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Independent System Operator

Grid Services from Renewable Generators

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Agenda

- Project Background
- Report Highlights
- Appendix: Study Findings (presented on 05/19/21)

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Project Background

Previous Presentations

Date	Working Group	Discussion Points and Links to Materials
01-21-21	ICAPWG/MIWG	2021 Market Projects Outlook Presentation https://www.nyiso.com/documents/20142/18559701/2021%20Market%20Design%20Project%20Outlook.pdf/0094ad10-3eea-bf35-10ce-fb20592a6d33
03-11-21	ICAPWG/MIWG	Kick-off presentation to discuss detailed study scope and seek stakeholder feedback https://www.nyiso.com/documents/20142/19871290/Grid%20Services%20from%20Renewable%20Generators_ICAPWG_MIWG_March%2011%202021_FINAL_CD.pdf/60a6a045-60bf-5b2e-2b19-0007ab790e01
05-19-21	ICAPWG/MIWG	Presentation on study findings https://www.nyiso.com/documents/20142/21581747/Grid%20Services%20from%20Renewable%20Generators_MIWG_051921_FINAL.pdf/aa6974b2-5e6b-03e4-eda5-c95a9e60a0b2

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Grid in Transition – A Multifaceted Approach

- **Aligning Market Incentives**
  - Carbon Pricing
  - Comprehensive Mitigation Review
- **Prepare for New Technologies**
  - DER Participation Model
  - Energy Storage Participation Model
  - Hybrid Co-Located Model
  - Hybrid Aggregation Model
  - Large Scale Solar on Dispatch
- And more....

Aligning Competitive Markets and New York State Clean Energy Objectives

- **Review Energy & Ancillary Services Design for Incenting Flexibility**
  - More Granular Operating Reserves
  - Regulation Up & Down Services
  - Ramping Services
  - Grid Services from Renewable Generators
- **Evolve the Day Ahead and Real-Time Markets to improve managing Forecast Uncertainty**
- **Track certain market metrics to evaluate incentives for flexible resources**
- And more...

Valuing Resource & Grid Flexibility

- **Enhancements to Resource Adequacy Modeling**
- **Improving Installed Capacity Market Incentives**
- **Review Capacity Market Resource Ratings to Reflect Reliability Contribution**
  - Expanding Capacity Eligibility
  - Tailored Availability Metric

Improving Capacity Market Valuation

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Project Scope

- **The Grid Services from Renewable Generators project has several key objectives:**
  - Describe the relevant Reliability Rules that the NYISO must comply with, per NERC, NPCC, and NYSRC mandates, and how current market rules support those requirements
  - Describe the nature of existing and possible future grid services and how they are procured and/or provided in New York
    - Operating reserves, regulation, voltage support service, black start service, fast frequency response, inertial response, separate regulation up and down, ramping*
  - Discuss the capability of renewable generators to provide various grid services, subject to technological capabilities and Reliability Rules
    - Onshore Wind, Offshore Wind, Utility-Scale Solar, Rooftop Solar, and Run-of-River Hydro
  - Discuss potential market design and/or product revisions that would improve reliable grid operations and possibly enable participation by renewable generators

*The NYISO does not currently have market products for the services listed in blue.

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Project Research

- **The NYISO conducted this study by reviewing industry literature and conducting industry interviews, the findings of which are summarized on subsequent slides**
  - Studies and Reports
    - NREL et al.: Avangrid Renewables Tule Wind Farm Report, 2020
    - NREL: Grid Friendly Renewables Report, 2019
    - EPRI: Ancillary Services in the United States, 2019
    - NREL et al.: Demonstration of Essential Reliability Services by a 200MW Solar Photovoltaic Power Plant Report, 2017
  - Industry Discussions
    - EPRI, NREL, renewable developers, renewable generator engineers, other ISOs (CAISO, SPP, ERCOT, MISO, PJM, Hawaii Electric)

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Report Highlights

Report Outline

- **The final study report, posted with today's meeting materials, discusses several key topics, including:**
  - Description of the selected grid services
  - Relevant reliability rules and their impact on the ability of renewable technologies to provide certain grid services
  - Technological capabilities of the selected renewable resource types to provide the selected grid services
  - Possible market rule changes in response to study findings

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Appendix: Study Findings (Presented on 05/19/21)

Reliability Rules

- **The NYISO is subject to reliability rules from several organizations (NERC, NPCC, NYSRC), some of which impact the ability of renewable generators to provide wholesale grid services**
  - A NPCC reliability rule that is pertinent to this project restricts the NYISO's ability to procure operating reserves from resources whose output may not be sustainable for one hour:
    - "A Balancing Authority's synchronized reserve, ten-minute reserve, and thirty-minute reserve, if activated, shall be sustainable for at least one hour from the time of activation."[1]
- **The NYISO has not identified any potentially relevant revisions to reliability rules that are in the process of being made**

[1]NPCC. *Regional Reliability Reference Directory #5*. R6. Page 7. *https://www.npcc.org/content/docs/public/program-areas/standards-and-criteria/regional-criteria/directories/directory-5-reserve-20200426.pdf*.

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Study Findings

- **Voltage Support Service**
  - Renewable Generators are currently eligible to provide Voltage Support Service
- **Black Start Service**
  - No demonstration of black start capability has been observed from intermittent renewable resources in the US
    - Further technological development is necessary to enable renewable resources to start and energize the grid without an outside power source
- **Operating Reserves**
  - NPCC rules implicitly preclude intermittent resources from providing operating reserves, since this service is not necessarily sustainable for one hour by intermittent resources[1]
    - Since run-of-river hydro typically has some ability to store water for later use to generate energy, this resource type can provide operating reserves

1 NPCC. *Regional Reliability Reference Directory #5*. R6. Page 7. https://www.npcc.org/content/docs/public/program-areas/standards-and-criteria/regional-criteria/directories/directory-5-reserve-20200426.pdf.

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Study Findings (cont'd)

- **Ramping Product**
  - Regions that have a "ramping" product (CAISO, SPP, MISO) aim to address increased uncertainty driven by renewable integration
  - The NYISO will consider the potential need for a ramping product as part of its continued review of the Grid in Transition to balance intermittent resources
- **Fast Frequency Response (FFR)**
  - In ERCOT, this product is intended to slow the rate of change of frequency following system disturbances
  - FFR may not always be desirable compared to regulation (oscillation effects)
  - The NYISO does not see a need for an FFR product due to the strength of the Eastern Interconnection in rectifying frequency disruptions

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Study Findings (cont'd)

- **Inertial Response**
  - Inverter-based resources can be programmed to provide "synthetic inertia" and a governor-like response similar to primary frequency response
  - No regions in the US have a market product for inertial response
  - Other RTOs have made efforts to monitor inertia (ERCOT, PJM, SPP)
  - The NYISO monitors inertia in its planning studies, which have not identified any inertia-related reliability needs to date[2]

[2]NYISO Reliability Planning reports can be found at https://www.nyiso.com/. Navigate to: Library > Reports > Planning Reports > Reliability Planning Process

Study Findings (cont'd)

- **The NYISO's research has found that the creation of separate regulation "up" and regulation "down" products is a potential opportunity to expand grid service eligibility for renewable generators**
  - Currently, regulation providers must be able to regulate both up and down
  - Wind and solar generators can provide regulation service through signals from the inverter Power Plant Controller (PPC), similar to curtailment response
    - Run-of-River hydro can provide regulation service by diverting water from turbines
  - Due to reliability concerns, regulation "down" is the only type of regulation service that the NYISO would be able to procure from renewable generators other than Run-of-River hydro
    - Regulation "up" may not be deliverable due to forecast/fuel uncertainty

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Additional Considerations for Creating Separate Regulation "Up" and "Down" Products

- Areas that have separate regulation "up" and regulation "down" (ERCOT, CAISO, and SPP) see few renewables participating due to economic incentives for renewables to provide energy
- Additional research is needed to determine if the system benefits of splitting the current regulation product would be worth the software effort and potential optimization impacts
  - Discussions with other RTOs highlighted optimization run time impacts due to separate regulation products
- The potential bifurcation of regulation service is also discussed in the 2019 Reliability and Market Considerations for a Grid in Transition Report[2]

[2] The *Reliability and Market Considerations for a Grid in Transition* report can be found at: https://www.nyiso.com/documents/20142/2224547/Reliability-and-Market-Considerations-for-a-Grid-in-Transition-20191220%20Final.pdf/61a69b2e-0ca3-f18c-cc39-88a793469d50

Technology-Specific Findings

- Offshore wind is expected to have similar grid service capabilities to onshore wind resources
- Aggregations of rooftop solar could install inverters with advanced controls capable of responding to NYISO dispatch, but this equipment may not be standard
  - The NYISO does not have any of this resource type participating in the wholesale markets today
- Run-of-River hydro is currently eligible to provide regulation service

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Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policymakers, stakeholders and investors in the power system

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