

# Integration of Renewables Forecasts into the EMS and MMS

---

Tolu Dina

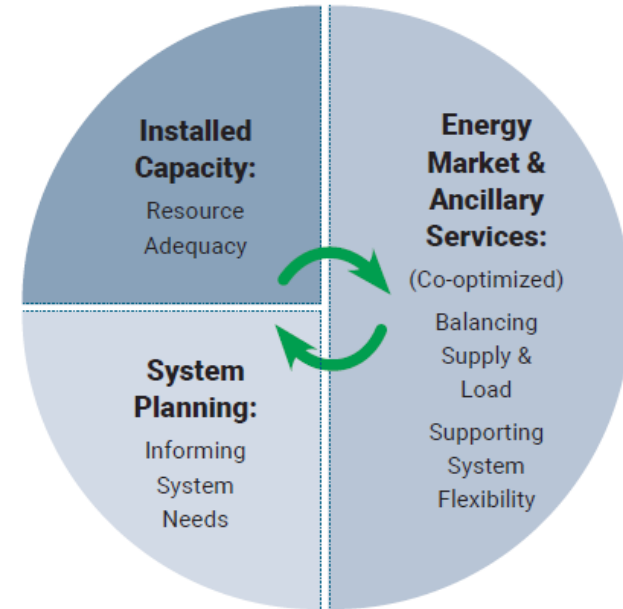
MANAGER, OPERATIONS PERFORMANCE & ANALYSIS

**ESIG Spring 2022 Forecasting Workshop**

June 08, 2022, Denver, CO

# Roles of the NYISO

- **Reliable operation of the bulk electricity grid**
  - Managing the flow of power on 11,000 circuit-miles of transmission lines from hundreds of generating units
- **Administration of open and competitive wholesale electricity markets**
  - Bringing together buyers and sellers of energy and related products and services
- **Planning for New York's energy future**
  - Assessing needs over a 10-year horizon and evaluating projects proposed to meet those needs
- **Advancing the technological infrastructure of the electric system**
  - Developing and deploying information technology and tools to make the grid smarter



# NYISO by the numbers



**20.2M**

New Yorkers served

## NYISO Footprint



**435**

Market Participants



**11,219**

circuit miles  
of transmission  
managed and  
monitored



**150,198**

total electric energy  
usage, in GWh, for 2020

## Supply & Demand

**33,956**

record peak  
demand, in MW,  
July 2013



**700+**

power  
generating  
units

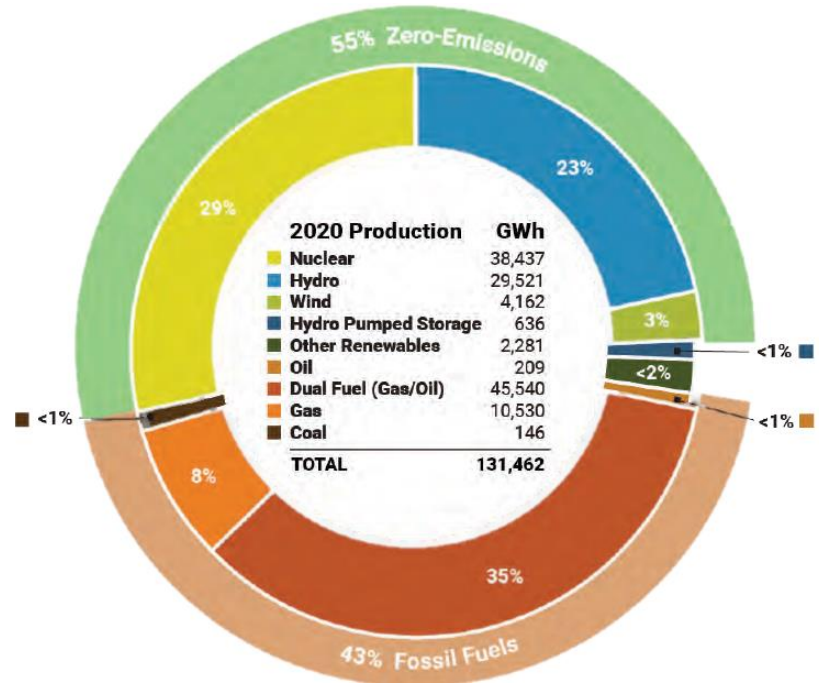
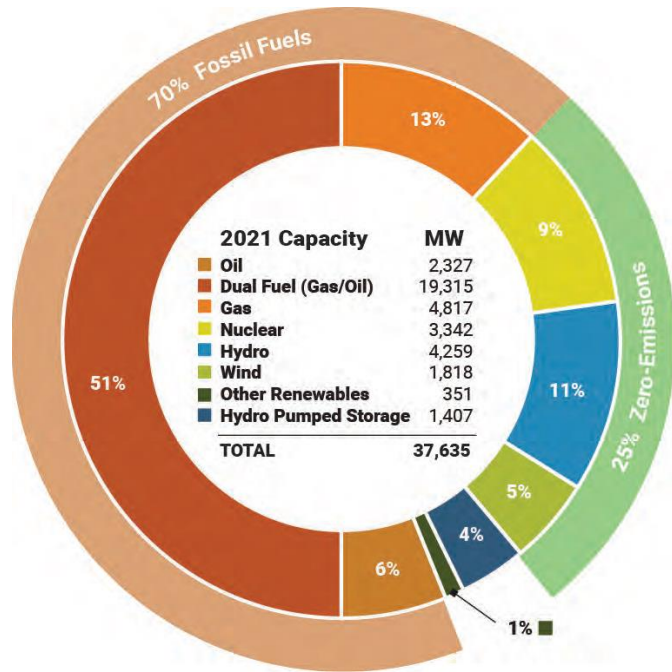


**27%**

of electric energy  
from renewables  
in 2020



# 2021 Fuel Mix & 2020 Energy Production



# Energy Market Overview



Full two-settlement market for energy, reserves, and regulation



Bid based Security-Constrained Economic Dispatch (SCED) and Commitment (SCUC)



Simultaneous co-optimization of energy, interchange, operating reserves and regulation to minimize total production cost



Shortage pricing for operating reserves and regulation



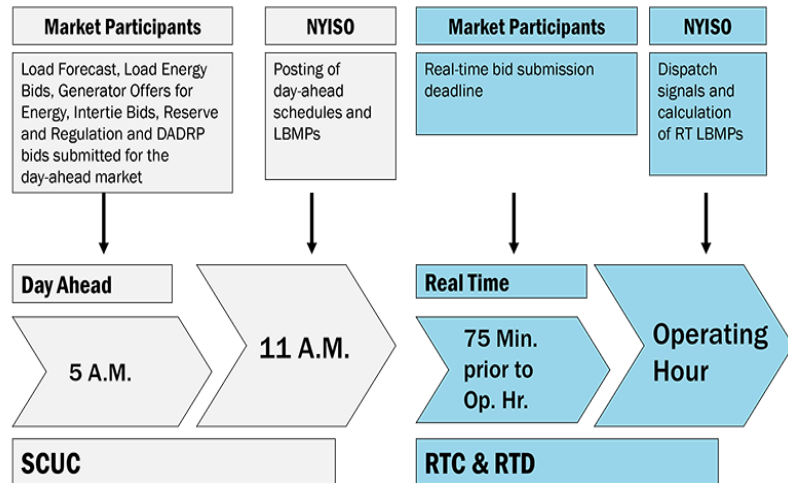
Demand side resource participation

**Who**

**What**

**When**

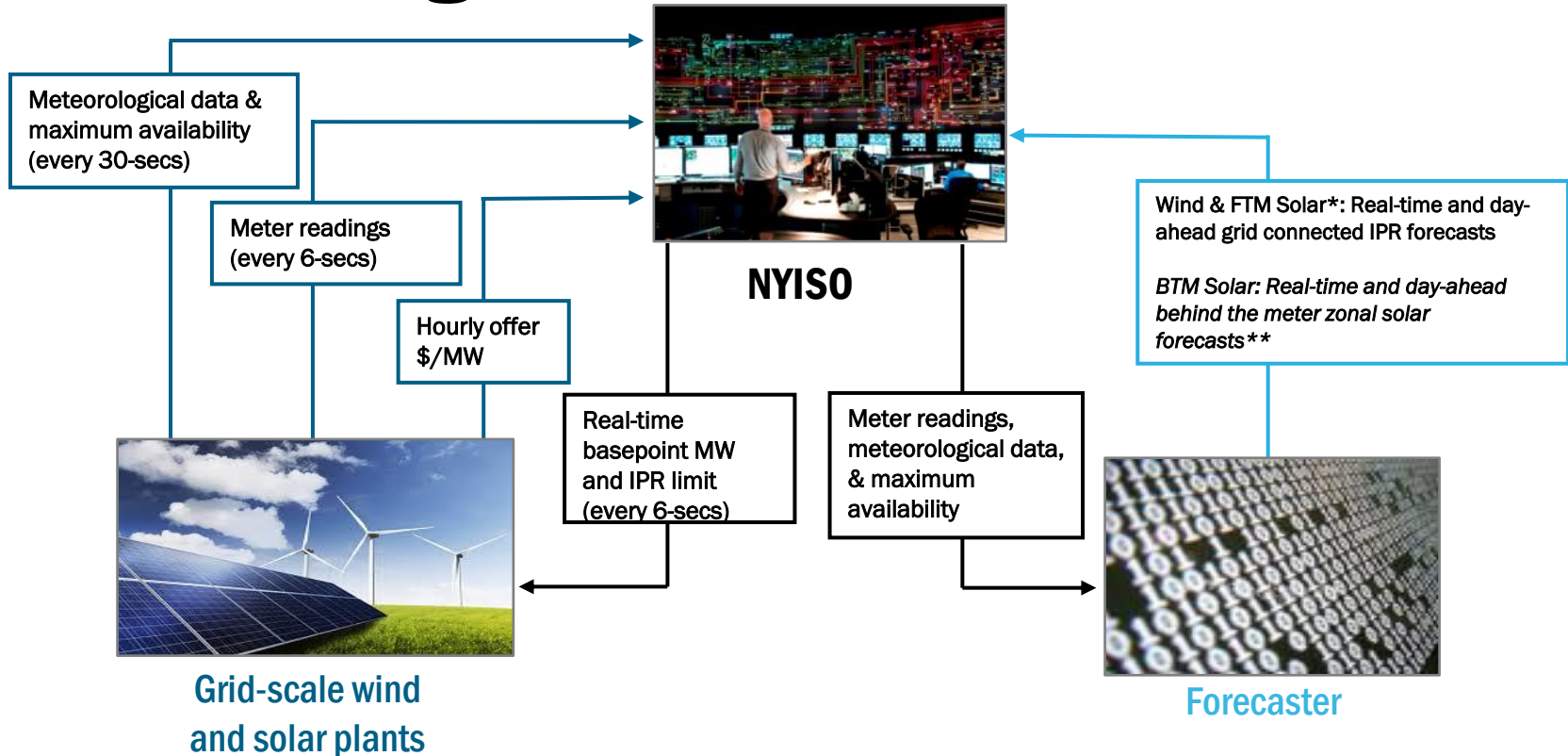
**How**



# Energy Market Overview (Cont.)

- **Day-Ahead Market**
  - Binding forward contracts issued to Suppliers and Load
  - Hourly Locational Based Marginal Prices (LBMP)
  - Bilateral Transaction scheduling
  - Virtual resource (zonal) scheduling
- **Real-Time Commitment (RTC)**
  - Runs every 15 minutes - optimizes over next 2 ½ hour period
  - Issues binding commitments for units to start
    - Provides for commitment of “quick start” resources including 10-minute and 30-minute gas turbines
  - Issues binding schedules for transactions
- **Real-Time Dispatch (RTD)**
  - Runs approximately every 5 minutes, optimizing over next 60 minute period
  - Produces 5-minute Locational Based Marginal Prices (LBMP)
  - Multi-period security constrained dispatch
  - Issues binding dispatch instructions for units to operate

# Forecasting Details



\* FTM Solar available for economic dispatch started in 2021

\*\* Behind the meter zonal solar forecasts are integrated into the NYISO's load forecasting tools

# Market Management System Integration

## ■ Day-Ahead Market

- Intermittent Power Resource (IPR) power forecasts are received just prior to 5AM initialization of Day-Ahead Market execution, covering the next market day
- IPR power forecasts are input into the Day-Ahead Market passes that solve for forecasted load, regardless of whether the IPR generator provided an offer
  - **Bid passes:** Only IPR generators that provide financial offers will be considered. Binding financial schedules may be established for IPR generators out of these passes.
  - **Forecast (reliability) passes:** IPR generator offers (if any) will be dropped and IPR generation forecasts are used. No binding financial schedules for IPR generators are established out of these passes.

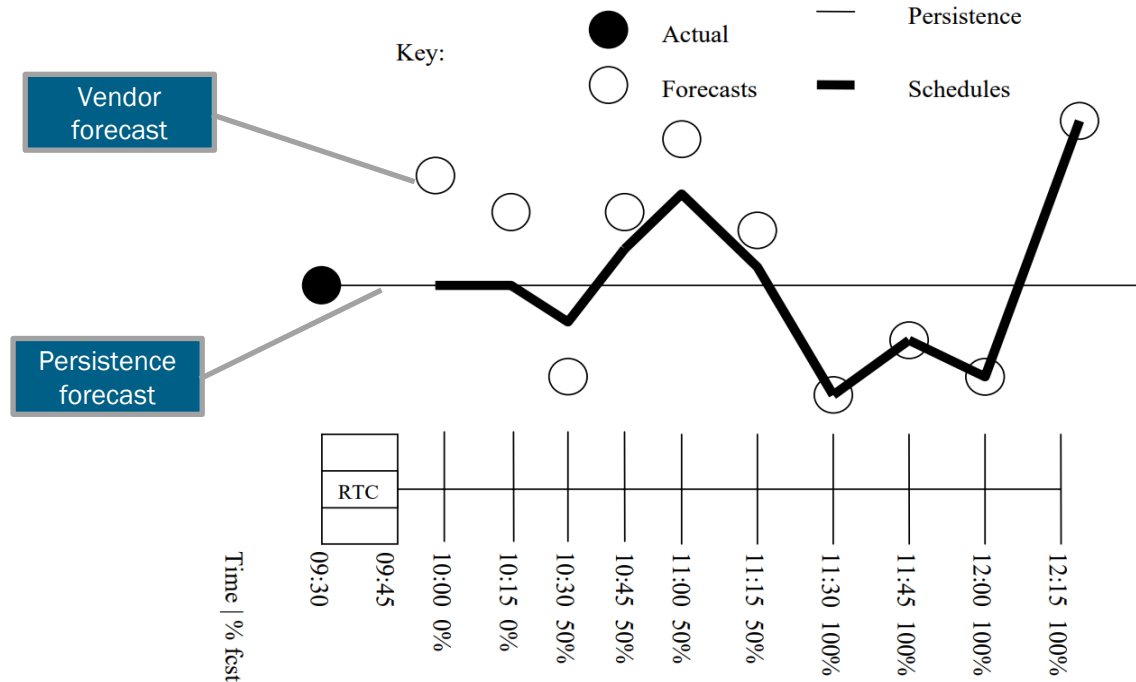


# Market Management System Integration (Cont.)

## ■ Real-Time Market

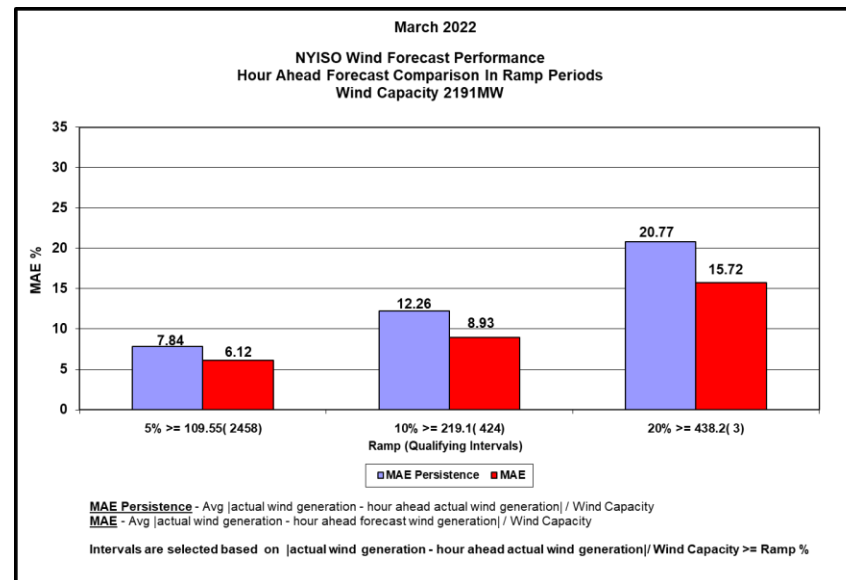
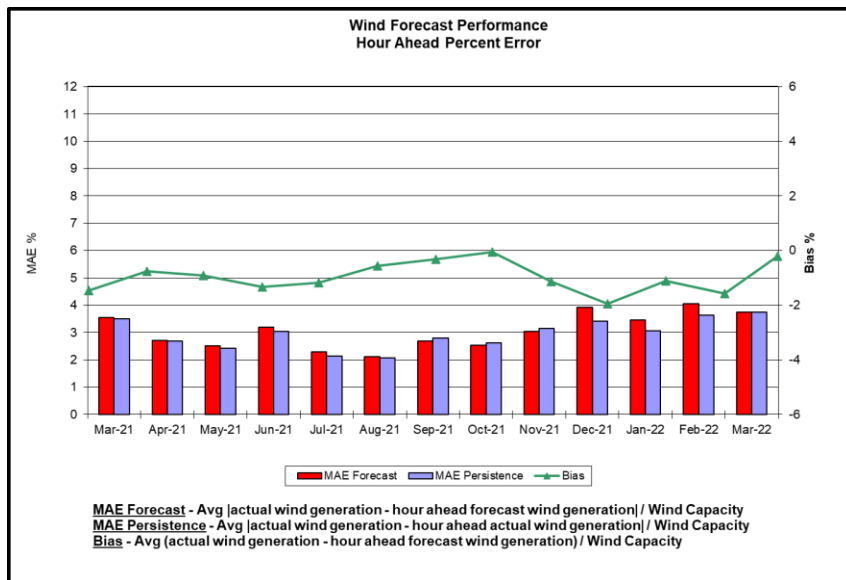
- IPR power forecasts are received every 15-minutes covering the next several hours
- IPR generators are expected to offer as flexible resources into the Real-Time Market, with an economic upper limit reflecting their full nameplate capability
- The economic upper limit for each IPR generator's offer is then adjusted by the NYISO's forecast for that generator for each time step
  - The NYISO's forecasted output is persistence-based for the most near-term time-steps, and gradually blends higher percentages of our external vendor's forecast with persistence over the forward-looking market horizon (see next slide for example).
- The Real-Time Market dispatches IPR generators between zero MW and their economic upper limit

# Example: blending persistence IPR forecast with vendor IPR forecast

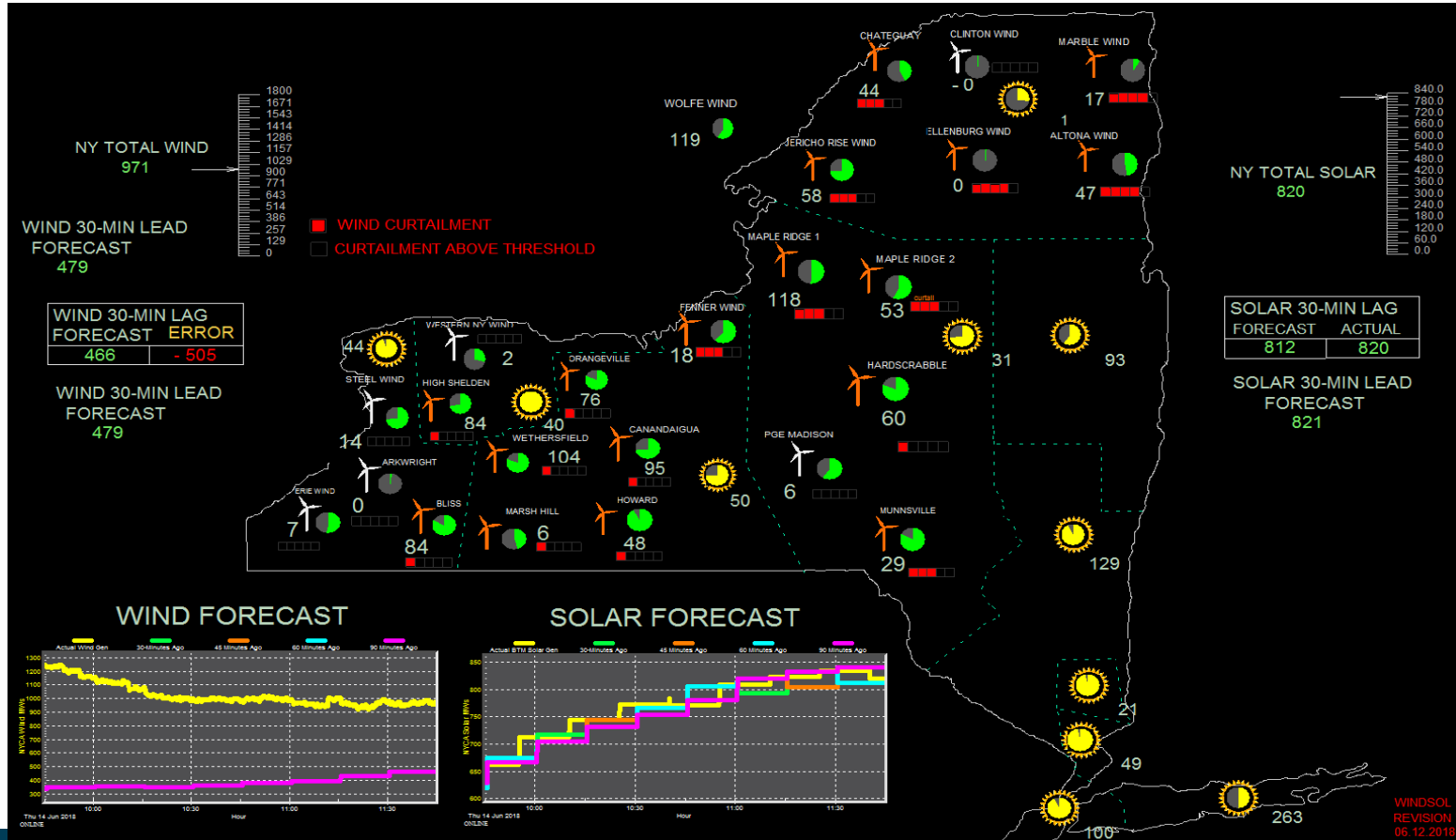


Note: Schedules above assume IPR generator is fully economic

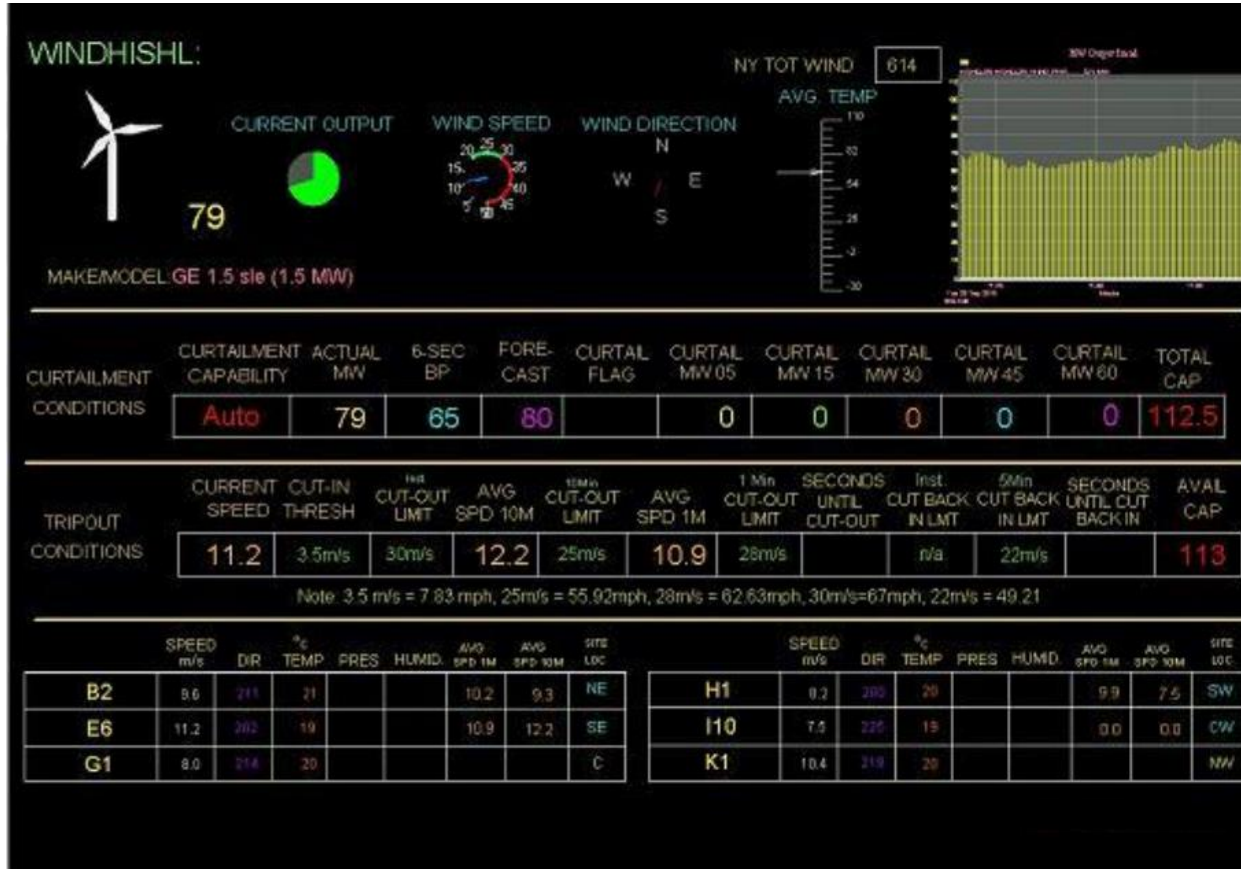
# Wind IPR Forecast Performance



# EMS Integration: Monitoring



# EMS Integration: Monitoring (Cont.)



Individual Wind Plant data, including cut-in and cut-out speeds, current meteorological conditions, and production levels.

# EMS Integration: Monitoring (Cont.)

**SOLARMENU**

- ZONE A WEST
- ZONE B GENESEE
- ZONE C CENTRAL
- ZONE D NORTH
- ZONE E MOHAWK VAL
- ZONE F CAPITAL
- ZONE G HUDSON VAL
- ZONE H MILLWOOD
- ZONE I DUNWOODIE
- ZONE J NYC
- ZONE K LONG ISLAND

TIME STALE: 0.0m

STALE THRESHOLD: 0.0m

STALE STATUS:

NY TOTAL SOLAR: **824**

CURRENT OUTPUT

---

CURRENT FORECAST 11:30

BTM + FTM: **823.9**

BTM SOLAR MW: **793.7**

GRID CONNECT: **30.2**

NET LOAD: **0**

SOLAR ADJUSTED (15MIN + BTM): **19159**

AVG IRRADIANCE: **832**

TOTAL SOLAR CAPACITY: **927**

---

FORECASTED CONDITIONS

	11:45	12:00	12:15	12:30	12:45	13:00	13:15	13:30	13:45	14:00	14:15
BTM SOLAR FORECAST	804.8	812.5	841.4	843.3	843.7	842.0	843.5	836.4	826.8	814.7	805.7
GRID CONNECT	30.4	30.5	31.4	31.4	31.4	31.5	31.6	31.5	30.8	31.0	30.8
NET LOAD	19665	19748	19766	19829	19906	20005	20082	20165	20224	20293	20341
SOLAR ADJUSTED	20470	20561	20608	20673	20749	20847	20926	21002	21051	21107	21147
IRRADIANCE	851	871	888	896	900	898	892	881	866	846	823

Behind-the-meter zonal solar output and forecasts

Grid-scale solar output and forecasts

# Ongoing Developments

- **FERC Order 2222 - Distributed Energy Resource (DER) Project**
  - Aggregations of IPRs will be forecasted and scheduled similarly to traditional IPR units
- **Dynamic Operating Reserves Project**
  - Considering expanding the methodology definition of source contingency to ensure it includes correlated source contingencies, such as the simultaneous reduction of offshore wind, as the largest source contingency
  - Scheduling of wind resources is currently based on a deterministic forecast tailored to minimize the mean absolute error
  - For example, wind resources in close geographic proximity are susceptible to a common weather pattern, which poses a risk of simultaneous loss (or reduction of energy output) of many resources (which may not share a single interconnection point)
  - The use of a higher POE (higher confidence) forecast would provide greater certainty of expected output and the difference between this, and the scheduled output (based on the deterministic forecast) could be integrated into a dynamic reserve calculation as the at-risk energy output from wind to be secured

# Our Mission & Vision



## Mission

Ensure power system reliability and competitive markets for New York in a clean energy future



## Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation



# Questions?