

Operational Capabilities to Address Sudden Changes in Intermittent Generation Output

Pramila Nirbhavane

Manager, Energy Security, New York ISO

NYSRC RRS/EWWG Joint Meeting

July 9, 2026, Rensselaer, NY

Agenda

- **Background**
- **Forecasting Capabilities to Improve Situational Awareness**
 - Demand Forecasting & Behind the Meter (BTM) Solar Forecasts
 - Wind and Front of the Meter (FTM) Solar Forecasts
- **Operational Capabilities to Address Generation Variability**
- **Market Projects To Address Forecast Uncertainty**
- **Planning Recommendations for PRR 153**

Background

Background

- **In December 2025, DNV presented a Contingency Framework and Recommendations for Renewable Generation Outages to the NYSRC**
 - Evaluate whether short-term renewable output drops warrant treatment as planning contingencies.
 - Analyze 15-minute weather-driven generation data across wind and solar resources.
 - Identify:
 - Frequency and magnitude of sudden outages
 - Geographic correlation (co-variability)
 - Seasonal and weather drivers
- **PRR 153**
 - Proposed rule to expand contingency planning criteria.
 - Would explicitly consider sudden, weather-driven loss of renewable generation (wind + solar) alongside traditional forced outages.
 - Would focus on capturing:
 - Rapid variability (minutes)
 - Correlated outages across multiple resources

<https://www.nysrc.org/wp-content/uploads/2025/12/PRR-153-Sudden-Outage-Analysis-and-Recommendations-FINAL.pdf>

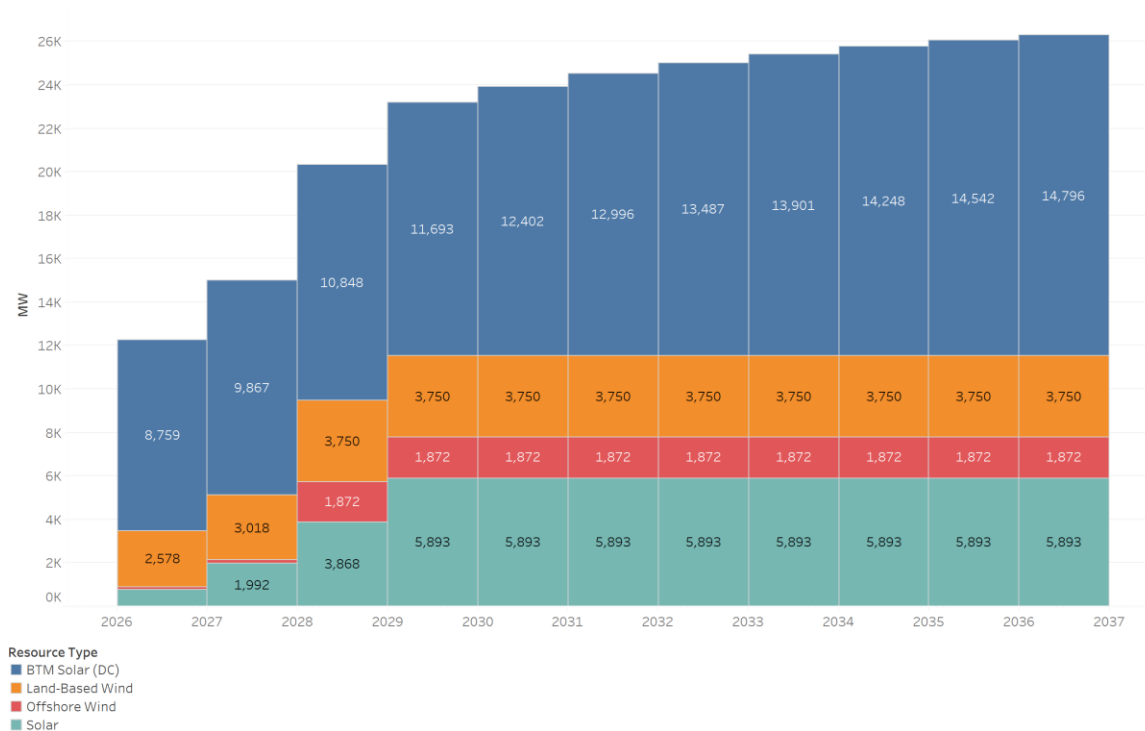
Background

- To analyze the data set, DNV defined "sudden weather-based outages" as either a $\geq 25\%$ or $\geq 90\%$ drop in output, relative to the installed capacity of each plant, that also occurs at adjacent plants within 15 minutes.
- NYISO has sufficient forecasting capability within the forecast horizon and adequate temporal forecast granularity to capture renewable energy output reductions, at the generator level, and operate the system accordingly during potential coordinated sudden loss of wind/solar generation.

NYISO Intermittent Installed Capacity

- Intermittent resources are a relatively small share of the total NYCA supply stack but are expected to grow over the next decade.
- Wind and FTM Solar account for 9% of NYCA summer capability.

Intermittent Resource Growth Trends (Summer Capability - 2026 Gold Book Table V-2a and I-9a (BTM))

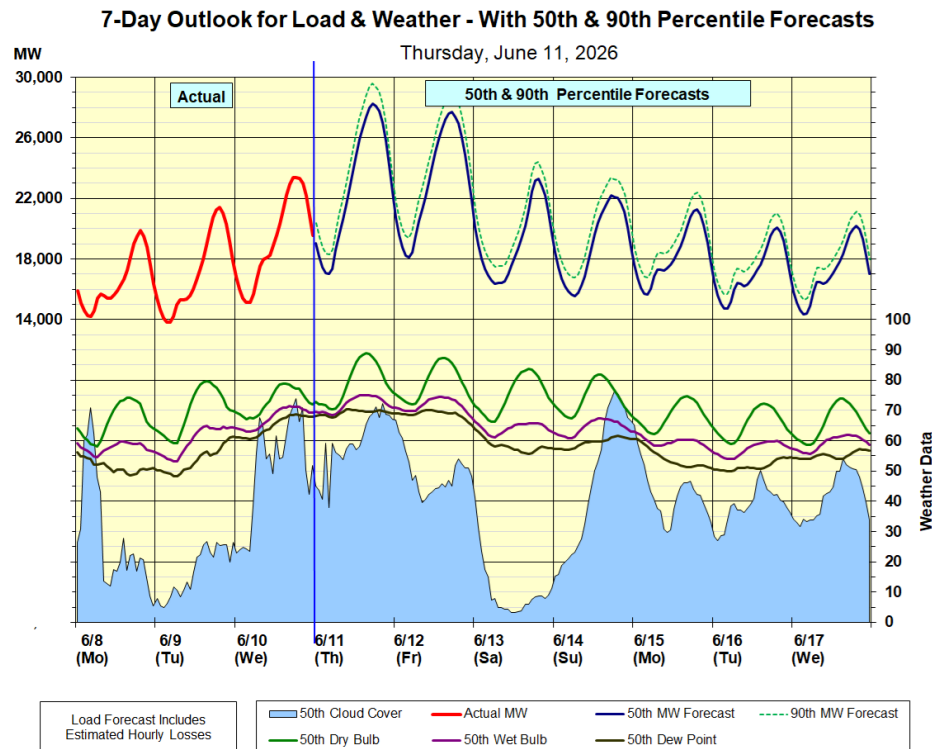


Forecasting Capabilities to Improve Situational Awareness

Demand Forecasting & Behind the Meter (BTM) Solar Forecasts

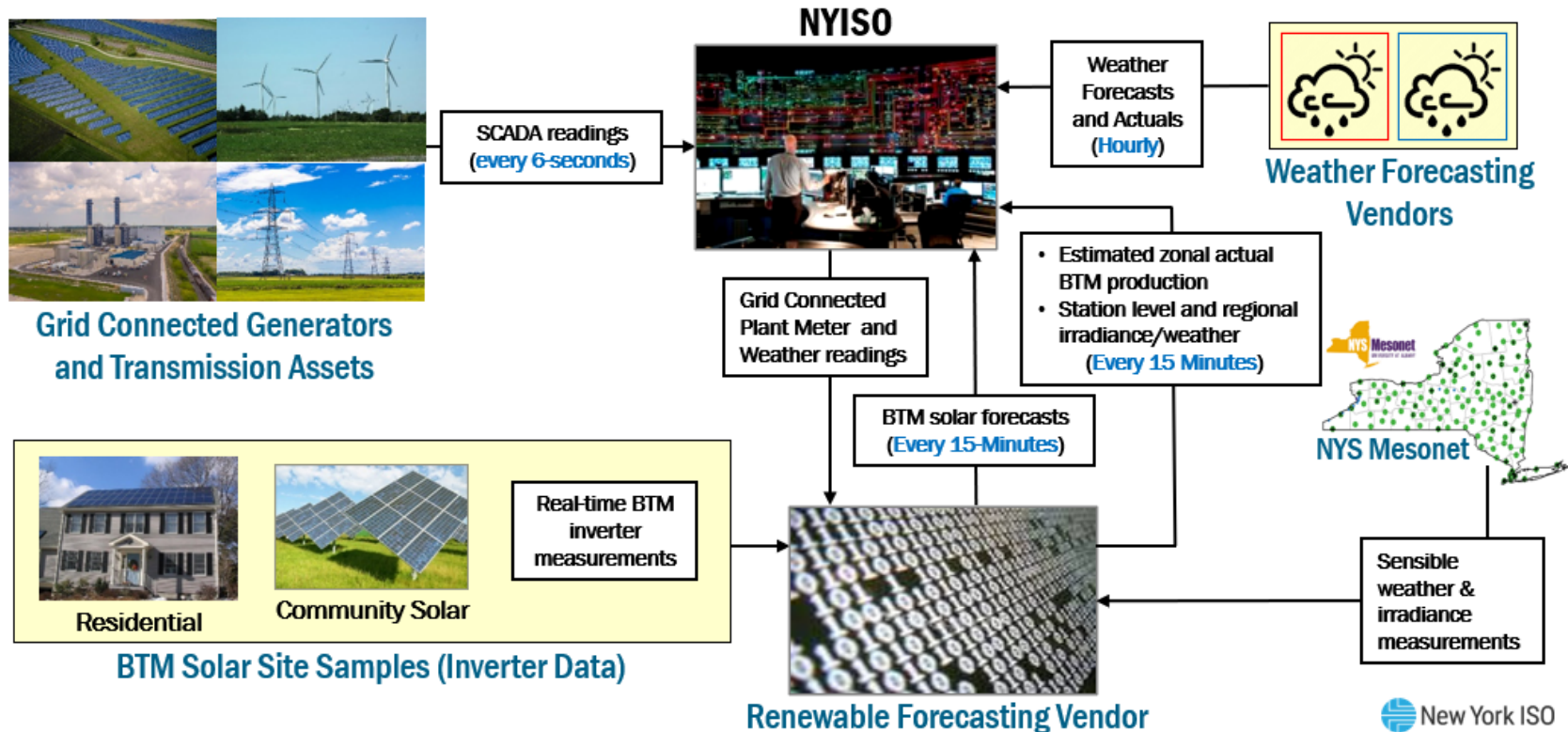
Demand Forecasting: Day Ahead

- Produces a 7-day load forecast to support grid operations, situational awareness, and reliability assessments under evolving weather conditions.
- Provides expected (50th percentile) and higher-load (90th percentile) outlooks informed by weather forecast scenarios.
- Monitors weather conditions and forecast uncertainty to assess potential impacts on anticipated system demand.
- Incorporates BTM solar forecasts to improve visibility into distributed generation impacts on net load.
- Forecast information is routinely updated and communicated to support situational awareness and operational preparedness.



Demand Forecasting: Hourly

- Real Time forecasts refresh every 5 minutes and cover the rest of the current day + the next three days



Wind and Front of the Meter (FTM) Solar Forecasts

Wind and Front of the Meter (FTM) Solar Forecasting

- **NYISO's renewable energy forecast vendor provides critical services that support Grid Operations in managing weather-related outage risk including.**
 - A two-day ahead power forecast for the wind and FTM solar fleet twice daily at 04:00 and 16:00.
 - Specialized forecasting products to enhance situational awareness during extreme weather conditions.
 - Probabilistic wind and solar forecasts expressed as Probability of Exceedance (PoE) levels at the 10%, 25%, 50%, 75%, and 90% intervals, extending up to 72 hours ahead.
 - Forward-looking risk visualizations (animations) with a 90-hour horizon for key extreme weather variables, including fog, variable cloud cover, snow accumulation on panels, sub-freezing temperatures, icing, high wind cutout conditions, and elevated temperature impacts.
 - These visualizations incorporate the geographic locations of generation resources and overlay the corresponding weather-related risk indicators.
 - Forecast Errors (Post hoc)
 - NYISO vendors sets bias and MAE thresholds used to trigger further analysis of forecast errors.
 - Thresholds are a system wide aggregate and vary by season due to the seasonal nature of wind forecast errors.
 - Important Point: Forecasts are developed at the individual level and then aggregated.

Operational Capabilities to Address Generation Variability

Day Ahead Market

- **Intermittent resource forecasts are incorporated into the day ahead market allowing for a reliable commitment of resources to meet system needs.**
 - Allows longer lead time start units to receive a forward schedule to meet load, statewide, and local reserve requirements.
 - Incorporates transmission security to account for any constraints that may limit deliverability.

Real Time Situational Awareness Capabilities

- Key meteorological parameters for wind and FTM solar output from each site are telemetered to the NYISO.
- Situational awareness displays have been created with appropriate alarming, including:
 - Alarming on high and low temperature and high speed cut out parameters being exceeded.

NYISO Operational Actions

- Commit additional out-of-market generation needed to meet forecasted system conditions.
- Utilize market tools to automatically curtail intermittent resources when necessary to maintain reliability and manage operational limitations.
- Manually curtail intermittent resources to maintain reliability and manage operational limitations not captured by the market tools.

Market Projects To Address Forecast Uncertainty

Balancing Intermittency

- The Balancing Intermittency project focuses on addressing forecast uncertainty in renewables and load by procuring operating reserves in both the Day Ahead Markets (DAM) and Real Time markets (RTM).
- The Uncertainty Reserve Requirements are calculated before the Day Ahead Market run using:
 - Net Load (defined as Load net of the impact of resources, such as BTM Solar)
 - Land-Based Wind
 - Offshore Wind
 - FTM Solar
- The Uncertainty Reserve Requirements are additive with existing contingency reserve requirements.
- This project is scheduled to be deployed in August 2026.

Renewable Energy Forecast Integration and Reporting Enhancements (REFIRE)

- The NYISO currently supports two distinct systems to meet its front-of-the-meter (grid connected) and behind-the-meter (distributed) renewable energy forecasting requirements.
- The current data systems separately provide data processing, real-time alerting, and reporting infrastructure for the NYISO that have developed over the last 20 years in response to the growing number of wind and solar installations across the NYCA.
- The demand for robust renewable forecast performance information and capacity/attribute tracking will continue to grow with the increasing number of renewable projects in the interconnection queues and potential new forecasting data streams (e.g., probabilistic wind and solar forecasts to support dynamic reserve market products).
- The REFIRE project objective is to build out a framework that will allow NYISO to integrate new forecasting data as needed in the future with a software design milestone.

Planning Recommendations for PRR 153

Planning Recommendations for PRR 153

■ DNV Industry Review Findings:

- Industry review performed by DNV, inclusive of U.S. entities and non-U.S. entities, showed that no updates were required to either planning guidelines or contingency planning requirements for design or extreme contingencies.
- As identified in the recommendations from DNV, the NYISO, along with other regions, have identified efforts to increase data granularity and modeling specificity to support enhanced generation forecasting and resource adequacy planning.

■ Design contingencies

- As there are sufficient operational insights into the expected behavior of renewable resources (as discussed in the slides above), the NYISO does not recommend developing design criteria contingencies for the sudden loss of generating resources on a geographic basis due to changes in weather.
- The NYISO will continue to evaluate, as required, based on existing reliability rules the outages of generation due to electrical-based faults.

■ Extreme Contingencies

- As discussed at an NYSRC Executive Committee Meeting earlier this year, the NYISO suggested that the assessment results conducted by DNV could result in the development of an extreme contingency.
- When considering the information with DNV, along with the operational insights, the NYISO also does not recommend the development of extreme contingencies.

Questions