NYPA Experience with Dynamic Line Rating Technology

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New York Power Authority History and Charter

- Established by the NY State Legislature in 1931.
- Largest state public electric utility in the United States.
- Wholesale power supplier throughout New York State and neighboring states as required by law.
- Provides, with generation and power purchases, about 25% of New York State's electricity. No Distribution System
- 2018 Net Generation: 30.1 million MWh; 70% hydro; 30% gas/oil
- Transmission lines: 1,400+ circuit miles; 115kV, 230kV, 345kV & 765kV
- New York State Canals is a subsidiary
- Non-profit energy corporation, does not use tax revenues or state credits, finances projects through bond sales and cash from operations
- Model for TVA

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New York Power Authority Transmission

- 765 kV Transmission **~155 circuit miles**
- 345 kV Transmission, **~928 circuit miles**
- 230 kV Transmission, **~338 circuit miles**
- 115 kV Transmission, **~35 circuit miles**
- Total Transmission, **~1,456 circuit miles**
- Bulk Transmission Substations
  21 substations
- Portion of Bulk NYS Grid
  ~13% (>115kV)
  ~34% (>230kV)

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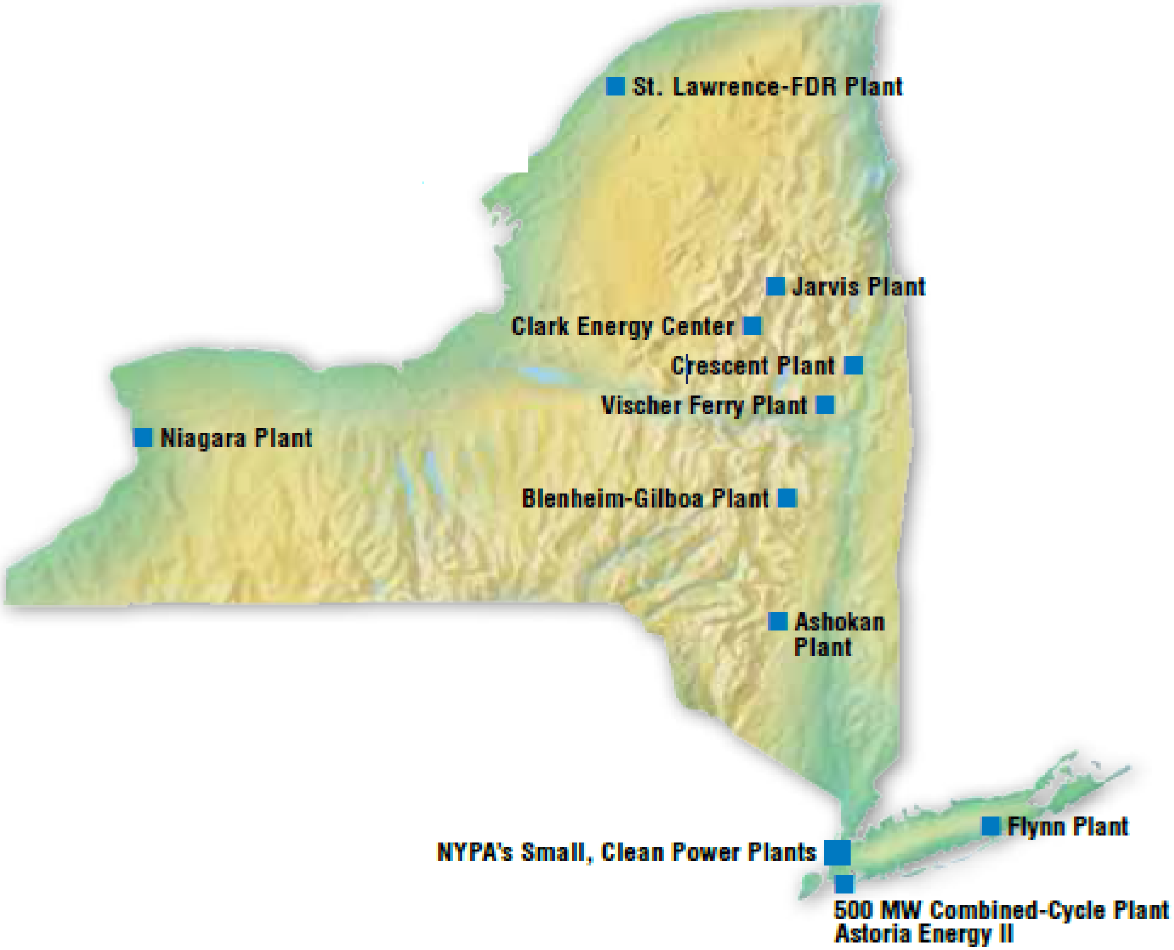
New York Power Authority Generation



- Niagara Power Project **~2,675 MW**
- St. Lawrence Power Project, **~800 MW**
- Blenheim-Gilboa, **~1,160 MW**
- Flynn Power Plant, **~167 MW**
- Astoria CC Plant, **~500 MW**
- Small Hydro Plants, **~83 MW**
- Small Clean Power Plants, **~461 MW**

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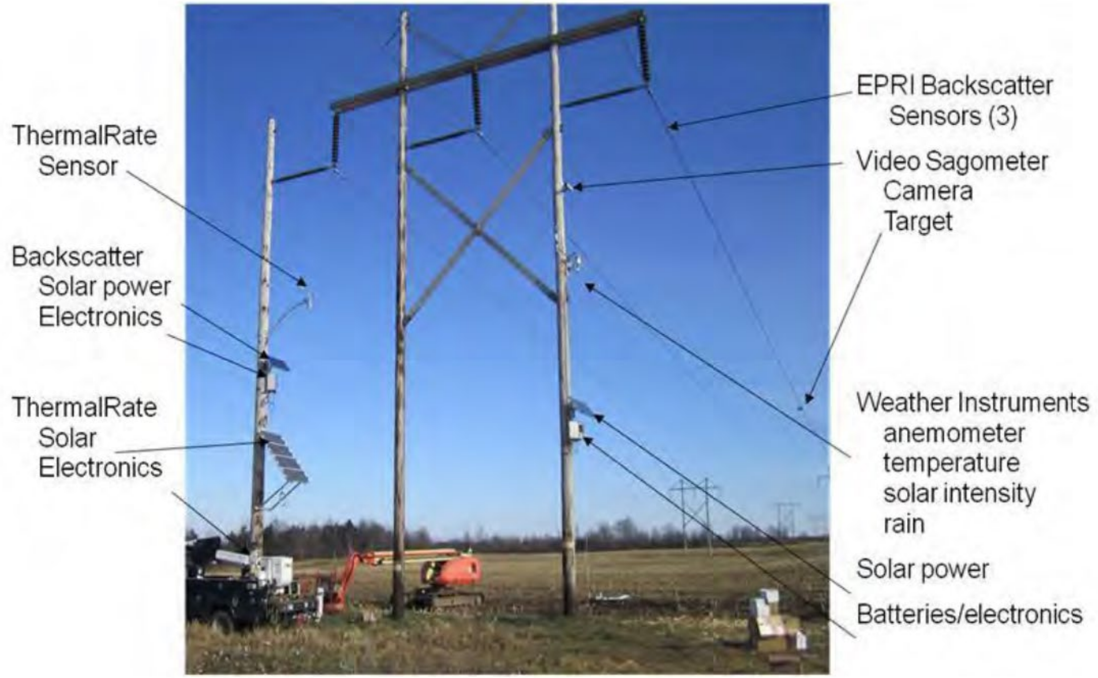
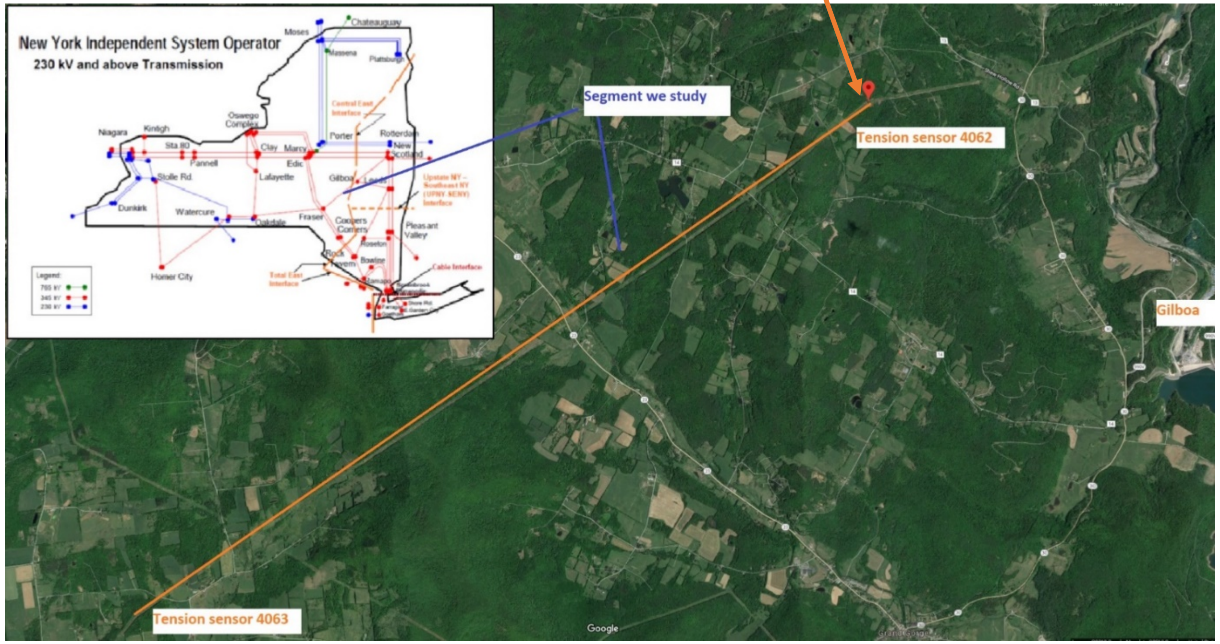
What we have done for OH Line DLRs: different technologies tried

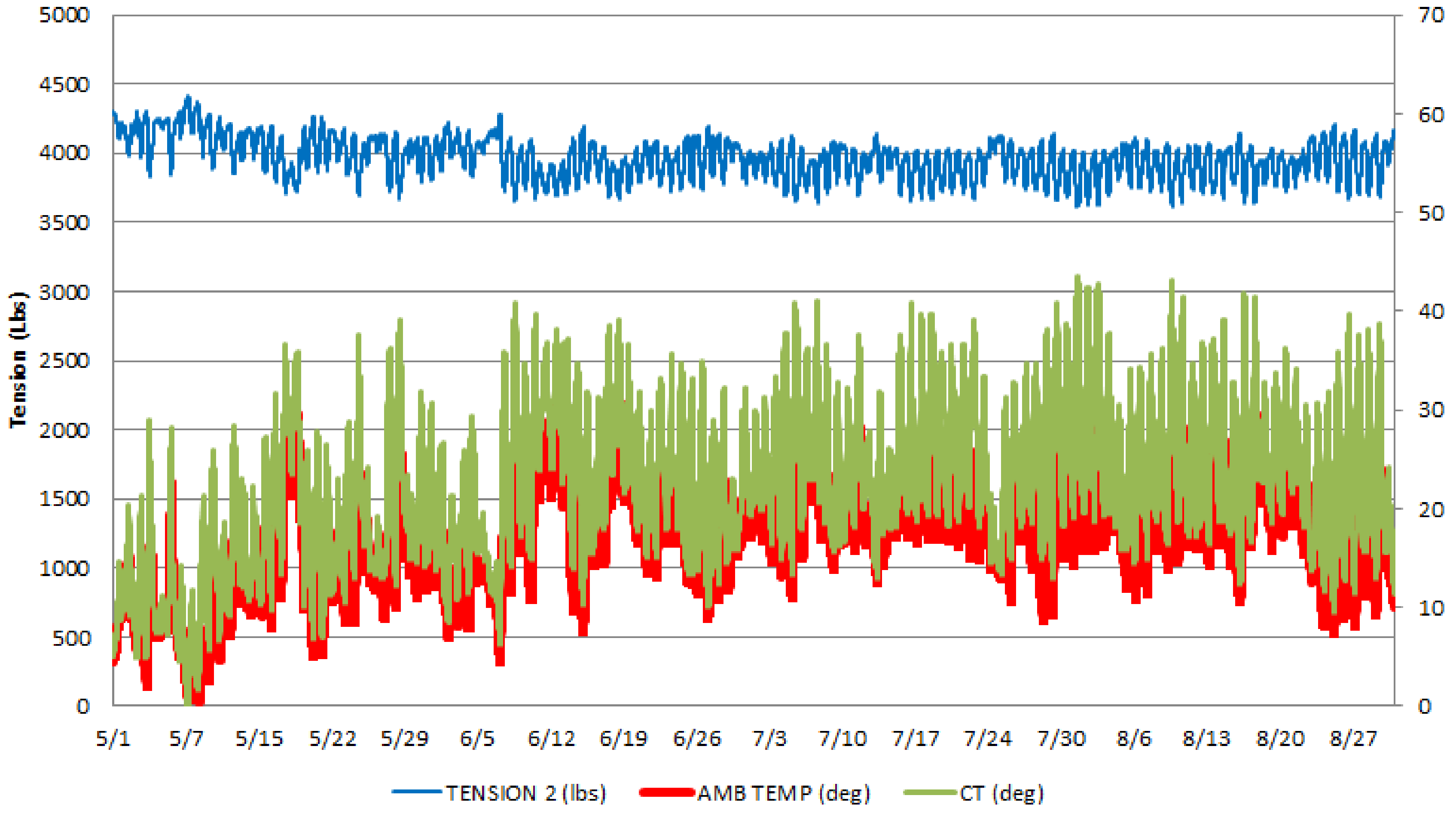
Technologies we have tried:

- Video Sagometer;
- Backscatter Sensor;
- Weather Station;
- ThermalRate;
- CAT





Some field data: measured tension, ambient temperature and derived conductor temperature data. Conductor temperature is derived using the conductor temperature/tension equation based on the initial field calibration.



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What we are doing for OH DLRs: A Forecast DLR Demo Project

- Project goals:
  - Demonstration and evaluation of an AI Big data based forecast Dynamic Line Rating (DLR) technology and assess its real-time, ambient adjusted and full forecast ratings
- Project tasks:
  - Install weather sensors at NYPA lines: the 70.81 miles 230 kV NYPA Moses-Wills-Plattsburgh transmission lines
  - Install and evaluate a DLR system
  - Training and technology transfer
- Project durations: 3 years (2019-2022)
- Project budget:
  - $1.02M – Project classified as R&D project
  - NYSERDA will co-fund 50% of the project (up to $0.51M)

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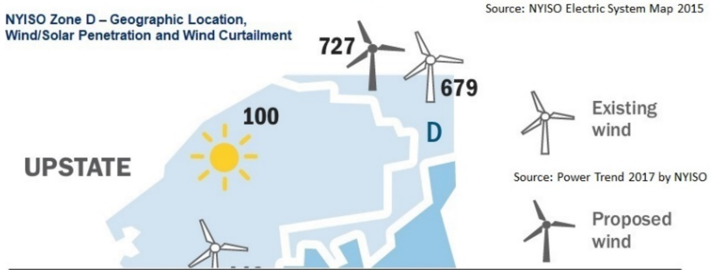
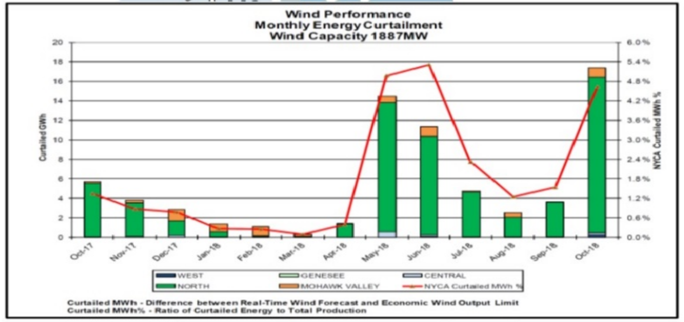
What we are doing for OH Line DLR: The Demo site and forecast DLR technology

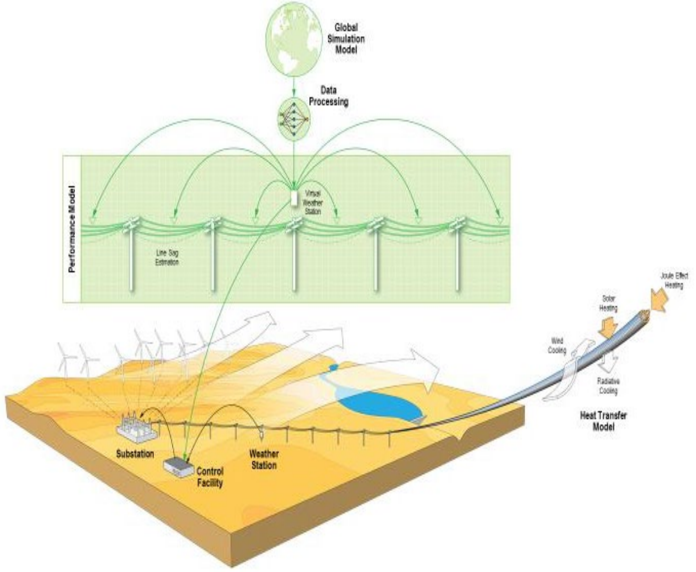
- The site starts from NYPA Moses-St. Lawrence Power Plant, passes by NYPA Willis Substation and ends at NYPA Plattsburgh Substation;
- Statistically correlate the results of weather forecast models and real-time measurements to improve the weather forecast model;
- Increase the weather forecast spatial resolution using higher resolution models with a price of large amounts of computing time;
- Apply the computation Fluid Dynamics models to refine the forecast results- First 3-dimensional CFD flow models are created from Geographic Information System (GIS) data bases;
- Span-by-span ratings.

Source: NYISO Electric System Map 2015





Source: Operations Performance Metrics Monthly Report by NYISO, Oct 2018



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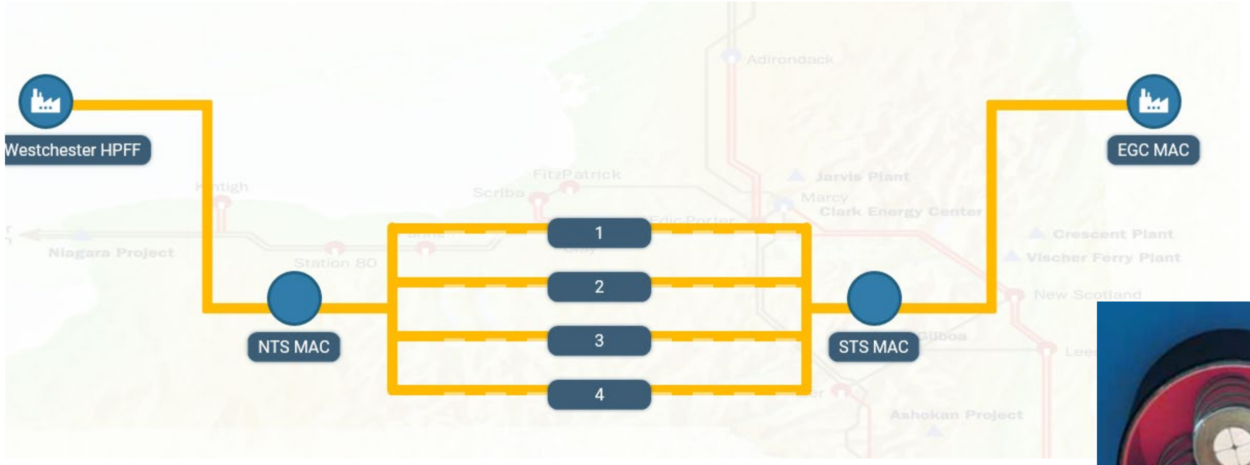
What we are doing for UG cable DLRs: Assessing the technology

- Unlike real-time Overhead (OH) DLRs which can change significantly in minutes, UG real-time DLRs vary slowly normally in hours making them more usable.
- A careful and complete data verification process (6 months-12 months) is necessary before implementing UG DLRs;



	Feeder Ratings			
	Circ OFF Dynamic	Circ OFF Book	Circ ON Dynamic	Circ ON Book
Normal	954	942	1132	1095
3 hr	1575	1390	1759	1514
20 min	2532	2229	3027	2297

Display Unit

◉ Amp

○ MW

Projected Ratings with

SBK Reactor 1	SBK Reactor 2	STS Reactor
IN	IN	IN

Lessons Learned and Challenges Faced

1. Real-time OH Line DLRs can vary a lot in a short period of time making them difficult to use;
2. DLR equipment reliability needs improvement;
3. Ambient adjusted ratings get more accepted but implementing the technology needs involvement of different parties and utility companies take the risk for implementing the technology;
4. Due to its nature, UG cable real-time DLRs change much slower than real-time OH line DLRs, making them easier to use. But assessment and verification need to be conducted carefully before utilizing the technology.