

Identifying and Mitigating the Impacts of Climate Change from New York's Energy Infrastructure*

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Search and Discovery Article #70047 (2008)

Posted December 1, 2008

*Adapted from oral presentation at AAPG Annual Convention, San Antonio, Texas, April 20-23, 2008

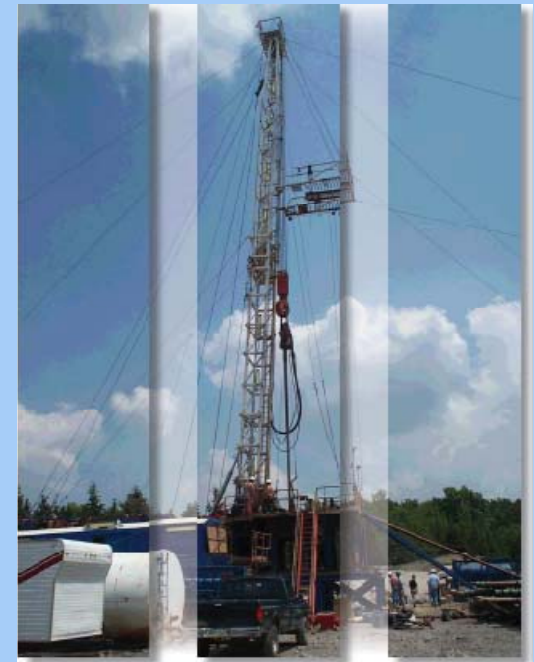
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Abstract

The New York State Energy Research and Development Authority (NYSERDA) is providing technical support for a number of initiatives that represent the foundation for New York's climate change policy. The program targets the direct and indirect aspects of climate change on the state, including its energy infrastructure. Through the Environmental Monitoring, Evaluation and Protection Program (EMEP), NYSERDA is developing a strategy to monitor the direct impacts of climate change, quantify the potential ecological, public health, infrastructure, and economic impacts of climate change in New York State, and identify mechanisms to manage and mitigate risk. The results will help design emergency response programs. The major indirect impact of climate change will likely be the alteration of traditional energy consumption. Gas demand is becoming bimodal with a winter heating peak and a summer electricity-generation peak. This is forcing a reevaluation of the natural gas delivery infrastructure. The development of the Regional Greenhouse Gas Initiative (RGGI) will directly impact the energy delivery system. Nine northeastern and Mid-Atlantic states, including New York, comprise RGGI, with the goal of reducing greenhouse gas emissions in the region. Key to this discussion is the possible development of a cap-and-trade program. A number of models have been developed to provide input into this effort. Under the RGGI framework, the reduction of methane emissions in the natural gas delivery system will be an offset. NYSERDA is working on the quantification and verification of methane emissions from the natural gas production and distribution infrastructure. Finally, programs to help develop carbon capture and sequestration in New York are now in place.

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John P. Martin and Amanda D. Stevens
NYSERDA R&D Program



Outline

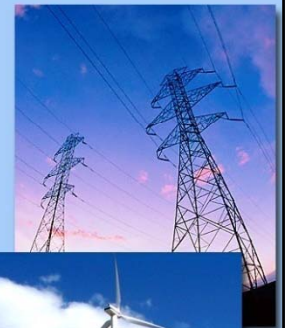
- About NYSERDA
- New York State's Energy Profile
- Impacts of Climate Change on Infrastructure
- Monitoring the Impacts of Climate Change
- NYS Response Programs
- Carbon Sequestration in NY

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Development of the Authority

- NYSERDA is a ***public benefit corporation*** created in 1975 by the New York State Legislature
 - Codified in Article 9 of the New York Public Authorities Law
- Governed by a Board consisting of 13 members, including:
 - Commissioner of the Department of Transportation
 - Commissioner of the Department of Environmental Conservation
 - Chair of Public Service Commission
 - Chair of the New York Power Authority
 - At large members appointed by the Governor and Legislature
- Budget over \$400 million



NYSERDA Approach

Primary Focus

- Energy
- Environment
- NYS Economic Development

Approach

- Forge public/private partnerships (businesses, municipalities, residents, state government, others)

Programs

- R&D – including RPS
- Energy Analysis
- Energy Efficiency Services Deployment
- West Valley Demonstration
- Economic Development
- Saratoga Technology + Energy Park in Malta



NYSERDA Program Results

- Produced \$340 million a year in energy bill reductions
- 1,113 MW of peak demand reduction (permanent and curtailable)
- Reduced air pollution annually by: 2,060 tons of NO_x, 3,800 tons of SO_x, and 1,600,000 tons of CO₂
- Leveraged \$3 of private project investment for every \$1 of System Benefits Charge invested
- 8,600 jobs created/retained in New York
- Reduced annual statewide electric energy requirements by 2,360 GWh
- Helped the State set natural gas production records in 2004-2006
- 382 MW wind installed, 1,200 MW by end of 2008
- Helped develop many products

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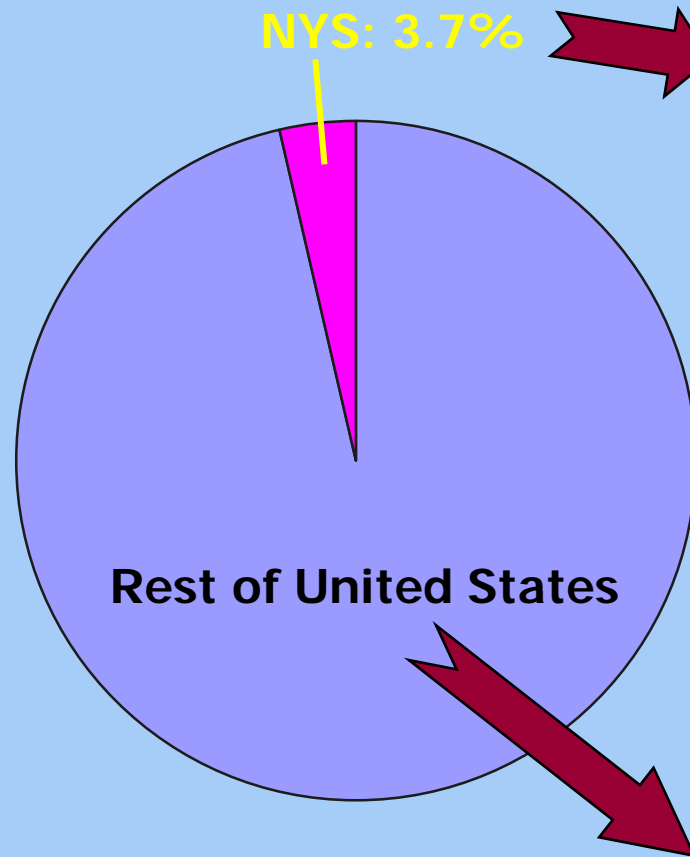
New York State “Energy” Demographics

- NY Population (2005): 19,255,000
 - NY % of USA: 6.2%
- NY Energy Consumption (2003): 4,221 TBtu (4th USA)
 - NY % of USA: 4.8%
- NYS is the most energy efficient of the “lower 48”



CO₂ Emissions

- **US: 5705.1 Million Tons CO₂**
- **NY: 211.5 Million Tons CO₂**



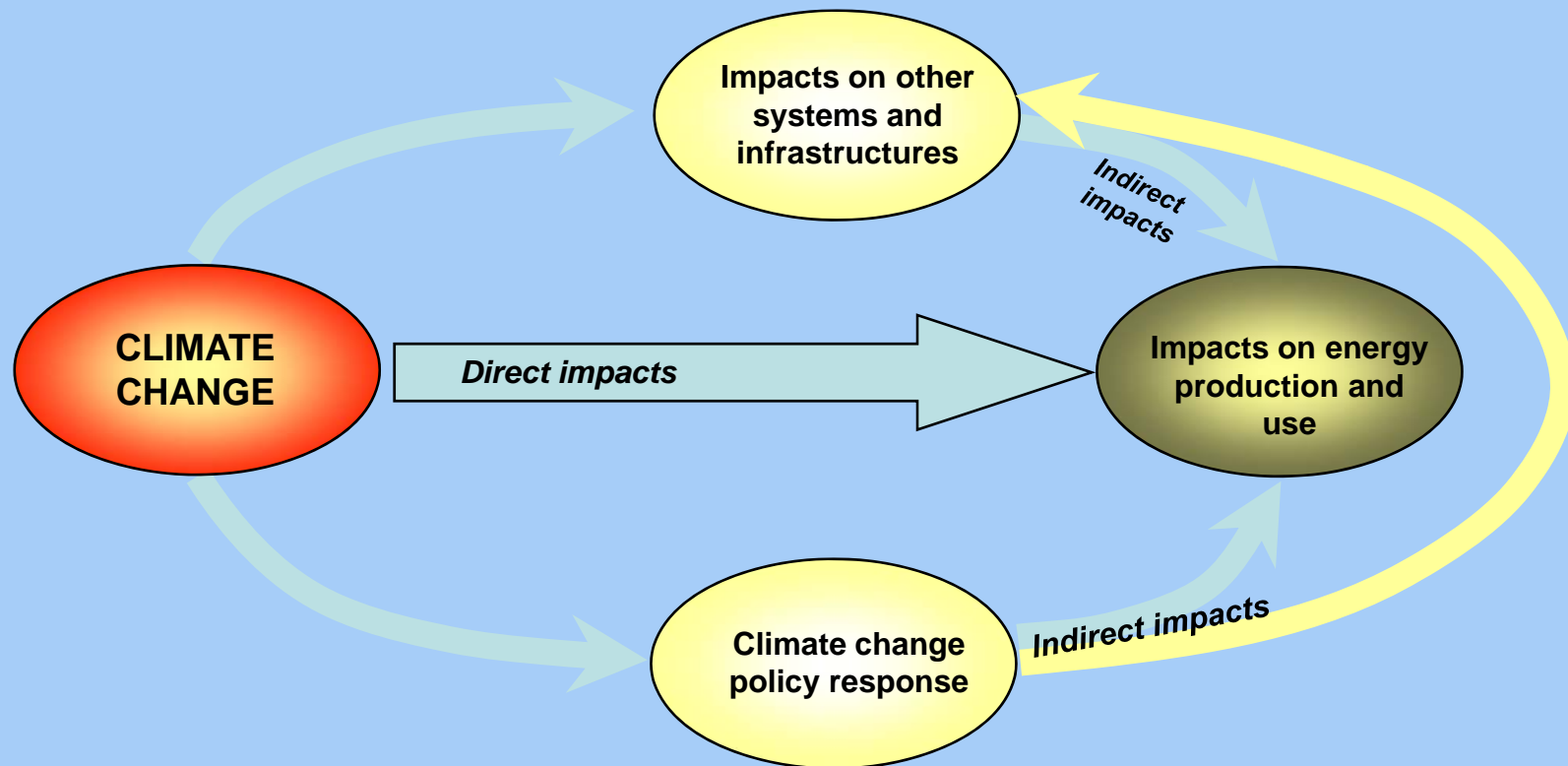
38% Transportation
25% Electricity
6% Industrial

39% Electricity
32% Transportation
18% Industrial

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Impacts on Energy Infrastructure



Direct and Indirect Impacts

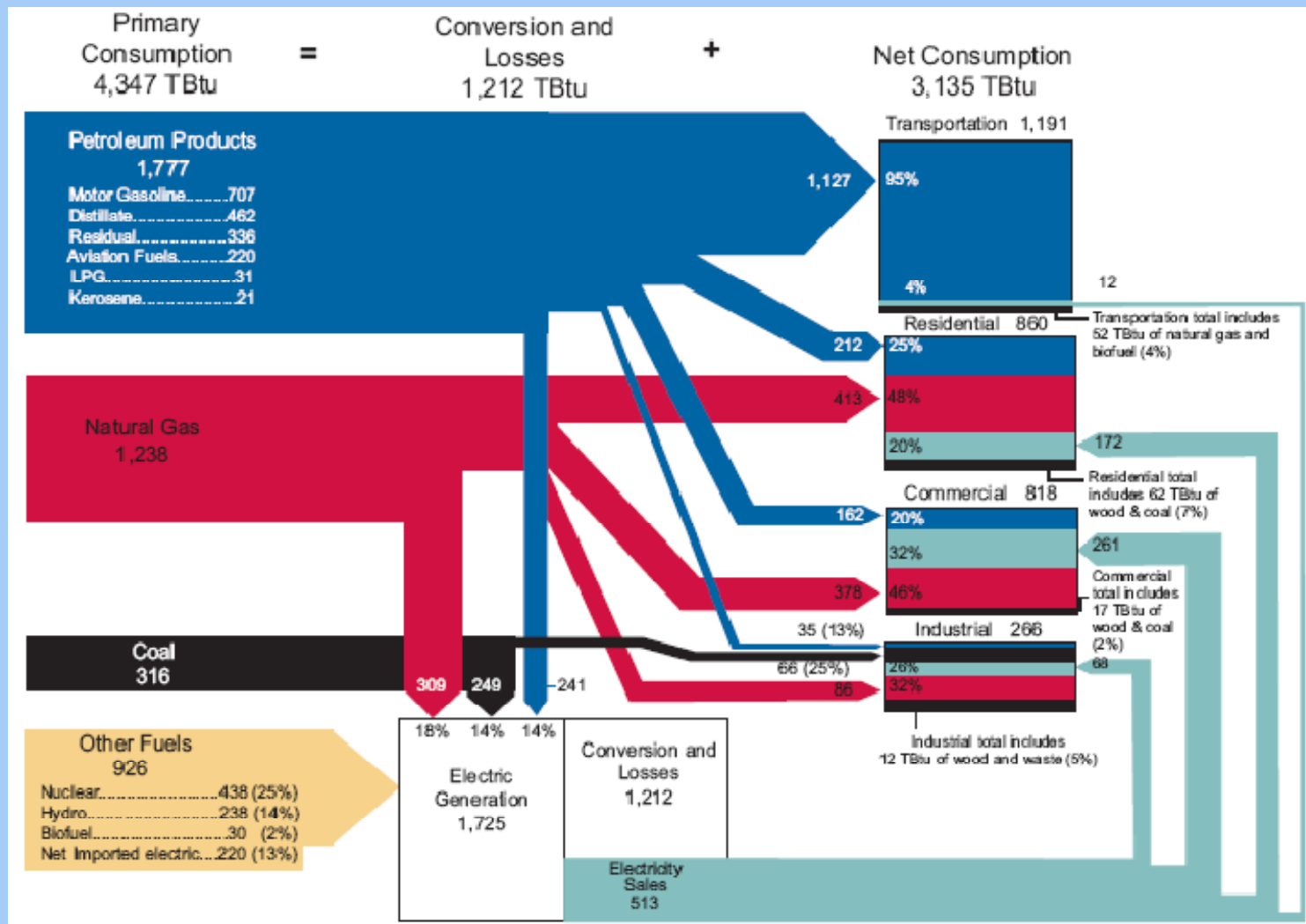
■ Direct Examples

- Changing rainfall conditions may impact hydropower production
- More extreme weather events could affect energy distribution systems

■ Indirect Examples

- Climate change mitigation policies (e.g., effects of stabilization-related emission ceilings on energy prices, energy technology choices, or energy sector emissions)
- Changes in energy demand from other sectors – NYS expects to see more cooling demand but less heating demand shifting pressure onto the electricity supply system

NYS Energy Sources & Consumption, 2005



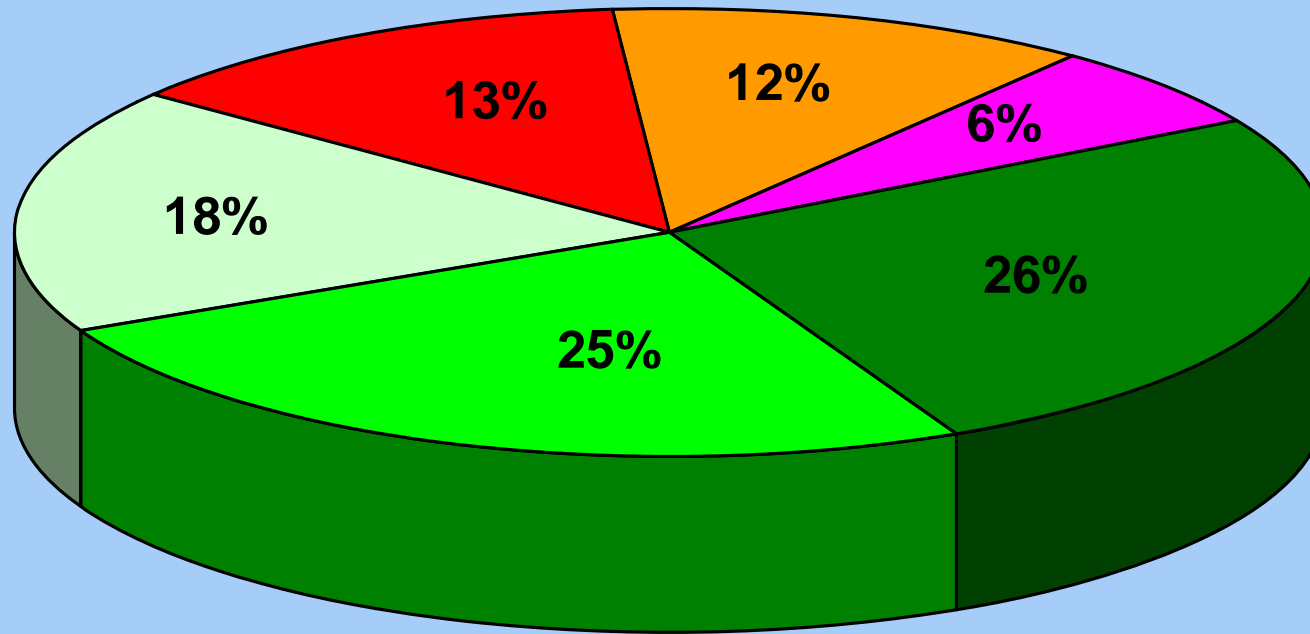
New York's Energy Infrastructure



- The New York Harbor area between New York and New Jersey has over 40 million barrels of refined product storage capacity, making it the largest petroleum product hub in the United States.
- New York produces more hydroelectric power than any other State east of the Rocky Mountains.
- The 2,253-megawatt Robert Moses Niagara plant, harnessing power from the Niagara River, is one of the largest hydroelectric facilities in the world.

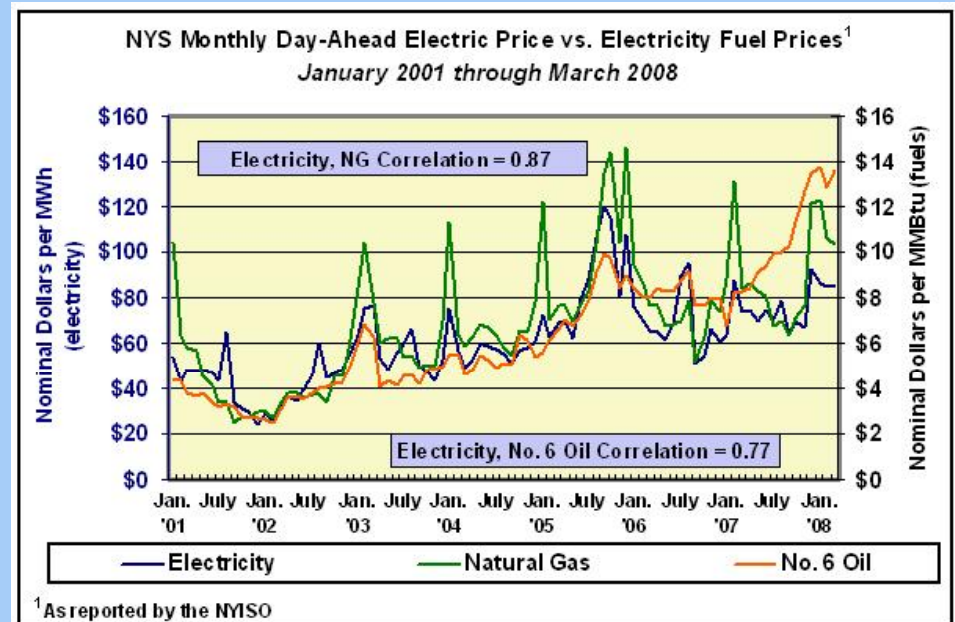
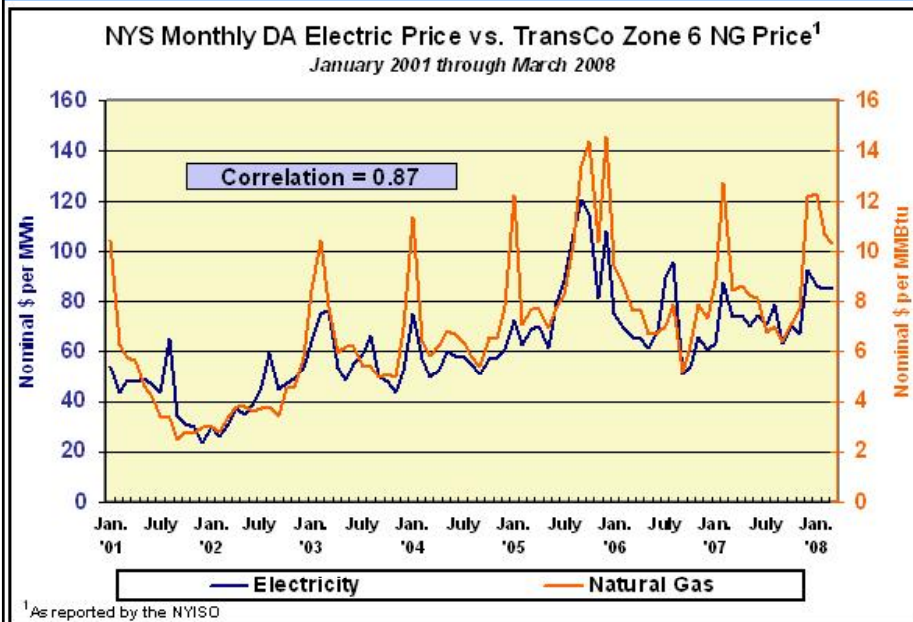
NYS Electricity Generation by Fuel Type 2006

(162,237 gigawatthours total)



■ Nuclear ■ Gas ■ Hydro ■ Coal ■ Imports ■ Other

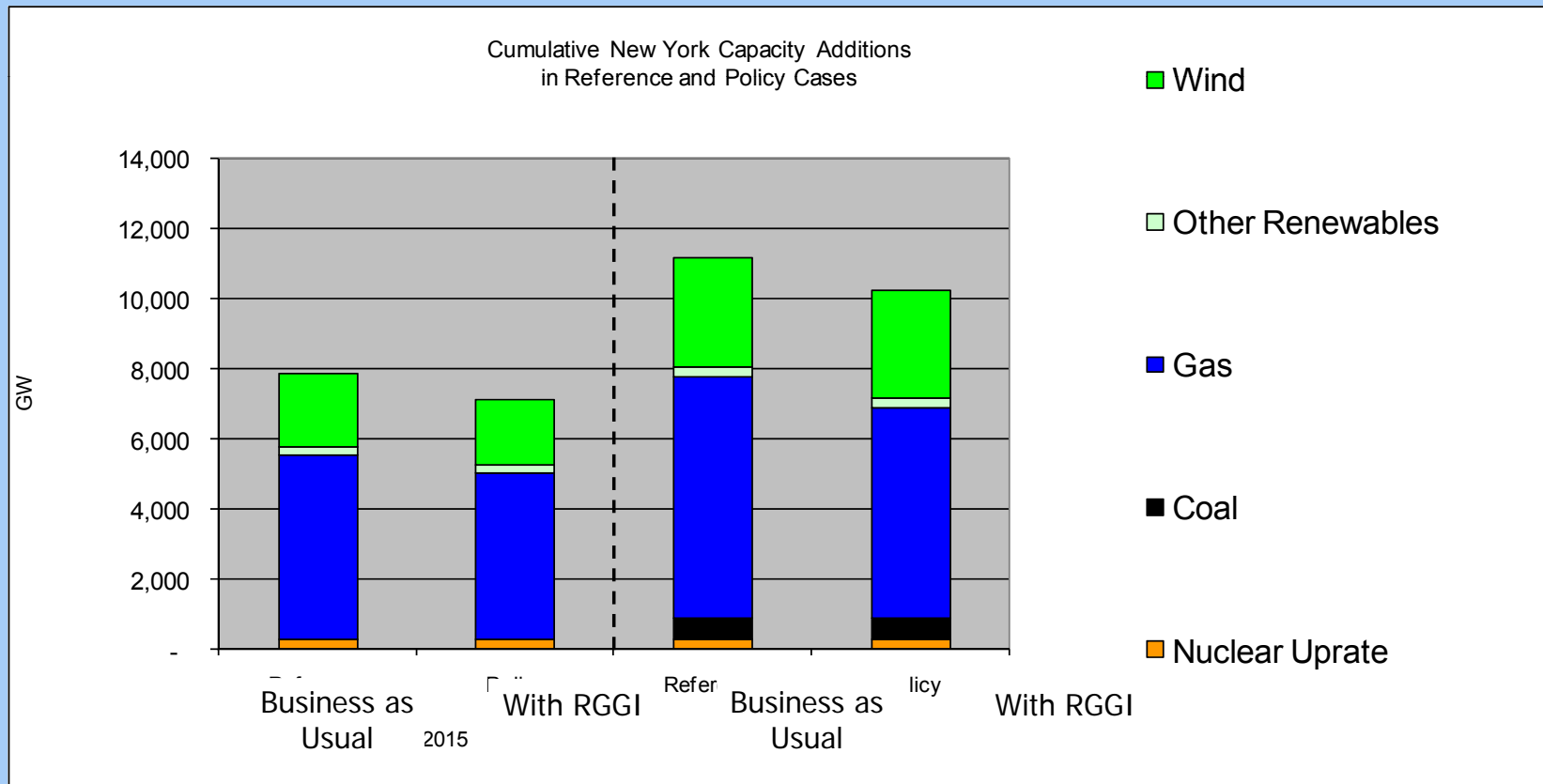
Electricity Prices Follow Natural Gas



No surprise, since gas is a major source of electricity and sets the market clearing price.

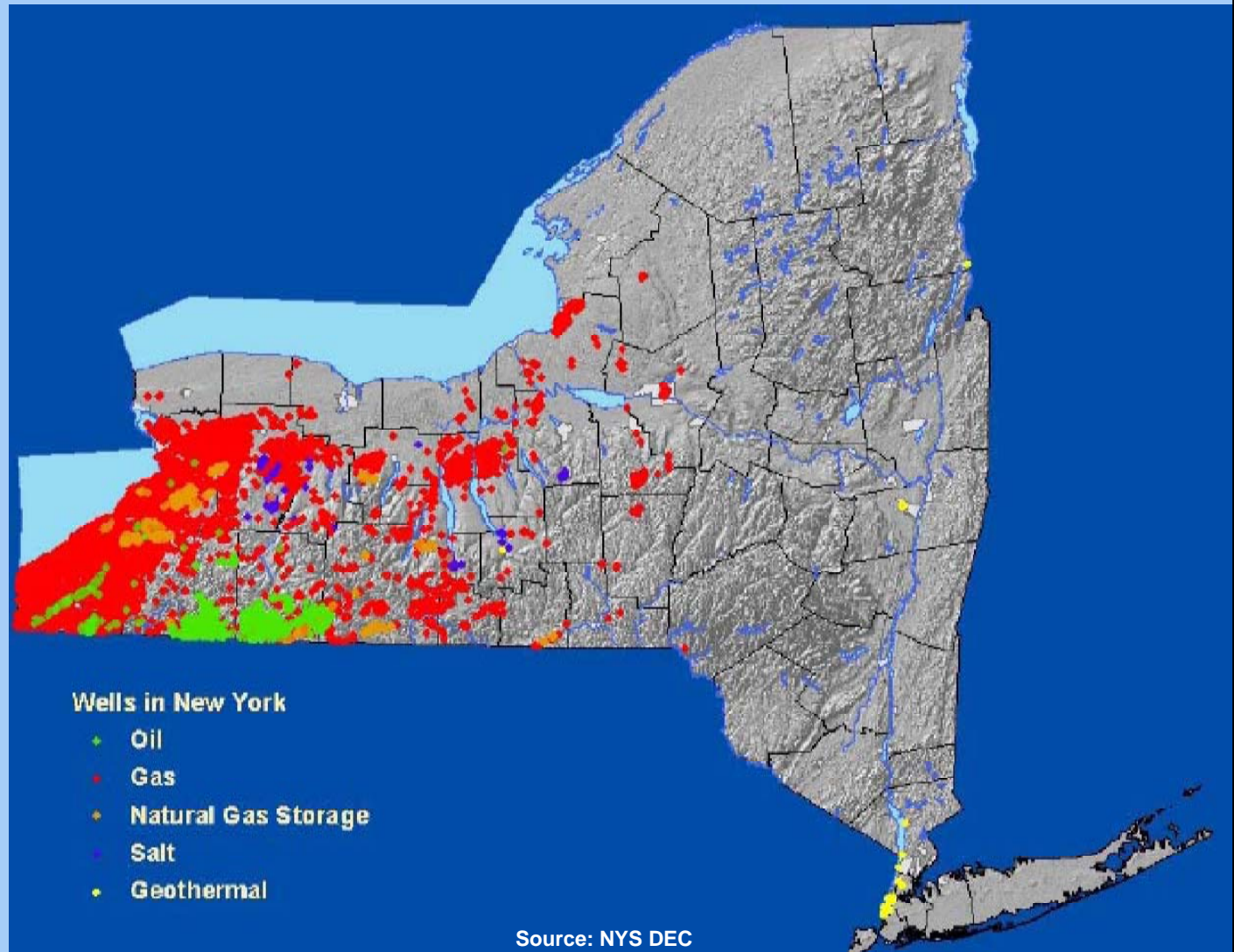
NYS Capacity Addition Projection

(NYS will increase by over 35,000 GWh by 2027)



Oil, Natural Gas, and Gas Storage Operations

- Oil and gas production in NYS dates back to the 1820s. Gas storage began in the early 1900s.
- 2006 Production: **56 Billion cubic feet** (Bcf) from over 5,000 wells
- 2006 Gas storage capacity: 219 Bcf



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Current Monitoring Program

- Long-term monitoring and assessment of mercury and acid deposition and effects on ecosystems
- Development and improvement of monitoring methods and technologies
- Monitor and determine long-term trends and baselines in fine-particle pollution
- RESULT: mercury, acid deposition, fine particles, and ozone research has directly affected both NYS and federal policies

Monitoring the Impacts of Climate Change

- What are the potential ecological, public health, infrastructure, and economic impacts of climate change in New York State, and how can those impacts be managed and mitigated?
- What are the key parameters that must be monitored to assess climate change impacts in New York?
- What are the most cost-effective climate change mitigation/adaptation strategies and policies that New York should consider pursuing?
- Monitoring may include infrastructure and land use, agriculture, air quality and human health, natural resources

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NYS Response Programs

- Regional Greenhouse Gas Initiative
- NYSERDA Climate Change Program
 - Renewable Portfolio Standard
 - NYSERDA R&D
 - Peak Load Reduction Program
- State Energy Plan
- NYS Disaster Preparedness Commission

Regional Greenhouse Gas Initiative

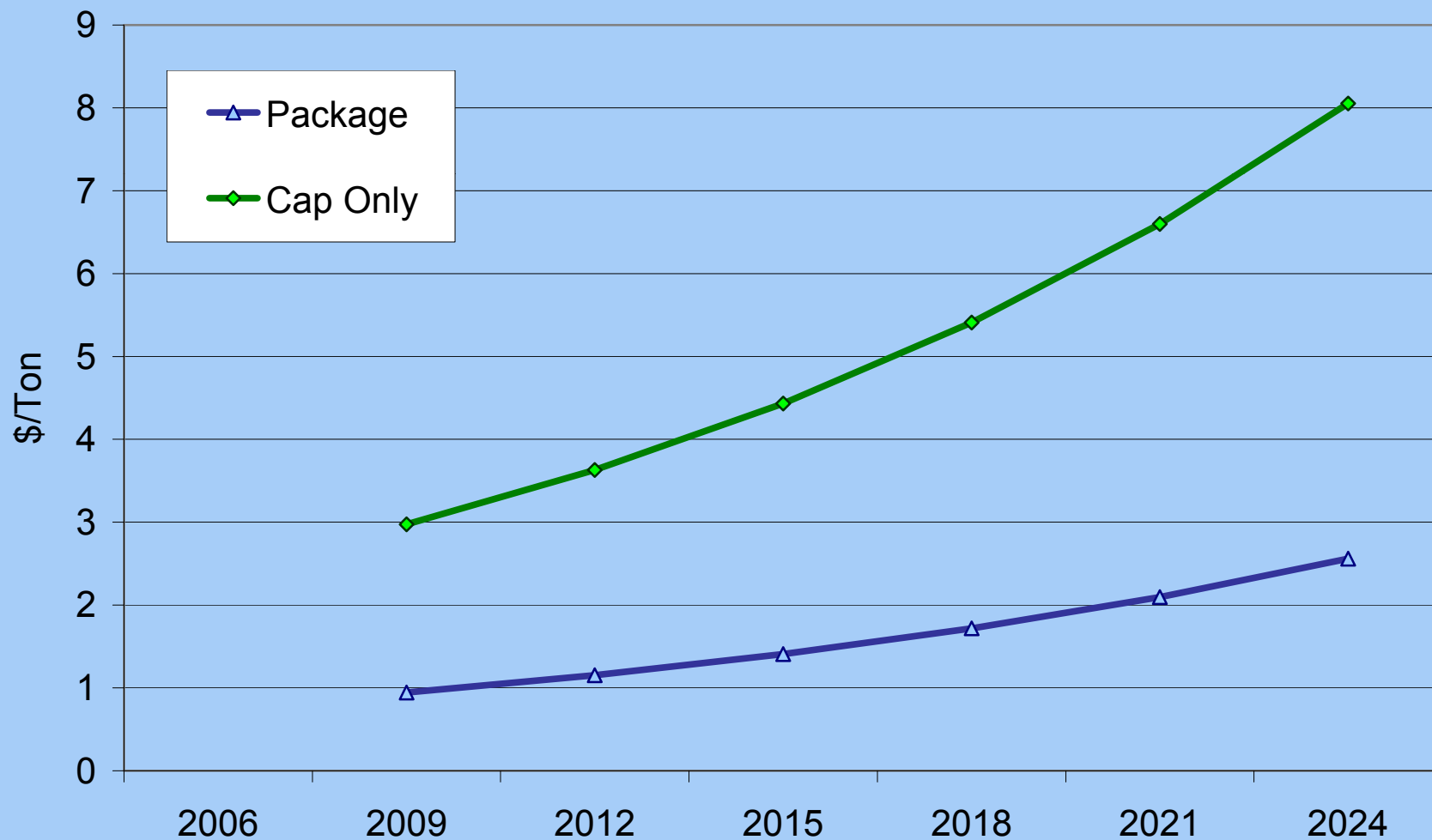
- Cooperative effort by 10 Northeastern and Mid-Atlantic states to reduce carbon dioxide emissions
- Develops the first multi-state cap-and-trade program with a market-based emissions trading system for GHG emissions in the power sector
- Through 2014—stabilize CO₂ levels at current level
- By 2019—reduce CO₂ emissions by 10%
- NYS will auction 64M tons of CO₂ offset credits starting in June 2008



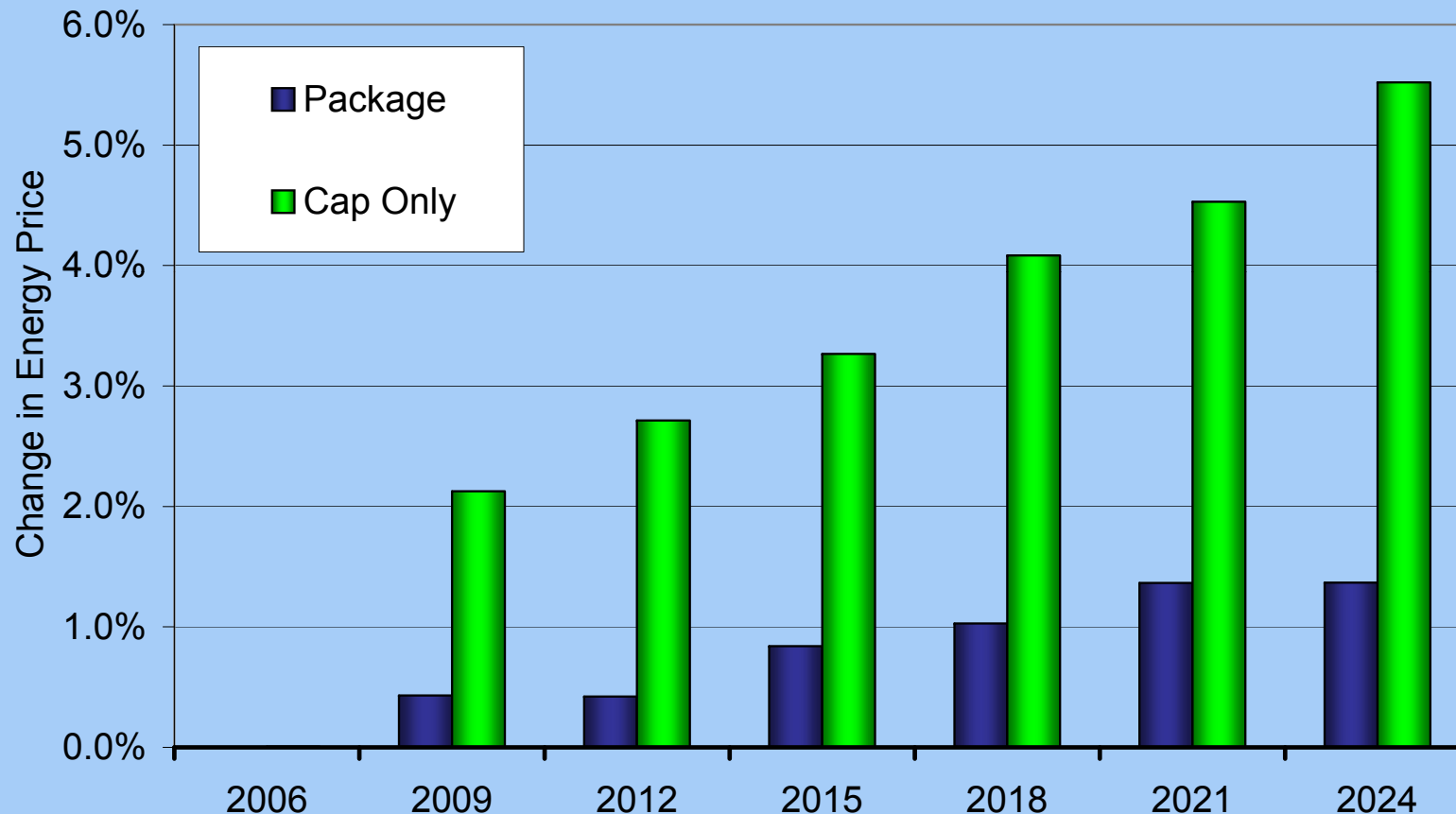
RGGI Design Principles

- Reduce CO₂ with flexible, market-based program to achieve least cost reductions.
- Create model for federal program.
- Maintain electricity affordability, reliability and fuel diversity.
- Make expandable to other states.
- Build on programs in place.
- Allow a range of offsets, including reducing methane leakage from infrastructure.

CO2 Allowance Prices (RGGI)



Change in Average Annual Energy Prices (RGGI)



NOTE: Energy prices represent wholesale market prices and include annualized capacity prices. Note that the RGGI Package Scenario assumes that current levels of annual state expenditures for public benefit programs continue through 2025. While these types of programs cause lower wholesale prices by reducing electricity demand, they are paid for by consumers through a line item charge at the retail level, and are therefore not reflected in the wholesale price changes shown above. Current retail electricity prices already include the annual costs of these programs.

While the modeling assumes that end-use energy efficiency is implemented entirely by public benefit programs, it is recognized that energy efficiency could also be implemented by actions such as appliance standards and building codes that do not require state funding and could possibly be done at lower costs.

State Energy Planning: New Executive Order

ESTABLISHING A STATE ENERGY PLANNING BOARD AND AUTHORIZING THE CREATION AND IMPLEMENTATION OF A STATE ENERGY PLAN

WHEREAS, decisions about how to meet the State's future energy needs can have significant impacts on the environment, public health, public welfare, safety, mobility, quality and reliability of services, energy costs, and the ability to maintain and grow the State's economy; and

WHEREAS, the burning of fossil fuels is a major contributor to global climate change, which poses a serious threat to the environment and the public health in New York State and elsewhere; and

WHEREAS, issues such as energy diversity, dependence on imported energy and fuels, the burning of fossil fuels, global climate change, acid rain and other airborne pollutants, ground-level ozone buildup, increased development, increased transportation demand, and waste generation and disposal from energy production are significant issues affecting New York and should be addressed in a comprehensive State energy plan; and



BY THE GOVERNOR

GIVEN under my hand and the Privy

Seal of the State in the City

of Albany this ninth day of

April in the year two thousand

eight.

David A. Paterson

Renewable Portfolio Standard (September 2004)

- Increase renewable electricity from 19% (2004) to 25% (2013)
- Main tier: medium to large scale generation facilities
- Customer-sited tier: fuel cells, PV, anaerobic, small wind
- \$741million ratepayer collections through 2013



NYSERDA R&D: Climate Change Research Program

- Systems Benefit Charge (SBC3, 2006) formally created a climate change research program at NYSERDA
- Joint research planning with New York Academy of Science and stakeholders (workshop: April 11, 2007)
- Targeted areas for research analysis:
 - Reducing Emissions of Greenhouse Gases and Mitigating Climate Change Impacts in NYS
 - Greenhouse gas reduction curves, energy efficiency, renewables, **CO₂ capture and sequestration (CCS)**, heat island mitigation
 - Understanding and Monitoring Impacts and Managing Risks in NYS
 - Infrastructure and land use, agriculture, air quality and human health, natural resources

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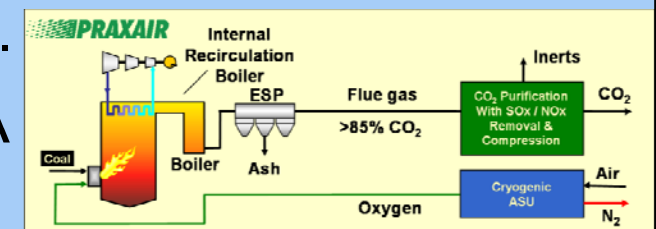
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NYSERDA CCS Research Program

- Detailed characterization of geological formations in NYS to identify storage opportunities (for example NYSERDA provided a geologic guidance document for NYPA ACCPPI).
- Develop New York's strategic technical capability by assisting NYS companies and universities to lead in this global effort. Develop staff competency.
- Become an active member in the Midwest Regional Carbon Sequestration Partnership.
- CCS projects developed through NYSERDA competitive solicitations. Seven projects, \$1.7 million NYSERDA funds)

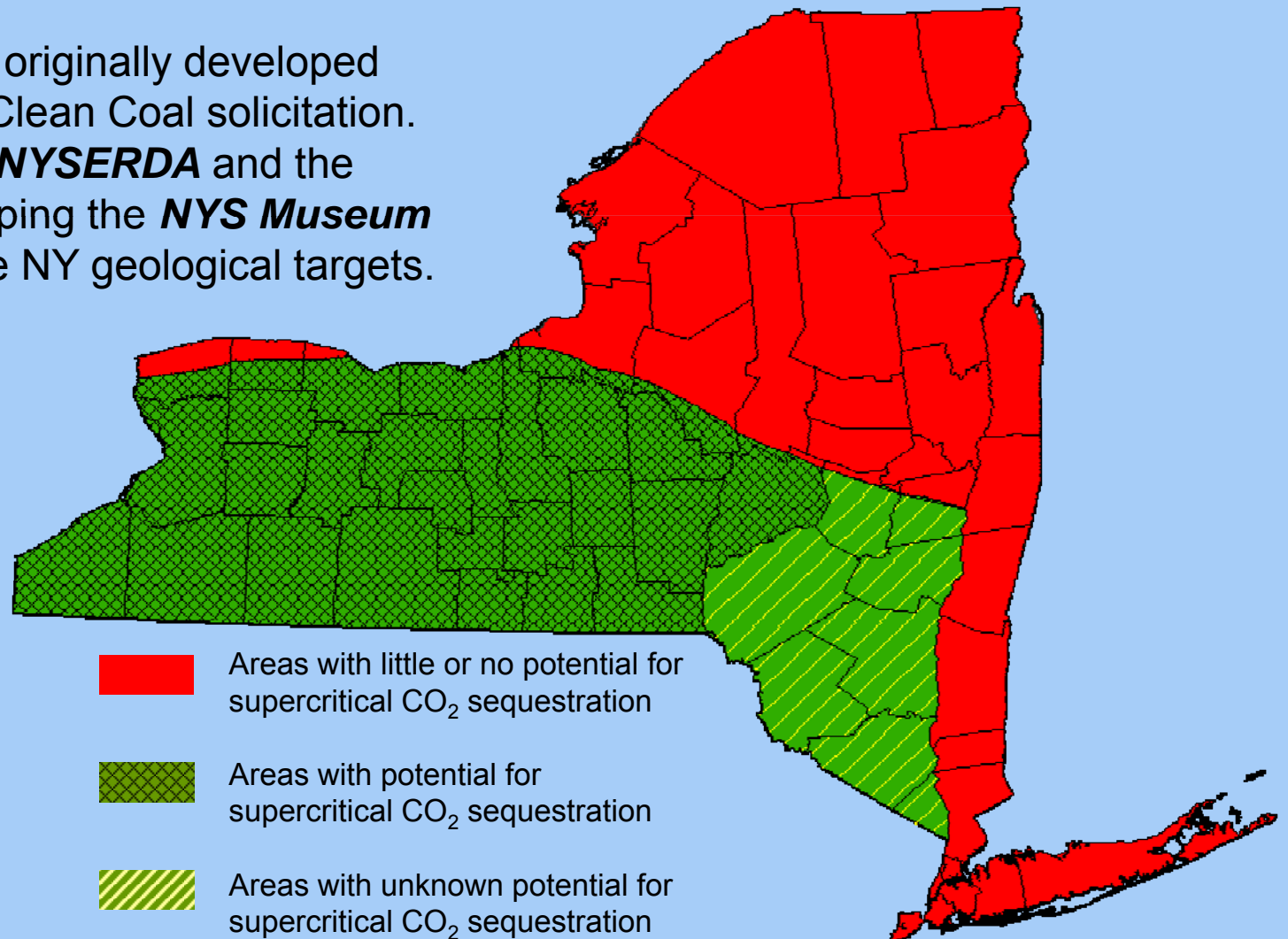


MRCSP
MIDWEST REGIONAL
CARBON SEQUESTRATION
PARTNERSHIP



Potential for Supercritical CO₂ Storage

This map was originally developed for the NYPA Clean Coal solicitation. Funding from **NYSERDA** and the **MRCSP** is helping the **NYS Museum** to characterize NY geological targets.



Other Current CCS Projects

NYSERDA currently manages several other capture and sequestration projects with NYS universities and companies:

- Mineral carbonation
- Algae capture research
- Ocean sediment sequestration research
- Oxycombustion technology development

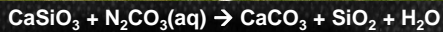
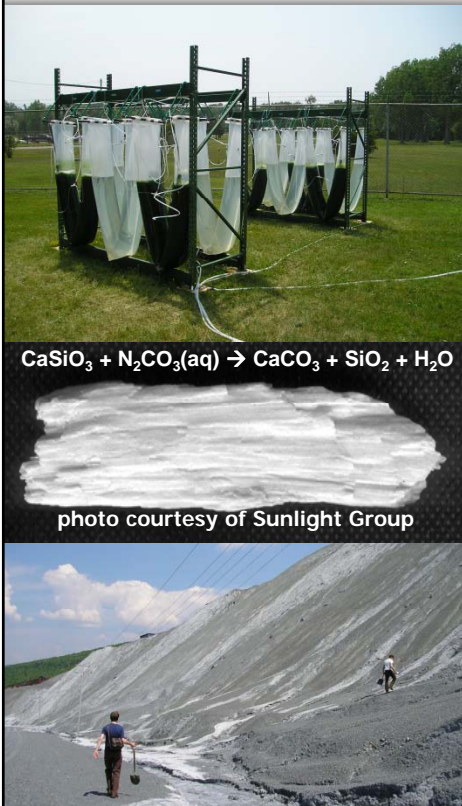
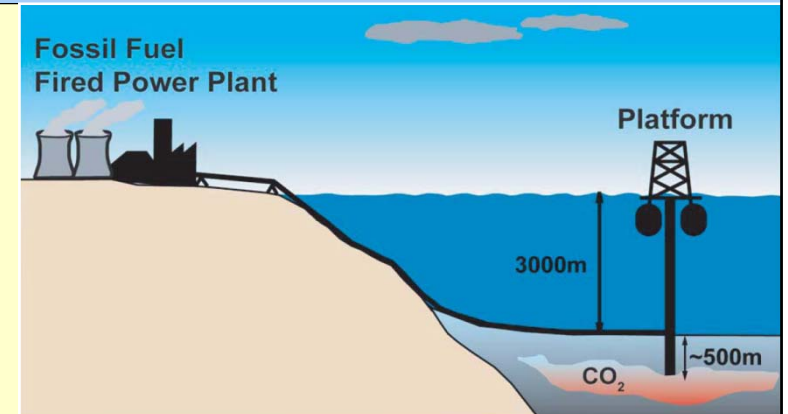
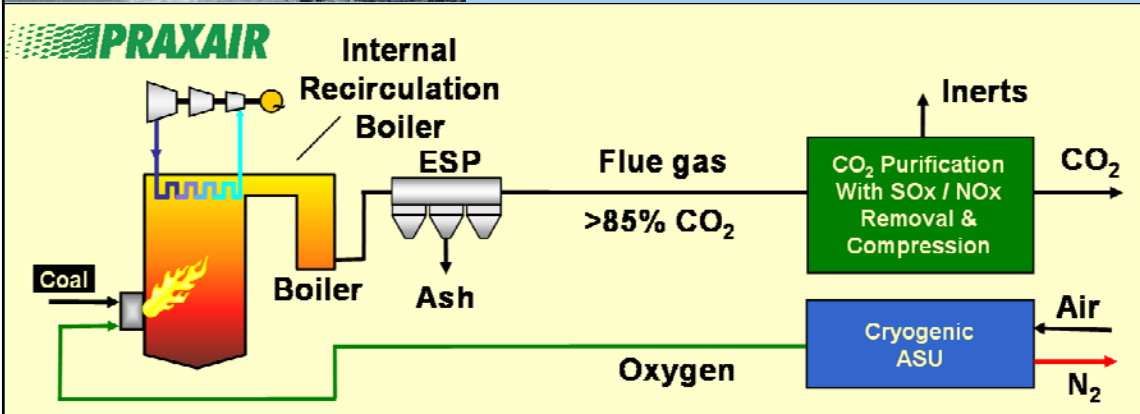


photo courtesy of Sunlight Group



Four New Projects Under Development

- Two projects—with Process Energy Solutions and Ecology & Environment—are site-specific studies to characterize the geology of two sections of western New York with respect to CO₂ sequestration and determine whether sequestration is feasible.
- SUNY at Buffalo along with Cornell University, AES and Geomatrix will characterize the geology of central New York with respect to CO₂ sequestration and assess the possibility of enhanced gas recovery.
- Advanced Resources International: evaluate New York State's gas shales for CO₂ sequestration and enhanced gas recovery potential.

New Initiative: Governor's Carbon Capture and Sequestration Working Group

- Formed in September, 2007 by the Governor's executive staff
- Two major subgroups: ***Regulatory/Siting*** and ***Science/Technology***
- Goals: 1) provide an assessment of technical viability best suited for NY; 2) provide a regulatory regime for CCS projects; and 3) advise on current CCS projects proposed for NY

References

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Questions?

