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NYPA Comments on the NYISO Reliability and Market Considerations for a Grid in Transition Whitepaper Outline

The New York Power Authority (NYPA) appreciates this opportunity to provide the following comments on the New York Independent System Operator's (NYISO's) "Outline for the White Paper: Reliability and Market Considerations for a Grid in Transition" (the White Paper), as discussed in the 2019 Annual Sector Meetings. NYPA supports the vigorous pursuit of the Governor's Green New Deal and we stand ready to lead, guide and inform the NYISO's transformation of the wholesale energy market to achieve New York's greener, more sustainable and affordable energy future.

1. Overview

Renewable and distributed resources have begun to measurably change the dynamics of both energy consumption and energy production. Public policies, such as the State's announced goals of 70% non-carbon energy production by 2030 leading to a 100% carbon-neutral grid in 2040, will move New York's grid to reflect the values and aspirations of our citizens. This dynamic transition to a greener and more sustainable energy future will enable the NYISO and its stakeholders to evolve wholesale markets to:

- preserve existing grid-scale non-intermittent zero emission generation resources;
- attract new locationally significant grid-scale non-intermittent zero emission generation resources;
- incent specialized generation and transmission operational characteristics;
- incent targeted transmission development new transmission technological capabilities.

The characteristics of intermittent generation, combined with the need to maintain a constant balance between load and generation, will challenge NYISO grid operations requiring greater flexibility and agility in the system to ensure reliability and meet policy goals. In the absence of economically viable large-scale storage, the burden of maintaining system reliability for upstate New York will heavily fall upon the flexible operation of NYPA's hydropower and hydro pumped storage assets and existing merchant nuclear generation, and, for downstate, thermal generation. However, especially for upstate hydro and hydro pumped storage and nuclear resources, the ability of these plants to enhance their operational flexibility is limited by both physical plant constraints and economic viability considerations.

The ability for New York to transition to a carbon neutral grid is dependent upon transmission being in place to bring clean renewable electricity to consumers across vast distances, and enable the grid-wide effectiveness of Ancillary Services (AS), e.g. frequency regulation, voltage support and operating reserves, provided by non-intermittent flexible traditional and distributed generation resources throughout the New York Control Area (NYCA). It will also require and transmission awareness and operational flexibility needed to reliably and efficiently balance that future mix of resources.

Finally, NYPA encourages the optimization of proper price formation of capacity and AS markets to inform investors about what capabilities and attributes are needed. Perhaps the most difficult challenge will be maintaining efficient and timely market signals necessary to accommodate the needs of the system actively transitioning, as intermittent resources penetration increases.

2. Challenges for a Generation Fleet in Transition

Today, the NYCA power system operates based on a complex body of regulations and market structures designed to maximize reliability and economic efficiency for a traditional generation based grid. Over the past 20 years, price signals from the NYISO's markets have resulted in transitioning the grid with more efficient resources entering the market, displacing less efficient generation. New emissions goals mandated to be achieved within specified timeframes will significantly accelerate the evolution of the grid and its economic construct more quickly than if just left to market forces. While the end state of the current and future systems remain the same – grid reliability and efficient markets - the operating characteristics, necessary system attributes, and the market design that achieve them, will be vastly different.

The NYISO wholesale energy markets will be challenged to rapidly escalate the penetration of non-emitting resources, some with and some without out-of-market revenues, while at the same sustaining essential non-emitting resources and thermal resources that do not have out-of-market revenues. With energy prices approaching zero, if not negative in many hours, will energy prices be sufficient to retain/attract non-intermittent generators which offer necessary ancillary services? Or will new subsidized intermittent resources displace existing non-emitting, non-intermittent renewable resources?

In a future carbon-neutral paradigm, NYPAs large hydro and hydro pumped storage generation will be crucial to achieving emissions goals while sustaining market stability and essential operational flexibility in ancillary services (e.g. frequency regulation, voltage support) in support of intermittent resources. Although these large generating resources are physically able to ramp and cycle to varying degrees, doing so will negatively impact their operations, maintenance schedules, and expected operational lifetimes. Retrofits, advanced control systems, and newer plant designs can improve flexible operations and provide better monitoring of physical wear, but these upgrades are not trivial and expensive requiring adequate market revenue, timing of which will be required to ensure that the necessary operating attributes are in place as intermittent penetrations increase. Can the markets incent such investment? And if so, will it be in a timeframe commensurate with the increasing penetration of intermittent resources? Will market incentives be sufficient to achieve the necessary investments to retro-fit and upgrading generation flexibility and agility? Will they be in time to sustain reliability through this transition?

Steady baseload nuclear and natural gas plants will also be necessary to achieve emission and reliability requirements. Nuclear plants are designed to be constant baseload, they were not designed for flexible operation. Natural gas plants, on the other hand, have been built, in part, with flexibility in mind in order to respond to the daily variations in load, but they derive a substantial amount of their revenue from providing baseload, and only a small percentage of their revenues from providing ancillary services. On a going forward basis, with increasing large-scale intermittent renewable penetration, the economic impacts of flexible operation will reduce the amount of electricity generated in a year relative to baseload operation while increasing the operational costs; this will significantly impact overall plant economic viability. Under current market structures and dispatch rules, this will make it more difficult for generator owners to recover costs because there will be fewer megawatt-hours across which to amortize their capital costs. These technologies with high capital costs will likely experience the greatest negative economic impacts from flexible operation. Displacing these resources with intermittent, largely weather-dependent intermittent resources will likely have significant energy and capacity market impacts (will increase the Installed Reserve Margin (IRM)), as well as reliability and resilience consequences.

The White Paper will need to study and present approaches to maintaining system reliability and efficient wholesale energy markets, such as: What will a well-adapted generation mix look like? How many gas peaking units and baseload plants does this mix require? How will they economically sustain themselves given low-utilization rates? How much and what types of Ancillary Services, e.g. Regulation and Reserves, etc., will be necessary to maintain reliability? How will this generation be compensated? What market and regulatory structures are required to ensure adequate compensation? Spot prices may decline in the short term due to the fuel cost of renewables, but will this lead to an economically efficient generation mix in the long-term?

3. The Transmission Grid and System Operations

A fundamental reality which often escapes the conversation about transitioning to a carbon-neutral grid is that the location of the best renewable resources tends to be remote from major load centers. Intermittent renewables and distributed generation resources will likely contribute to power systems at both the transmission and distribution levels. Transmission and distribution expansion and technology improvements will be necessary to access and deliver sufficient amounts of energy from remote northern regions to Southeastern New York's large population centers. Also, transmission and distribution expansion to allow for locationally critical injections of ancillary services, e.g. regulation and reserves, necessary to support intermittent/variable resources will need to be incented through appropriate market signals.

For example, the distribution system will have to accommodate the back-feed problem, as well as to allow for more advanced control of generation resources. Transmission technologies that can span longer distances and minimize power losses to address "Geographic Aggregation" — smoothing the intermittency of wind and solar energy over large distances — will be required. Other innovations, such as increasing network interconnections to facilitate balancing through electricity imports and exports, would also benefit from new transmission technologies.

One key technology that significantly aids the integration of intermittent renewables is the utilization of new sensors and dispatch algorithms that can monitor and respond to power system changes in real time. In New York, NYPA has led this effort through its undertaking the installment of sensors on equipment throughout its statewide network of 16 power plants and 1,400 miles of transmission lines, including on such equipment as transformers, reactors, turbines, generators, breakers, battery banks, cables, and capacitors. When complete, NYPA's sensor system is capable of feeding information such as temperature, power loads, vibrations, pressure, emissions, and moisture into our Integrated Smart Operations Center (ISOC) in near real-time. NYPA already has sensors feeding approximately 26,000 points of data to the ISOC from across its power system. With the addition of 50,000 sensors installed through this robust, new sensor deployment program, NYPA aims to have a total of 75,000 points of data or more feeding into the ISOC by the conclusion of this program. We welcome the opportunity to share our development and operational experience to the NYISO in support of understanding and valuing this capability.

NYISO will need to develop market enhancements that appropriately value existing transmission assets necessary to access and deliver renewable energy to Southeast New York. Questions to consider in the White Paper include: Will distribution system contributions to the bulk power system need to be compensated? Markets will need to incent deployment of new transmission technology development for real-time awareness and enabling optimal (uncongested) ancillary service support necessary for grid reliability?

4. Capacity and Ancillary Service Market Enhancements

In order to achieve the State's clean energy goals, we will have to get the right market signals incenting investment in generation and transmission assets with the desired attributes. The capacity market historically served as the foundation for revenue adequacy for New York generation development. This transformation of the grid will undoubtedly impact the NYISO capacity markets and its market signals. To begin to understand these impacts, the NYISO and its stakeholders should evaluate the need to modify the capacity demand curve to understand a "Transitional State," a new "Carbon-Neutral State" and the choice of an appropriate proxy unit that could actually be built in the new market paradigm. The results of this evaluation must be transparent and fully vetted with stakeholders before making any changes to the capacity market design.

In assesssing the impacts on the capacity market, the NYISO will also need to consider the increasing penetration of intermittent resources and the increase this will have on the New York State Reliability Council's Installed Reserve Margin. This upward pressure will occur as NYISO forecasts the addition of as much as 15,000MW of

intermittent resources in a market that is already long, causing the potential displacement of as much as 5,000MW. Taken together, these issues will help guide an efficient market design that will enable future capacity prices to send the right investment signals.

Potential market enhancements identified to date, e.g. quick ramping and and flexible ramping products, will cause a "shifting" of revenues from capacity to AS to attract necessary attributes and operational characheristics. This must be done with transparency to, and input from, stakeholders to minimize any risks to asset economic viability. If the AS price signal is sufficient, it will be sufficient to justify the selection of a resource type which provides the flexibility, agility and other attributes the NYISO and Utility Grid Operators will need. If NYISO markets shift too much revenue to the AS market from the capacity market, investors may see declining debt/equity ratios. Investors may also assign valuations based on increased risk of greater reliance on real-time AS performance based revenues, not annual capacity payments. If the AS price signal is too low to justify a more expensive resource with the necessary attributes, developers will not build the needed resources. To the extent there are shortage conditions, there will be potential reliability problems and market power will need to be addressed.

5. Timing

Perhaps the most difficult aspect of transitioning the grid to fulfill Governor Cuomo's Green New Deal is time and timing. Given the time it takes to: finalize a comprehensive outline for the White Paper; performing the commensurate studies and assessment; bring project candidates through the NYISO Stakeholder process; complete market designs; and have FERC approve tariff amendments for implementation, is minimally a three year process. Timing of that market signal being available to developers will be pivotal to achieving the 70% non-carbon energy production by 2030 requirement. This is the case because it will take another 4/5 years to finance, site and construct new generation, or retrofit existing generation, and transmission that have the operating characteristics necessary to accommodate the transitioning needs of the system – that will be 2026/27. The time it takes to reform the market design and planning processes, and the timing of implementing those reforms, will be paramount to sustaining reliability and efficient markets throughout this transition.

Given the transformational goals announced by the Governor in his 2019 State of the State Address, the magnitude of change upon the NYISO wholesale markets and systems operations will need to be equally transformative. In order to do so successfully and efficiently, the NYISO must look to stakeholders to define this undertaking, prioritize its efforts and collaborate in its market, planning and operational redesign. NYPA supports the vigorous pursuit of the Governor's Green New Deal and we stand ready to lead, guide and inform the NYISO's transformation of the wholesale energy market to achieve New York's greener, more sustainable and affordable energy future.

Respectfully submitted,

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