that the Energy Storage Resource forgoes by deviating from the wholesale market schedule that would result in the highest profits ("optimal schedule") for a given day-ahead or real-time market interval. Opportunity costs are anticipated to be the primary component of an Energy Storage Resource's marginal costs, and thus their Reference Levels.

All Generators, including Energy Storage Resources, will be permitted to simultaneously submit (1) an Opportunity Cost Adjustment ("OCA") to the NYISO with its Day-Ahead or Real-Time Market Bid, and (2) an Energy Bid that includes the claimed opportunity costs. Similar to how Fuel Cost Adjustments ("FCA"s) are implemented today, an OCA will not be used to modify the Energy Storage Resource's Bid directly. Rather, if an OCA submission passes the NYISO's automated and manual screening processes, the OCA will be used to modify (increase) the reference level that is used to test the Energy Storage Resource's simultaneously submitted

Bid for possible Energy market mitigation. Incorporating accurate OCAs into reference levels will prevent overmitigation and enhances price formation.

Simplified examples of how the NYISO will calculate reference levels for Energy Storage Resources that include opportunity costs are provided below (Example 1 and Example 2). For these Examples, the following simplifying assumptions apply:

- the market day is only three hours long,
- the Locational Based Marginal Price (“LBMP”) does not vary intra-hour,
- the hourly prices are predictable,
- the conduct threshold is an offer that exceeds the reference level by 10% or more,
- the impact threshold is an increase to LBMP of 10% or more,
- the Energy Storage Resource has only one full hour of discharge capability, and
- the Energy Storage Resource is fully charged at the start of the day. Its cost to fully charge was \$20/MWh (which would represent the resource’s cost-based reference level in this simplified example).

**Example 1**

Hour	Expected LBMP [\$/MWh]	Opportunity Cost [\$/MWh]	Energy Storage Resource offer to inject [\$/MWh]	Withholding Conduct?	LBMP Impact?
1	15	50	50	No	No
2	15	50	50	No	No
3	50	0	50	No	No

In Example 1, in order to maximize its revenue, the Energy Storage Resource should discharge completely during hour 3, at which time it would receive \$50/MWh. The Energy Storage Resource submits offers to inject for hours 1 and 2 that reflect the revenue that would be lost by injecting when the LBMP is lower than the expected hour 3 price of \$50/MWh. The NYISO would not identify the hour 1 or hour 2 offers as economic withholding.

In contrast, the offers supplied for hours 1 and 2 in Example 2 would fail the conduct test, but would not cause an LBMP impact. In this example, the Energy Storage Resource’s offers are higher than the baseline opportunity cost-based reference level that the NYISO develops based on its forecast of future LBMPs. If the Energy Storage Resource timely submitted an OCA to justify its \$75/MWh offers, the NYISO would review the justification, which could result in a finding that no conduct violation occurred.<sup>24</sup>

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<sup>24</sup> Offers are only mitigated if the conduct test is violated **and** a market impact occurs.

**Example 2**

Hour	Expected LBMP [\$/MWh]	Opportunity Cost [\$/MWh]	Energy Storage Resource offer to inject [\$/MWh]	Withholding Conduct?	LBMP Impact?
1	15	50	75	Depends on threshold	No
2	15	50	75	Depends on threshold	No
3	50	0	50	No	No

The simplified calculations of opportunity cost above become more complicated when looking at a 24-hour time period with varying LBMPs. The first step in calculating an Energy Storage Resource’s opportunity cost based reference level will be to determine expected LBMPs. Hourly Day-Ahead Market reference levels will be developed by averaging Day-Ahead Market LBMPs for the last 90 days. Hourly Real-Time Market reference levels will be determined using the LBMPs from the Day-Ahead Market run for the same market day.<sup>25</sup> Once expected LBMPs have been determined, the NYISO will next determine the optimal schedule to maximize revenue for the Energy Storage Resource. The optimal schedule is determined by comparing expected peak (high) and trough (low) LBMPs for the market-day. If an expected peak LBMP is greater than the trough LBMP divided by the resource’s Roundtrip Efficiency, then this would indicate that a net profit can be achieved by scheduling injections and withdrawals. The comparison is performed for all hours over the Day-Ahead Market day to determine the optimal schedule. With the optimal Day-Ahead Market schedule defined, the opportunity cost for a given hour can be calculated as the revenue foregone by an incremental deviation from the optimal schedule.

Example 3 is a more complex (but still simplified) example of how NYISO will develop an opportunity cost-based reference level for the Day-Ahead Market. For Example 3, the following simplifying assumptions apply:

- The LBMP does not vary intra hour,
- The hourly prices are predictable,
- The unit starts the day at its minimum storage level (zero MWh),
- The unit can completely charge or discharge in one hour,
- The round trip efficiency of the unit is 70%, and
- The unit can store up to 14 MWh.

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<sup>25</sup> In both the Day-Ahead and Real-Time Markets, the reference levels the ISO develops should be considered a starting point. The NYISO expects an Energy Storage Resource to submit its expectation of opportunity costs and to justify deviating from the baseline reference level that the NYISO calculates.

**Example 3**

Hour	Expected LBMP [\$/MWh]	Optimal Schedule [MW]	State of Charge [%]
0	20.00	0	0%
1	17.00	0	0%
2	15.00	0	0%
3	13.00	-20	100%
4	14.00	0	100%
5	16.00	0	100%
6	22.00	0	100%
7	26.00	0	100%
8	27.00	0	100%
9	29.00	0	100%
10	27.50	0	100%
11	27.00	0	100%
12	26.50	0	100%
13	26.00	0	100%
14	25.00	0	100%
15	26.00	0	100%
16	28.00	0	100%
17	30.00	0	100%
18	29.50	0	100%
19	31.00	0	100%
20	36.00	14	0%
21	28.00	0	0%
22	22.00	0	0%
23	19.00	0	0%

Based on the table of expected LBMPs and the optimal schedule, the NYISO can calculate the opportunity cost for an incremental MW of injection in Hour Beginning (“HB”) 08. There are multiple options for a suboptimal schedule that includes an extra MW of injection in HB 08. The unit could inject one less MW in HB 20. Alternatively, the unit could withdraw again after HB 08 to satisfy the scheduled injection in HB 20. The opportunity cost calculated will be based on the suboptimal schedule that provides the most revenue to the unit. The opportunity cost of injecting a MWh in HB 08 instead of injecting in HB20 would simply be the price the injection in HB 20 would have received; \$36.00/MWh. The opportunity cost for scheduling an additional withdrawal in order to inject a MWh in HB 08 would be the price of the extra withdrawal divided by the Roundtrip Efficiency of the Energy Storage Resource. To minimize the impact on revenue, the extra withdrawal should occur at the minimal LBMP available between HB 08 and HB 20; in this case HB 14. Assuming an efficiency of .7, the opportunity cost would then be  $25/.7 = \$35.71/\text{MWh}$ . For an incremental injection in HB 08, the minimum of these two options would represent the suboptimal schedule that has the least impact

on the Energy Storage Resource's net revenue, so the opportunity cost for an incremental MW of injection in HB 08 is \$35.71/MWh. This methodology would apply to all hours and segments of the Energy Storage Resource's energy curve, including offers to inject or withdraw.

The examples provided above explain how NYISO will calculate a baseline Incremental Energy reference level that incorporates expected opportunity costs for an Energy Storage Resource. A Market Party can submit for the NYISO's consideration an alternative calculation of its resource's opportunity costs, or an entirely different type/category of opportunity cost. If the NYISO determines that the proposed revised opportunity cost calculation, or a different type of cost is appropriate, then it will be included in the Energy Storage Resource's reference level.<sup>26</sup> For example, the rules for developing opportunity costs that were filed in this proceeding would permit an Energy Storage Resource to demonstrate and the NYISO to consider and accept (where appropriate) as a valid opportunity cost, the incremental cost increase that the co-located and co-metered retail load will incur if its retail demand charge increases as a result of wholesale market dispatch.<sup>27</sup>

#### **Commission Question 4(c)**

*How does NYISO's dispatch-only model allow a resource to self-manage its operations through its real-time energy offers?*

#### **NYISO Response**

As described in the NYISO's response to Question 2(a) above, an Energy Storage Resource may choose to self-manage or have the NYISO manage its state of charge in the Real-Time Market.<sup>28</sup> An Energy Storage Resource has the option to switch modes between hours of the Real-Time Market. For example: an Energy Storage Resource can elect to be ISO-Managed in its real-time energy offer for HB 00 and can switch to Self-Managed in its offer for HB 01.<sup>29</sup>

Additionally, an Energy Storage Resource that elects to self-manage its operations in the Real-Time Market can modify its Upper Operating Limit and/or Lower Operating Limit to account for its state of charge availability or choose to offer as an injection or withdrawal

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<sup>26</sup> See proposed Section 23.3.1.4.1.3 of the Services Tariff.

<sup>27</sup> In order to prevent economic withholding by Energy Storage Resources, the NYISO will expect the Energy Storage Resource to demonstrate that it is reasonably expected to incur the demand charge as a prerequisite to allowing the demand charge to be reflected as an opportunity cost on a particular Day-Ahead Market day, or for a particular Real-Time Market hour. Market Participants continue to have the option to consult with the NYISO, on a case-by-case basis, to demonstrate valid opportunity costs to be included in reference levels.

<sup>28</sup> The NYISO's dispatch-only model also allows the Energy Storage Resource to choose to self-manage or have the NYISO manage its state of charge in the Day-Ahead Market. An Energy Storage Resource is required to choose between being ISO-Managed or Self-Managed in the Day-Ahead Market for the entire day because the day-ahead optimization horizon is 24 hours. An Energy Storage Resource has the flexibility to switch modes between the Day-Ahead Market and the Real-Time Market (*i.e.*, switch from being ISO-Managed in the Day-Ahead Market to Self-Managed in the Real-Time Market or vice versa).

<sup>29</sup> Electing to be ISO-Managed in real-time will prevent the resource from being eligible to receive a Bid Production Cost Guarantee payment. See Compliance Filing at p 38.

resource on an hour by hour basis. The Energy Storage Resource can also indicate its willingness to inject or withdraw through its Incremental Energy Bid Curve, in which it may reflect opportunity costs. For example, if an Energy Storage Resource does not wish to inject in the morning because higher prices are expected in the evening, the Energy Storage Resource could offer to inject in the morning at the expected evening price. This would effectively prevent the Energy Storage Resource from being scheduled to inject energy at a low price when it is not economic. Finally, consistent with its treatment of other Generators, the NYISO permits Energy Storage Resources to submit self-committed Bids, which enable the resources to attain specific injection and withdrawal levels.<sup>30</sup>

#### **Commission Question 4(d)**

*On page 55 of its transmittal letter, NYISO states that Energy Storage Resources will not be permitted to engage in dual participation until NYISO develops and implements additional tariff changes at an unspecified date. How does NYISO's proposed model for Energy Storage Resources accommodate the current commercial circumstances of existing Energy Storage Resources? Would resources that have limited commercial obligations (e.g., seasonal retail commitments or other commercial commitments for a portion of the resource's capacity) be prohibited from participating in NYISO markets when unobligated by those commercial circumstances? Would a resource be able to register only a portion of its capacity as an Energy Storage Resource with NYISO and reserve the remaining capacity for other commercial obligations?*

#### **NYISO Response**

In its compliance filing, the NYISO stated that “Energy Storage Resources will not be permitted to . . . engage in dual participation until the tariff changes” required to permit it become effective.<sup>31</sup> This statement was limited to an Energy Storage Resource seeking to simultaneously participate in the NYISO-administered markets and in programs or markets operated to meet the needs of distribution systems – *i.e.*, to offer the same MW to the NYISO and a distribution system at the same time.

The NYISO does not currently have rules in place for Generators to simultaneously provide service to the NYISO-administered markets and to distribution systems.<sup>32</sup> However, while the NYISO was developing its participation model for Energy Storage Resources in compliance with Order No. 841, it was separately engaged with its stakeholders in developing dual participation requirements as part of its initiative to create a new market design for DERs. As previously described to the Commission, the development of dual participation rules required

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<sup>30</sup> See the NYISO's response to Question 2(a) above.

<sup>31</sup> Compliance Filing at p 55.

<sup>32</sup> The NYISO does permit Special Case Resources (“SCR”) and Emergency Demand Response Program (“EDRP”) participants to also provide services to the applicable utilities. However, those programs are fundamentally different than the Energy Storage Resource participation model proposed by the NYISO. See NYISO February 2019 Answer at p 13 n 31.

the NYISO and its stakeholders to examine, among other things, appropriate metering and accounting practices, day-ahead and real-time coordination with New York State's utilities, the appropriate value of the capacity that dual participating resources provide, and certain planning requirements to ensure that the NYISO can meet applicable reliability requirements.<sup>33</sup> The dual participation rules developed in the DER initiative will, when applicable, apply to all Generators (including Energy Storage Resources) as well as DERs.

The NYISO's stakeholders recently approved tariff changes to implement the new market design for DERs, including dual participation requirements. The new dual participation requirements will allow Generators located in the New York Control Area ("NYCA") to simultaneously participate in the NYISO-administered markets and in programs or markets operated to meet the needs of distribution systems located in the NYCA. In particular, a Generator participating in the NYISO-administered wholesale markets with other distribution system related obligations outside of these markets will manage the outside obligations through its offers to the NYISO. Such Generators must continue to meet all applicable rules and obligations set forth in the NYISO's tariffs, and the NYISO will have the authority to determine schedules for resources engaged in dual participation.

The NYISO expects to file the tariff revisions concerning the DER market rules, including the dual participation requirements, in the second quarter of 2019 after and contingent on authorization by the NYISO's Board of Directors. The NYISO intends for the dual participation requirements to be in place and available for use by Energy Storage Resources by the time that the Energy Storage Resource rules proposed in this proceeding are implemented.

The Energy Storage Resource's ability to participate in the NYISO's and other programs would depend on the specific circumstances. Both the NYISO's existing tariff requirements and its new dual participation requirements could allow an Energy Storage Resource: (i) to participate in the NYISO-administered markets for some length of time and in other programs for other times (*e.g.*, seasonal),<sup>34</sup> or (ii) to participate in the NYISO-administered markets with some portion of its capacity and in some other program with some other portion of its capacity. The Energy Storage Resource's ability to do so will depend on its ability to manage its obligations, so that it continues to meet all applicable rules and obligations for participating in the NYISO-administered markets, its metering configuration, and the requirements of the other programs in which it seeks to participate.

Energy Storage Resources will also be subject to the NYISO's existing Energy and Capacity market power mitigation requirements, including requirements concerning physical withholding and the Pivotal Supplier rules for Mitigated Capacity Zones.

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<sup>33</sup> See NYISO February 2019 Answer at pp 13-14.

<sup>34</sup> ICAP Suppliers may, depending on the specific characteristics of the Resource, choose to sell capacity or not sell capacity in a given month during the Capability Year (subject to the NYISO's existing Energy and Capacity market power mitigation requirements). The ICAP Load Forecast, however, is completed on an annual basis, and will not fluctuate month-to-month.

**Commission Question 4(e)**

*Did NYISO test any modifications or alternatives to its existing SCUC software that would allow for commitment of an Energy Storage Resource with a shorter solve time? If not, please explain why not. How long would it take NYISO to make the necessary changes to the SCUC software to allow Energy Storage Resources to be committed with an acceptable solve time?*

**NYISO Response**

In developing its Energy Storage Resource participation model, the NYISO tested modifications to its existing Security Constrained Unit Commitment (“SCUC”) software that would allow for the commitment of Energy Storage Resources that have infeasible operating regions between their withdrawal and injection ranges (*i.e.*, “non-continuous” operating ranges). As discussed in the Compliance Filing, enabling the commitment of Energy Storage Resources with non-continuous operating ranges would require the creation of an additional operating state within the NYISO’s market software.<sup>35</sup>

During 2018, the NYISO engaged ABB, its software vendor, to extend its SCUC and Security Constrained Economic Dispatch model to include Energy Storage Resources with commitment decisions and to evaluate the impact on model execution performance. ABB enhanced the NYISO’s existing SCUC model and incorporated all Energy Storage Resource operating parameters specified in Order No. 841. The model, which co-optimizes Energy and Ancillary Services, underwent testing to evaluate results and performance. ABB worked to understand the impacts of key parameters on model execution time if new Energy Storage Resources were added to the New York Control Area, including:

1. Different quantities and different combination of Energy Storage Resource units;
2. Energy Storage Resource operating conditions and parameters; and
3. Solution engine tuning parameters that impact performance.

ABB tested a series of cases with the new Energy Storage Resource model, in the latest software environment that is representative of the NYISO’s future state after the system upgrade to its Energy Management System (“EMS”) and Business Management System (“BMS”) platforms.<sup>36</sup> These tests included adding eight sample Energy Storage Resources with a non-continuous operating range to the market model, which were simulated at existing generator locations. The solve times from those tests exceeded acceptable limits and would place the existing Day-Ahead Market 11 a.m. posting requirement at risk. If required to run on 5 and 15 minute bases in RTD and RTC, these solve times would likely also lead to missed 5-minute

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<sup>35</sup> “The NYISO’s commitment and dispatch software have historically evaluated Resources based on two commitment states – online or offline. An Energy Storage Resource that features an infeasible operating region (*i.e.*, that has a non-continuous operating range between its injecting and withdrawing states) adds a third operating state for the software to evaluate – injecting, withdrawing, and off.” Compliance Filing at p 19.

<sup>36</sup> The upgrades to the NYISO’s EMS/BMS platform are described on pages 64 and 65 of the Compliance Filing.

dispatches and 15-minute commitment runs, placing the Real-Time Market, and potentially grid reliability, at risk.

The preliminary assessment conducted by ABB and the NYISO required over six months and the full-time support of several members of ABB and NYISO staff to complete. The NYISO also engaged Gurobi, the vendor of the NYISO's optimization solver, to determine if changes to its tuning parameters could significantly improve solution times. This effort yielded only marginal improvements. Time did not permit the NYISO to explore alternatives to the existing SCUC software. Due to the complexity of the NYISO's market software, alternatives would likely require extensive testing and development and could not be implemented in the near-term.

As detailed in the NYISO's response to Question 2(a)(i) above, the commitment parameters proposed in Order No. 841 are not required to allow advanced storage technologies to participate fully in the NYISO-administered wholesale markets while allowing the Energy Storage Resource to effectively manage its operation. Minimum and maximum run time constraints would impose a significant computational burden and delay without providing a clear benefit.

The NYISO is continuing to work with its vendors on modifications or alternatives to the formulation of the Energy Storage Resource commitment issue to determine whether solve times can be improved. The NYISO is committed to continuing to research performance improvements to the SCUC algorithm so that future energy market enhancements can be accomplished within the time constraints of the Day-Ahead and Real-Time Markets, including improvements to the dispatch-only Energy Storage Resource participation model, modeling of additional reliability products and transmission constraints, and scheduling of small DER aggregations.

At this time, the NYISO does not know how long it will take to improve the interaction of the Energy Storage Resource commitment formulation with the Mixed Integer Programming ("MIP") solver so that solve time can be substantially reduced. The desired improvements represent uncharted territory for production grade MIP-based unit commitment algorithms that must determine a least-cost co-optimized schedule of energy, operating reserves, and regulation service with consistent marginal prices. The NYISO is not aware that any other region has solved the problems that the NYISO is working to resolve.

**Commission Question 4(f)**

*In footnote 45 of the transmittal letter, NYISO states that the need to manage an Energy Storage Resource's Energy Level and to account for Roundtrip Efficiency also affects the amount of time required for the Day-Ahead SCUC software to develop a solution. Please explain. Recognizing that the dispatch-only model alleviates some of the time it takes SCUC to develop a solution, what proportion of the additional time required to solve the SCUC is a result of using a dispatch-only model versus managing these parameters? In other words, could the amount of time saved by foregoing management of these parameters allow for the SCUC to make commitment decisions with an acceptable solve time?*

### **NYISO Response**

The NYISO's testing to date has been with a full commitment model that includes all of the operating parameters identified in Order No. 841. As noted in footnote 45 of the Compliance Filing, the NYISO's testing revealed that variations in the Roundtrip Efficiency parameter impacted solution time. This is believed to be because Roundtrip Efficiency, which is considered part of the Energy Level constraints, introduces an additional state variable to track when the Energy Storage Resource is withdrawing. For example, to achieve a certain injection level later in the optimization window, the Energy Storage Resource may need to withdraw energy earlier in the optimization window, and Roundtrip Efficiency is used to ensure enough energy is withdrawn to meet the later injection schedule. Test cases where Energy Storage Resources were modeled with lower Roundtrip Efficiency values corresponded to longer solution times, and test cases where Energy Storage Resources were modeled with Roundtrip Efficiencies closer to 100% ran more quickly.

The Energy Level constraint also appears to negatively impact SCUC's solution time. The preliminary assessment is that the intertemporal coupling in SCUC causes the number of possible solutions evaluated to increase significantly, especially when enforcing an Energy Level constraint for each Energy Storage Resource that is marginal, as the schedule for each hour in the Day-Ahead Market may impact an Energy Storage Resource's Energy Level for every other hour in the day. While the increase in solution time was generally observed in testing, more testing would be required to fully quantify the relative impacts for each changed additional parameter in the model. In the test environment used, the more complex models tested sometimes reached maximum time limits and were concluded without producing a solution. Therefore, it is not possible to use these test results to accurately estimate the proportional time impacts.

The scenarios tested with the Energy Storage Resource commitment model took significantly longer to solve when compared to a production model that did not include any Energy Storage Resources. The NYISO did not test all possible permutations of the commitment model with and without various parameters. Therefore, it is not possible to use the existing test results to quantify exactly how much time could be saved by eliminating the Roundtrip Efficiency parameter and Energy Level Management. It is not expected, however, that exchanging Roundtrip Efficiency and Energy Level Management for unit commitment parameters would result in acceptable solve times. As discussed in the Compliance Filing and in the response to Question 4(e) above, commitment of Energy Storage Resources requires the existence of three operating states: injecting, withdrawing, and off/idle. The existence of a ternary operating state imposes a much larger computational burden than Roundtrip Efficiency and Energy Level, both of which can be represented in a dispatch-only model.

For ISO-Managed Energy Storage Resources, the NYISO believes that the Roundtrip Efficiency parameter is necessary to ensure both accurate scheduling and reliability. As noted in the Compliance Filing, however, the NYISO continues to test the potential impact of integrating the Roundtrip Efficiency parameter to determine potential impacts on the SCUC, RTC and RTD

solve times.<sup>37</sup> If this parameter were to be eliminated, the availability of Energy Storage Resources with low Roundtrip Efficiencies could be significantly misrepresented in the Day-Ahead and Real-Time Market solutions. For example, consider an Energy Storage Resource that normally forgoes 30% of its withdrawal energy to conversion losses. While evaluating such a resource in the Day-Ahead Market, the NYISO would assume perfect conversion if there were no Roundtrip Efficiency parameter. Such an Energy Storage Resource would then be estimated to have 30% more energy after charging than it is physically capable of injecting. It could therefore be scheduled infeasibly across the 24-hour Day-Ahead Market optimization horizon, placing reliability at risk.

For Self-Managed Energy Storage Resources, the Roundtrip Efficiency parameter will only be used to ensure that the schedule for the next Real-Time Market interval (5 minutes in RTD, 15 minutes in RTC) is physically feasible. Self-Managed Energy Storage Resources will otherwise be expected to manage their own inefficiencies through their offers.

#### **Commission Question 4(g)**

*Please explain whether Energy Storage Resources that have start-up costs will have an opportunity to recover these costs. Are all Energy Storage Resources in NYISO prohibited from submitting start-up bids or recovering no-load costs? If so, is this prohibition consistent with NYISO's treatment of other generators in its markets? If not, why not? Please explain.*

#### **NYISO Response**

As detailed in the NYISO's response to Question 4(a) above, the NYISO expects that all electric storage facilities that participate through the Energy Storage Resource participation model will be able to recover their costs through their incremental offers as no start-up decision or minimum load, or related commitment costs, are required for these resources.

The NYISO's approach for Energy Storage Resource cost recovery is consistent with its treatment of other Generators in its markets. In the NYISO-administered markets, start-up bids identify the payment a Supplier requires to bring a Generator up to its specified minimum operating level from an offline state. In addition, minimum generation identifies the minimum operating level a Supplier requires, once started, to operate and synchronize a Generator to the grid. Based on its discussions with stakeholders and developers, the NYISO understands that the battery-based electric storage facilities that are being developed in New York are capable of being synchronized to the grid without injecting or withdrawing any Energy and can be dispatched to inject or withdraw Energy from an idle state (*i.e.*, where there is no Energy injection or withdrawal occurring). Accordingly, all electric storage facilities that participate through the Energy Storage Resource participation model will not submit start-up bids or minimum load and will not recover related costs.

At the present time, there is one electric storage facility in the NYISO's markets that is eligible to submit start-up bids, to recover minimum generation costs, and to withdraw Energy as negative generation in the NYISO's markets. That resource is the Blenheim-Gilboa Pumped

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<sup>37</sup> Compliance Filing at p. 28 n. 78.

Storage Power Project (“Gilboa”), which has participated the NYISO’s markets since their inception in 1999.

The scheduling and operation of modern electric storage facilities expected to enter service by the time NYISO implements the Energy Storage Resource tariff requirements is very different from the manner in which mature energy storage technologies, such as Gilboa, must operate. Unlike a battery, Gilboa relies on enormous hydroelectric turbines to produce Energy and equally large electric motors to pump water back into its reservoirs. While a modern battery-based electric storage facility can inject small amounts of Energy, it is not possible to operate the large hydroelectric turbines at Gilboa to produce small quantities of Energy. The turbines simply will not spin, or will not spin quickly enough, to produce electricity. Similarly, the enormous electric motors that are used to pump water into the reservoir at Gilboa require a substantial amount of Energy to operate and are not capable of starting nearly-instantaneously. In many ways, large hydroelectric facilities have more in common with traditional fossil fuel-based generating units than they do with modern electric storage facilities. These differences between modern battery-based electric storage facilities and pumped storage facilities justify treating modern electric storage facilities differently for the purposes of start-up and minimum generation.

#### **Item 5 - Metering and Accounting Practices for Charging Energy**

Order No. 841 required each RTO/ISO to prevent electric storage resources from paying twice for the same charging energy (i.e., they should not have to pay both the wholesale and retail price for the same charging energy).<sup>38</sup>

#### **Commission Question 5(a)**

*Please explain and provide citations to the relevant proposed tariff language that demonstrate how NYISO will ensure that Energy Storage Resources are charged only the wholesale rate.*

#### **NYISO Response**

To ensure that the NYISO can accurately settle Energy Storage Resources for injections and withdrawals at the wholesale rate, the NYISO will require that all Energy Storage Resources participating in its wholesale markets be directly metered, including Energy Storage Resources that are co-located with Load or retail customers.<sup>39</sup> An Energy Storage Resource will be treated as a NYISO customer that must satisfy the NYISO’s tariffs and procedures, regardless of any other obligations. Direct metering will enable the NYISO to separate the Energy Storage

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<sup>38</sup> Order No. 841 at P 326.

<sup>39</sup> See Order No. 841 at P 322 (errata version) (“To help accomplish this, we require each RTO/ISO to directly meter electric storage resources, so all the energy entering and exiting the resources is measured by that meter.”)

Resource's wholesale market operations from any other obligation the customer has, and to settle Energy Storage Resources solely for their wholesale transactions.<sup>40</sup>

The NYISO's proposed Energy Storage Resource metering requirements will not measure other energy withdrawals co-located at the same facility that are not energy withdrawals for the purpose of charging the Energy Storage Resource (*e.g.*, those withdrawals to serve co-located Load). Other transactions, such as those between a utility and an Energy Storage Resource that is also participating in the retail market, are outside of the NYISO's responsibilities. The NYISO worked closely with all New York Transmission Owners and understands that any wholesale withdrawals by an Energy Storage Resource for later injection will be excluded from retail withdrawals to serve Load for the corresponding Load Serving Entity. The NYISO does not have access to the retail invoices of individual New York State electricity consumers, and therefore does not have a way to independently determine whether the energy withdrawn to charge an Energy Storage Resource has also been included on a facility's retail invoice.

Section 13 of the Services Tariff requires all NYISO Customers to provide the meter data information necessary for the NYISO to perform its functions and to fulfill its responsibilities under the Services Tariff. The meter specifications and standards for all Generators are located in the ISO Procedures. The NYISO will update these procedures as necessary to include any additional specifications and standards necessary for the direct metering of Energy Storage Resources. In addition, all resources must provide proposed metering schematics as part of the NYISO's interconnection process. The NYISO will use its existing metering review process for Generators to ensure that Energy Storage Resources satisfy the updated procedures, including that they are directly metered and have obtained agreement with their respective utility to account for wholesale withdrawals separately from retail withdrawals to serve Load.

#### **Item 6 - Buyer Side Mitigation Rules**

Order No. 841 stated that, to the extent that market power concerns arise as a result of electric storage resources de-rating capacity to provide capacity or other services, each RTO/ISO may consider whether it is appropriate to update and/or apply existing market power mitigation processes to electric storage resources to alleviate market power concerns.<sup>41</sup>

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<sup>40</sup> Compliance Filing at pp 61-62. As described in the Compliance Filing, directly metering Energy Storage Resources will reduce the changes necessary to the NYISO's settlements software and ensure that all injections and withdrawals of Energy are settled at wholesale market LBMPs. Like other Generators, Energy Storage Resources will be required to submit one set of meter data for all injections. Energy Storage Resources will also be required to submit a second set of meter data for all Energy withdrawals. This will ensure that the NYISO can separately and accurately account for Energy withdrawals and injections. The NYISO will require the Meter Authority for the Load co-located with the directly metered Energy Storage Resource to submit the full Load for the appropriate Load Serving Entity, without netting the Energy Storage Resource's injections and withdrawals. This will ensure that the directly metered Energy Storage Resource's injections and withdrawal MW are treated as generation and negative generation respectively, and not counted as the wholesale Load for the corresponding Load Serving Entity.

<sup>41</sup> Order No. 841 at P 97.

**Commission Question 6(a)**

*Please explain NYISO's reasoning for applying buyer side mitigation rules to Energy Storage Resources under 2 MW and provide support explaining the circumstances under which such resources could affect prices or exercise market power.*

**NYISO Response**

As the Compliance Filing explained,<sup>42</sup> the NYISO proposed to reinstate the buyer side mitigation rules applicable to a certain category of facilities, including resources 2 MW and under (*i.e.*, the "Category III" Examined Facility rules), that the NYISO had removed from the tariff in 2016. The NYISO proposed to restore the language because the decision to remove it was based on an error.<sup>43</sup> Unlike other exemptions in the BSM Rules, which have been justified based on economic analysis, the NYISO did not present an economic rationale for removing the Category III language. Instead, the NYISO removed it because it understood (incorrectly) that other tariff modifications it was making at that time would render Category III obsolete. Commission precedent<sup>44</sup> directs the NYISO to evaluate all new entrants under its buyer-side capacity market power mitigation rules ("BSM Rules") unless a specific exemption has been justified on economic grounds. The NYISO therefore determined that the Compliance Filing should propose to restore the BSM Rules applicable to Category III facilities, including Energy Storage Resources 2 MW or less.

Specifically, the Category III provisions were accepted by the Commission in 2010.<sup>45</sup> The Examined Facility categories were added to clarify that the NYISO would "make exemption determinations regardless of whether (or when) one is requested," that such determinations would be made for "all potential new entrants," and because differences between certain types of projects necessitated the "application of different rules in order to timely capture the projects."<sup>46</sup> "Category III" encompassed projects that: (i) were either in a Class Year prior to 2009/10 and had not commenced commercial operation or been cancelled, and for which the NYISO had not

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<sup>42</sup> Compliance Filing at 52

<sup>43</sup> *Id.*

<sup>44</sup> *See, e.g., N.Y. Pub. Serv. Comm'n v. N.Y. Indep. Sys. Operator, Inc.*, 153 FERC ¶ 61,022 (2015) (rejecting multiple proposed exemptions from the BSM Rules that had not been justified.)

<sup>45</sup> Prior to 2010, the resources that fell within Category III were subject to the original version of the BSM Rules. In 2010, the Commission accepted proposed NYISO enhancements that categorized the types of Examined Facilities to reflect the establishment of more detailed rules governing the timing of various determinations under the BSM Rules. *See New York Independ. Sys. Operator, Inc.*, 133 FERC ¶ 61,178 (2010). The NYISO's 2010 enhancements were consistent with the Commission policy articulated in earlier orders establishing the BSM Rules. The Commission's rulings resulted in the application of buyer-side mitigation rules to all resources. *See, e.g.*, 124 FERC ¶ 61,301 at P 27 ("Rather, the proposed rules, as modified herein, assure that uneconomic new capacity will not be allowed to distort market supply curves and inefficiently depress market clearing prices below a competitive level.")

<sup>46</sup> *See Proposed Enhancements to In-City Buyer-Side Capacity Mitigation Measures, Request for Expedited Commission Action, and Contingent Request for Waiver of Prior Notice Requirement*, Docket No. ER10-3043-000 at 10 (Sept. 27, 2010).

made an exemption or Unit Net CONE determination, or (ii) that were not subject to a deliverability requirement and provided specific written notification no later than a date specified by the NYISO that it planned to commence commercial operation and offer UCAP in a month that coincided with the Mitigation Study Period. At the time, the NYISO's deliverability requirements did not apply to resources that connected to distribution facilities beyond the scope of the NYISO's interconnection procedures.

However, in 2016, the NYISO filed, and the Commission accepted, tariff revisions that required resources greater than 2 MW interconnecting to non-FERC jurisdictional distribution to satisfy the deliverability requirement if they wished to supply capacity.<sup>47</sup> It was believed that because of this change, no facilities would fall into "Category III."<sup>48</sup> Based on that understanding, the NYISO removed the Category III language in its 2016 filing.

It subsequently became apparent that there may, in fact, be Category III Examined Facilities and, thus, that the removal of the Category III provisions could result in resources falling outside the scope of the BSM Rules. If the error had been discovered closer in time to the 2016 filing, the NYISO could have made an errata filing to correct it. The NYISO proposed to restore the Category III provisions as part of its "On Ramps/Off Ramps" market design proposal in 2017 and 2018. However, that proposal was not accepted by stakeholders for reasons unrelated to the restoration of the Category III provisions. Accordingly, the NYISO proposed to restore the Category III provisions in its Compliance Filing.

With respect to the "circumstances under which [small] resources could affect prices or exercise market power," the MMU has stated that "the need for BSM measures is driven not by the size of individual generating projects, or portfolios but by the aggregate amount of generating capacity that receives out-of-market subsidies. For example, the effects of one hundred individual 5 MW projects entering the market is no different from one 500 MW generator entering the market."<sup>49</sup>

The Commission has likewise previously recognized that the cumulative impact of smaller resources could have material price effects. The NYISO takes as instructive the Commission's directive to the NYISO to establish a Renewable Exemption while acknowledging that although most renewables would lack the incentive or ability to suppress prices some could have characteristics that would make mitigation appropriate.<sup>50</sup> In 2016, the NYISO submitted a compliance filing proposing to create a Renewable Exemption subject to a maximum MW amount per Class Year. While this matter remains pending, the Commission's order may be informative on the issue of small resources.

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<sup>47</sup> See *New York Independ. Sys. Operator, Inc.*, 155 FERC ¶ 61,166 (2016) (accepting tariff revisions to govern the participation of Behind-the-Meter Net Generation Resources in the NYISO-administered markets.)

<sup>48</sup> Compliance Filing at 52.

<sup>49</sup> See *Request to Intervene Out-of-Time, Request for Leave to Answer, and Limited Answer of the NYISO Market Monitoring Unit*, Docket No. ER19-467-000 at 4 (Feb 25, 2019).

<sup>50</sup> See *N.Y. Pub. Serv. Comm'n v. N.Y. Indep. Sys. Operator, Inc.*, 153 FERC ¶ 61,022, at P 78 (2015).

The NYISO is currently considering potential ways to streamline its procedures under the BSM Rules to ensure that the testing process will not impede the timely market entry of what could be a very large number of new small resources. The NYISO is also open to working with its stakeholders to determine whether an exemption for some or all small resources is justified. If warranted, the NYISO could propose new tariff revisions to establish a properly defined exemption in the future.

### **Commission Question 6(b)**

*Please explain whether, under NYISO's current buyer side mitigation rules, a resource 2 MW or less is subject to mitigation and, if so, whether it can avoid mitigation after passing one of these three buyer side mitigation tests. Or, absent NYISO's proposal, would an Energy Storage Resource 2 MW or less be subject to mitigation automatically because it does not qualify for an exemption? Does NYISO anticipate that most Energy Storage Resources 2 MW or less will receive exemptions under NYISO's proposal to include them in its BSM rules?*

### **NYISO Response**

A resource 2 MW or less is not subject to mitigation under the NYISO's currently effective BSM Rules.<sup>51</sup> Such a resource would therefore not be "subject to mitigation automatically" if the NYISO's proposal to reinstate Category III rules in this proceeding is rejected. The NYISO noted in its Compliance Filing that it was requesting an effective date for the proposed Category III provisions that was (at the earliest) after the Commission's issuance of an order accepting such provisions.<sup>52</sup> The NYISO also noted that until the provisions were effective it would not apply the BSM Rules to Category III Examined Facilities.<sup>53</sup>

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<sup>51</sup> The discussion in this section equally applies to those projects that were determined to be eligible to receive CRIS under the CRIS transition rule that was introduced with the NYISO's 2016 tariff revisions to govern the participation of Behind-the-Meter Net Generation Resources in the NYISO-administered markets. See *Proposed Amendments to the NYISO Open Access Transmission Tariff and Market Administration and Control Area Services Tariff to Incorporate Behind-the-Meter Net Generation Resources into the NYISO's Energy, Ancillary Services and Capacity Markets*, Docket No. ER16-1213-000 (March 17, 2016) at 4-5, 41, 47-52. See also NYISO OATT, Attachment S, Section 25.9.3.4.1.

<sup>52</sup> Compliance Filing at 65-67.

<sup>53</sup> Compliance Filing at 67 ("Whichever effective date is ultimately adopted, the BSM Rule revisions would apply prospectively to Category III Examined Facilities that may be examined along with facilities in the Class Year (or if bifurcated, Class Year X-1) in which those revisions become effective. The reinstatement of the Category III provisions would not impact any determinations previously made under the BSM Rules. Their reinstatement also would not impact any entrant that—prior to these tariff revisions being in effect (as described above)—was not a Category III Examined Facility but would have been had the BSM Rule revisions proposed herein been effective.")

The BSM Rules are applied only to “Examined Facilities” and to “NCZ Examined Projects.”<sup>54</sup> The Services Tariff currently establishes two categories of Examined Facilities.<sup>55</sup> A resource 2 MW or less would not fall within either of these categories. Such resources would only be subject to the BSM Rules if Category III is reinstated, as the Compliance Filing proposed.

Some have suggested that the BSM Rules apply to all entrants, regardless of whether they are defined as Examined Facilities. Under this interpretation, entrants that are not Examined Facilities would automatically be subject to mitigation but be ineligible for any kind of exemption. The “automatic mitigation” interpretation appears to be based on a single sentence in Section 23.4.5.7 of the Services Tariff. That sentence states that, “[u]nless exempt as specified below, offers to supply Unforced Capacity from a Mitigated Capacity Zone Installed Capacity Supplier: (i) shall equal or exceed the *applicable* Offer Floor; and (ii) can only be offered in the ICAP Spot Market Auctions . . .” (emphasis added). Whatever its basis, an “automatic mitigation” interpretation would be unreasonable, inconsistent with Commission policy, and incompatible with other provisions of the BSM Rules.

For more than a decade, the Commission has emphasized that just and reasonable mitigation rules must “strike a careful balance between over-mitigating and under-mitigating new capacity resources.”<sup>56</sup> Automatically subjecting resources that are not Examined Facilities to mitigation, even if they would otherwise be economic under the Part A or Part B tests or would qualify for a Competitive Entry Exemption, would clearly constitute over-mitigation. The Commission has also held that new Special Case Resources entering the NYISO-administered capacity markets should not be subject to the BSM Rules.<sup>57</sup> The NYISO’s proposed revisions to implement this directive are pending in Docket No. ER17-996-000. It would be unreasonable to interpret the tariff in a manner that makes it inconsistent with the Commission’s ruling.

In addition, ever since they were revised in 2010, the BSM Rules have been structured around the assumption that they will be applied to Examined Facilities. They simply do not include various provisions that would be needed if they applied to resources that are not

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<sup>54</sup> “NCZ Examined Projects” would only exist if the NYISO were in the process of establishing a new Mitigated Capacity Zone. In 2016, the NYISO confirmed that its most recently completed analyses did not trigger the creation of a new zone. *See Letter Order*, Docket No. ER16-1280-000 (May 27, 2016). If the NYISO were to determine in the NCZ Study in 2020 or some future NCZ Study, that there should be a new Locality, *see Services Tariff Section 5.16.4*, then the currently effective BSM Rules would not apply to any resources that would fall under Category III either.

<sup>55</sup> Section 23.4.5.7.3 of Attachment H to the Services Tariff sets forth the currently effective definitions of “Category I” and “Category II” Examined Facilities. The NYISO is not proposing any changes to those definitions in this proceeding.

<sup>56</sup> *See N.Y. Pub. Serv. Comm’n v. N.Y. Indep. Sys. Operator, Inc.*, 158 FERC ¶ 61,137 at P 34 (2017). *See also, Consol. Edison Co. of N.Y., Inc. v. N.Y. Indep. Sys. Operator, Inc.*, 150 FERC ¶ 61,139 at P 4 (2015); *citing PJM Interconnection, L.L.C.*, 143 FERC ¶ 61,090, at P 26 (2013); *Midwest Indep. Sys. Operator, Inc.*, 111 FERC ¶ 61,043, at P 78 (2005); *New England Power Pool & ISO New England Inc.*, 101 FERC ¶ 61,344, at P 28 (2002); *Edison Mission Energy, Inc. v. FERC*, 394 F.3d 964, 969 (D.C. Cir. 2005)).

<sup>57</sup> *N.Y. Pub. Serv. Comm’n v. N.Y. Indep. Sys. Operator, Inc.*, 158 FERC ¶ 61,137 (2017).

Examined Facilities. For example, the BSM Rules clearly describe how Offer Floors are to be established for resources that are not exempt. That is, the Offer Floor shall be the lesser of an Examined Facility's Unit Net CONE or the Mitigation Net CONE Offer Floor (commonly referred to as the "default Offer Floor").<sup>58</sup> But no tariff provision explains how Offer Floors would be determined for resources that are not Examined Facilities.

Similarly, the BSM Rules define how Offer Floors are to be adjusted from the date of the Starting Capability Period to the date of entry. By contrast, there is no rule governing how Offer Floors would be adjusted for a resource 2 MW or less because such a resource would not be studied along with a Class Year and thus would not have a Starting Capability Period. In the same vein, no rule governs the calculation of default Offer Floors for such resources because those calculations are based on the BSM Forecast of ICAP Spot Market Prices associated with the ICAP Demand Curve for the relevant Starting Capability Period.

In short, the BSM Rules should not be interpreted in a way that would plainly contravene the Commission precedents referenced above, require the NYISO to apply provisions that are clearly limited to Examined Facilities to other kinds of resources, and effectively create substantial gaps in the BSM Rules.<sup>59</sup> The single sentence in Section 23.4.5.7 that might arguably support an "automatic mitigation" interpretation should instead be read in a manner consistent with precedent and the rest of the BSM Rules. That is, it should be construed to require that offers by Examined Facilities that do not secure an exemption be subject to an Offer Floor but not as imposing automatic mitigation on resources that fall outside the tariff definition of "Examined Facilities."

In response to the Commission's final question in this Question (b), the NYISO cannot predict with certainty whether "most Energy Storage Resources 2 MW or less will receive exemptions under NYISO's proposal to include them in its BSM Rules." The answer to that question depends on many variables that cannot be known in advance. These include: (i) the extent to which Energy Storage Resources enter the market (and the locations where they enter); (ii) the characteristics of those Energy Storage Resources – including the extent to which they may qualify for a Competitive Entry Exemption; (iii) future Commission action on the NYISO's pending compliance filings in Docket No ER16-1404-000 and ER17-996-000, since whether or not the mitigation exemptions proposed in those filings are implemented (and in what exact form) will necessarily impact other analyses under the BSM Rules, (iv) future entry decisions made by other capacity resources; and (v) other guidance the Commission might provide in other dockets regarding capacity market power mitigation.

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<sup>58</sup> See Section 23.4.5.7.1 of the Services Tariff. See also Section 23.2.1 at definition of "Offer Floor, and Section 23.4.5.7.3.

<sup>59</sup> An "automatic mitigation" interpretation would also ignore the word "applicable" in Section 23.4.5.7 and simply define it to mean the default Offer Floor.

**Commission Question 6(c)**

*Please clarify whether, in the absence of applying buyer side mitigation rules to Energy Storage Resources 2 MW or less, these resources would still be required to participate in NYISO's Class Year process. Please explain whether a resource could be subject to the Class Year buyer side mitigation evaluation and not be subject to the Class Year deliverability analysis.*

**NYISO Response**

Whether or not the BSM Rules apply to Energy Storage Resources 2 MW or less does not determine whether such resources are required to participate in a Class Year process. Resources could be subject to the BSM Rules and not be subject to the Class Year deliverability analysis.

The Class Year Interconnection Facilities Study ("Class Year Study") is the final interconnection study for Large Generating Facilities and certain Small Generating Facilities proposing to interconnect to the NYISO and receive Energy Resource Interconnection Service ("ERIS"). The Class Year Study also evaluates the deliverability of resources that are seeking Capacity Resource Interconnection Service ("CRIS") in order to qualify as capacity suppliers. It is the deliverability study portion of the Class Year Study that the NYISO understands the April 1 Letter to be referring to when it mentions the "Class Year process."

Small Generating Facilities (20 MW and smaller) only participate in a Class Year Study if they (1) require non-Local System Upgrade Facilities in order to receive ERIS, and/or (2) are larger than 2 MW and request CRIS through the deliverability study. Projects that are 2 MW or less receive CRIS without being studied for deliverability.<sup>60</sup>

Beginning in 2016, resources greater than 2 MW interconnecting to non-Commission jurisdictional distribution—and, as such, not subject to the NYISO's interconnection procedures—are also required to satisfy the NYISO's deliverability requirement and obtain CRIS in order to participate in the capacity market. Again, resources that are 2 MW or less receive CRIS without being studied for deliverability.<sup>61</sup>

Thus, regardless of how the Commission addresses the NYISO's proposal to reinstate the Category III rules in this proceeding, Energy Storage Resources 2 MW or less would not be required to enter a Class Year Study for evaluation under the NYISO's Deliverability

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<sup>60</sup> See Section 25.31 of Attachment S to the OATT and Section 32.1.1.7 of Attachment Z to the OATT.

<sup>61</sup> Prior to 2016, certain resources that interconnected to distribution facilities not subject to the NYISO's interconnection procedures were not subject to a deliverability requirement, including deliverability evaluation in the Class Year process, in order to become an Installed Capacity Supplier. The NYISO revised its OATT in 2016 to require that all resources larger than 2 MW, regardless of whether their interconnections are "FERC-jurisdictional" (*i.e.*, subject to the NYISO's interconnection procedures), must obtain CRIS in order to become an ICAP Supplier and in order to obtain CRIS, must meet the NYISO's Deliverability Interconnection Standard in capacity Class Year Facilities Study.

Interconnection Standard in order to be eligible to sell capacity.<sup>62</sup> If the NYISO's Category III provisions are reinstated, Energy Storage Resources 2 MW or less would be (prospectively) subject to the BSM Rules. This BSM evaluation would occur along with and on the same timeline as projects in the Class Year process, but would not make it a Class Year project subject to the Class Year deliverability study evaluation.

### **Item 7 - State of Charge Management**

Order No. 841 required each RTO/ISO to allow resources using the participation model for electric storage resources to self-manage their State of Charge.<sup>63</sup>

#### **Commission Question 7(a)**

*Please explain and provide citations to the relevant proposed tariff language to demonstrate how NYISO's proposal to require Energy Storage Resources to use the ISO-Managed Energy Level in order to participate in the capacity market complies with Order No. 841's directive to allow Energy Storage Resources to manage their own state of charge. To the extent NYISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

#### **NYISO Response**

As described in the Compliance Filing, the NYISO will require Energy Storage Resources participating as an Installed Capacity Supplier ("ICAP Supplier") in the NYISO-administered Installed Capacity market to elect ISO-Managed Energy Levels in their Day-Ahead Market Bids.<sup>64</sup> The NYISO requires this rule to administer its Installed Capacity Market in conjunction with its Day-Ahead Market in a manner that ensures comparability of treatment with other ICAP Suppliers, achieves efficient market outcomes, and maintains system reliability.

In Order No. 841, the Commission indicated that, to provide capacity, energy, and ancillary services, a resource "using the participation model for electric storage resources will still need to meet the technical requirements for any of the services that it wants to provide."<sup>65</sup> The Commission clarified that "technically capable" of providing a service meant "that a resource can meet all of the technical, operational, and/or performance requirements that are necessary to reliably provide that service."<sup>66</sup> The Commission did not require RTOs/ISOs to

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<sup>62</sup> Such resources could also still be included in the Class Year process for ERIS if they are Large Facilities over 20 MW or Small Generating Facilities that require non-Local System Upgrade Facilities.

<sup>63</sup> Order No. 841 P 253.

<sup>64</sup> Compliance Filing at p 43.

<sup>65</sup> Order No. 841 at P 76.

<sup>66</sup> Order No. 841 at P 78.

establish new processes by which an electric storage facility could demonstrate that it was technically capable, but did encourage RTOs/ISOs to consider whether modifications or additions were required to facilitate the participation of electric storage facilities in its markets.<sup>67</sup> As detailed below, due to the unique characteristics of Energy Storage Resources, these resources cannot participate in the NYISO-administered Installed Capacity market in the same manner as conventional resources without potentially creating inefficient market outcomes or reliability issues. Accordingly, the NYISO has proposed the ISO-Managed Energy Level bidding requirement for the Day-Ahead Market as a mechanism to facilitate the participation of Energy Storage Resources in its Installed Capacity market. Energy Storage Resources participating in the Installed Capacity market may still Self-Manage their state of charge in the Real-Time Market.

The NYISO tariffs require ICAP Suppliers (with limited exception) that have sold capacity to, on a daily basis, (i) schedule a Bilateral Transaction associated with this capacity; (ii) bid Energy in each hour of the Day-Ahead Market associated with this capacity; or (iii) notify the NYISO of any outages.<sup>68</sup> These requirements help ensure that the NYISO is aware of the physical capacity that is actually available and can optimally schedule the ICAP Suppliers to meet system reliability needs. As with conventional resources, Energy Storage Resources participating as ICAP Suppliers must satisfy these requirements.

A conventional resource participating in the NYISO-administered markets that does not have duration limitations (and has not scheduled a Bilateral Transaction or notified the NYISO of an outage) is expected to be capable of supplying Energy in all hours for which it submitted a Day-Ahead Market Bid. An Energy Storage Resource, on the other hand, is duration limited. As such, it is not capable of supplying Energy for all hours in a market day for which it has sold capacity (even in the absence of a Bilateral Transaction and or full or partial outage). Given these physical operating parameters, an ICAP Supplier comprised of an Energy Storage Resource cannot be assured of being awarded a feasible Day-Ahead Market schedule if treated like a conventional resource that participates in the Installed Capacity market. If an Energy Storage Resource receives an infeasible Day-Ahead Schedule, then the NYISO's Day-Ahead Market solution will not fully address system reliability needs.

Accordingly, the NYISO proposes to require Energy Storage Resources participating in the NYISO-administered Installed Capacity market to elect ISO-Managed Energy Levels in their Day-Ahead Market Bids.<sup>69</sup> By doing so, the NYISO's scheduling software can optimize, based upon the hourly economic offers supplied by the resource, the resource's injections and withdrawals throughout the market day being evaluated by the Day-Ahead Market software to

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<sup>67</sup> Order No. 841 at P 81.

<sup>68</sup> Services Tariff Section 5.12.7. A conventional resource that is out of, or low on fuel, is expected to notify the NYISO of its full or partial forced outage. The NYISO's Energy Storage Resource participation model and associated tariff revisions do not require Energy Storage Resources to identify a forced outage due to its Energy Level, however, if the Energy Storage Resource Self-Manages its Energy Level and is no longer able to inject Energy, its Upper Operating Limit will be reduced to zero until such time that it can again inject Energy.

<sup>69</sup> Proposed Services Tariff Section 5.12.1.13.

maintain consistency among its schedule and its capability. Importantly, the NYISO can also schedule Energy Storage Resources to best meet the reliability needs of the system at the least cost. The NYISO will ensure that an Energy Storage Resource's Day-Ahead Schedule is consistent with the resource's capability by evaluating the Energy Storage Resource's physical parameters, such as Roundtrip Efficiency, Lower Operating Limit, Upper Operating Limit, Upper Storage Limit, and Lower Storage Limit in conjunction with its Beginning Energy Level. The NYISO's approach will: (i) allow the Day-Ahead Market software to schedule an Energy Storage Resource consistent with its Beginning Energy Level, (ii) economically optimize the Energy Storage Resource's schedule across all Day-Ahead Market intervals, and (iii) establish Day-Ahead schedules that are consistent with expected Energy Levels throughout the day and hourly offers. In this manner the NYISO will ensure that its Day-Ahead Market solution is sufficient to meet recognized resource adequacy needs.

The NYISO cannot simply rely on some type of financial penalty to address its concerns. The NYISO's tariffs do not currently assess a penalty when an ICAP Supplier is "over scheduled" in the Day-Ahead Market. If an ICAP Supplier cannot meet its Day-Ahead schedule, its obligation is to buy-out of that position at the real-time LBMP.<sup>70</sup> In general, conventional resources are not unexpectedly exposed to assuming a buy-out obligation in the normal course of business. However, by virtue of their duration limitations, Energy Storage Resources may more frequently be required to buy-out of infeasible Day-Ahead schedules if the duration limitation is not properly accounted for in the Day-Ahead Market economic evaluation.

Infeasible Day-Ahead schedules may create reliability issues and inefficiencies in the markets as a whole. If a resource that has a Day-Ahead schedule becomes unavailable after the Day-Ahead Market closes, the NYISO may need to commit and/or dispatch less efficient and more costly resources in real-time or potentially resort to taking out-of-market actions to ensure resource adequacy in real-time. Depending on the particular facts and circumstances, the NYISO may be required to conduct a Supplemental Resource Evaluation ("SRE") to commit additional megawatts out-of-market to meet reliability needs. Because SRE actions are out-of-market, they can result in distorted prices by the shifting of costs into uplift payments to resources.

### **Item 8 - Price for Charging Energy**

Order No. 841 added section 35.28(g)(9)(ii) to the Commission's regulations to require that the sale of electric energy from the RTO/ISO markets to an electric storage resource that the resource then resells back to those markets be at the wholesale LMP.<sup>71</sup> With respect to transmission charges, Order No. 841 found that electric storage resources should not be charged transmission charges when they are dispatched by an RTO/ISO to provide a service (such as frequency regulation or a downward ramping service).<sup>72</sup>

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<sup>70</sup> Depending on the relationship between the Day-Ahead price and the real-time price, an Energy Storage Resource may actually receive payment for being unavailable in real-time.

<sup>71</sup> Order No. 841 at P 294.

<sup>72</sup> Order No. 841 at P 298.

### **Commission Question 8(a)**

*Please explain and provide citations to the relevant proposed tariff language that demonstrates how Energy Storage Resources will not be responsible for transmission service charges. To the extent NYISO intends to comply with Order No. 841 by relying on existing tariff provisions generally applicable to many types of resources, please explain and provide tariff citations to demonstrate that such provisions will apply to electric storage resources as required by Order No. 841.*

### **NYISO Response**

An Energy Storage Resource will be a Generator under the NYISO's tariffs. In the Compliance Filing, the NYISO proposed to treat Energy Storage Resources' bids to withdraw energy for later injection onto the grid as negative injections (or "negative generation") rather than as withdrawals to serve Load.<sup>73</sup> As with other Generators, an Energy Storage Resource will only be assessed charges in the NYISO's tariff based on its injections, rather than as Load based on its withdrawals.

Consistent with Order No. 841,<sup>74</sup> the NYISO proposed in its compliance filing that the LBMP paid by a withdrawing Energy Storage Resource will be calculated at the applicable Generator bus based on negative injections, rather than as Load withdrawals, for which the LBMP is calculated at the zonal level. Specifically, the NYISO proposed to revise the LBMP requirements in Section 17.1 of the Services Tariff to provide that "Energy withdrawals by Withdrawal-Eligible Generators are treated as negative generation, and can set price." The NYISO also proposed to revise Section 17.1.5 of the Service Tariff to remove from the zonal LBMP calculation methodology applicable to Loads "Energy withdrawals by [Withdrawal-] Eligible Generators for later injection onto the grid." In addition, the NYISO proposed to revise the definition of Load in its tariffs to provide expressly that: "Energy withdrawals by Withdrawal-Eligible Generators are not Load."<sup>75</sup> The NYISO also proposed conforming revisions to Service Tariff Sections 4.1.6, 4.2.1.1, 4.2.1.4, 4.2.6, 4.4.1.2.1, and 4.4.1.4 to make clear that Energy Storage Resources can both sell Energy and purchase Energy as "negative generation," and to distinguish Energy Storage Resource withdrawals from Load.

Transmission charges are assessed to customers in the NYCA at the zonal level based on their energy withdrawals to serve Load. For example, the NYISO assesses transmission charges under the rate schedules of its OATT to customers based on their energy withdrawals.<sup>76</sup> In addition, the New York Transmission Owners, using values provided by the NYISO, assess

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<sup>73</sup> Compliance Filing at pp 21-22.

<sup>74</sup> Order No. 841 at P 296 (stating that stated that "an electric storage resource's wholesale energy purchases should take place at the applicable nodal LMP, and not the zonal price.").

<sup>75</sup> Proposed Services Tariff Section 2.12 (Definition of "Load").

<sup>76</sup> See, e.g., OATT Section 6.1.3.1 (NERC and NPCC charges), Section 6.1.6.5.1 (Non-ISO Facilities Payment Charge).

customers with Transmission Service Charges based on their customers' energy withdrawals.<sup>77</sup> Similarly, the NYISO assesses customers with New York Power Authority Transmission Adjustment Charges based on customers' energy withdrawals.<sup>78</sup> The NYISO similarly assesses Ancillary Services and uplift costs to customers based on their energy withdrawals to serve Load.<sup>79</sup>

The NYISO does not calculate and assess such charges to Generators based on their injections (or negative injections) at the individual Generator bus (or node). Accordingly, the NYISO does not propose to assess such transmission charges to Energy Storage Resources based on their injections or negative injections.

The NYISO has proposed to revise its tariff to provide that an Energy Storage Resource will be responsible for its share of those charges assessed to customers based on their injections. Specifically, the NYISO recovers its annual budgeted costs and annual FERC fee pursuant to Rate Schedule 1 of the ISO OATT from customers based on their Withdrawal Billing Units and their Injection Billing Units.<sup>80</sup> The NYISO proposed to revise the definition of Injection Billing Units to provide that "Injection Billing Units shall include the absolute value of negative injections by Withdrawal-Eligible Generators."<sup>81</sup> Accordingly, Energy Storage Resources will be responsible for this charge based on their injections and negative injections.

### **Commission Question 8(b)**

*Please explain whether treatment of Energy Storage Resources as negative generation for the purpose of modeling Energy Storage Resources in NYISO's software complicates or prohibits accurate assessment of transmission charges for withdrawals.*

### **NYISO Response**

The NYISO's treatment of Energy Storage Resources' withdrawals as negative generation for the purpose of modeling Energy Storage Resources in its software does not complicate or prohibit accurate assessment of transmission charges for withdrawals. By treating withdrawals for later injection as negative generation, the NYISO is able to keep such transactions entirely separate in all of its settlement calculations from withdrawals to serve Load. This ensures that only withdrawals to serve Load are assessed transmission charges, as detailed in the NYISO's response to Question 8(a).

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<sup>77</sup> OATT Section 2.7.2.1.

<sup>78</sup> OATT Section 2.7.2.4.2.

<sup>79</sup> See, e.g., OATT Section 6.1.8.1 (residual costs payment/charge), OATT Section 6.3.2 (charges for regulation service).

<sup>80</sup> Twenty-eight percent of the NYISO's annual budgeted costs and annual FERC fees are allocated based on Injection Billing Units, and seventy-two percent are allocated based on Withdrawal Billing Units. See OATT Section 6.1.2.2.

<sup>81</sup> OATT Section 1.9.

## **II. Notification of Implementation Issues that Will Necessitate Limited Additional Compliance Tariff Revisions**

As noted above, in the time since the Compliance Filing was submitted, the NYISO has discovered two related implementation issues that will impact the ability of electric storage facilities to participate in the NYISO-administered markets as Energy Limited Resources. First, the Compliance Filing stated that the NYISO is presently capable of accommodating the operation of electric storage facilities in its markets as Energy Limited Resources that can withdraw Energy to charge or refill.<sup>82</sup> Second, the Compliance Filing also stated that, after its proposed Energy Storage Resource-related tariff revisions become effective, electric storage facilities that need to withdraw Energy to recharge would be able to choose between operating as an Energy Storage Resource or operating as an Energy Limited Resource that can withdraw Energy to recharge or refill.<sup>83</sup> The NYISO believed that both of these assertions were accurate when it made the Compliance Filing. However, in the course of developing specifications to implement the Energy Storage Resource functionality that it proposed in this proceeding, the NYISO has determined that these statements are not correct. The three tariff corrections that the NYISO intends to submit as an amendment to the Compliance Filing are necessary to ensure that the Tariffs reflect the NYISO's extremely limited ability to permit Generators to withdraw Energy as negative generation.

With regard to the NYISO's inability to permit electric storage facilities to operate as withdrawal eligible Energy Limited Resources, the NYISO's market and settlement systems are not presently designed to economically evaluate Bids to withdraw Energy or settle Energy withdrawals as negative generation at the generator bus for any resource other than the Gilboa pumped storage facility. Gilboa commenced operation before the NYISO-administered markets were first implemented in 1999. It is presently the only pumped storage resource in the NYCA that is able to withdraw Energy as negative generation to fill its reservoirs. At the time that the NYISO submitted the Compliance Filing, it believed that the software that accommodates Gilboa's participation in the markets could be quickly adapted to permit electric storage facilities to participate as Energy Limited Resources. This has proven not to be the case.

The market and settlement software that NYISO developed to accommodate pumped storage as an Energy Limited Resource is specifically tied to the Gilboa unit's operation and to its associated generator buses. The existing software does not include the functionality to add new resources; not even resources that have operating characteristics similar to Gilboa's. Furthermore, the current software design provides limited bidding flexibility that is sufficient for pumped storage, but that the NYISO no longer expects to be adequate to accommodate new battery technologies. Because of the described limitations of this software, the NYISO will not be able to permit new resources to withdraw Energy as negative generation until its Energy Storage Resource software is completed and deployed.

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<sup>82</sup> See Compliance Filing at pp 6, 21.

<sup>83</sup> See Compliance Filing at pp 6, 8, 11, 14, 15, 20 and 21.

With respect to the second implementation issue (after the Energy Storage Resource software is implemented, permitting energy storage facilities to choose between participating as an Energy Storage Resource or a withdrawal-eligible Energy Limited Resource), the NYISO has determined that it cannot readily enhance and expand its existing software to permit new resources that need to withdraw Energy in order to recharge to participate as Generators that are Energy Limited Resources. The NYISO has learned that substantial additional effort (effectively, an entire additional project) would be required to reconstruct and enhance the existing software to permit the flexible scheduling and settlement of new Energy Limited Resources that withdraw Energy.

The Compliance Filing indicated that the NYISO anticipates implementing the Energy Storage Resources-related tariff revisions proposed in this filing no earlier than May 1, 2020. However, the NYISO would not be able to undertake the additional work to enable Energy Limited Resources to withdraw Energy as negative generation without significantly impacting the delivery schedule for the Energy Storage Resource functionality. When the NYISO files its proposed tariff amendments later this month, the NYISO will explain that it would be unreasonable to delay the implementation of the Energy Storage Resource participation model until the NYISO is also able to permit Generators that are Energy Limited Resources to withdraw Energy as negative generation.

In order to determine if software enhancements to permit Generators that are Energy Limited Resources to withdraw Energy are of high value to the NYISO's stakeholders and are worth pursuing, the NYISO is presenting this set of enhancements to its stakeholders as a project that can be prioritized for development commencing in 2020. If stakeholders indicate sufficient support for the ability of Energy Limited Resources to withdraw Energy as negative generation at their generator bus, then the NYISO will move forward with developing this additional functionality, including any necessary supporting Tariff revisions.

For modern batteries (which comprise 100% of the energy storage resources that are presently in the NYISO's interconnection queue), the NYISO expects that the Energy Storage Resource participation model will provide superior opportunities to participate in the NYISO-administered Energy and Ancillary Services markets (and similar opportunities to participate in the Capacity market) compared to operating as an Energy Limited Resource that can withdraw Energy as negative generation at its bus. The NYISO will therefore ask the Commission to permit it to concentrate its resources on implementing the Energy Storage Resource participation model as quickly as practicable.

### **III. Service**

The NYISO will send an electronic link to this filing to the official representative of each of its customers, each participant on its stakeholder committees, the New York State Public Service Commission, and the New Jersey Board of Public Utilities. In addition, the complete filing will be posted on the NYISO's website at [www.nyiso.com](http://www.nyiso.com).

#### IV. Conclusion

WHEREFORE, the New York Independent System Operator, Inc. respectfully submits the additional information provided in Section I for the Commission's consideration, and provides the notification described in Section II.

Respectfully submitted,

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