Power Trends 2019

Reliability and a Greener Grid

New York Independent System Operator

Market Metrics, State of the Grid, Public Policy & the Grid, Making Policy Work, and Grid in Transition
The Mission of the New York Independent System Operator, in collaboration with its 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

www.nyiso.com
Key Challenges:

• **Aggressive public policy** goals focused on shifting patterns of demand for electricity serve to influence how investors, policymakers, and consumers view electricity production, transmission, and consumption.

• Complicating achievement of these goals is the fact that these changes must be pursued in the context of a bulk power system that operates to **the strictest reliability rules in the nation**.

• Underlying all NYISO processes has been the belief that open, competitive markets for wholesale electricity result in the most efficient allocation of resources and **serve New Yorkers best by minimizing the costs and investment risk**.
Key Trends:

- **New technologies**, such as storage and solar, are beginning to enter the wholesale markets. Distributed Energy Resources (DERs) are changing how energy is produced and consumed. New wind projects, including offshore projects, are being proposed.

- **Public policies** aimed at reducing emissions and expanding the use of renewable power resources.

- **Infrastructure** expansion and market enhancement are necessary to support achievement of public policy goals efficiently and reliably.

- **Economic influences** led by low natural gas prices and changing consumption forecasts.

- **Bolstering grid resilience** through effective operations, market design features, and planning.
Key Opportunities:

• **Carbon Pricing:** The NYISO is developing a proposal to incorporate the societal costs associated with CO$_2$ emissions into its energy markets to better reflect the state’s policy of reducing emissions. The proposal creates stronger incentives for efficiency improvements to existing resources, developing zero-emitting resources like wind and solar, and helping NYS more efficiently attain its clean energy goals.

• **Markets Enhancements:** The NYISO plans further enhancements to its markets to establish stronger price signals for resources, such as energy storage and DERs, and is evaluating its planning processes to identify opportunities to more flexibly respond to the increased volume of proposals from smaller resources seeking to interconnect.
State of the Grid
Demand Trends

2000-2018
Actual and Weather Normalized Energy Usage

• The amount of electricity supplied by the grid has generally declined since peaking in 2007
• Annual Electricity usage in New York increased by 3.03% in 2018 from 2017.
• Upstate saw the largest percentage increase (4.29%)
Demand Trends

2018-2029 Forecast

- Grid-supplied energy usage forecast to decrease by 4.88% in 2029 as compared to 2018

- **Energy efficiency and DERs** forecast to reduce grid-supplied electricity by 22,879 GWh in 2029
  - Equivalent annual consumption of ~3.2 million NY households

Electric Energy Usage Trends and Forecast in New York State: 2018-2029

![Graph showing energy usage trends](image-url)
Peak Trends

2018-2029 Forecast

- Peak demand decreases 2.3% in 2029 as compared to 2018
- Energy efficiency and DERs forecast to reduce peak demand by 4,859 MW in 2029

Electric Peak Demand Trends in New York State – Actual & Forecast: 2018-2029

- Forecast without Effects of Energy Efficiency and BTM generation
- Baseline Forecast

31,861 MW
Actual 2018 Peak
Electric Vehicle Energy & Peak Impacts Forecast

2019-2039

- EV adoption rates are expected to increase annual energy use on the grid by 4.2 million MWh by 2030
- Summer 2030 demand impact 410 MW
- Winter 2030 demand impact 650 MW
Energy Storage Capacity Forecast

2019-2039

• The NYISO expects grid-connected storage resources to participate in wholesale markets as competitive suppliers.

• The NYISO also projects growth in behind-the-meter storage deployments that will serve to reduce peak demand.
Fuel Mix – Generating Capacity

New York Statewide Generating Capacity by Fuel Source: 2019

<table>
<thead>
<tr>
<th>Fuel Source</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>2,407</td>
</tr>
<tr>
<td>Dual Fuel (Gas/Oil)</td>
<td>19,112</td>
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<tr>
<td>Gas</td>
<td>3,777</td>
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<tr>
<td>Coal</td>
<td>837</td>
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<tr>
<td>Nuclear</td>
<td>5,400</td>
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<tr>
<td>Hydro</td>
<td>4,253</td>
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<tr>
<td>Hydro Pumped Storage</td>
<td>1,411</td>
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<tr>
<td>Wind</td>
<td>1,739</td>
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<tr>
<td>Other Renewables</td>
<td>358</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>39,295</strong></td>
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Upstate (zones A-E) Generating Capacity by Fuel Source: 2019

<table>
<thead>
<tr>
<th>Fuel Source</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>802</td>
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<tr>
<td>Dual Fuel (Gas/Oil)</td>
<td>1,706</td>
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<tr>
<td>Gas</td>
<td>1,587</td>
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<tr>
<td>Coal</td>
<td>837</td>
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<tr>
<td>Nuclear</td>
<td>3,346</td>
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<tr>
<td>Hydro</td>
<td>3,905</td>
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<tr>
<td>Hydro Pumped Storage</td>
<td>230</td>
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<tr>
<td>Wind</td>
<td>1,739</td>
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<tr>
<td>Other Renewables</td>
<td>127</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>14,288</strong></td>
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Downstate (zones F-K) Generating Capacity by Fuel Source: 2019

<table>
<thead>
<tr>
<th>Fuel Source</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
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<tr>
<td>Dual Fuel (Gas/Oil)</td>
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<tr>
<td>Gas</td>
<td>2,190</td>
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<tr>
<td>Coal</td>
<td>2,054</td>
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<tr>
<td>Nuclear</td>
<td>348</td>
</tr>
<tr>
<td>Hydro</td>
<td>1,371</td>
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<tr>
<td>Hydro Pumped Storage</td>
<td>232</td>
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<tr>
<td>Other Renewables</td>
<td>70</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25,007</strong></td>
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</tbody>
</table>
2018 Annual Capacity Factors for Clean Energy Resources

Capacity Factors

Capacity and Energy:

• It would require 3 MW of wind capacity to produce the same amount of energy as 1.0 MW of hydro capacity

• Production from intermittent renewables cannot be dispatched in the same manner as more conventional generation can
Tale of Two Grids

2018 Regional Energy Production Profiles

Energy Produced from:
- Fossil Fuel
- Zero Emission
- Hydro Pumped Storage
- Other Renewables

UPSTATE

DOWNSTATE

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Renewable Resources at Peak Load

Intermittent Resource Contribution to Load on 2018 Peak Demand Day (August 29)

Average Hourly Load
Average Hourly Wind Output
Average Hourly Solar Output

Wind curtailment begins
780 MW Peak solar production

31,861 MW 2018 Peak Energy Demand
444 MW Wind Production at Peak Demand
409 MW Solar Production at Peak Demand

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Fuel Costs & Electricity Prices

Natural Gas Costs & Electric Energy Prices: 2000-2018

• 2018 average wholesale electric energy price was $44.92/MWh
Public Policy & The Grid
Cleaner Generation

Emissions Rates from Electric Generation in New York: 2000-2018

From 2000 through 2018, emission rates of:

- Sulfur dioxide (SO₂) dropped 98%
- Nitrogen oxides (NOX) dropped 89%
- Carbon dioxide (CO₂) dropped 51%

Sources: U.S. EPA, U.S. EIA
Almost half the CO₂ emissions come from the Transportation sector.
Proposed Generation

Proposed Generation by Region:
NYISO interconnection queue as of March 1, 2019

- **Upstate (zones A-E)**
  - Natural Gas: 2,078
  - Wind: 4,313
  - Solar: 2,966
  - Storage: 540
  - All Others: 9

- **Capital Region & Hudson Valley (zones F-I)**
  - Natural Gas: 1,879
  - Dual Fuel: 750
  - Solar: 968
  - Storage: 340
  - All Others: 28

- **New York City (zone J)**
  - Natural Gas: 2,309
  - Dual Fuel: 1,386
  - Wind: 5,776
  - Storage: 747

- **Long Island (zone K)**
  - Dual Fuel: 599
  - Wind: 7,132
  - Solar: 104
  - Storage: 345
  - All Others: 32

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Wind Energy Curtailment

Monthly Wind Energy Curtailment

- **Curtailed GWh** – Difference between real-time wind forecast and economic wind output limit
- **% NYCA Curtailed** – Ratio of curtailed energy to total production

*Curtailed GWh - Difference Between Real-Time Wind Forecast and Economic Wind Output Limit
**% NYCA Curtailed - Ratio of Curtained Energy to Total Production*
Examining transmission investment needs driven by public policy requirements:

- Needs are identified by the NYS Public Service Commission
- Solutions are solicited by the NYISO
Questions?