



Introduction to the NYISO & NY's Wholesale Electricity Markets

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Topics

- **NYISO's Origin & Roles**
- **NYISO Market Structure**
- **Markets at Work**
- **Integrating Renewables into the New York Electricity Market**



What We Do & How We Got Here

NYISO'S ROLES & ORIGIN

ISOs & RTOs

- **The NYISO is one of nine Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) in North America**
- **They serve 2/3 of U.S. electricity customers & more than 1/2 of Canadian consumers**



NYISO Facts & Figures

- ◆ New York State population
 - ◆ **19 million**
- ◆ Retail Electricity Customers
 - ◆ **8.1+ million**
- ◆ 2015 Load Forecast
 - ◆ **160,121 GWh**
- ◆ 2015 Required Installed Capacity
 - ◆ **39,273 MW**
- ◆ Record peak
 - ◆ **33,956 MW (July 19, 2013)**
- ◆ Power Generation
 - ◆ **700+ units**
- ◆ High-Voltage Transmission
 - ◆ **11,000+ circuit-miles**
- ◆ Average Annual Market Transactions
 - ◆ **\$7.5 Billion**
- ◆ Market Participants
 - ◆ **400+**



What is the NYISO?

- Independent by design, the NYISO is a non-profit, non-government organization
- NYISO's federally approved tariffs stipulate independence and impartiality
- The 10-member Board of Directors — *and all staff* — have no direct business or financial relationships with market participants
- NYISO's system of shared governance provides all market participants — *from electricity consumers to power providers* — a voice in the operation and evolution of the marketplace

The average electricity customer pays less than **50¢ per month** for the work we do to keep the lights on throughout New York State



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

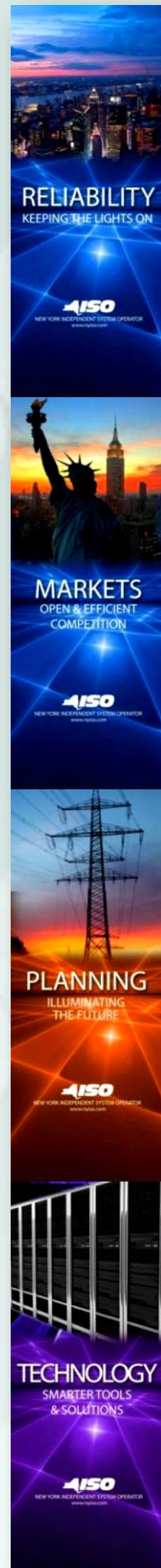
- *Bringing together buyers and sellers of energy and related products and services*

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*



Power Grid Operations

Every six seconds...

**NYISO dispatches power from
hundreds of power plants...**

*Over thousands of miles of
transmission lines...*

**To meet the needs of millions
of electricity consumers**



Reliability Standards

- **NYISO answers to federal, state, and regional regulators**
 - *Subject to the most rigorous reliability standards in the nation*
 - *Meeting ~1,000 individual reliability requirements*



Market Origins

- **NYISO wholesale electricity markets were created through federal & state restructuring of the electric industry in the 1990s**

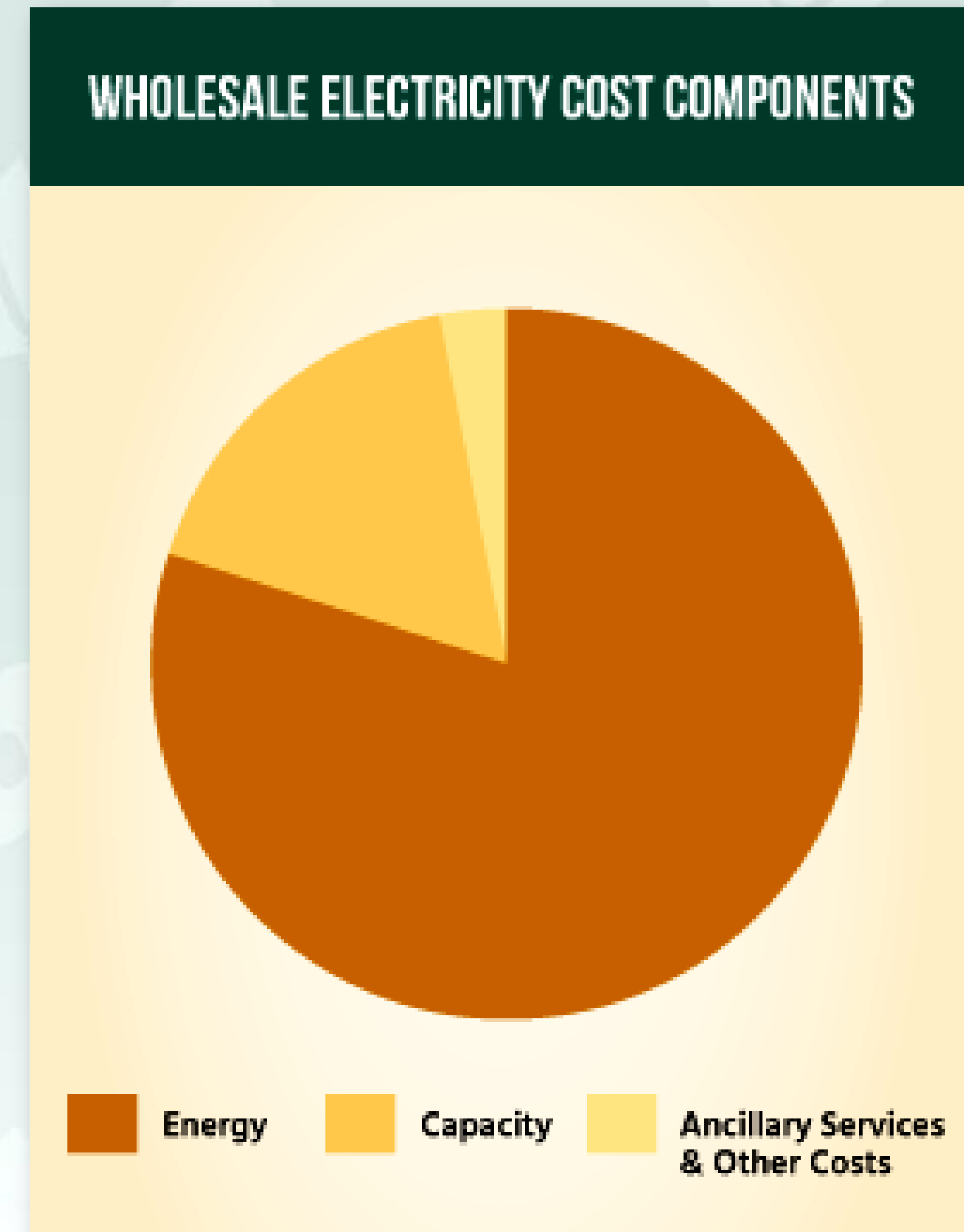


Designed for Progress

NYISO MARKET STRUCTURE

NYISO Markets

- **The reliable supply of electricity depends on a set of markets for:**
 - *Energy that flows constantly through the wires*
 - *Capacity needed when demand is the greatest*
 - *Ancillary services that keep the system running safely and securely*



Energy Markets

- A “two-settlement process” sets the price of energy based on market and grid conditions at specific times
 - *The first settlement is based upon day-ahead bids and the corresponding schedule and prices, or day-ahead commitment*
 - *The second settlement is based upon the real-time bids and the corresponding real-time commitment and real-time dispatch*
- As a result of the day-ahead commitment process, a set of generators is scheduled to produce energy in each hour of the next day to match corresponding demand bids submitted by utilities and other load serving entities
 - *From this schedule, day-ahead prices are computed*
- During real-time operation, changes in operating conditions, additional real-time supply offers, and variations in actual load will cause real-time needs to differ from the day-ahead schedules
 - *These differences in generation levels and in load consumption are settled at the second settlement, or real-time price.*

Capacity Market

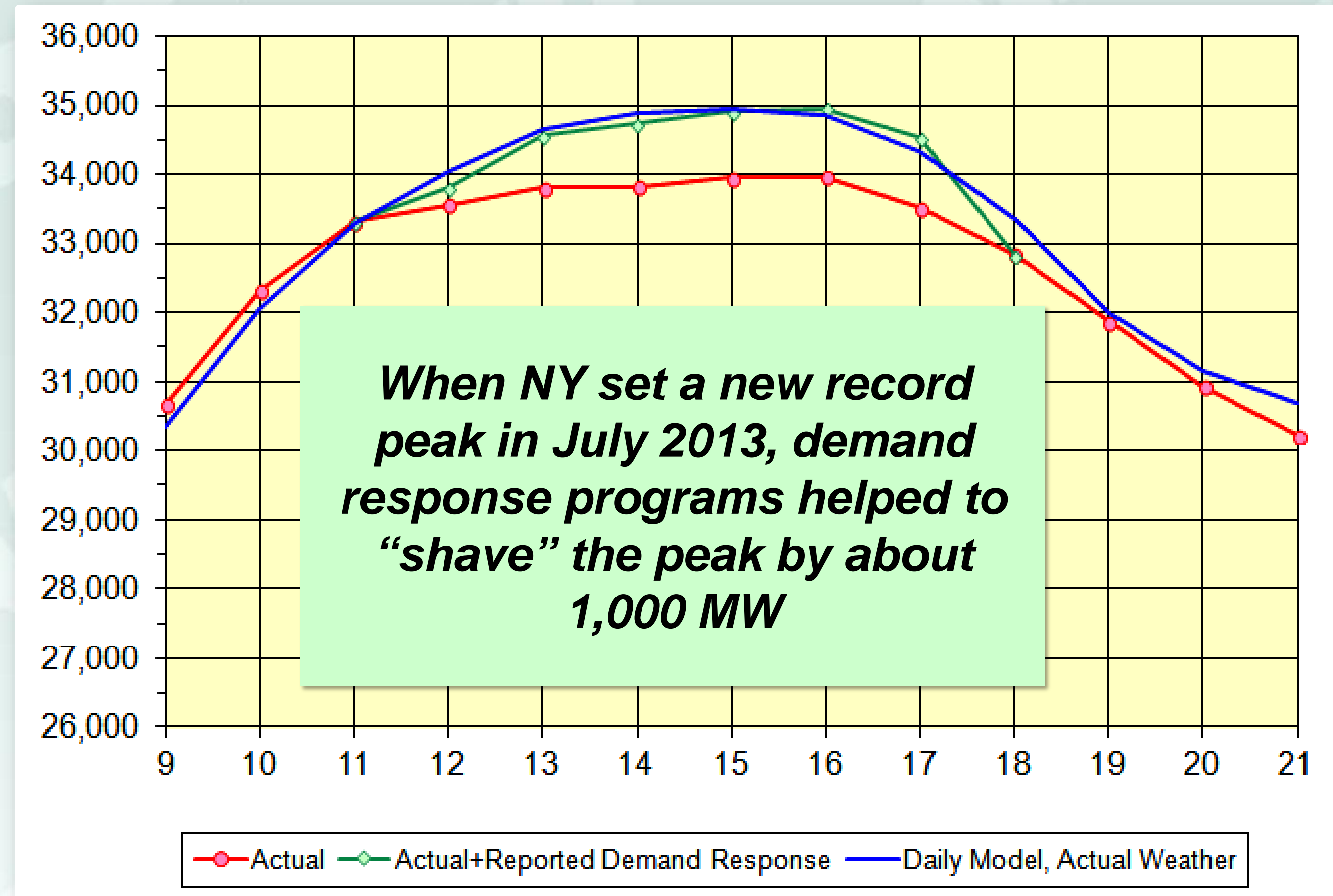
- **NYISO administers an Installed Capacity (ICAP) Market to maintain adequate power supplies to meet New York's electricity demands,**
 - ***The capacity market enables utilities and other load serving entities to satisfy their obligations to meet the peak demands of their retail customers while also securing reserves for reliability purposes via:***
 - **A six-month seasonal period (*Capability Period, or Strip*) Auction**
 - **A Monthly Auction**
 - **A monthly Spot Market Auction**

Ancillary Services

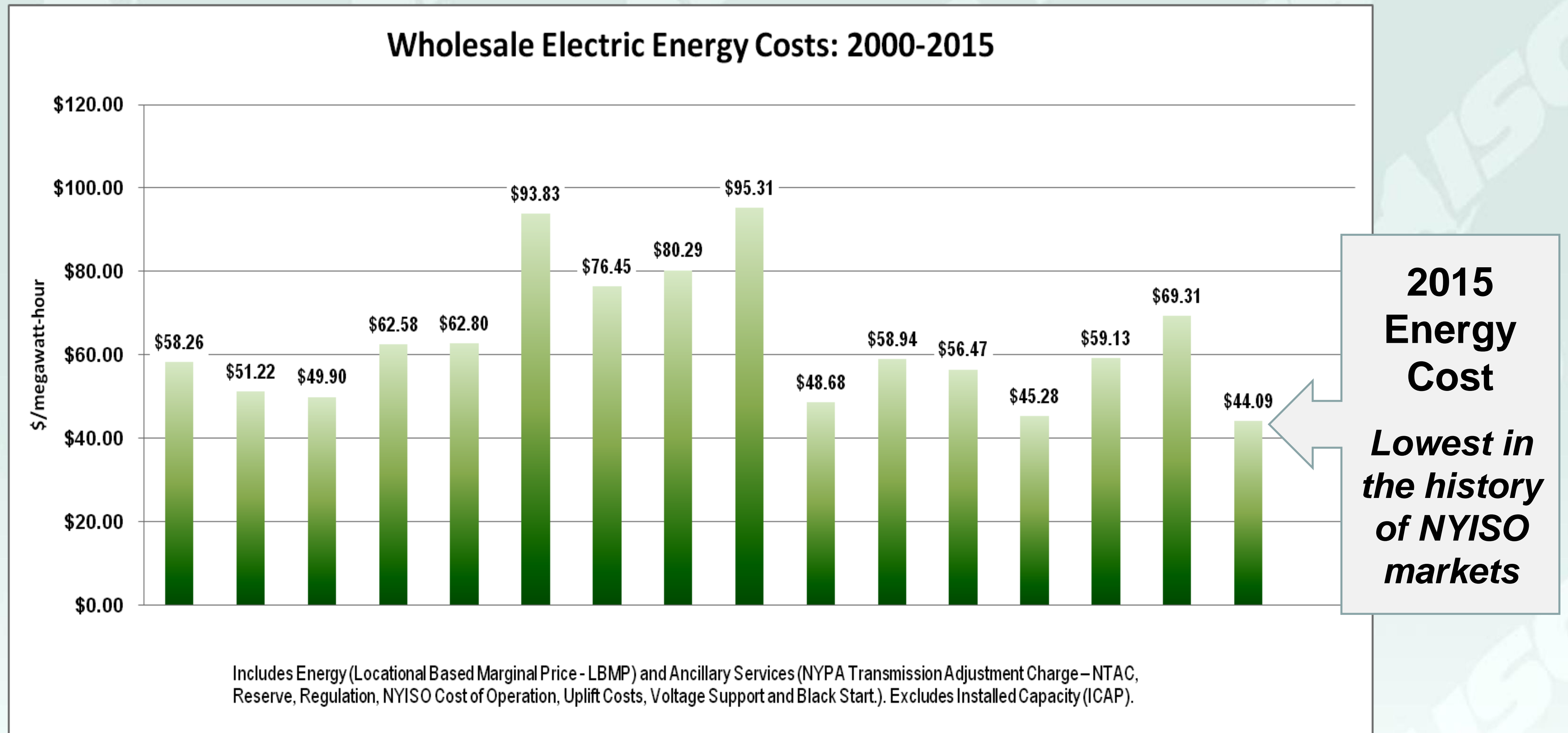
- **Ancillary Services are necessary to support the reliable transmission of energy from generation resources to consumers**
 - *Regulation and Operating Reserves*
 - *Energy Imbalance (Market-based pricing)*
 - *Voltage Control and Black Start (Cost-based services)*

Demand Response

- Demand response resources enlist consumers who can reduce energy use during periods of high demand such as summer heat waves
- Large power customers and aggregated sets of smaller consumers participate in several demand response programs developed in NYISO markets

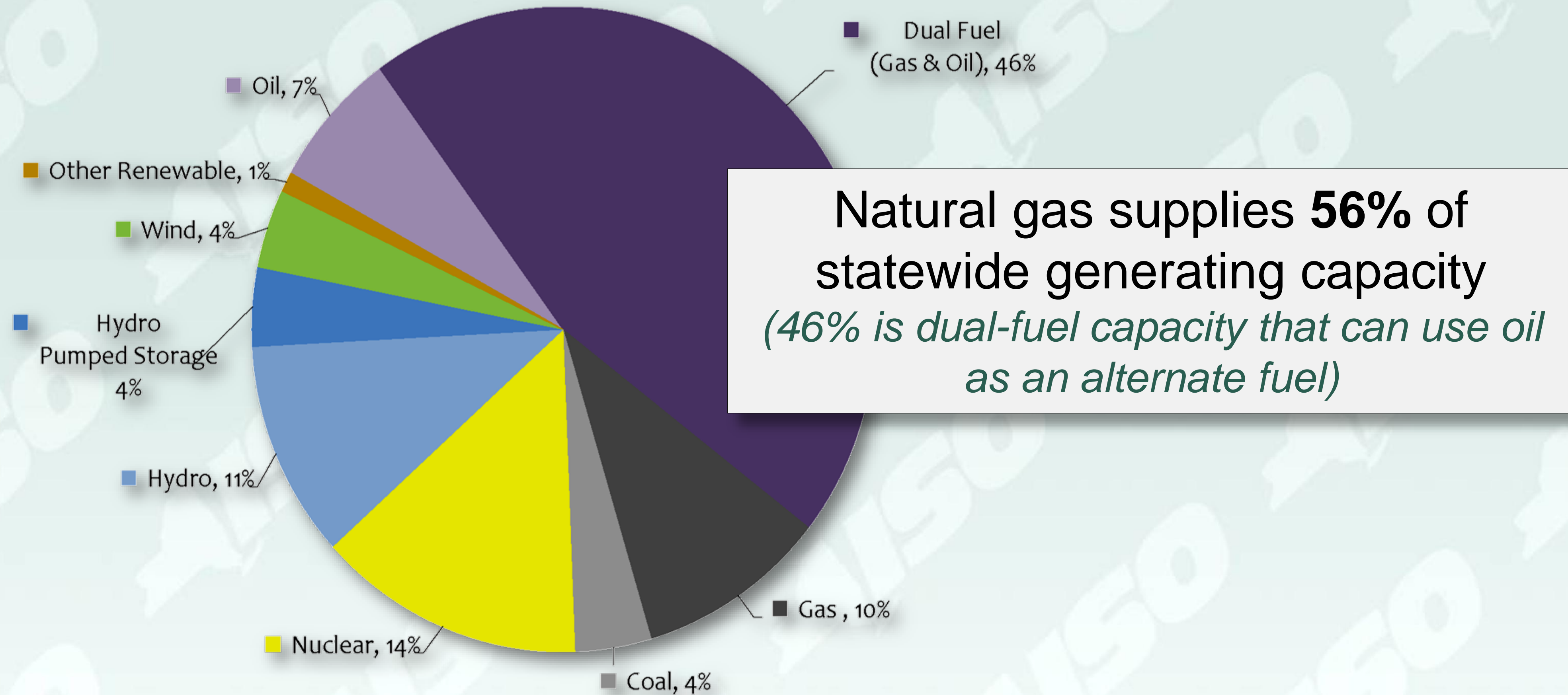


Wholesale Energy Costs



New York State Fuel Mix

Generating Capacity by Fuel Source

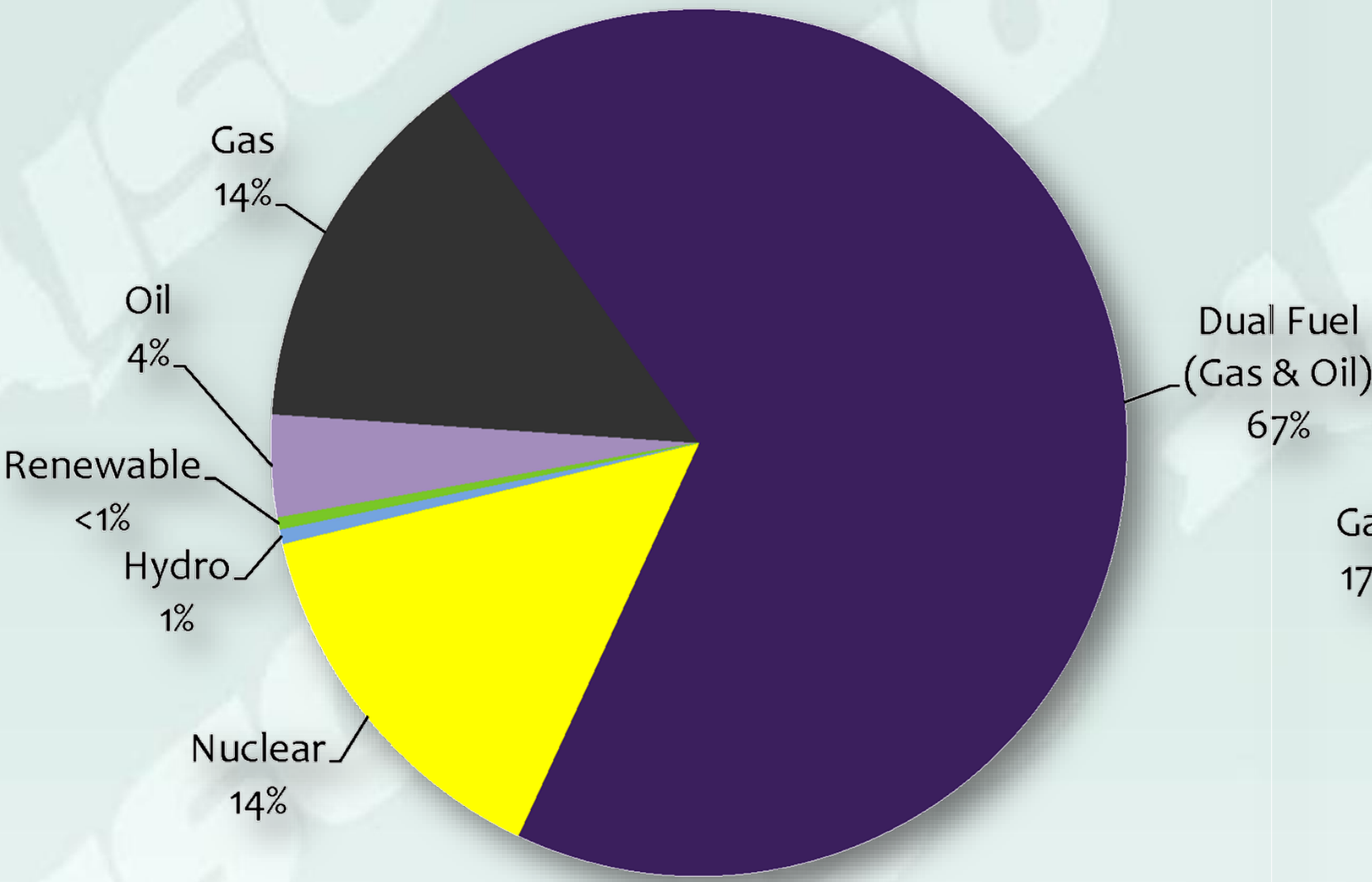


SOURCE: Power Trends 2015, New York Independent System Operator, June 2015

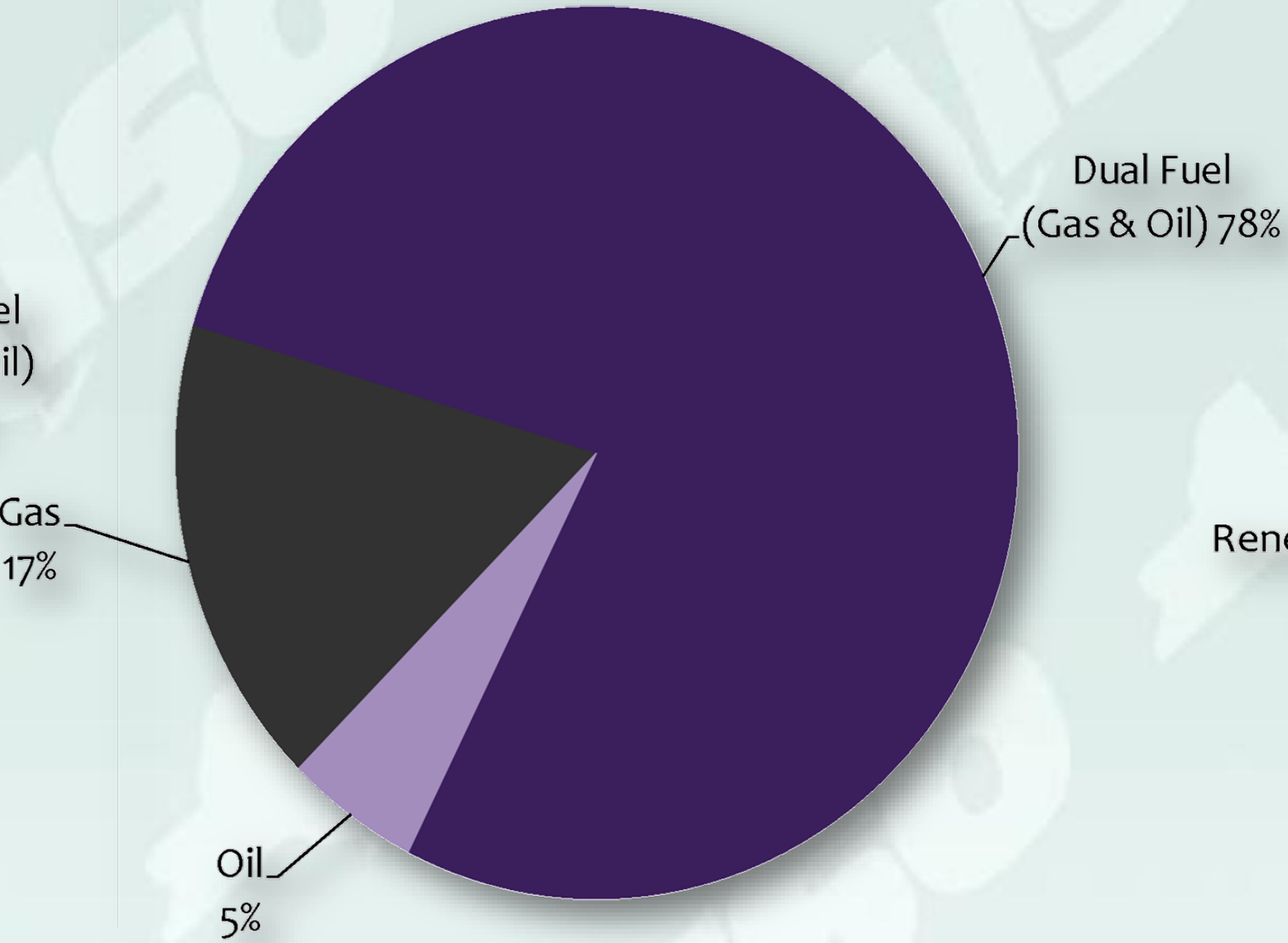
Regional Fuel Mix

Generating Capacity by Fuel Source

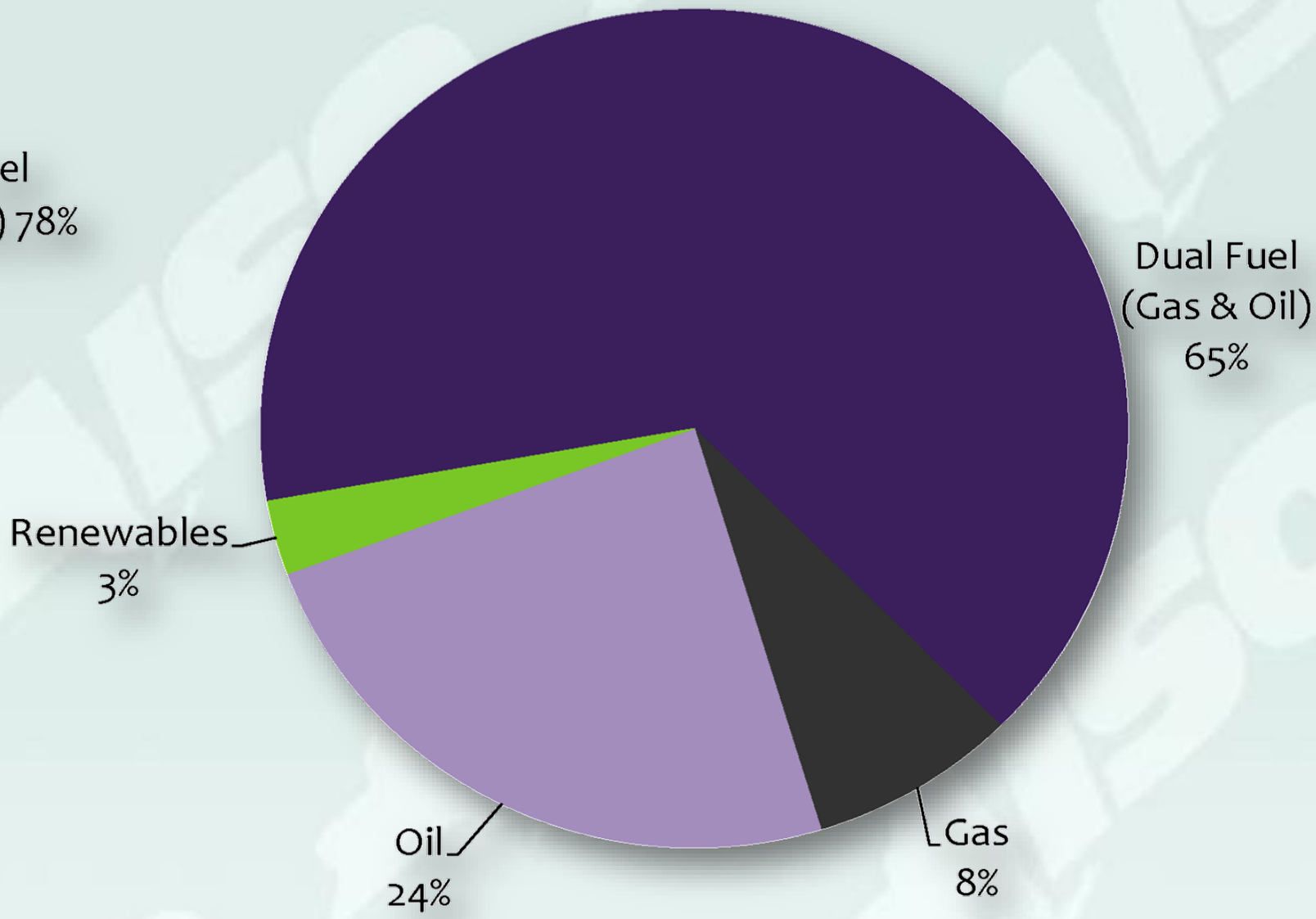
Lower Hudson Valley: 2015



New York City: 2015



Long Island: 2015



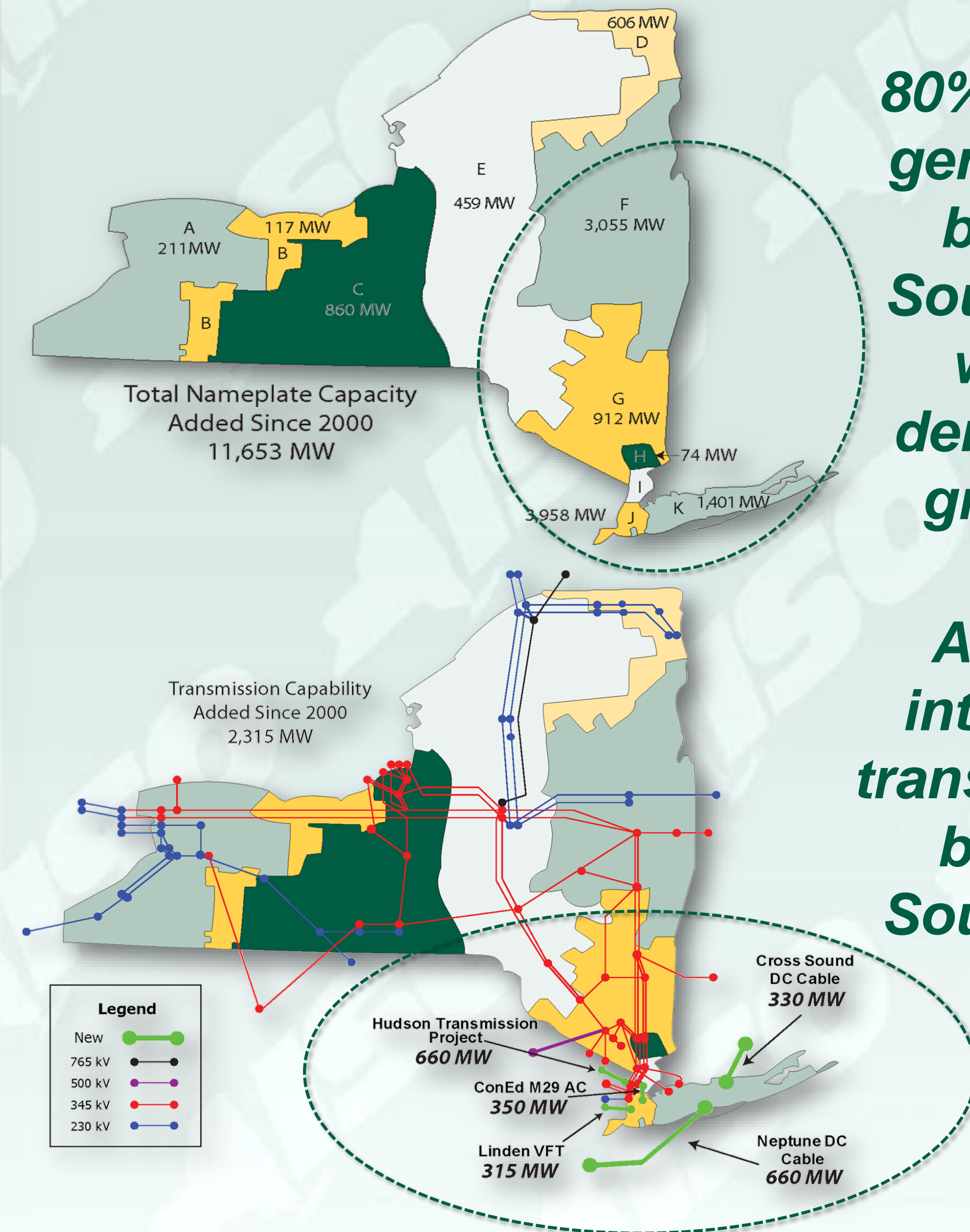
SOURCE: *Power Trends 2015*, New York Independent System Operator, June 2015

Value of Competition

MARKETS AT WORK

New Infrastructure

- Locational market signals have driven investments in both generation and transmission to high demand regions
- Majority of new investments have been directed to metropolitan Southeastern NY region where both energy and capacity prices are the most attractive

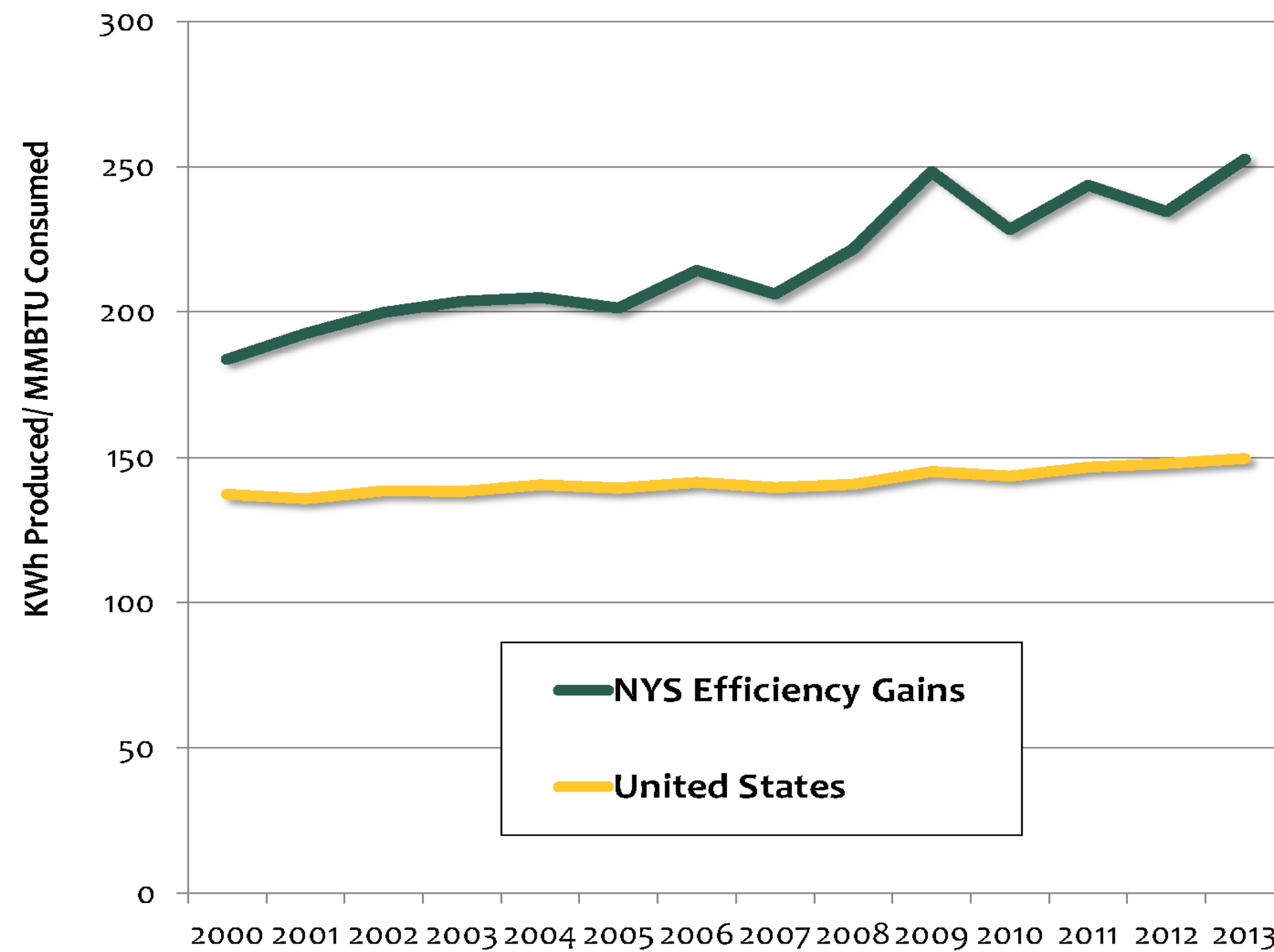


80% of new generation built in South/East where demand is greatest

All new interstate transmission built in South/East

Increased Fuel Efficiency

Electricity System Fuel Efficiency: 2000-2013



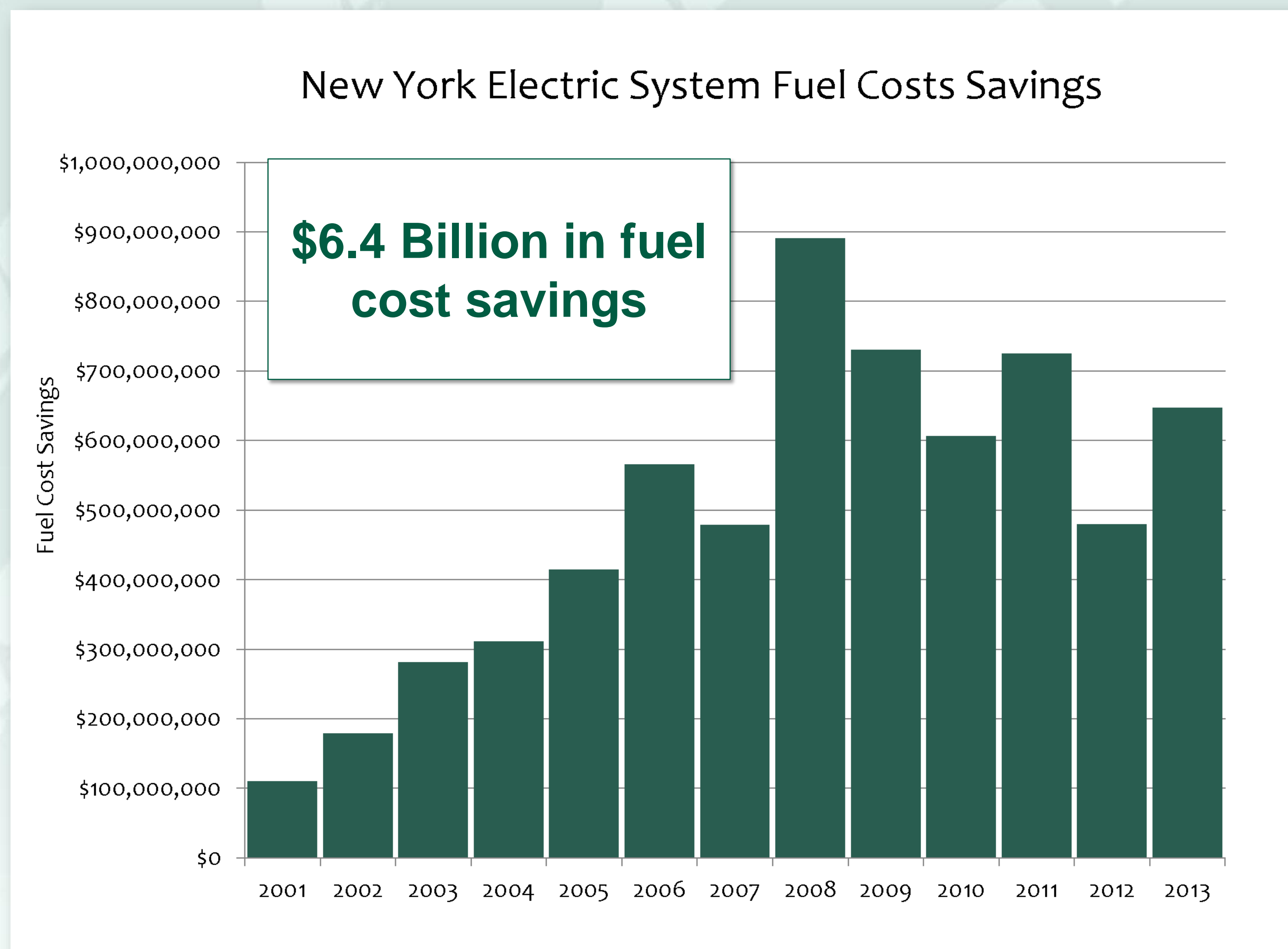
Data Source: U.S. Energy Information Administration

**N.Y.
27%**

**U.S.
8.25%**

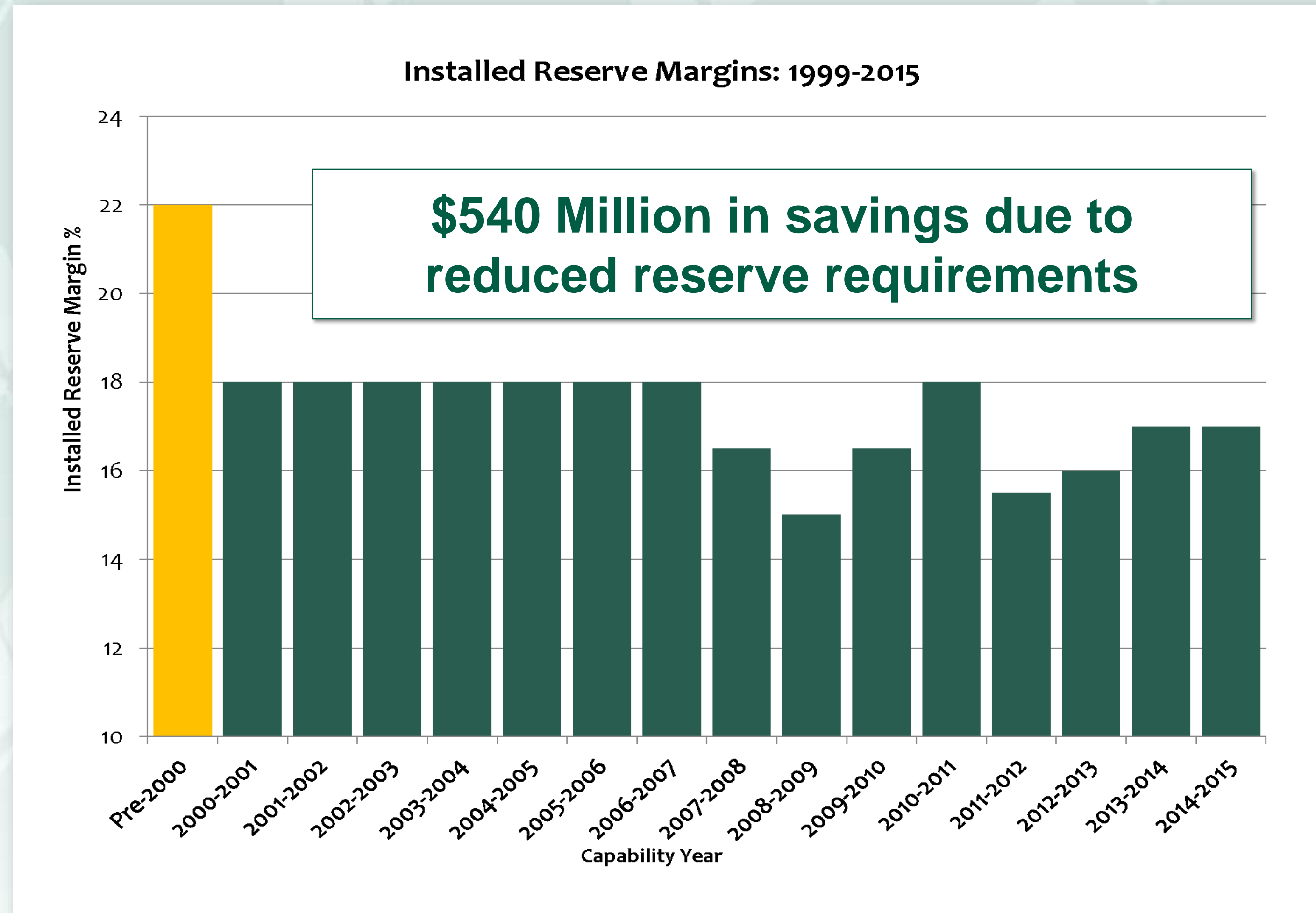
SOURCE: *Power Trends 2015*, New York Independent System Operator, June 2015

Fuel Cost Savings



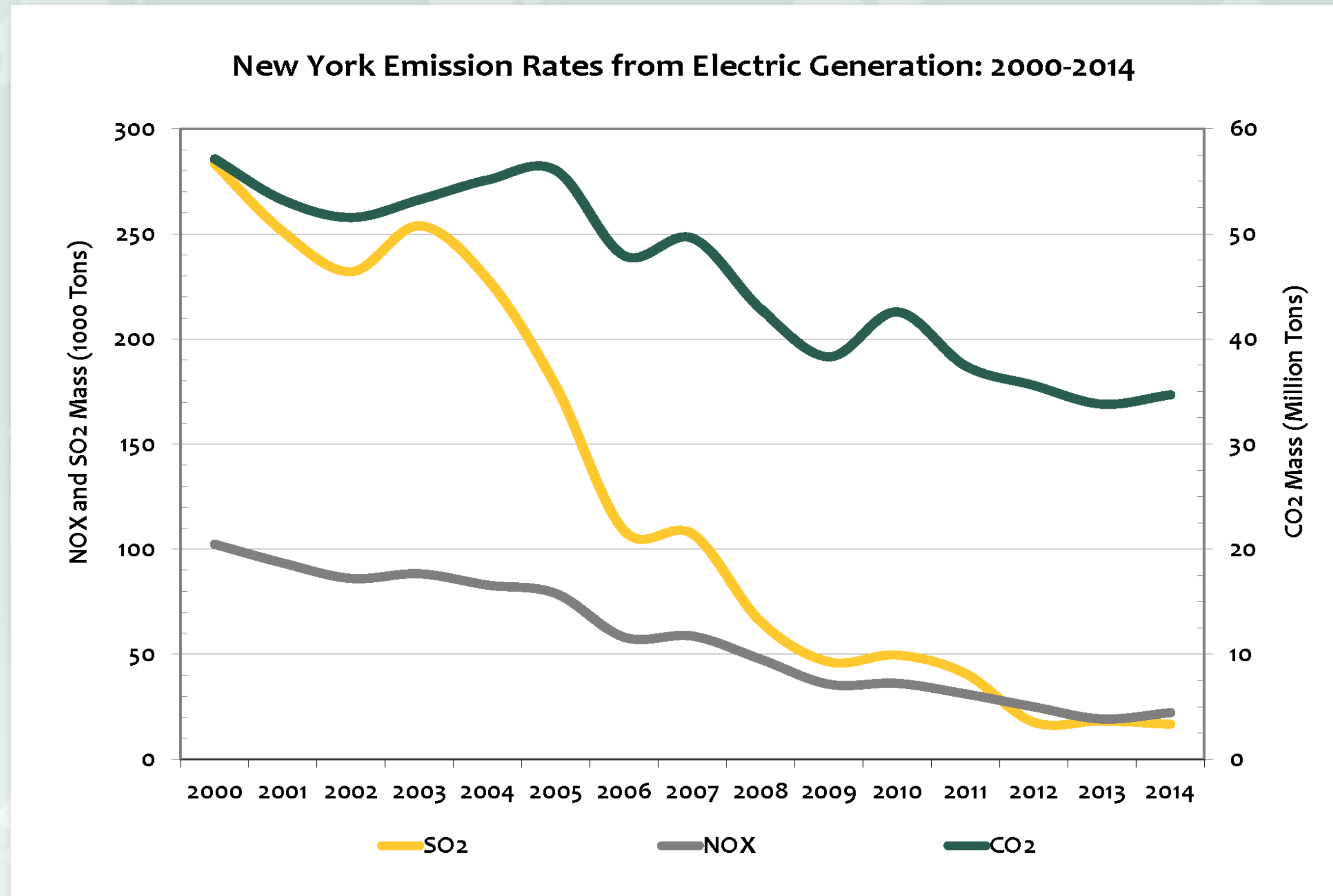
SOURCE: *Power Trends 2015*, New York Independent System Operator, June 2015

Lower Reserve Requirements



SOURCE: *Power Trends 2015*, New York Independent System Operator, June 2015

Reduced Emissions



SOURCE: *Power Trends 2015*, New York Independent System Operator, June 2015

From 2000
through
2014...

↓ **SO₂**
94%

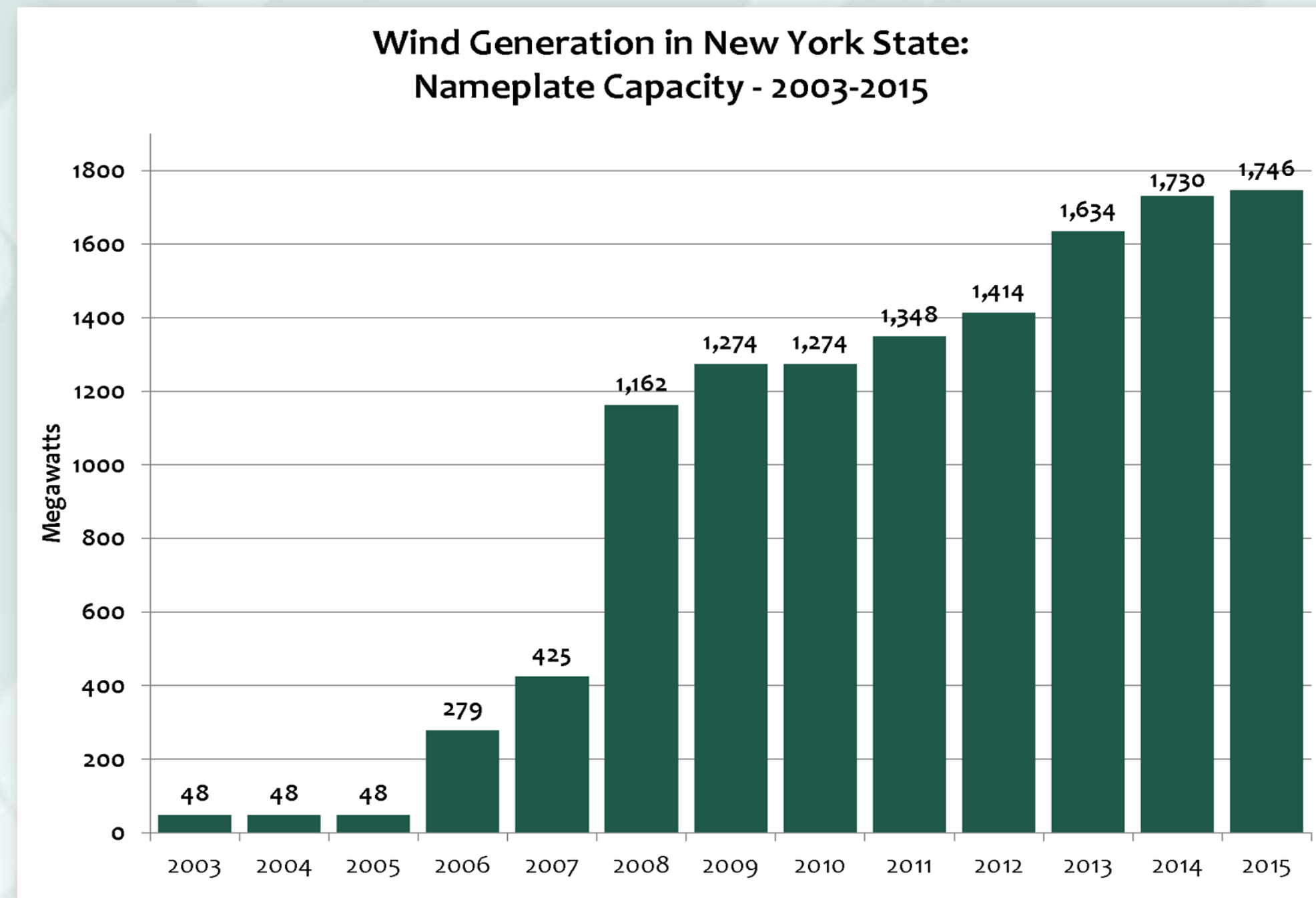
↓ **NO_x**
78%

↓ **CO₂**
39%

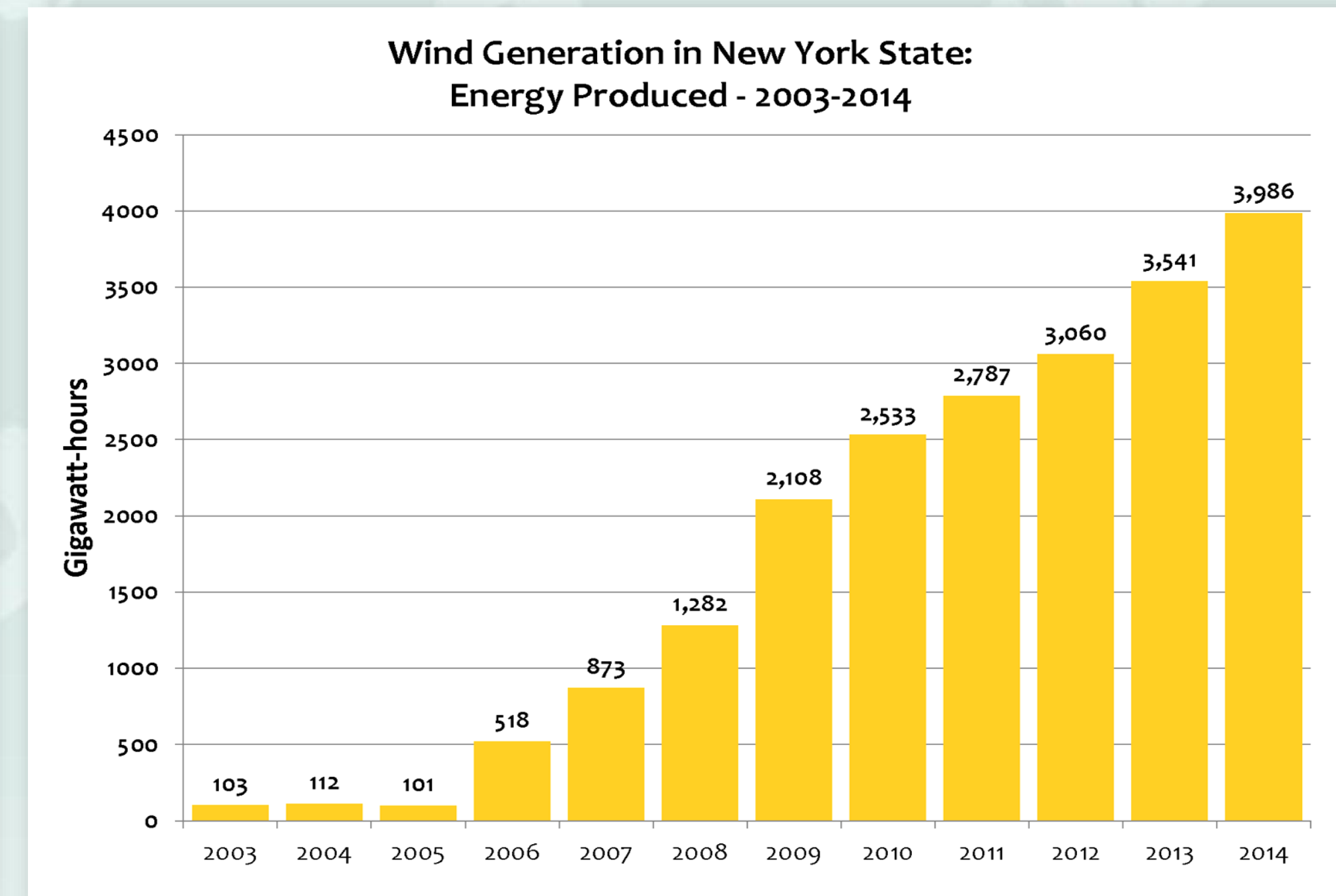
Cultivating Green Power

INTEGRATING RENEWABLES

Growing Wind Power



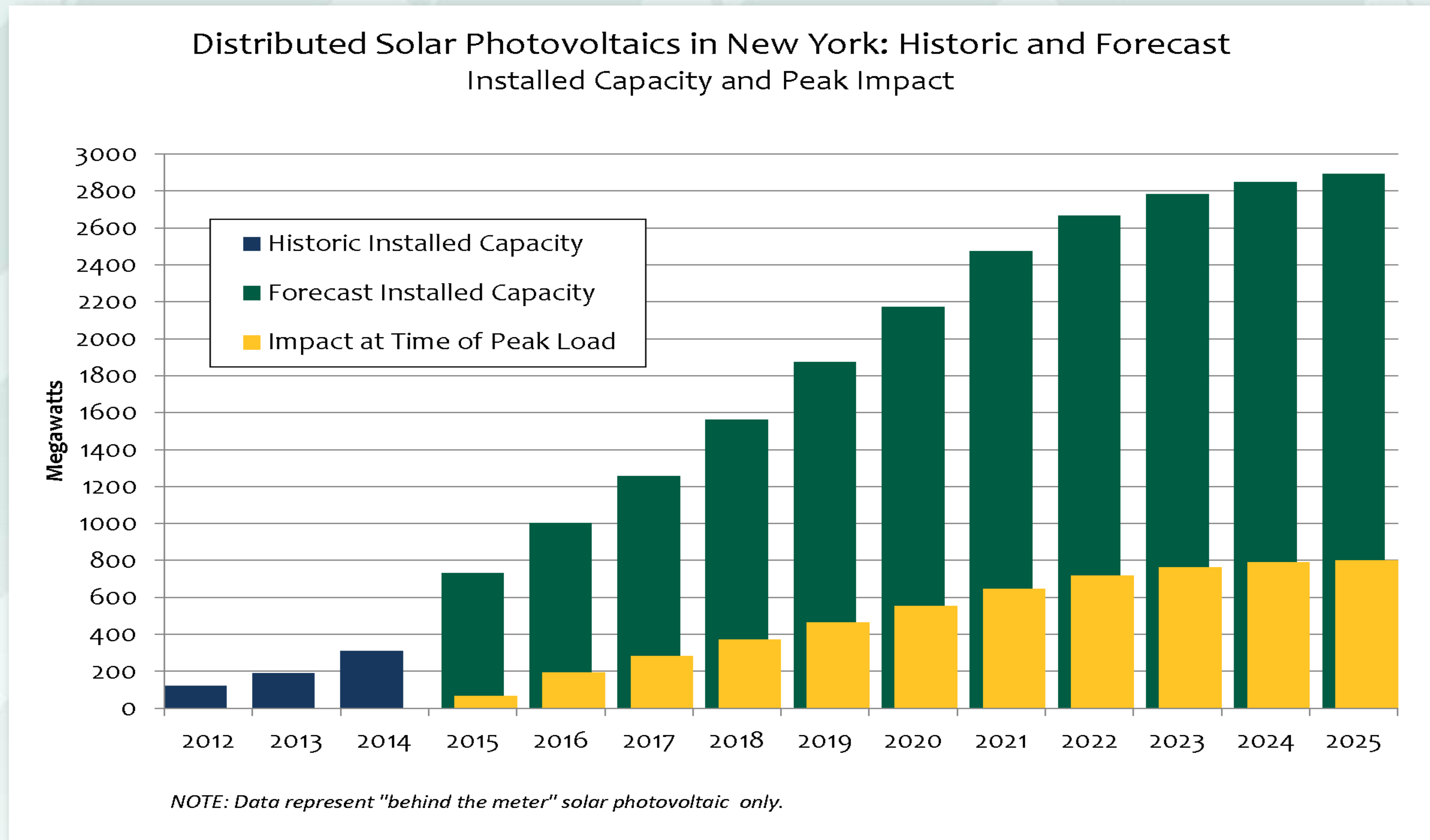
Wind **capacity** grew from
48 MW in 2003-2005 to
1,746 MW in 2015



Wind **generation** grew from
112 GWh in 2004 to
3,986 GWh in 2014

SOURCE: *Power Trends 2015*, New York Independent System Operator, June 2015

Growing Solar Power



SOURCE: *Power Trends 2015*, New York Independent System Operator, June 2015

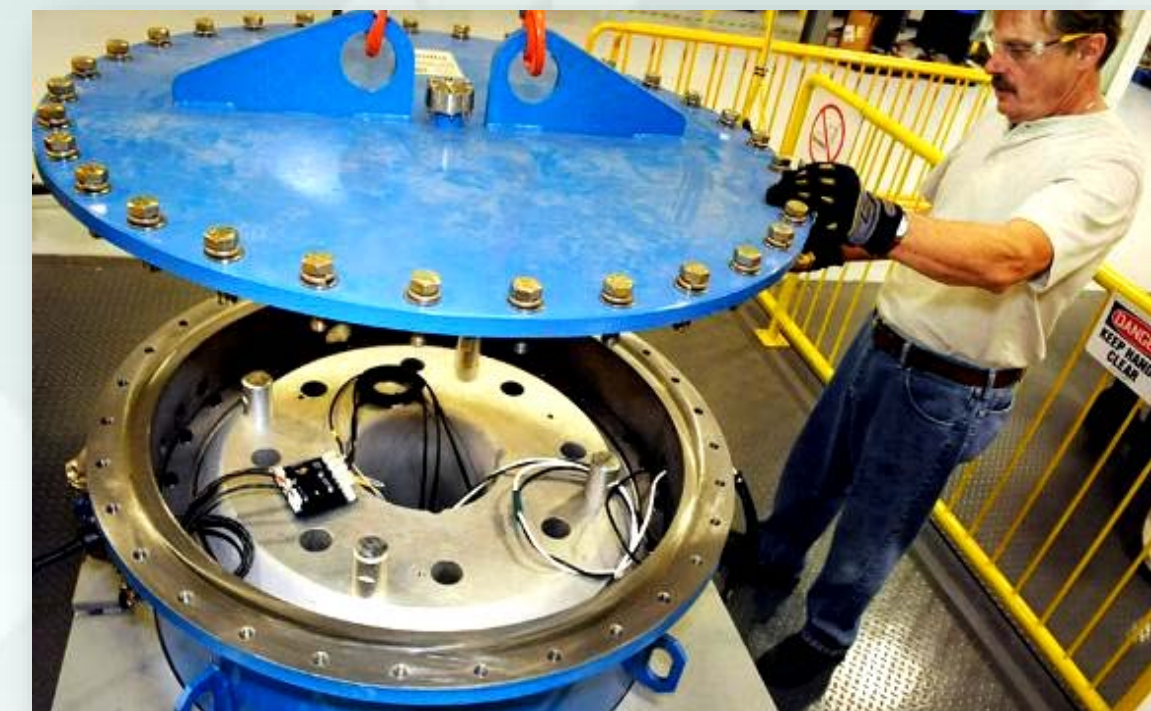
Solar Integration

- **Solar forecasting system** *(under development for implementation in 2017)*
 - *Day-ahead and real-time operations*
 - *Small number of large grid-connected solar farms*
 - *Thousands of small distributed units in each zone*
- **Solar capacity (as of September 2015)**
 - *31 MW grid-connected solar farm*
 - *455 MW installed nameplate capacity behind-the-meter*
- **Expanding capacity**
 - *Behind-the-meter solar capacity is growing by ~15 MW/month*
 - *173 MW (from 5 large solar farms in NYISO interconnection queue) could be completed by end of 2016*



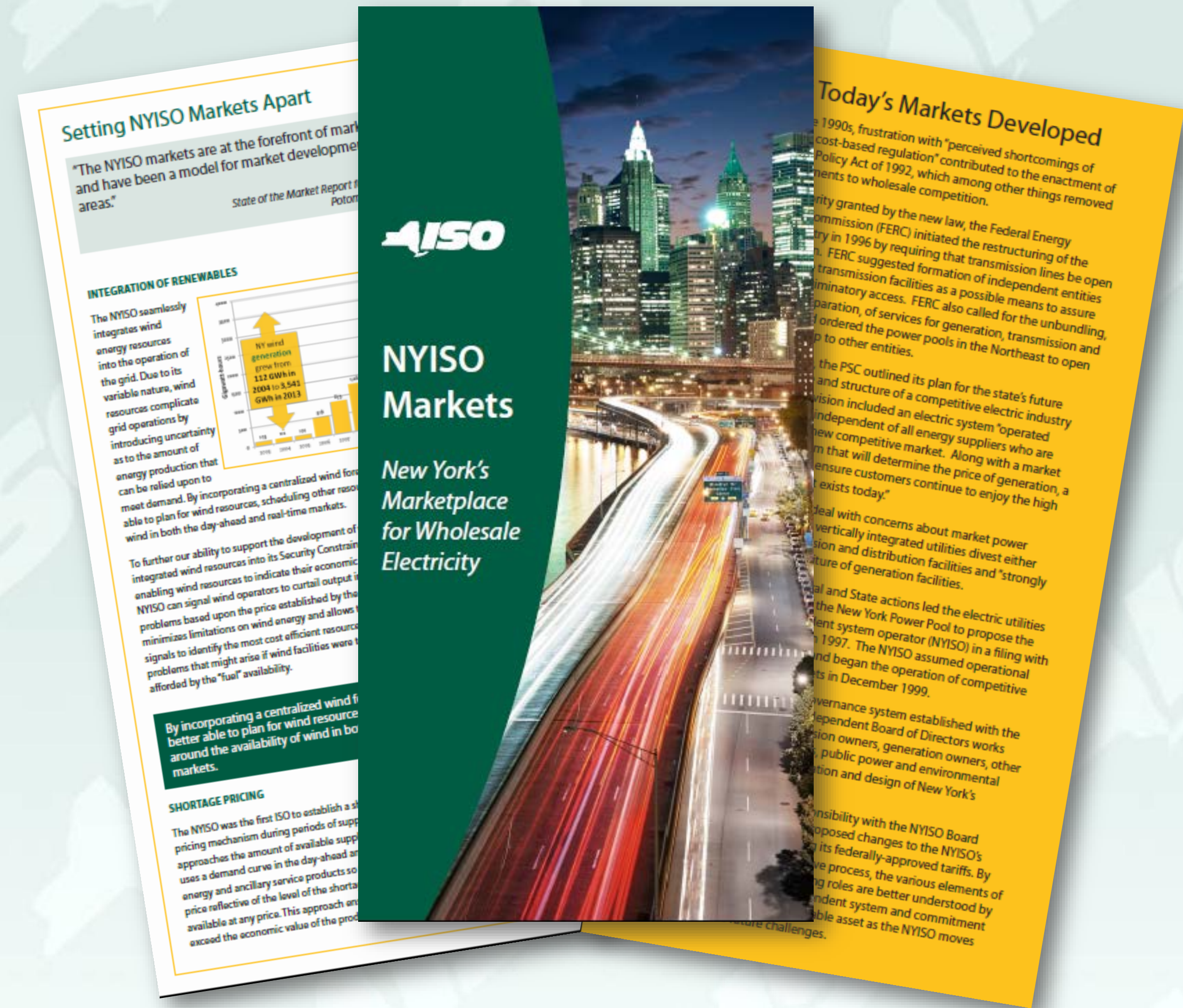
Energy Storage

- **NYISO -- *First grid operator in US to implement market rules enabling storage systems to participate in the markets as frequency regulation providers***
- **Beacon Power 20-MW flywheel project in Stephentown -- *First full-scale flywheel energy storage facility to provide frequency regulation service in US***



For More Information

- **NYISO Markets:
New York's
Marketplace for
Wholesale
Electricity**
- **Available via
NYISO website –
www.nyiso.com**



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 policy makers, stakeholders and investors in the power system*

www.nyiso.com