

I. INTRODUCTION

RENEW is a non-profit association uniting the renewable energy industry and environmental advocates whose mission involves coordinating the ideas and resources of its members with the goal of increasing environmentally sustainable energy generation in the Northeast from the region's abundant, indigenous renewable resources.³ RENEW has focused on highlighting the value of grid-scale resources- specifically offshore and onshore wind and small hydropower- and the benefits of transmission investment to deliver renewable energy to load centers in the Northeast. RENEW members own and/or are developing large-scale wind and hydropower facilities across the Northeast. Others are independent transmission developers with proposals for transmission facilities to connect clean energy resources from around the region to the load centers.

RENEW strongly supports the ISO's proposal to implement a system for the real-time economic dispatch of wind and intermittent hydro resources that are not Settlement Only Generators. However, a number of details about how this program will be implemented have yet to be developed including the physical parameters of intermittent hydro generators that will need to be incorporated in order for the automatic dispatch system to dispatch these units, what may happen if any of these units are found unable to be dispatched automatically, when other non-dispatchable resources will become dispatchable, what the DNE calculation duration will be, what type of transparency DNE Dispatchable Generators will have to the inputs that are used to calculate their DNE instructions, and what process will be used to ensure that all hydro DNE Dispatchable Generators are aware of the implications of waiting to become dispatchable, all of which are discussed further in this filing. The DNE Dispatch Changes are a major change

³ The comments expressed herein represent the views of RENEW and not necessarily those of any particular member of RENEW.

in the way these resources participate in the market. Accordingly, a high level of attention and cooperation with the affected participants will be required for the implementation of this program to be successful and avoid unintended consequences.

Incorporating intermittent wind and hydro resources into the real-time economic dispatch is necessary for continued reliable operability of the system, efficient use of the transmission infrastructure, economic efficiency, and sending correct price signals, all of which the ISO identified in its filing.⁴

In its filing the ISO described the need for real-time economic dispatch of intermittent wind and hydro resources arising from the 878 MW (nameplate) of wind⁵ and 321 MW (winter Seasonal Claimed Capability) of intermittent hydro resources⁶ in operation today. The over 4,000 MW (nameplate) of wind and intermittent hydro⁷ resources that are active in the interconnection queue is an even stronger driver for making this change to the markets as this quantity of additional non-dispatchable generation seems entirely unmanageable under today's manual dispatch process.

RENEW supports the ISO's flexible approach of using Do Not Exceed ("DNE") dispatch instructions for intermittent wind and hydro resources rather than standard Desired Dispatch Point ("DDP") instructions. This change will provide the greatest level of flexibility in output that can be reliably accommodated so that energy from these resources is not unintentionally lost due to forecast error or output fluctuations that might occur within the dispatch interval.

⁴ Testimony of Jonathan Lowell in ISO Filing at 10-11.

⁵ *Id.* at 4.

⁶ The nameplate capability of these resources is greater than the 321 MW of Seasonal Claimed Capability (SCC), but the latter is the metric publicly reported by the ISO. See SCC Monthly Report May 2015, available at http://iso-ne.com/static-assets/documents/2015/05/scc_may_2015.xls

⁷ As of May 8, 2015.

Strong precedent exists for FERC to approve the DNE Dispatch Changes with NYISO, MISO, PJM, and ERCOT, have previously implemented real-time economic dispatch of intermittent resources.⁸

As the ISO described in its filing, price transparency and price formation is important for developers of new generation and transmission for them to site projects at efficient locations on the grid and evaluate the economics of making additional system upgrades to reduce congestion.⁹ Transparency and accurate pricing signals are similarly needed for making appropriate and efficient decisions regarding generator retirement as well as for decisions about imports and exports.

The ISO began stakeholder discussions about real time economic dispatch of wind at the March 7, 2012, Markets Committee meeting. While stakeholders and the ISO have worked together productively since that time to shape this proposal, the important benefits of the market enhancements are persuasive in requiring this market change be implemented as soon as practicable and not delayed beyond April 10, 2016- the deadline given in the ISO's filing.¹⁰

II. COMMENTS

A. **Physical Input Parameters Should Be Implemented to Allow the ISO to Dispatch All Intermittent Hydro Resources through the Automated Dispatch Process**

Section III.1.11.5 of the Tariff changes submitted by the ISO states "All Intermittent Power Resources that are wind and hydro, excluding Intermittent Settlement Only Resources,

⁸ See Mark Ahlstrom et. al., *Knowledge Is Power* IEEE Power & Energy Magazine November/December 2013 45-52 (describing NYISO, ERCOT, and MISO approaches to wind on dispatch).

⁹ See Lowell Test., *supra* note 4, at 2-3.

¹⁰ ISO Filing at 7.

must be capable of receiving and responding to electronic Dispatch Instructions no later than April 30, 2017.” RENEW understands this to mean that all of these resources will, as a general practice, be represented as available for dispatch in the market software subject to the physical constraints of the resource.

This change may require the ISO to modify its operational practices or automated dispatch software to recognize and accommodate certain parameters unique to these types of resources. For example, an intermittent hydro resource may have an operating license that requires its operators to sound a horn 30 minutes prior to reducing river flows or spilling water. Following that 30 minute waiting period the resource would be able to respond to dispatch instructions within its dispatchable range and subject to its ramp rate.

Though this type of ramp-down notification period is analogous in many ways to the start-up notification time parameter that dispatchable generators provide to the ISO today, no system now exists, as RENEW understands, to incorporate a ramp-down notification time into the automated dispatch process. If such a constraint and operating parameters were not incorporated into the dispatch process, a resource that requires such a delay might continue to be managed manually outside of the automated dispatch process either by setting its dispatchable range to zero, setting its ramp rate at the minimum possible, or going into the non-dispatchable control mode in the dispatch software. Any of these approaches would not achieve the reliability, market efficiency, or price transparency goals described by the ISO in its filing. Identification of these constraints and their incorporation into the dispatch process is critical to giving these resources the ability to offer their full, true flexibility to the market.

During the stakeholder process, the ISO stated its intention to develop the parameters that will be used for dispatching intermittent hydro and incorporating them into its Operating Procedure No. 14. RENEW requests the ISO work with stakeholders to develop these physical

input parameters that will allow the ISO to dispatch intermittent hydro resources through the automated dispatch process without either setting their dispatchable range to zero or their ramp rate to a minimal level as a proxy for these units' true physical parameters.¹¹

If through this process the ISO determines individual exceptions (i.e., that there are intermittent hydro resources that must remain on manual dispatch or alternatively must have their dispatchable range set to zero or their ramp rate set to a minimal level) exist after April 30, 2017, RENEW requests the ISO report on any exceptions to stakeholders and make a subsequent filing with the Commission laying out the conditions under which intermittent hydro resources would be exempt from the automatic dispatch process.

In addition, should any such exceptions be identified, RENEW requests the ISO clarify in its subsequent filing if and under what conditions these resources would continue to be eligible to set price at the offer floor price, as the ISO describes they would during the transition period from April 10, 2016 through April 30, 2017.¹²

B. All Non-Settlement-Only Generators Should Be Made Dispatchable as soon as Practicable

All Generators in New England have the ability to elect to be non-dispatchable regardless of their physical characteristics or whether or not they have installed a Remote

¹¹ For example, if an intermittent hydro generator required a one hour notification prior to being able to respond to a dispatch instruction, and once that hour had passed it had a dispatchable range of 20 MW and a 3 MW/minute ramp rate, RENEW is concerned that a shortcut or proxy for representing this notification time in the automated dispatch software would be to reduce the dispatchable range of the unit to 0 MW or reduce its ramp rate to 0.1 MW per minute (or the minimum allowable by the software) such that the automated dispatch software is no longer able to dispatch effectively the unit despite the unit's physical capability to respond after a one hour notification. If, on the other hand, an intermittent hydro generator truly had no physical capability to provide a dispatchable range, then this would be appropriate to reflect in the automated dispatch software.

¹² See Lowell Test., *supra* note 4, at 14.

Terminal Unit (“RTU”). Of the 30,254 MW¹³ of generation in New England that participates in the markets, 5,284 MW (17.5%) is categorized as non-dispatchable.¹⁴ As RENEW understands, even those generators that have dispatchable capability may have the participant change their status in the ISO’s systems to non-dispatchable on a temporary but unlimited basis. With this Tariff change, intermittent wind and hydro will not have the option to elect to be non-dispatchable.¹⁵

Having generators registered and operated as non-dispatchable generation- even though those generators may have dispatchable capabilities- puts a number of challenges on reliable system operation and market efficiency. In addition to the challenges summarized in the ISO’s filing, non-dispatchable resources place the burden on dispatchable generation for managing transmission constraints and changes in load. The ISO procedures for managing system constraints call for all dispatchable resources to have their output reduced to the bottom of their dispatchable range prior to curtailing any non-dispatchable generation.¹⁶ As wind resources are extremely flexible, the bottom of their dispatchable range is generally between 0 MW and 1 MW. This means that once wind becomes dispatchable on April 10, 2016, the ISO curtailment procedures will turn all wind plants off prior to requesting any output reductions from non-dispatchable resources, even for those resources having a true marginal operating cost that is greater than a wind resource. As the ISO describes in its filing, this result is not economically efficient.¹⁷

¹³ See SCC Monthly Report May 2015, available at http://iso-ne.com/static-assets/documents/2015/05/scc_may_2015.xls

¹⁴ See SCC Monthly Report May 2015, available at http://iso-ne.com/static-assets/documents/2015/05/scc_may_2015.xls .

¹⁵ Attachment (Redlined Tariff Sheets) to ISO Filing at III.1.11.3(e); See Lowell Test., *supra* note 4, at 13.

¹⁶ ISO New England, Control Room Operating Procedures CROP 35005, Section 12.

¹⁷ ISO Filing at 5.

The area of northern New Hampshire, known as the Coos loop, provides a good illustration of this concern. In this export constrained area are nine generators nearly all of which are renewable resources.¹⁸ The maximum capability of these generators frequently exceeds the local load and export capability leading to regular curtailments, and additional generators in the queue propose to interconnect to this area. Today, only one of the existing generators in this area is dispatchable. The ISO's proposal will make five more subject to the DNE Dispatch Changes. Three generators, all biomass plants, will remain non-dispatchable unless they voluntarily choose to become dispatchable.

<u>Generator</u>	<u>Fuel Type</u>	<u>Dispatchability</u>
Lost Nation	Gas Turbine	Dispatchable
Granite Reliable Power	Wind	DNE
Pontook Hydro	Hydro	DNE
Burgess Biopower	Biomass	Non-dispatchable
Gorham	Hydro	DNE
Great Lakes Berlin	Hydro	DNE
Smith	Hydro	DNE
Bethlehem	Biomass	Non-Dispatchable
DG Whitefield	Biomass	Non-Dispatchable

Once DNE Dispatch Changes go into effect, the three biomass generators in the Coos loop area will be able to continue operating at self-chosen output levels while wind and intermittent hydro generators in this area will be dispatched down to manage the local transmission constraint. One might assume that these biomass plants have a higher true marginal cost of energy than the wind or hydro resources given their fuel costs, so it is reasonable to assume that the generator dispatch in this area will not be economically efficient until these biomass generators are required to become economically dispatchable as well.

¹⁸ See SCC Monthly Report May 2015, available at http://iso-ne.com/static-assets/documents/2015/05/scc_may_2015.xls

Making all resources be operated by the ISO as dispatchable up to their full physical capability is the right approach for market efficiency. DNE dispatch is a first step but many other resources already have the capability and equipment installed to enable them to be easily operated by the ISO as dispatchable. For example, a biomass plant may already have an RTU but may have elected to be treated as non-dispatchable. Simple inquiry by the ISO and change in the classification of that generator alone might be sufficient for the generator to be operated as dispatchable.

The ISO has stated its intent to make all non-settlement-only generation dispatchable in the future.¹⁹ Its wholesale market project plan²⁰ lists this project with an estimated start in the stakeholder process in the fourth quarter of 2015 with an earliest effective date of 2016. RENEW requests this project be prioritized to minimize the amount of time that wind and dispatchable intermittent hydro will be inefficiently curtailed.

RENEW requests all generators (except settlement only generators) be made dispatchable on the DNE Dispatch Changes implementation date of April 10, 2016, if they have an RTU and by April 30, 2017, if they do not have an RTU. If generators other than wind and intermittent hydro are allowed to elect to be non-dispatchable after this time even though they have dispatchable capability, then the implementation of the DNE Dispatch Changes, due to its mandatory nature, become discriminatory towards wind and intermittent hydro and can yield non-efficient market outcomes in local areas where wind, hydro and dispatchable, but registered as non-dispatchable, generators are operated.

¹⁹ Vamsi Chadalavada, ISO New England, presentation made to the NEPOOL Participants Committee, *Discussion of the 2015 Work Plan* 43 (February 6, 2015), http://www.nepool.com/uploads/NPC_20150206_Composite5.pdf

²⁰ ISO New England, *2015 Wholesale Market Project Plan* (April 6, 2015), available at http://iso-ne.com/static-assets/documents/2015/04/april_2015_wholesale_market_project_plan.pdf

C. Limit DNE Calculation Duration to Less than the Dispatch Interval of Five Minutes to Avoid Stale Data Increasing the Forecast Error Rate; the ISO Should Provide Each DNE Dispatchable Generator with the Equipment Availability and Unconstrained Energy Output Values Used to Calculate Each DNE Instruction

The ability of the DNE Dispatch Changes to result in an efficient economic dispatch and correct pricing signals is reliant on the dispatch algorithm using accurate values for the unconstrained output of each DNE Dispatchable Generator for the next dispatch interval.²¹ For wind generators, this unconstrained output value will come from the ISO's centralized wind forecasting system. For intermittent hydro generators, this unconstrained output value will be submitted by each generator operator.²² The accuracy of the values used in the economic dispatch process is dependent upon using input data that has not become stale or incorrect due to time lag.

The first step in creating the ISO wind energy forecast is for wind generator operators to submit to the ISO the availability and operating status of the wind turbines that comprise their wind farms.²³ This data is sent by the ISO to the wind forecaster and, together with the wind speed forecast created by the wind forecaster, is used to produce the wind energy forecast that is updated every five minutes.²⁴ The forecaster sends the wind energy forecast back to the ISO where it is incorporated into the determination of a DDP in the economic dispatch process.

In today's wind forecasting system, wind operators provide to the ISO at the top of each hour the expected availability of their wind turbines for each upcoming hour. In real time,

²¹ See Lowell Test., *supra* note 4, at 8.

²² See Jonathan Lowell, ISO New England, presentation to the NEPOOL Markets Committee, "Do Not Exceed" *Real-Time Dispatch*, 10-12 (February 10, 2015) (final presentation to the Markets Committee), http://www.iso-ne.com/static-assets/documents/2015/02/a03_iso_presentation_02_10_15.pptx

²³ See Lowell Test., *supra* note 4, at 6.

²⁴ ISO New England, Operating Procedure No. 14, Appendix F 10, http://iso-ne.com/static-assets/documents/rules_proceeds/operating/isone/op14/op14f_rto_final.pdf

they also telemeter the current availability and operating status of their turbines to the ISO every five minutes.²⁵ RENEW understands that the ISO is still determining how this equipment availability data will be used to develop the short term forecasts used in the economic dispatch process. As individual wind turbines that are unavailable due to routine maintenance or unplanned faults may be brought back online in a matter of minutes, relying on hourly-updated data will certainly introduce errors into the process. If the hourly forward-looking data is to be used, RENEW asks that the current system be updated to allow wind plant operators to update this data as it changes within the hour to avoid the use of stale data.

Whether the forward-looking data or the real-time telemetered data is used, the most recently available data should be used in each calculation of the DNE instruction and computation times must be kept short enough that dispatch instructions can be calculated using the most recently available data. To illustrate this with an example, assume a wind farm had four turbines available at 09:00 and eight turbines available at 09:15. If at 09:00 the ISO tells the forecaster that the wind farm has four turbines available and the forecaster takes 10 minutes to incorporate this into the forecast, then at 09:10 the forecaster sends the forecast back to the ISO based on there being four turbines available. Assume that the ISO then takes 10 minutes to incorporate the forecast into the DDP and DNE calculations, resulting in a DNE instruction at 09:20 that was based on the now-incorrect assumption that the wind farm has only four turbines available when in fact it has eight turbines available and could be producing twice as much power as the forecaster indicated. This operation may result in the wind farm being inadvertently held down and an inefficient economic dispatch. RENEW understands the ISO is still determining the time required to compute each DNE instruction.

²⁵ *See id.*

Wind forecast error rates increase very rapidly over the first hour of the forecast, with error rates approximately doubling with each 5 minutes for the first 15 minutes of the forecast.²⁶ The difference between a time lag of 5 minutes and a time lag of 15 minutes in the DNE calculation process might mean a quadrupling of the wind energy forecast error rate, before accounting for any impacts due to inaccurate equipment availability data.

RENEW therefore requests every effort be made to keep the DNE calculation duration for wind plants, starting with sending the current or expected turbine availability to the forecaster and ending with sending the wind plant its DNE instruction, to less than the dispatch interval of five minutes in order to avoid stale data increasing the error rate in the process. For intermittent hydro plants, RENEW requests the calculation duration, starting with receipt of the current or expected unconstrained plant output and ending with sending the hydro plant its DNE instruction, be similarly kept to less than the dispatch interval of five minutes.

RENEW suggests the ISO periodically report to stakeholders on hydro forecast error and bias rates in an anonymized format, as it does with the wind forecasting program. By April 2018, sufficient data should be available for the ISO to report to stakeholders on whether having hydro plants submit their own forecasts is working as well as expected and whether a need or opportunity exists for improved forecast accuracy.

In addition, RENEW requests the ISO provide each DNE dispatchable generator with the equipment availability (in MW) and unconstrained energy output (in MW) values used to calculate each DNE instruction. This visibility will allow these generators to determine if a potentially incorrect input parameter was used so that they can identify whether they need to correct the data they are submitting to the ISO in order to resolve the error. Without this data it

²⁶ See Ahlstrom, *supra* note 8, at 47 (figure 2).

may be difficult for a DNE Dispatchable Generator being held down to determine whether this situation is due to data errors that can be corrected or economic/reliability reasons.

D. Intermittent Hydro Should Affirm Prior to the April 10, 2016, DNE Dispatch Changes Start if It Will Not Be Dispatchable on that Date

RENEW supports the ISO's proposal to allow intermittent hydro resources that do not already have an RTU installed to choose not to become dispatchable at the DNE Dispatch Changes April 10, 2016 start date and to wait instead until a date prior to April 30, 2017, to become dispatchable. As the ISO described, such resources will continue to be manually curtailed during this time but, unlike today, will be eligible to set price at -\$150/MWh when they are curtailed.²⁷

RENEW is concerned many intermittent hydro operators do not participate actively in the market today or track market rule changes. These operators may be unaware of the implications of not becoming dispatchable at the start of the DNE Dispatch Changes on April 10, 2016, and may inadvertently end up setting prices at -\$150/MWh. This outcome could harm not only these resources but all other generators that are either inefficiently curtailed or receive the -\$150/MWh price due to the inadvertent actions of another generator. It is not market efficiency and will not result in competitively set prices.

The ISO has indicated it can take operators up to six months to install the equipment and communications circuits to become dispatchable. If these resources unwittingly cause these improper prices for over half a year until they can install the equipment to become

²⁷ See Lowell Test., *supra* note 4, at 14.

dispatchable, the market will be economically inefficient and unjust and unreasonable for affected generators.

To avoid unintended price outcomes, RENEW requests the ISO require all resources to which the DNE dispatch applies to notify the ISO whether they intend to become dispatchable at the April 10, 2016, start or at a later date and that they understand the implications of operating under manual dispatch if they elect a later date. This notification can prevent inadvertently having these resources deemed to have made an uneconomic and uncompetitive -\$150/MWh offer resulting in improper price formation for a long period of time.

E. The ISO Should Not by Default Exclude Variable Resources from the Regulation Market

In the ISO's testimony it states DNE Dispatchable Resources are excluded from the regulation and reserves markets because they cannot be expected to respond to instructions to increase output.²⁸ For that reason, it explains, it included Tariff language to explicitly exclude DNE Dispatchable Resources from the regulation and reserves markets.²⁹

Many wind resources can provide this service by holding the resource down below its unconstrained capability by the quantity of regulation or reserve service that is desired³⁰ This action allows the wind plant to respond to instruction to increase output. At the current time, New England market prices for these services compared with the large lost opportunity cost for the energy not produced make it economically inefficient for wind resources to participate.

²⁸ See Lowell Test., *supra* note 4, at 11.

²⁹ Attachment (Redlined Tariff Sheets) to ISO Filing at III.1.11.3(e).

³⁰ Jacob Aho et. al., *Controlling Wind Turbines for Secondary Frequency Regulation: An Analysis of AGC Capabilities Under New Performance Based Compensation Policy* NREL/CP-5D00-62815 (February 2015), <http://www.nrel.gov/docs/fy15osti/62815.pdf>

However, these resources may participate in these markets in the future when there is a higher proportion of zero-fuel generation on the system. For this reason, RENEW believes the ISO should not explicitly exclude these resources from these markets. Rather, the market rule should be technology neutral. RENEW requests the language explicitly excluding these resources from these markets be removed from the Tariff.

If the ISO believes that additional Tariff language would be required in order to further define how these resources would participate in these markets before removing this exclusionary language from the Tariff, RENEW requests the ISO work with stakeholders to develop rules for how these resources will participate in these markets when participation becomes economically desirable.

III. CONCLUSION

RENEW respectfully requests that the Commission accept the ISO's proposal to implement a Do Not Exceed Dispatch system for real time economic dispatch of intermittent wind and hydro generators that are not settlement only generators and direct the ISO as follows:

1. Work with stakeholders to develop physical input parameters that will allow the ISO to dispatch all intermittent hydro resources through the automated dispatch process in a way that would not require any of these resources to remain subject to manual dispatch, to set their dispatchable range to zero, or to reduce their ramp rate to a minimal level;
2. Clarify, if the ISO determines any intermittent hydro resources must remain on manual dispatch after April 30, 2017, if and under what conditions these resources would continue to be eligible to set price at the offer floor price;

3. Make all generators (except settlement only generators) dispatchable on the DNE Dispatch Changes implementation date of April 10, 2016, if they have an RTU, and by April 30, 2017, if they do not;
4. Keep the DNE calculation duration for wind plants, starting with sending the current or expected turbine availability to the forecaster and ending with sending the wind plant its DNE instruction, to less than the dispatch interval of five minutes;
5. Keep the DNE calculation duration for intermittent hydro plants, starting with receipt of the current or expected unconstrained plant output and ending with sending the hydro plant its DNE instruction, to less than the dispatch interval of five minutes;
6. Provide each DNE dispatchable generator with the equipment availability (in MW) and unconstrained energy output (in MW) values used to calculate each DNE instruction;
7. Require all intermittent hydro generators to which the DNE dispatch applies to notify the ISO whether they intend to become dispatchable on April 10, 2016, or at a later date, and that they understand the implications of operating under manual dispatch if they elect a later date; and
8. Remove from the Tariff the language explicitly excluding these resources from the regulation and reserve markets, or work with stakeholders to develop rules for how these resources will participate in these markets for when participation becomes economically attractive.

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Document Content(s)

ER15-1509 - RENEW Comments 2015-05-14.PDF.....1-18