New York State Energy Research and Development Authority

Market-Based Environmental Protection Mechanisms and the Impact on Energy Production and Use

Final Report

October 2011

No. 11-31

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Market-Based Environmental Protection Mechanisms and the Impact on Energy Production and Use

Final Report

Prepared for the

New York State Energy Research and Development Authority

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NYSERDA Report 11-31 | NYSERDA 9677 | October 2011

Notice

Abstract

Several market-based trading programs currently operate in New York State (NYS) to address various environmental problems. Because these programs rely on market mechanisms to achieve efficient and economical emissions reductions, they are often referred to as market-based programs. With each of these programs operating in overlapping jurisdictions and with different certification protocols and definitions of the commodity/attribute being traded, however, markets can become balkanized and fail to function properly. Lack of precision and homogeneity in the underlying commodity leads to less efficient markets and works to society's disadvantage by diminishing our ability to attain environmental and energy goals. To address this potential problem, this report provides a systematic review of these market-based environmental programs, both mandatory and voluntary, in current use or in the advanced stages of development, and examines the relationships and interactions among them. The following four trading platforms are discussed: (1) Acid Rain/NYS Acid Deposition Reduction Program; (2) Clean Air Interstate Rule (CAIR)/Clean Air Transport Rule (CATR); (3) New York Renewable Portfolio Standard (RPS); and (4) Regional Greenhouse Gas Initiative (RGGI). The following three trading currencies are also discussed: (1) Emission Reduction Credits (ERCs); (2) Emission Allowances (EAs); and (3) Renewable Energy Credits (RECs). Where applicable, this review considers voluntary greenhouse gas credit markets; clean energy set-asides in emission allowance programs, and the use of emission reduction credits as offsets for non-attainment pollutants under the NYS New Source Review (NSR) air permitting program.

Keywords

Allowance

Attainment area

Clean Air Interstate Rule (CAIR)

Clean Air Transport Rule (CATR)

Currency

Emission Allowances (EAs)

Emission Reduction Credits (ERCs)

Emissions

Greenhouse Gases (GHGs)

Leakage

Markets

Nitrogen oxides (NO_x)

Ozone (O_3)

Particulate matter (PM)

Regional Greenhouse Gas Initiative (RGGI)

Renewable Energy Credits (RECs)

Renewable Portfolio Standard (RPS)

Sulfur dioxide (SO_2)

Trading

Volatile organic compounds (VOCs)

Acknowledgments

The project team thanks the New York State Energy Research and Development Authority (NYSERDA) for funding this work. In particular, the team is grateful to Sandra Meier, NYSERDA Senior Project Manager, for her support and guidance throughout the term of the project.

The team expresses its appreciation to the following advisors for reviewing the draft report and for providing constructive comments during the final review process.

Larry DeWitt, The Commons
Rob Sliwinski, NYSDEC
Karl S. Michael, NYSERDA
Kevin C. Hale, NYSERDA
Peter Carney, NYISO
Dave Shaw, NYSDEC
Gernot Wagner, EDF
Jim Austin, DPS
John Saintcross, NYSERDA

The team is greatly indebted to the following persons for generously sharing their valuable insights on market-based programs:

Vince Brisini
Harry Klodowski, Law Offices of Harry F. Klodowski
Francisco Padua, Amerex
Jon Harvey, World Energy
Roger Caiazza, NRG Energy, Inc.
Naeem Hukkawala, Skystream Markets
Patricia Stanton, Conservation Services Group
Art Diem, USEPA
David Oppenheimer, NatSource

The team also thanks the Pace Energy and Climate Center graduate student interns for their supportive efforts throughout the writing of this report: Alexander Casadonte, Matthew Guenther, and Christopher Riti.

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Introduction

The Federal Clean Air Act (CAA) Amendments of 1990 resulted in the world's first pollutant cap-and-trade program.[1] Known as the Acid Rain Program, it was intended to reduce emissions of the acid rain-causing pollutants: nitrogen oxides (NO_X) and sulfur dioxide (SO_2). The Acid Rain Program became the model for all subsequent pollution cap-and-trade programs, including programs currently operating in New York State. Because these programs rely on market mechanisms to achieve efficient and economical emissions reductions, they are often referred to as market-based programs.

This report includes a systematic review of the market-based environmental programs in New York State (NYS), both mandatory and voluntary, in current use or in the advanced stages of development. The following trading platforms and trading currencies are discussed:

Four Trading Platforms:

- Acid Rain/New York State Acid Deposition Reduction Program
- Clean Air Interstate Rule (CAIR)/Clean Air Transport Rule (CATR)
- New York State Renewable Portfolio Standard (RPS)
- Regional Greenhouse Gas Initiative (RGGI)

Three Trading Currencies:

- Emission Reduction Credits (ERCs)
- Emission Allowances (EAs)
- Renewable Energy Credits (RECs)

Where applicable, this review also considers voluntary greenhouse gas credit markets; clean energy set-asides in emission allowance programs; and the use of emission reduction credits as offsets for non-attainment pollutants under the New York State New Source Review (NSR) air permitting program.

[1] "Cap and Trade" refers to a market-based policy approach to controlling emissions from a group of sources at costs that are lower than if sources were regulated individually. The regulating body first sets an overall cap, or maximum amount of emissions per compliance period. Emissions allowances, or authorizations to emit the covered pollutant, are then allocated (distributed) or auctioned, with the total number of allowances equaling the cap. Sources are allowed to buy and sell allowances, hence the "trading" concept. Sources that reduce their emissions can make money by selling their excess allowances to those who need them, or save money because they needn't buy allowances they do not hold. Sources must measure and report all emissions over the compliance period, and surrender the corresponding number of allowances. If a source does not hold sufficient allowances at the time they must be submitted for compliance, the source must pay a penalty significantly higher than the market clearing price of an allowance. In this manner, market forces ensure that emissions reductions are achieved in the most cost-effective manner, while also sending the appropriate market signal that polluting has a cost. Over time, the cap is lowered.

Table I-1. New York State Market-Based Programs Summary Matrix

Program	The Tradeable Commodity is	How Commodity is Created	Pollutants Governed	Lifetime of Commodity	Geographic Scope	Ownership & Transfer	Governing Authority
ERC (Emission Reduction Credit)	A credit created by reduction in the emission of a specific pollutnant by 1 ton per year (TPY), in perpetuity	2 points of origin: ·Emissions Unit Shutdowns, or ·Source Reductions	·Fine Particulate Matter (<10μ, <2.5μ) ·Ozone (VOCs[1], NO_X) ·CO	Credits do not expire	New York, Pennsylvania, Connecticut	Credits are transferable with NYS DEC[2] approval	NYCRR §§ 231-2.10, 231-2.6
EA (Emission Allowance)	An allowance or permit to emit 1 ton of NO_X or SO_2, during a control period, for the time specified	Budgets fixed by regulatory authority. Allocations to sources based on historical emissions and generation size in megawatts (MW) or obtained in market.	·NO_X (Annual, Seasonal) ·SO_2	·NO_X allowances expire after 5 years ·SO_2 allowances do not expire	28 states[3] and Washington, DC	Transferable to EGUs[4] or other affected sources[5]	NYCRR §§ 243, 244, 245 (Administered by NYSDEC)
REC (Renewable Energy Credit)	A credit that represents 1 megawatt hour (MWh) of renewable energy	Unbundling the environmental attributes of a renewable energy from the underlying electricity	Avoided emissions: ·SO_2 ·NO_X ·CO ·GHGs[6]: CO_2, CH_4, and others	·No expiration in NY ·Credits may expire in other states	Not exclusive to NY, but some barriers exist across state lines	Transferable under NYSERDA protocol	PSC Order (September 24, 2004), Retail Renewable Portfolio Standard, Case 03-E-0188
RGGI (Regional Greenhouse Gas Initiative)	An allowance that allows a source to emit 1 ton of CO_2	Allowances created by NYSERDA & DEC in lots of 1,000 per 3 months	CO_2	Allowances do not expire and can be carried forward through the life of the program.	CT, DE, ME, MD, MA, NH, NJ, NY, RI, VT	·Owners must register with COATS[7] ·Allowances are transferable	6 NYCRR §§ 200, 242 21 NYCRR § 507 (Administered by NYSERDA & NYSDEC)

[1]VOCs: Volatile Organic Compounds
[2]DEC: Department of Environmental Conservation
[3]CAIR: AL, AR, CT, DE, FL, GA, IA, IL, IN, KY, LA, MA, MD, MI, MN, MO, NC, NJ, NY, OH, PA, RI, SC, TN, TX, WI, WV, VA
[4]EGU: Electricity Generating Unit
[5]Affected sources include large industrial boilers and Portland cement manufacturers
[6]GHGs: Greenhouse Gases
[7]COATS: CO_2 Allowance Tracking System

The Rationale for Market-Based Emission Control Schemes

This section provides a theoretical justification for establishing a market-based emissions trading program as an instrument for meeting state, regional and national environmental goals and objectives.

Emissions Control Objective and Approaches

The environmental objective is to reduce the amount of emissions of a regulated pollutant released in a specific geographic area or from a specific set of emissions sources.[2] The objective can be met in a number of different ways. Historically the regulator would specify a specific pollution control solution, such as Best Available Control Technology (BACT) or Reasonably Available Control Technology (RACT). The emissions at each source would be controlled by regulation either by specifying a particular technology solution or a fixed allowable rate of emissions or total mass for a performance period.

Command and Control Approach

The traditional approach to regulating emissions is often referred to as a "command and control" model. Under command and control, emissions sources are required to install specific pollution control technologies or meet a specific emissions rate. Assuming that the control equipment is operating according to manufacturers' standards, each site will reduce its emissions in a predictable manner. This approach is particularly desirable if adverse public health and environmental damages occur with increasing local accumulation of the pollutant. Another instance where a prescriptive approach may be warranted is one in which the transport of pollutants from one geographic area into another causes a larger damage cost at the receiving end, or frustrates the ability of the downwind area to meet environmental or air quality objectives. In general, when the damage costs are distinctly different across geographic locations, it may be advantageous to prescribe by regulation a specific limit on the level of emissions at each source.

The critique of the highly prescriptive, command and control approach has been that it fails to take advantage of the knowledge of regional or local decision makers regarding how to most cost effectively meet an environmental objective. Various forms of market-based emission control schemes have been proposed as an alternative that could achieve emission reductions at a much lower cost to society compared with the command and control model.

Market-Based Approach

One form of market-based emissions control is the cap-and-trade model. In this approach a maximum emission limit or "cap" is established for a specified geographic area and set of emissions sources. The cap is set to satisfy a local, regional or national environmental objective. Pollution regulations specify the sources of emissions that fall under the program's jurisdiction; these are the sources of pollution that are affected by the program. Such sources are allocated a share of the total emissions cap, or budget that has been set for the area, state, or region.

[2] This report contains examples of programs at the state (RPS), regional (RGGI), and national (CAIR/CATR) levels.

The allocation comes in the form of "allowances" that confer the right to emit a certain amount of the regulated pollutant. In most cases the unit measure of an allowance is one short ton. In other words, holding one allowance gives an affected source the right to emit one ton of the regulated pollutant, whereas holding 25 allowances would imply that the source has been conferred the right to emit 25 tons of the regulated pollutant. How to most effectively allocate allowances from an emissions budget to individual sources is itself a contentious issue (*i.e.*, auctioned, allocated at no cost to emissions sources, or some combination of the two), but one that is not addressed in this paper.

Sources monitor the amount of the pollutant being emitted at their site. On an annual or on a program period[3] basis the source must surrender to the regulator a total amount of allowances equal to the recorded amount of pollutant emitted at the site for the period covered. If the site reported emitting 100 tons of the regulated pollutant during the program period and it had been awarded 50 allowances at the start of the period, for example, that site must purchase an additional 50 allowances. Conversely, if the site reported emitting 50 allowances over the program period and it was awarded 100 allowances at the start of the period, that site would have an additional 50 allowances that it could offer for sale (the "trade" component of the program) to a source that was deficient in its holdings of allowances.

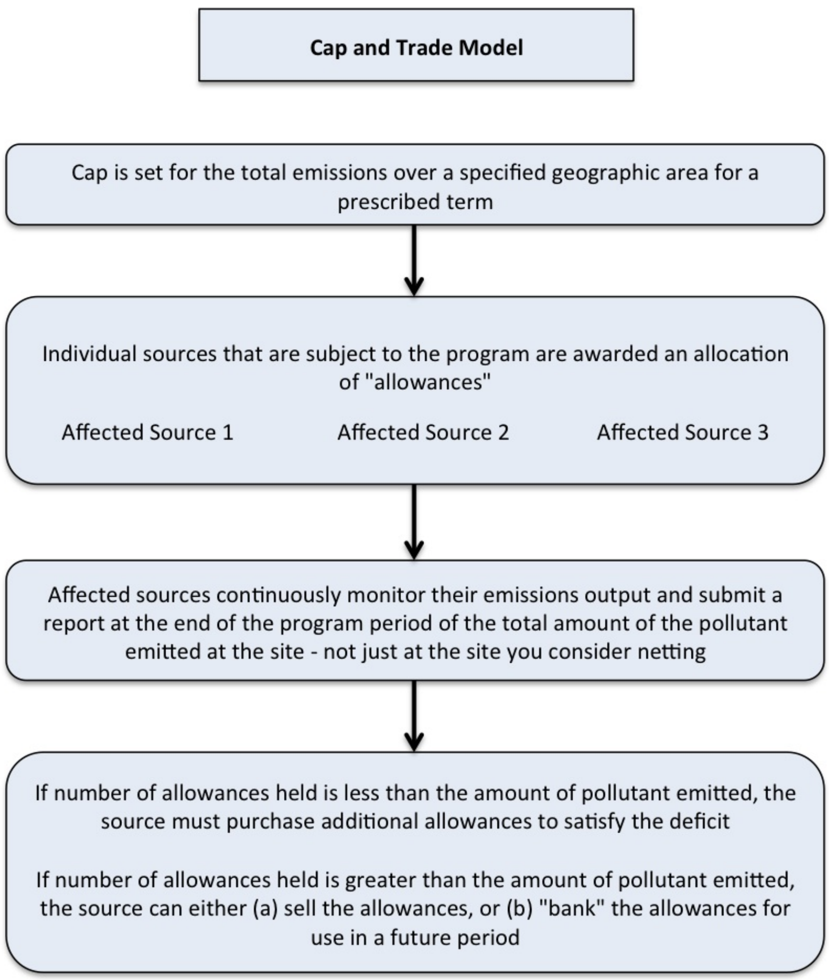

Figure I-1. Cap-and-trade Model

[3] In the case of the Ozone Season program the period is May to September.

COMPARISON OF EMISSION CONTROL APPROACHES

A primary difference between the command-and-control and cap-and-trade approaches is the degree of flexibility afforded to individual sources. Sources subject to traditional command-and-control emissions limitations or technology requirements have less flexibility in choosing among alternatives for meeting an emission requirement. In general, a narrower set of alternatives in theory can lead to higher costs of compliance for affected sources. In contrast, the same source under a cap-and-trade program can choose from a menu of options including installing pollution control equipment, fuel switching, fuel blending, purchasing allowances, or other alternatives that satisfy the affected source's budget requirements. The overall cap ensures the environmental objective is met in the aggregate across all sources.

The greater the number of compliance alternatives, the greater the possibility of meeting the environmental objective at a lower cost through cap and trade as compared with the command and control approach. If there are a large number of potential compliance options, then decentralizing decision making to the affected source provides greater flexibility in achieving the environmental objective. If there are sources that can readily "over-control" their emissions (*i.e.*, achieve emissions reductions greater than applicable requirements) at a cost that is markedly below the cost of controls, then those sources can benefit by selling their excess allowances. Sources where the cost of control is more expensive than purchasing allowances likewise benefit as they are able to comply at a lower cost.

If every source faces the same compliance cost, then there are no gains from a trading regime. To the extent there is homogeneity in abatement costs, there will be little to no advantage using a more flexible trading system as compared with a command and control system. Another approach to improving the potential gains from trade is to open up the system to a broader set of industries. This was done in the NO_X Budget Trading Program by including industrial boilers in addition to electric generators. One rationale was that by bringing in additional emissions sources, additional reduction opportunities would also be introduced—and therefore the potential gains from trade—would be broadened.

When markets are allowed to work to seek out the lowest cost reductions, environmental emissions reduction objectives can often be met at lower total cost to society than under a command-and-control system. For example, prior to the establishment of the national SO_2 trading system, modeling results projected that the costs of requiring pollution control equipment at all sites would be too high to be politically feasible.

Decentralizing decision making through a market-based system also promotes process and product innovation, inasmuch as it engenders a more robust competition among alternative compliance mechanisms. The institution of a trading system is only partially responsible for the lower total cost of meeting environmental objectives. The other and perhaps more important component is the ability to select from a menu of alternative compliance options rather than being required to install pollution control equipment.

One of the unexpected outcomes of the national SO_2 program, for example, was the lower cost of compliance achieved as a result of fuel switching. Although analysts expected that there would be some switching from higher emitting Eastern coal to lower emitting Western coal, no one anticipated the sharp drop in transportation costs that occurred, as well as increased productivity and lower costs in the fuel markets themselves. Competition in input markets lead to a decline in the cost of production for coal-fired electricity.

With respect to the preference of market participants in the design of market-based mechanisms, market participants prefer broader markets to more restricted trading markets. In other words, a national market is preferred to a regional market and a regional preferred to state or local markets. Market participants also prefer that the commodity to be certified and traded be as homogeneous and consistent as is feasible. When distinctions become important, such as a ton of NO_X in one area being distinct and not tradable into another area, the market becomes more fragmented, more balkanized, and therefore less efficient.

An important question is whether or not the marginal damage costs vary substantially by the location of the emitting source. If the answer to this question is yes, then it is important that regulations address the spatial dimension, thereby recognizing differential impacts by geographic location.

Factors More Favorable to Market-Based Emission Approaches

- Broader geographic markets preferred to more restricted geographic markets
- Broader set of industries participating preferred to more restricted set of industry participants
- One or a few standard commodities preferred to many commodities
- One program with one set of rules preferred to a multiplicity of programs and rules

1. Market-Based Environmental Protection Mechanisms Applicable to New York State

This chapter describes the market-based environmental protection mechanisms operating in New York State (NYS). Each of the trading currencies is described and characterized with attention to the following parameters:

- What is the commodity being traded? (What are the pollutants covered?)
- How is the commodity created and certified?
- What are the rules regarding ownership, transfer, environmental claims and disclosure?
- What is the lifetime of the commodity?
- What is the geographic scope of the market?
- What are the owner responsibilities and the market and operating risks?
- What is the state of the financial markets for tradable emission rights?
- Have the program outcomes to date met expectations?

1.1 Emission Reduction Credits

In order to protect the public health and welfare, the Clean Air Act (CAA) establishes national ambient air quality standards (NAAQS) for each of the CAA's six criteria pollutants.[4] States must ensure that these standards, expressed in terms of concentration levels that may not be exceeded, are met for federally-determined air quality control regions (AQCR). If a state fails to meet the NAAQS for a particular AQCR, that region is deemed to be a nonattainment area. In NYS, several metropolitan areas are in nonattainment for ozone and particulate matter (PM), as shown in Figure 1-1.

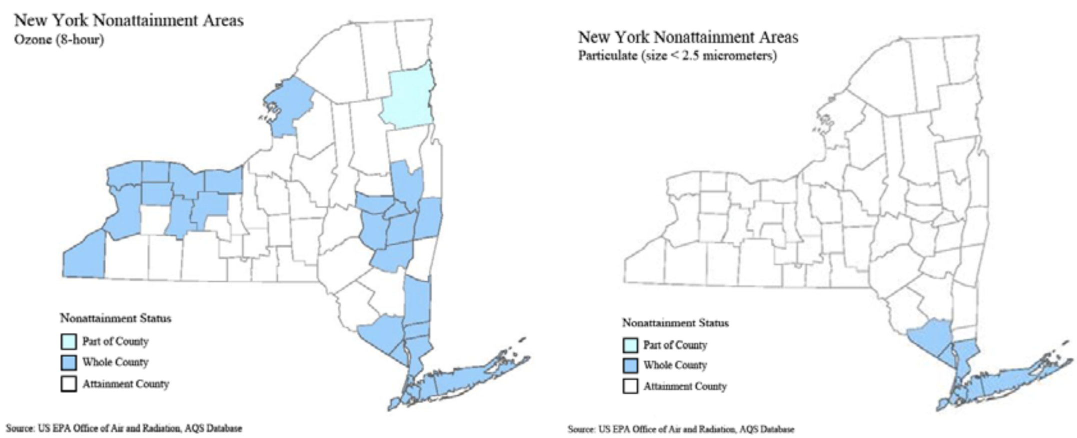

Figure 1-1. New York State non-attainment areas for ozone (left) and fine particulate matter, $PM_{2.5}$ (right)

The CAA New Source Review (NSR) program requires that emissions from new or modified facilities located in nonattainment zones be fully offset. The ratio of offsets to new emissions increasing with the severity of the NAAQS

[4] Criteria pollutants include: sulfur dioxide (SO_2), particulate matter (PM), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O_3), and lead (Pb).

violations in the region where the increased emissions will occur. The NYS Department of Environmental Conservation (NYSDEC) instituted the Emission Reduction Credit (ERC) Program[5] in order to comply with these CAA requirements. In NYS nonattainment areas, the NYSDEC ERC program regulates emissions of carbon monoxide (CO), nitrogen oxides (NO_X), volatile organic compounds (VOCs), and PM. The program ensures that new or modified major stationary sources of these pollutants do not contribute to further violations of the NAAQS. ERCs created from verified reductions can be used to offset the projected increased emissions from new or expanded sources.

1.1.1 What is the Commodity Being Traded?

An ERC in NYS represents a reduction in emissions of one ton of a nonattainment contaminant that is:

1. Surplus: The reduction is in excess of CAA requirements or other applicable state law;
2. Quantifiable: The reduction has been calculated using reliable and replicable means for determining the amount and rate of reductions;
3. Permanent: The reduction can be demonstrated to be indefinite in duration; and
4. Enforceable/Certifiable: The reduction is otherwise certifiable according to the standards of the NYSDEC.

An ERC for a criteria pollutant represents a right to the holder to emit one ton of that pollutant in perpetuity. The source of the ERC must therefore certify to the NYSDEC that the reduction it is requesting certification for is a permanent reduction.

1.1.2 How is the Commodity Created and Certified?

According to NYSDEC regulations, "ERCs may be created from past or future emission reductions resulting from facility shutdown, emission source shutdown, curtailment, emission source reduction, over control of emissions beyond an applicable limit, or any other reduction mechanism acceptable to the department."(6NYCRR Part 231-10) An emission rate reduction and/or utilization reduction can occur with a switch to a lower-emission fuel, process modifications including higher efficiency systems, the installation of pollution control technology, or simply curtailment of operations at the site. These changes must be codified through an enforceable permit modification. If the source is claiming emission reductions at an emissions unit, the operator must demonstrate that the unit is inoperable or has been removed. If the source is claiming emission reduction because it is shutting down the entire facility, it must surrender its Title V operating permit. Emission reductions will result in the creation of ERCs only if the emitting facility was included in the NYS Implementation Plan (SIP) Inventory.[6]

The deadline to apply for ERCs in NYS is five years after the emission reduction or facility shutdown occurs. The applicant must provide specific and accurate data demonstrating its Actual Baseline Emissions. The baseline is created using emissions data from any consecutive 24-month period within five years immediately preceding the reduction. For purposes of calculating future reductions, the baseline is created using emissions preceding the date the application is received. Lack of data for any part of the 24-month baseline period is considered an indicator of zero emissions in that period.

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[5] See 6 NYCRR Part 231-10. Examination of the full complexities of the New York regulatory scheme for ERCs is outside the scope of this report, but further information on the ERC Registry may be found at http://www.dec.ny.gov/chemical/8564.html.

[6] Under the CAA, states are required by the EPA to submit State Implementation Plans (SIPs), detailing the individual state's strategy for attaining national air quality standards. One component of this plan is the SIP inventory, "a comprehensive, accurate, current inventory of actual emissions from all sources of the relevant pollutant or pollutants in such area." 42 U.S.C. §7502(c)(3).

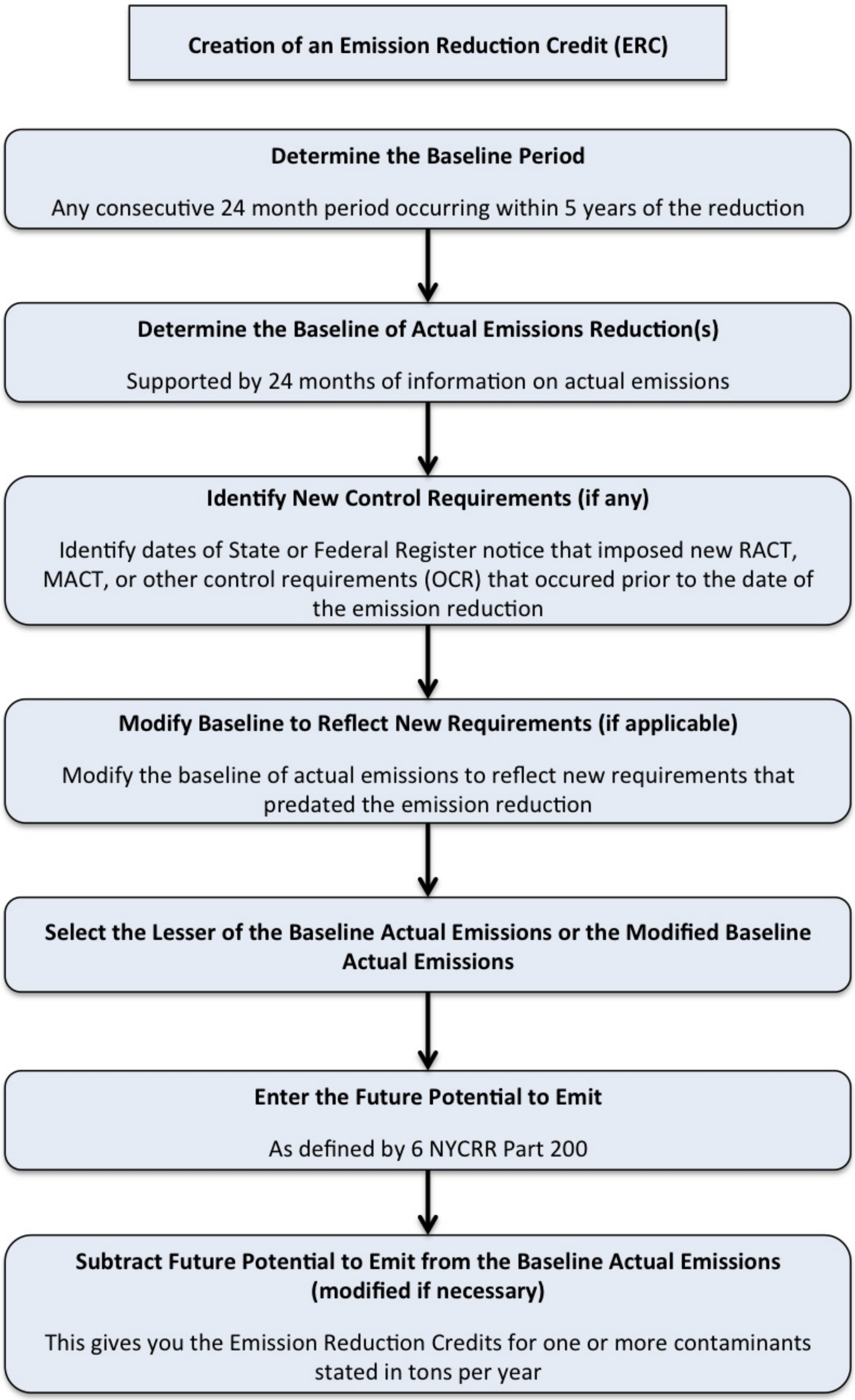

Figure 1-2. Creation of an Emission Reduction Credit (ERC)

1.1.3 What are the Rules Regarding Ownership, Transfer, Environmental Claims and Disclosure?

In order to facilitate exchanges between buyers and sellers, NYSDEC maintains an inventory of registered ERCs available for sale (the ERC Registry). ERCs are easily transferred between seller and buyer; both parties sign and date the reverse side of the ERC certificate, the signatures are notarized, and the certificate is sent to NYSDEC. NYSDEC then issues new certificates to both parties reflecting the transfer. ERCs may also originate in upwind states with whom NYS has entered into a Memorandum of Understanding (MOU). In cases of inter-state transfer, the terms of the MOU govern how ERCs are to be extinguished in the originating state's registry.

Prior to the sale, the seller must submit a *Use of Emission Reduction Credits* form to NYSDEC, specifying the terms of the pending transfer. If NYSDEC approves the transaction, it will note the details of the sale on the online ERC Registry. Posting on the ERC Registry provides assurance to the buyer that the commodity being exchanged satisfies all applicable standards.

1.1.4 What is the Lifetime of the Commodity? Are there Opportunities for Banking, Borrowing, Conversion, or Other Flexibility Provisions?

The particular characteristics of ERCs, such as lifetime and banking provisions, vary widely from state to state. In NYS, ERCs are entered into a state registry and do not expire. Massachusetts, on the other hand, permits banking and retires ERCs held in the Rate ERC Bank after 10 years if they have not been used, but permits ERCs held in the Massachusetts ERC Bank to continue indefinitely. New Jersey, for its part, also allows banking, but the tonnage value of the ERCs diminishes and ultimately reverts to the state. In Pennsylvania, the source of the reduction determines whether or not an ERC will expire. ERCs generated by decreases in production or facility shutdown must be used within 10 years, while those resulting from over-control of emissions do not expire. Connecticut ERCs have historically had no expiration date; however, recent policy changes have resulted in the attachment of a five year expiration date to ERCs created from source reductions in Connecticut.

1.1.5 What is the Geographic Scope of the Market? To what Extent is there a Common Currency Tradable Across Jurisdictional Lines? What are the Barriers to Development of a Common Currency?

Geographic location is a critical attribute of an ERC. ERCs are based on the emissions reductions achieved at the end-user's location, which must be within the nonattainment area. The markets for ERCs are constrained by state boundaries and are further constrained by the severity of the degree of nonattainment.[7] New or expanding sources must obtain ERCs created in the same nonattainment zone and state in which the proposed source is to be located or from other nonattainment areas of equal or higher classification in the same state, or upwind if emissions from such other areas contribute to a violation of NAAQS. An ERC that has been certified in an area of lesser nonattainment severity within a state may not be sold to a buyer for application in an area of greater nonattainment severity. For example, an exchange of 100 tons of NO_X ERCs from a source in Albany to a site in the Bronx would not be permitted, inasmuch as the Albany site is a moderate nonattainment area for ozone whereas the Bronx site resides in a severe nonattainment area for ozone. NO_x is an ozone precursor and therefore ERCs for NO_x are required in ozone nonattainment areas. Figure 1-3 illustrates the non-attainment areas in NYS (U.S. EPA(g)).

[7] NYS treats NO_x and volatile organic compounds (VOCs) as nonattainment contaminants statewide because all of NYS is within the ozone transport region (U.S. EPA(f))

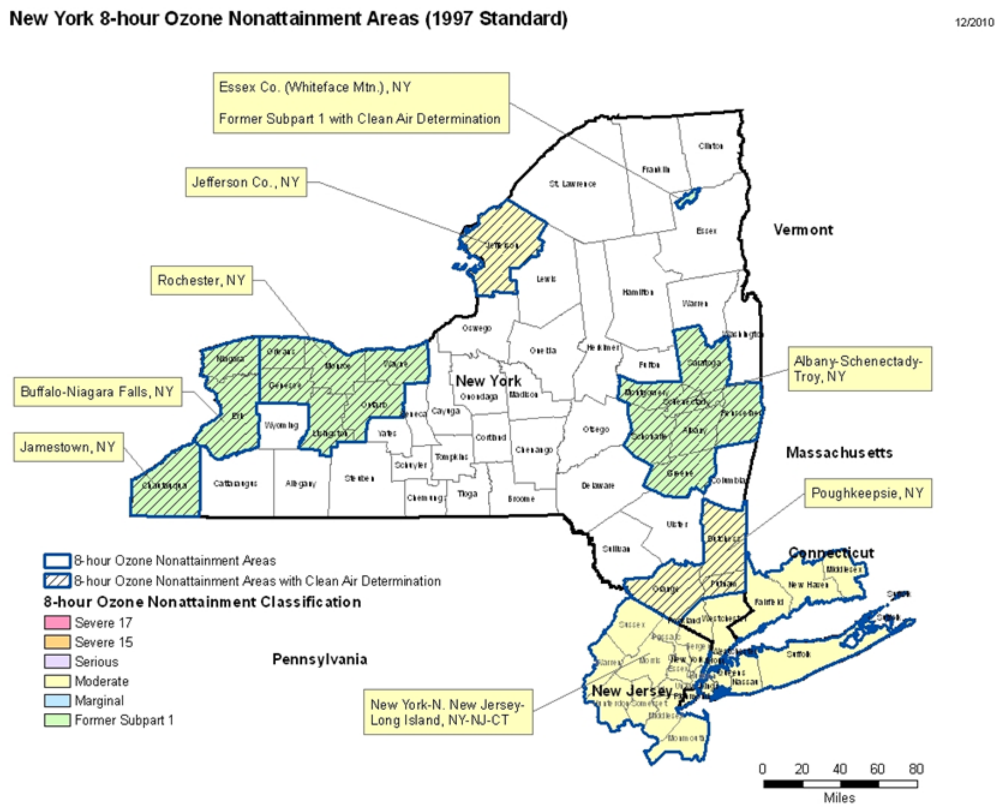

Figure 1-3. NYS 8-hour Ozone Nonattainment Areas (EPA)[8]

In general, interstate trades of ERCs are permitted only by means of a formal memorandum of understanding (MOU) between the participating states. Trades between NYS and Pennsylvania or Connecticut, respectively, are permitted pursuant to established memoranda of understanding (MOU) and reciprocity agreements authorizing such trades for NYS (PA DEP 1996, CT DEP 1999). Similar agreements would need to be established with other states to further broaden the geographical scope of the market across state lines.

The NYS/Pennsylvania MOU and the NY/Connecticut reciprocity agreement impose the following conditions on cross-border ERC trades:

- Only emissions that are surplus, permanent, quantifiable, and federally enforceable at the time of generation may be certified as ERCs
- The state in which the ERCs were generated will notify the user state of any violations of permit conditions
- The state generating the ERCs is responsible for assisting the user state in responding to comments on ERCs received by the user state; and
- Each state will maintain a registry of all certified ERCs, and provide the other state a copy within 15 days after the end of each calendar quarter.

[8] EPA is issuing a new ozone standard, probably lowering the limit from 0.075 to 0.070 ppm, which would likely put most of the state out of compliance. The comment period for the new standard has closed, and a rule is expected to be issued by EPA, but not by July 29, 2011, the date EPA originally intended.

1.1.6 What are the Owner Responsibilities, Market and Operating Risks?

Owners of ERCs are required to submit sufficient information to support ERC certification and regulatory follow-up, general monitoring (to ensure the legitimacy of the credit), and regional processing (NYSERDA et al. 2008). According to the NYSDEC ERC program, "[t]he applicant must submit an 'Air Permit Application'…" which must include "a complete 'Emission Reduction Credit Quantification Form' with supporting documentation establishing that the emission reduction is surplus, quantifiable, permanent and enforceable."[9] Every major facility is required to have a stack testing protocol in place, which will be complemented by site-specific testing.[10]

The primary risk to investors is that ERCs are not, at this writing, worth very much, and this seems unlikely to change in the near future. The value of ERCs fluctuates with the level of demand, and demand for ERCs is to a large degree dependent on new construction in the energy and industrial/manufacturing sectors. New investment in electric utility generating stations and large industrial facilities has markedly diminished in NYS over the last decade; consequently, the NYS ERC market has been largely inactive during that time. The value of ERCs is further limited by the geographical scope of the market and rules governing where a specific ERC may or may not be sold within that market.

On a regional scale, the Northeast has undergone a transition from a manufacturing to a service-based economy. This is a long and well-established trend, based on the price of labor, demographic shifts and shifts of markets, tax rates, and other variables, which will likely prove difficult to reverse. Concomitant with these macro-economic factors, there has been a decline in the emissions intensity of new or repowered utility and manufacturing facilities that remain. These trends have contributed to an improvement in the quality of the regional environment, but have also worked to depress the demand for, and the value of, ERCs. While demand for ERCs is low, the cost of ERC creation at times can be high. The ERC certification process can take anywhere from several months to several years. In the latter case, the payback period for ERC creation, even assuming a high value for ERCs, might be unreasonably long.

In addition to the market risk and transaction costs, small sources of ERCs face a problem of scale. Since the costs of certifying ERCs are largely fixed, small projects cost significantly more per ton to certify than larger projects. On the buyer's side, most ERC users require large volumes of ERCs. A buyer would prefer to execute a single contract for 100 tons of ERCs, for example, rather than 10 contracts of 10 tons each. Small-scale sources of ERCs are less able to attract buyers for their ERCs on the same terms as large-scale sources. ERC aggregators (which bundle ERCs from different sources) could create a more robust market for the smaller scale sources but would require a fee for their services, further diminishing the value the ERC.

1.1.7 Assessment of the Financial Markets for Tradable Emission Rights, With Respect to Performance Attributes Such as Liquidity, Volume of Trades, Price Volatility, and Strategic Behavior

NSR requires all new Electric Generating Units (EGUs) in nonattainment areas (or in the ozone transport region that encompasses the entire state) to offset their projected emissions at an offset ratio that varies based on the classification of the nonattainment area. The market for ERCs therefore depends heavily on the market for new EGUs. As there has been little construction of new EGUs in the region, demand for ERCs in NYS has been stagnant since 2001.

As noted above, buyers generally need, and prefer, to purchase ERCs in relatively large quantities, meaning that aggregation of ERCs from numerous smaller emissions reduction projects may occur. In Pennsylvania, for example, new natural gas plants will most likely be treated as one aggregated source for purposes of permitting, and this should lead to increases in demand for NO_X and VOC ERCs (H. Klodowski, 2010). At the same time, Evolution Markets has

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[9] 6 NYCRR §231-10.3(b)(2)
[10] 6 NYCRR Part 202.

described ERC trading volume as having no typical transaction lot size: "Volumes are dictated by the needs of an individual buyer or the supply of an individual seller." (Evolution Markets (a) 2009).

Historically, the contaminant with the greatest ERC trading activity has been NO_X. Past NO_X ERC prices have ranged from approximately $1,000 to approximately $29,000 per ton (occurring in the New York City severe nonattainment area). ERC prices are higher in severe areas and lower in moderate ones. Current prices are at historic lows due to limited demand over the past several years, for the reasons described above.

All ERCs are listed in the cumulative ERC registry maintained by the NYSDEC Division of Air Resources, Bureau of Stationary Sources (NYSDEC ERC registry).[11] As of May 20, 2011, there were 14,788.472 total NO_X ERCs available (measured in fractional tons). There were also 3,202.023 VOC ERCs available with 1,149.08 used; 378.17 CO ERCs available; and 2.26 PM ERCs available.

Table 1-1. ERC availability as of May 20, 2011. (NYSDEC ERC registry)

Nonattainment Area	NO_x	VOC	CO	PM-10
Attainment (OTR)	**5617.860**	**755.207**	-	-
Marginal Ozone	4543.210	1361.911	-	-
Moderate Ozone	713.872	108.650	-	-
Severe Ozone	3913.530	976.255	-	-
Moderate	-	-	378.17	2.26
Total	**14788.472**	**3202.023**	378.17	2.26

1.1.8 What were the Desired Program Outcomes, and Have they Met Expectations?

The objective of the ERC Program is to reduce the emissions from major new sources of NO_X, VOCs, PM and CO in areas of NYS designated as nonattainment zones. The ERC program has been utilized to some extent; however, there is little current demand for ERCs, for the reasons described in this section.

Although air quality data for NYS indicate improvement over the last decade, no analysis has quantified the extent to which those emissions reductions can be attributed to the ERC program. The entire suite of programs, including the NYS Acid Deposition Reduction Program, the Clean Air Interstate Rule (CAIR), NYS Renewable Portfolio Standard (RPS), and the Regional Greenhouse Gas Initiative (RGGI), and reductions achieved through RACT standards such as 6 NYCRR Subpart 227-2 NO_X have all contributed to total emissions reductions within the state.

A fundamental issue with ERCs is that as a relatively small market, new potential market entrants oftentimes need to purchase ERCs from existing sources that are often competitors. Some have argued that existing sources are subsidized by new sources. In certain circumstances in order to enter into the market, sources would need to pay their competitor. This can serve as an impediment to a fluid market.

[11] For information on how many ERCs have been used, *see* Use of Emission Reduction Credits, http://www.dec.ny.gov/chemical/8947.html.

1.2 Emission Allowances

EPA promulgated CAIR (40 C.F.R. § 96) in 2005, capping NO_X and SO_2 emissions and implementing a uniform and accessible emissions allowance (EA) trading program in 28 eastern states, including NYS and the District of Columbia. CAIR became effective in 2009, replacing two earlier programs in NYS: the NO_X Budget Trading Program and the Acid Deposition Reduction Program. Under CAIR, emitters able to achieve reductions most cost-effectively and innovatively could sell excess allowances to those with higher compliance costs for emissions reductions. Over time, the total emissions would be reduced as the cap was lowered, meaning fewer allowances would be allocated. CAIR's system of unlimited interstate allowance trading in theory made it possible for states to exceed their annual emissions, potentially adversely affecting air quality in downwind nonattainment locations in other states.

On July 11, 2008, the D.C. Circuit in North Carolina v. EPA ruled that, among other things, CAIR's interstate emission trading allowances violated the "good neighbor" provision of the Clean Air Act, which requires states to curb emissions that significantly contribute to nonattainment areas in downwind states. According to the court's decision, CAIR in its current form was not adequate to address emissions in upwind states, and therefore had to be vacated (*i.e.*, thrown out). In the meantime, however, the court allowed CAIR to remain in effect until a replacement rule was promulgated.[12]

On July 6, 2010, EPA proposed the Clean Air Transport Rule (CATR) to replace CAIR. CATR aims to attain and maintain PM and ozone levels as required under NAAQS while addressing the deficiencies identified by the court in the design of CAIR. CATR enforces conditions in the CAA that require states to prohibit emissions determined to significantly contribute to nonattainment of NAAQS in downwind states. CATR will regulate EGU emissions in 31 states, including NYS and the District of Columbia. Under CATR, EPA will set maximum NO_X and SO_2 emission allowances for each state and opportunities for interstate allowance trading will be limited. Once CATR is promulgated, EPA will set Federal Implementation Programs (FIPs) to ensure each state is able to meet its emission requirements and to avoid delay in program implementation. Although all states will initially operate under FIPs, states would be allowed to develop State Implementation Plans (SIPs) to realize emission reductions. The Final Rule is expected to be issued in 2011 with reductions beginning in 2012.[13]

[12] http://www.epa.gov/airmarkets/progsregs/cair/docs/CAIRRemandOrder.pdf. Also noted in Court's decision, "Here, we are convinced that, notwithstanding the relative flaws of CAIR, allowing CAIR to remain in effect until it is replaced by a rule consistent with our opinion would at least temporarily preserve the environmental values covered by CAIR. Accordingly, a remand without vacatur is appropriate in this case."

[13] Since this report was drafted, EPA replaced CAIR with the Cross-State Air Pollution Rule (CSAPR). CSAPR will take effect January 1, 2012. For more information on CSAPR, see: http://www.epa.gov/airtransport

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1.2.1 What is the Commodity and What are the Trade Limitations?

An EA grants the holder the right to emit one ton of the regulated pollutant, either ozone seasonal NO_X, annual NO_X, or SO_2. Under CAIR, NO_X and SO_2 allowances are traded in separate markets, as are seasonal NO_X (which runs from May through September) and annual NO_X. The EA markets for these programs are distinct, and trading is limited to the respective markets.[14]

Emission allowances are allocated to EGUs and other affected sources in one ton increments.[15] EGUs with capacities greater than 15 MW will be required to possess an EA for each ton of NO_X or SO_2 emitted. The programs have a control period that extends either over a calendar year, or for the ozone season, which runs from May 1 to September 30. At the end of the control period, all affected sources must have the requisite number of allowances to cover their emissions for that period. The "Allowance Transfer Deadline" is the statutory deadline by which all allowance transfers must be made to a source's compliance account in order to be recorded for the applicable control period. For example, in the case of the Ozone Season program, the final day for transferring allowances into a source's compliance account is November 30 of the year in question.

Under CAIR, all affected sources in states covered by the program can engage in trade of allowances. In the absence of other complications, a broader geographic trading area is preferred to several small trading areas. EPA's preferred approach under the proposed CATR assigns states to one of two groups. States with the most severe air quality issues are included in Group 1, while Group 2 includes those states requiring less stringent emission reductions. If CATR allows for interstate trading, states will be able to trade allowances only with other states of the same Group.

1.2.2 How is the Commodity Created and Certified?

Emission allowances for both NO_X and SO_2 are created by EPA and passed through NYSDEC to affected sources. The total number of allowances allocated to NYS for the Ozone season NO_X program is fixed at a level of 31,091 tons for program years 2009—2014. NYSDEC allocates the allowances based on need, historical emissions, and generation size.[16]

NYSDEC allocates allowances to EGUs using calculations specified for two different control periods: the Phase I control period (2009-2014) and the Phase II control period (beginning in 2015). The regulations provide calculations pertaining to existing CAIR NO_X units, new unit set-asides, and the Energy Efficiency and Renewable Energy Technology (EERET) Account (see section 1.2.3).

[14] Regulations regarding CAIR NO_X Ozone Season allowance allocations may be found at 6 NYCRR §243-5.3.
[15] In NYS affected sources include EGU's, large industrial boilers >250MMBTUs/hour and Portland Cement Kilns.
[16] 6 NYCRR §§243.5 (Ozone Season allowances), 244.5 (CAIR NO_X Allowance Allocations).

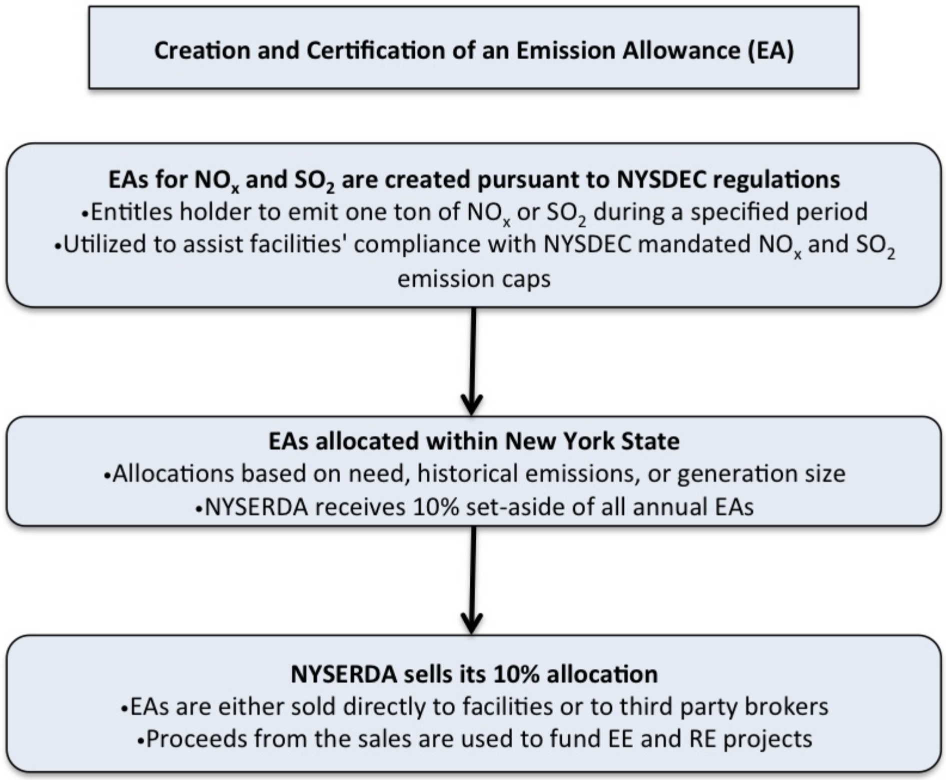

Figure 1-4. Creation and Certification of an Emission Allowance (EA)

1.2.3 What are the Rules Regarding Ownership, Transfer, Environmental Claims and Disclosure?

EAs are allocated by states to regulated sources. A source must have sufficient allowances to cover its emissions at the end of each control period, but it is free to transfer, sell or bank any surplus allowances available at the close of the period. Any affected source may transfer allowances from related entities or purchase them to fulfill its needs (U.S. EPA(b)).

Allowances needed for compliance with CAIR are held in compliance accounts. To transfer allowances, the owner must apply to open a general account, which is an account specifically intended to hold and transfer CAIR allowances. These accounts are established for each of the respective emissions trading programs.17

Under the NOX seasonal and annual trading program, NYSDEC allocated 10% of the State's seasonal and annual NOX allowances to an EERET account, operated and administered by NYSERDA. NYSERDA sells these allowances and uses the proceeds to fund energy efficiency and renewable energy projects that implement clean energy technology (NYSERDA 2009). This account replaced the former Energy Efficiency/Renewable Energy Allowance Set-Aside under the precursor to the CAIR program, the NOX Budget Trading Program, which was in effect from 2003 to 2008. Under the prior program, energy efficiency and renewable energy projects could petition for and, if approved, obtain allowances from the EE/RE Set Aside account. Under the Set-Aside provisions, NYSDEC allocated 10% of the CAIR NOX Ozone Season Trading Program budget to the EERET account, to be administered by NYSERDA. In the event that NYSERDA is unable to accept the allowances into the account for a particular control period, or if NYSERDA is

[17] For more information on NYS regulations regarding the allowance tracking systems, which includes compliance accounts, for the SO_2, NO_x Annual and NO_x Seasonal trading programs please see New York State Clean Air Interstate Rule: http://www.dec.ny.gov/chemical/37878.html.

unable to sell all of the allowances within 12 months of receiving them into its account, provisions exist for returning unused allowances back to NYSDEC for distribution into other accounts.

1.2.4 What is the Lifetime of the Commodity? Are there Opportunities for Banking, Borrowing, or Conversion, or Other Flexibility Provisions?

Under CAIR, allowances may be used for the current control period, which for the CAIR NO_X Ozone Season Trading Program (with certain exceptions) is the period beginning May 1 and ending September 30 of the same year. For the CAIR NO_X Annual Trading Program and CAIR SO_X Trading Program, the control period runs from January 1 to December 31. CAIR allowances under any of the trading programs do not expire. They may be banked and will stay in the compliance account until they are either "deducted or transferred."

Unlike CAIR, CATR will not allow Acid Rain Program SO_2 allowances to be used for compliance. Similarly, CATR SO_2 allowances will not be allowed for compliance with the Acid Rain Program. Regarding NO_X allowances, EPA's preferred option is to not permit CAIR NO_X allowances to be used in the new CATR program.

Banking provisions exist under the current CAIR rule, as they did in the prior NO_X budget program that was the predecessor to the CAIR program. Under the prior NO_X budget program there were "Progressive Flow Control" provisions that reduced the value of banked allowances, once the size of the bank exceeded a certain threshold level. The flow control provisions were not carried over into the CAIR program.

In general, banking affords affected sources greater flexibility as they set out a multi-year compliance plan. Allowance banking should reduce market volatility related to unplanned circumstances. Banking also provides an incentive to engage in early compliance.

Under the proposed CATR, banking of EAs issued under the program would be permitted. According to the proposed rule, "[b]anking (or saving) allowances for future use in any given year allows sources flexibility in compliance planning. Banking lowers costs and helps reduce market volatility. Banking also acts as an incentive to reduce emissions early and accumulate allowances that can be used for compliance in future periods." (Federal Implementation Plans at 45CFR 34).

Compliance with CATR will reduce SO_2 emissions to below 2010 Acid Rain Program caps. As sources comply with CATR, demand for Acid Rain Program allowances will decrease, reducing those SO_2 allowance prices (to nearly zero). (Federal Implementation Plans at 45CFR 34).

1.2.5 What is the Geographic Scope of the Market? To what Extent is there a Common Currency Tradable Across Jurisdictional Lines? What are the Barriers to Development of a Common Currency?

The CAIR NO_X and SO_2 trading programs cover 28 eastern states and the District of Columbia. Trades can take place without restriction across the entire region. The EPA Clean Air Markets Division prepares an annual report on transaction types and volumes.

For purposes of analysis and reporting, EPA classifies transactions into two categories:

i. transfers between separate and distinct entities, and
ii. transfers within a company or between related entities

EPA refers to trades within the first category as "economically significant." These are trades between unaffiliated parties. The second category represents trades that are intra-company or among enterprises that are in some form of a parent-affiliate relationship.

Table 1-2. Allowance Transactions

Allowance Transactions			
CAIR NO_X Ozone Season Program	Distinct Entities	99,639	26%
	Related Entities	289,851	74%
CAIR NO_X Annual Program	Distinct Entities	335,137	57%
	Related Entities	253,509	43%

Source: The Clean Air Interstate Rule: 2009 Emission, Compliance, and Market Analyses. Table 6. Page 11. Published Sept. 20, 2010 http://www.epa.gov/airmarkets/progress/CAIR_09/CAIR_2.html

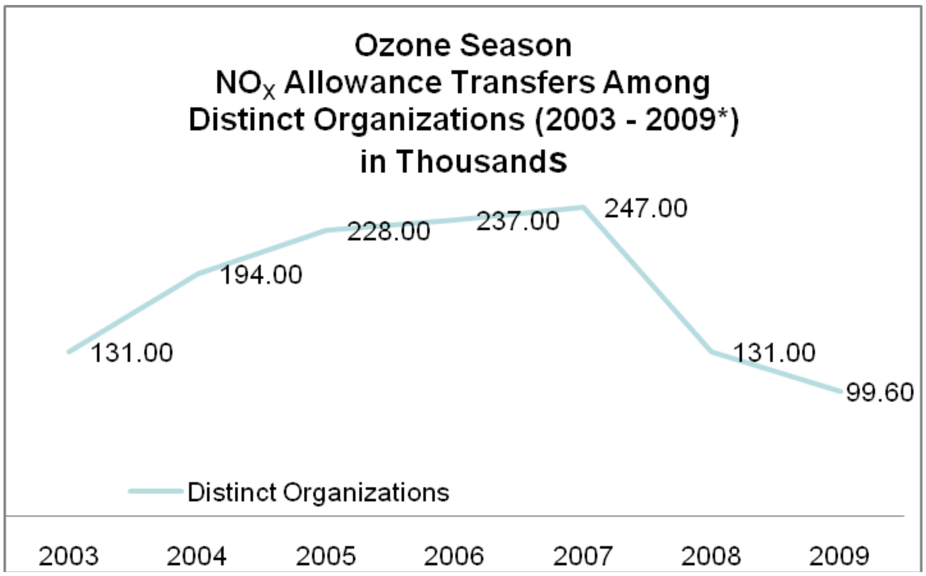

Figure 1-5. Ozone Season NO_X Allowance Transfers.

A CAIR EA is a common currency that is tradable across jurisdictional lines. It is an open market in the sense that allowances may be bought and sold not only by affected sources, but also by individuals, corporations, state and local governments and not-for-profit entities without restriction.

There are no current barriers to the creation of a common currency, but as CAIR is replaced by CATR there will be significant restrictions placed on interstate trading. As noted above, the courts found that the structure of the CAIR program did not adequately account for controlling emissions in upwind states that could adversely affect downwind states. The proposed remedy is to restrict interstate trading in a manner that addresses the potential consequences of emissions occurring in the upwind states. As a consequence, a uniform trading market covering 28 states and the District of Columbia will be replaced by many smaller market trading areas based upon the upwind/downwind relationship of the states.

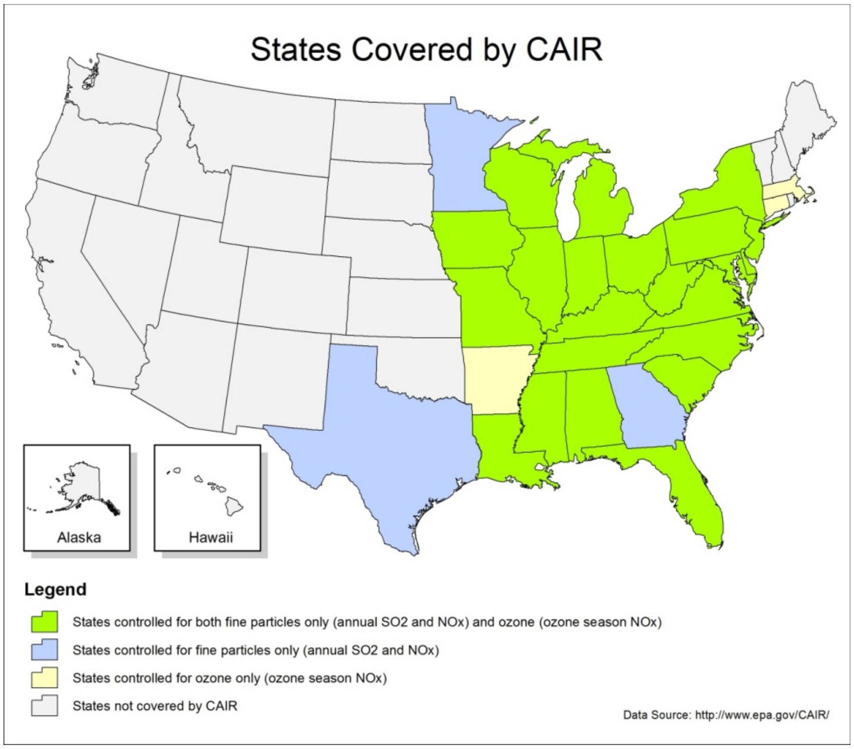

Figure 1-6. States Covered by CAIR.

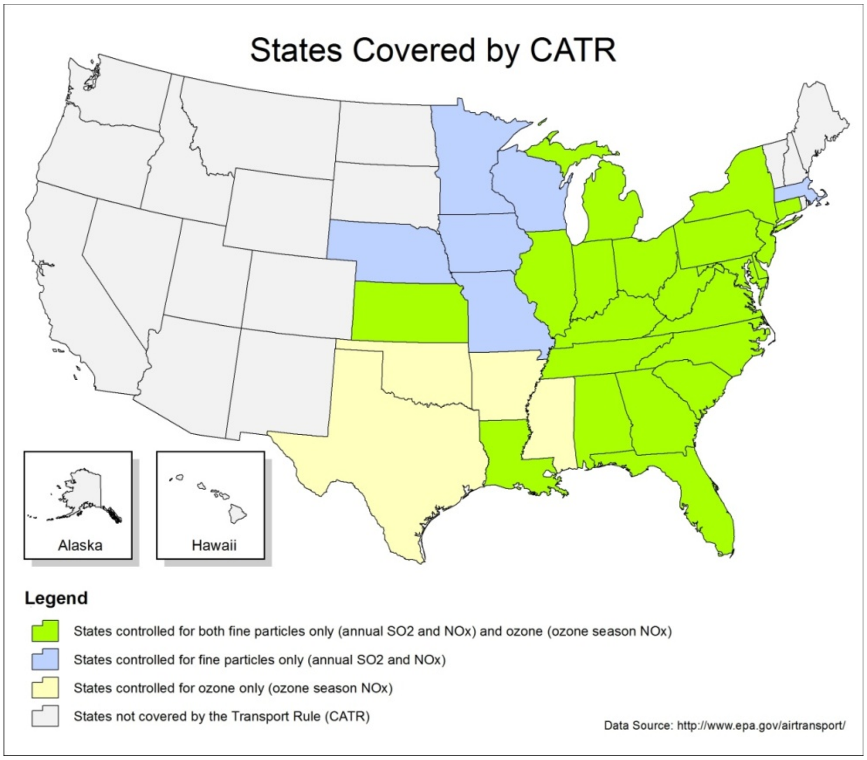

Figure 1-7. States Covered by CATR.

1.2.6 What are the Owner Responsibilities, Market and Operating Risks?

Regulated sources must operate in compliance with their CAIR permits, and must comply with monitoring, recordkeeping and reporting requirements provided in the EPA Air Programs regulations.

1.2.7 Assessment of the Financial Markets for Tradable Emission Rights With Respect to Performance Attributes Such as Liquidity, Volume of Trades, Price Volatility, and Strategic Behavior

The current state of the markets for CAIR allowances, seasonal and annual, has remained clouded by the uncertainties first created with the July 11, 2008, decision by the D.C. Circuit that vacated EPA’s CAIR. These uncertainties have continued as the EPA has been developing a new trading structure to replace CAIR in 2012.

Prices for ozone season current year vintage allowances in the predecessor NO_X Budget Program were in excess of $1,400/ton in early July 2008. Upon the issuance of the D.C. Court decision on July 11, 2008, prices dropped sharply, initially falling below $900/ton and eventually declining to a period end closing price of $592/ton in November 2008.

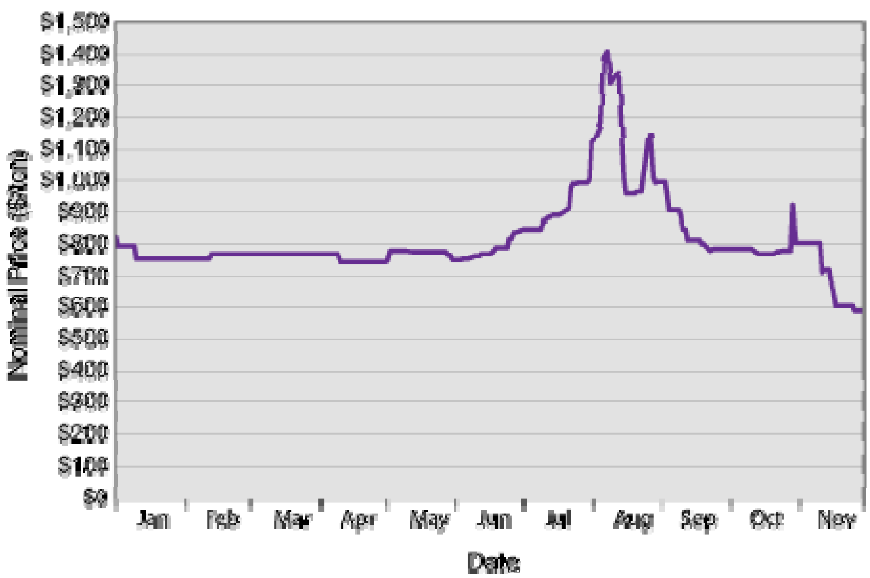

Figure 1-8. NO_X Allowance Spot Price (Prompt Vintage), January 2008—November 2008

Note: Prompt vintage is the vintage for the “current” compliance year. For example, 2008 vintage allowances were considered the prompt vintage until the true-up period closed at the end of November 2008. Source: CantorCO2e's Market Price Indicator (MPI), 2009. Reprinted from The NOX Budget Trading Program: 2008 Emission Compliance and Market Analyses. Page 10. Source: http://www.epa.gov/airmarkets/progress/NBP_2.html

In 2009, the CAIR NO_X Ozone Season Program replaced the prior NO_X Budget Program. The programs are not entirely comparable, as the CAIR program encompassed more states and included both an annual as well as a seasonal NO_X program. Nevertheless, the direction of change in market prices can be instructive. During the course of 2009, the CAIR ozone season NO_X allowances prices fell from a period opening price of $550/ton in January 2009 to a period ending price of $73/ton in December. At the time of this writing, the price of NO_X Ozone season allowances stands at $20 per ton.[18]

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[18] http://new.evomarkets.com/index.php?page=Emissions_Markets-Markets-NOx_Seasonal_Allowances.

The degree to which the uncertainty surrounding CAIR affected EA markets is documented by Evolution Markets in its April 2009 newsletter. Evolution Markets notes that on March 26, 2009, EPA sent NO_X account representatives letters "warning them that there was no guarantee future annual NO_X allowances would be included in a future trading program" because of EPA's ongoing revision of CAIR (Evolution Markets 2009a). Largely as a result of this EPA letter, vintage 2011 NO_X annual allowance prices dropped from $800 at the beginning of April to $300 by the end (Evolution Markets 2009a). Evolution Markets also reported that the price of vintage 2009 NO_X annual allowances dropped from $2,000 at the beginning of April to $1,100 by the end of April, which was due to lower than expected electricity demand. The price for NO_X seasonal allowances also dropped from $500 at beginning of April, ending below $400 by the end of April with lower than normal trading due also to surplus allowances and lower projected electricity demand for the summer (Evolution Markets 2009a).

In comparison to other years, allowances for SO_2 closed very low as well, although SO_2 allowance trading increased to 200,000 tons in June 2009, possibly due to the activity surrounding the action in the U.S. Congress approving the American Clean Energy and Security Act (ACES, or Waxman-Markey bill) (Evolution Markets 2009b). The SO_2 Annual Trading Program takes effect in a series of three phases, each phase increasing the required ratio of allowances. For emissions occurring through 2009, one SO_2 allowance would be surrendered for one ton of SO_2 emissions. For emissions occurring between 2010 and 2014, two allowances must be surrendered for each ton of SO_2 emissions. After 2014, 2.86 allowances must be surrendered for each ton of SO_2 emissions.[19]

In a recent study, the EPA found that throughout the history of the various EA trading programs, the markets for allowances have been relatively stable (U.S. EPA 2009). Although allowance markets are small in comparison to traditional financial markets, they have remained liquid and routinely trade on a daily basis. In addition, the allowance markets have attracted a large and diverse group of traders, including more than 3,500 regulated SO_2 sources and 2,500 NO_X sources, as well as numerous non-regulated entities ranging from brokers to non-profits (Evolution Markets (b)).

The price of EA has been influenced by various factors such as the cost of compliance, the costs associated with achieving each incremental ton of emission, and external market forces that include demand for electricity, the price of coal and gas, and the weather. Regulatory changes in the trading programs, such as the implementation of CAIR in 2005 and the follow up court decision remanding CAIR to the EPA, have also influenced both the price of EA and the volume of trading. The latter was minimal in April 2009, following EPA's March 2009 letter. The announcement of the proposed CATR on July 6, 2010, however, had a notable effect on EA prices. Vintage 2009 SO_2 allowances, for example, decreased from $15 to $5, and NO_X annual allowances Vintage 2010 dropped from $465 to $400 and continued downward to $230 on July 9 (Evolution Markets 2010).[20] These dramatic declines in prices were undoubtedly due in large part to the uncertainty surrounding the future of CAIR allowances in the CATR program. (Given that SO_2 allowances cannot be carried over, it is seen as unlikely that NO_X allowances will be eligible for carry-forward.)

The programmatic structure established under CATR may also have impacts on the manner in which this market operates. According to one analyst, CATR will have several negative effects on the EA markets. First, it will limit flexibility in terms of how sources may meet their EA requirements. The most significant impacts on flexibility relate to the restrictions placed on interstate trading. According to one review of the rule, the extent to which sources may engage in interstate trading is contingent upon sources not exceeding the state budget plus a variability limit. (Evolution

[19] Note that these phase 2 surrender ratios may be changed, depending on how EPA resolves the flaws in CAIR, as required by the U.S. District Court of Appeals.
[20] Evolution Markets, July 6, 2010, "EPA Proposes Interstate Emissions Transport Rule," http://new.evomarkets.com/desks/emissions/post/298/.

Markets (c)).[21] This review states that "[t]he EPA will evaluate which sources in the state had emissions exceeding their pro rata share of state budget with variability limit, regardless of whether or not the source had enough allowances to cover the emissions. Source owners who exceed their share of emissions would have an allowance surrender requirement of one allowance for each ton emitted over the owner's proportional share of the amount by which state emissions exceed the state budget." (Evolution Markets(c)). Although the EPA believes that these "assurance provisions" penalizing sources for exceeding their budgets will not be triggered, others believe it is possible and may lead to hostile trading situations. Specifically, in a situation where interstate trading is not possible because the limit has been reached and there are only two sources in a state, one of which needs to purchase EAs, the other source would be able to drastically raise the price of the EAs. This essentially forces the source in need of EAs to purchase them at inflated prices, thus creating volatility in the market.

As a result of new interstate trading rules that may constrain trading, companies with locations in multiple states may have to revise their strategies of EA management. Such companies often plan emissions reductions based on the ability to trade EAs among several sources at various locations. Restrictions on interstate trading will limit the ability to do this. Further, the variability limit mentioned above is based on a complex formula, making it difficult for sources in general to plan ahead, and sources will also be more reluctant to sell excess allowances.

In addition to problems associated with limited interstate trading, CATR effectively penalizes early actors. Typically, those sources that install control equipment and make early reductions are rewarded. Under CATR, however, those sources that have either installed such equipment or are planning to would receive fewer allowances. This practice would essentially reward those sources that have not made emissions reductions and punish those that have taken the lead on reducing emissions. Sources in NYS would be negatively affected by this because the State often takes the initiative and requires emissions reductions ahead of federal initiatives, and these efforts would not be rewarded under the new system.

As a result of these restrictions, it is possible that EAs might become so limited that plants would be forced to shut down. Many source owners are reluctant to install emission control equipment on coal plants less than 200MW, for example, because it might be more cost effective to simply shut them down, according to one analyst who was interviewed for this report.

1.2.8 What were the Desired Program Outcomes, and Have they Met Expectations?

The EPA expected the CAIR program to achieve the largest reductions in both NO_X and SO_2 emissions since the implementation of the 1990 Clean Air Act Amendments. Moreover, the cap-and-trade approach instituted under this program—one that incorporated the pre-existing NO_X and SO_2 markets—was expected to achieve such significant emissions reductions at the most cost-effective prices possible. As CAIR is not yet fully implemented, and as the rule itself is being rewritten by the EPA, it is impossible to determine whether the program will meet these expectations.

CAIR was carefully crafted to build upon the experience of the existing, highly successful trading programs, in terms of logistics, economics, and actual results. The overall benefits—human health improvements along with emissions, ozone, and regional haze reductions—were expected to outweigh projected costs by more than 25 times (U.S. EPA (e)). The projected costs of CAIR total $2.3 billion in 2010, $3.6 billion in 2015, and $4.7 billion by 2020 (EPA 2004). Still, the history of cap-and-trade programs—most notably the SO_2 Trading Program—demonstrates that they are cost-effective. Emissions reductions are achieved well under the projected costs and billions of dollars in savings result from the associated health and environmental benefits. Indeed, in 2003, a study conducted by the Office of Management and

[21] Evolution Markets (c). August 2010. New Clean Air Rules Take Markets on a Detour. http://new.evomarkets.com/pdf_documents/New%20Clean%20Air%20Rules%20Take%20Markets%20on%20a%20Detour.pdf. (to be inserted in reference section).

Budget (OMB) "found that the Acid Rain Program accounted for the largest quantified human health benefits—more than $70 billion annually—of any major federal regulatory program implemented in the last 10 years, with benefits exceeding costs by more than 40:1" (U.S. EPA(c)).

The EPA used air quality modeling to determine the pollution reductions achievable under CAIR's more stringent emissions limitations, provided that states employed the interstate cap-and-trade program recommended by the agency (U.S. EPA(e)). EPA predicted that by 2020, when CAIR would be fully implemented, NO_X and SO_2 emissions from power plants would each fall by two million tons, a 73% reduction from 2003 levels for SO_2, and a 61% reduction during the same period for NO_X. The nascent CAIR implementation has not yet begun to realize this potential—NO_X caps went into effect in 2009, with SO_2 following in 2010—and the anticipated results are subject to uncertainty associated with the final implementation of the rule. Still, it is useful to look to the achievements of predecessor programs, such as the NO_X Budget Trading Program and the Acid Rain Program, as indicators of potential success for the even more ambitious CAIR program. In 2008 alone, the NO_X Budget Program achieved ozone season emissions that were 75% lower than in 1990 (U.S. EPA(i)). The Acid Rain Program reduced SO_2 emissions by about 6.8 million tons, or 43%, since 1990." (U.S. EPA(a)). The objective of CAIR—or whatever rule succeeds it—is to achieve similar results through aggressive emissions caps and cost-effective trading markets.

The predecessor program to CAIR, known as the NO_X Budget Program, was in effect from 2003 through 2008, and met with substantial and quantifiable success. Per EPA's final progress report, emission rates for all units covered under the program fell by 45% over the 2003-2008 period. For units without controls, there was a 50% decrease in emission rates over that five-year program period. In 2008, there were 2,568 units affected by the program and only two units were out of compliance for the 2008 performance period (May–September 2008) (US EPA (i), 2008).

1.3 Renewable Portfolio Standards (RPS)

In response to concerns about energy security, climate change, and intensifying global competition for natural resources, a growing number of national and local governments have adopted policies that reduce reliance on fossil fuels by promoting the use of renewable energy resources. As a result of these policies, renewable energy displaced fossil fuels as the world's fastest growing source of new electric capacity in 2008 (U.S. DOE(a)). The United States is hardly an exception to this trend. In 2008, the U.S. consumed more than 7.3 quadrillion BTUs of renewable energy, nearly twice the amount consumed in 2004 (EIA, 2008).

Over the past decade, a market for tradable renewable energy credits or certificates (RECs) has emerged in the United States. RECs represent one or more specific attributes of the electricity produced by renewable resources. Initially, the driver for RECs has been voluntary markets, which sell RECS to green pricing programs and those wanting to offset their personal or commercial energy use. Voluntary purchases of renewable energy from electricity providers and retail REC marketers by residential and business consumers totaled approximately 18 million MWh at the end of 2007, an increase of approximately 50% from the previous year, according to the National Renewable Energy Laboratory (NREL, 2008). The primary source of demand for RECs in voluntary markets historically has included:

- The Energy Policy Act of 2005 (EPAct 2005), which required federal agencies to purchase 5% of their electricity from renewable sources by 2010 and 7.5% by 2013
- RECs used to supply utility "green pricing" programs, whereby individuals can opt to purchase RECs from an independent broker or (in deregulated markets) by signing up for a specific "supply mix" of electricity through an Energy Service Company (ESCO).

More recently, state and local government policies have adopted policies promoting renewable energy. Renewable portfolio standards are the primary policy mechanism used for these purposes.

1.3.1 What are Renewable Portfolio Standards? What is New York's RPS?

Generally speaking, RPS requires certain electricity retailers to provide a minimum specified share of their total electricity sales from qualifying renewable power generation by a certain date. Currently, 29 states plus the District of Columbia have adopted binding RPS policies; seven additional states have non-binding renewable portfolio goals (DSIRE c).

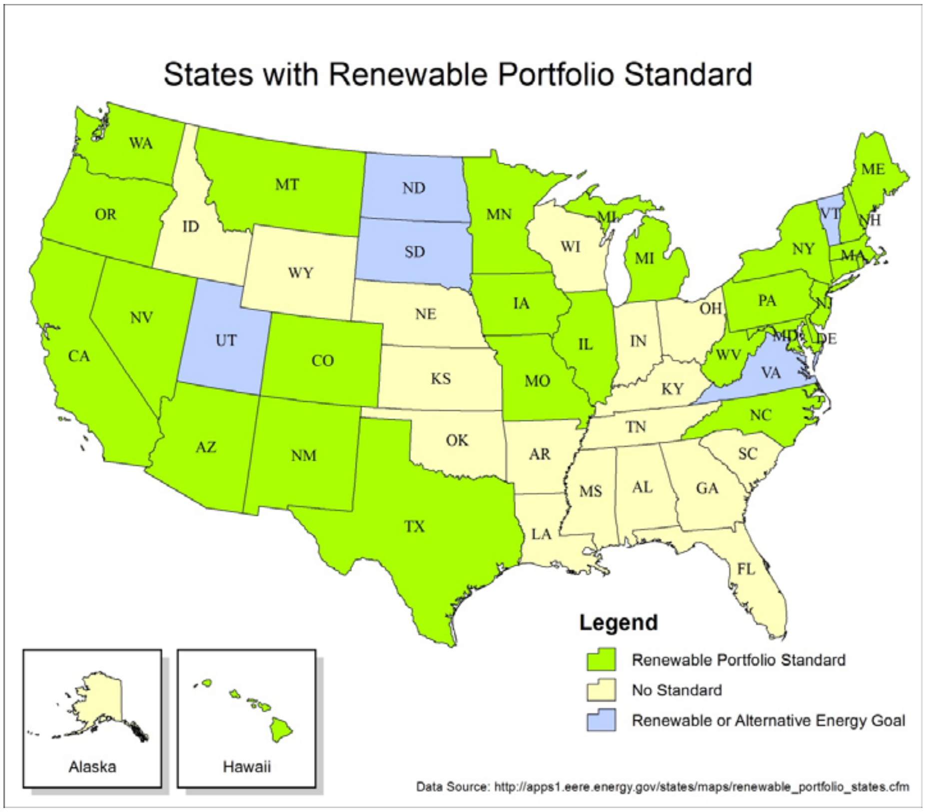

Figure 1-9. States with Renewable Portfolio Standards, DOE/EERE.2009

In order to demonstrate compliance with a state's RPS policy, renewable energy attributes must be certified and quantified. Attributes, which may be specified or unspecified by each state, may include energy source, emissions, generating plant location, generation type and vintage (Holt & Wiser, 2007). These attributes may be traded separately from the associated electricity in the form of RECs. RPS policies commonly incorporate market-based mechanisms that enable obligated entities to buy or sell tradable RECs to demonstrate compliance.[22]

Most state RPS programs require utilities to supply customers with a certain percentage of electricity generated from renewable sources annually. For example, Connecticut's RPS requires utilities located in the state to provide retail customers with a minimum percentage of power produced by renewable energy annually, which the utilities are responsible for purchasing in the market. By contrast, the NYS RPS program relies on a central administrator—NYSERDA—to procure RECs from electricity generators that produce and deliver their energy to the New York Independent System Operator (NYISO) for ultimate consumption in the state.

[22] Economists contend that the flexibility introduced in market-based trading systems lowers the overall cost in meeting the goal of expanded renewable energy use.

In 2004, the New York State Public Service Commission (PSC) created an RPS for New York State, which required that 25% of all electricity consumed in New York State be generated by renewable sources by 2013. (PSC.2004) A subsequent 2010 Order increased that target to 30% by 2015. This adjustment was made in part to ensure that reductions in overall electricity demand from the Energy Efficiency Portfolio Standard (EEPS) did not diminish the absolute number of MWhs procured under the state's RPS.[23]

New York's RPS program is funded through the RPS surcharge that is levied on electricity ratepayers subject to the System Benefits Charge (SBC). The major investor-owned utilities collect this surcharge from ratepayers, and NYSERDA in turn uses these funds to administer the RPS program. The program is broken into two components: a Main Tier that funds utility scale wind, biomass (both 100% eligible biomass and co-firing of biomass by fossil fuel-burning plants), biogas (landfills, manure digestion, etc.), ocean/tidal, liquid biofuels and hydroelectric installations; and a Customer Sited Tier that funds smaller installations (on the customer-side of the meter) of distributed solar PV, small wind, anaerobic digesters, and fuel cells. A 2010 PSC Order added solar thermal as a customer-sited eligible technology, and incorporated a new geographic equity component to site distributed renewables downstate.[24] The following discussion focuses on the Main Tier, which accounts for a majority of both funding and MWhs achieved under the NYS RPS.[25]

Under the RPS Main Tier, renewable electricity generators are selected through a competitive request for proposals (RFP) process and are then paid production incentives by NYSERDA for electricity delivered for end use in NYS. In exchange for production incentives, the renewable electricity generator agrees to deliver the contracted electricity to the NYISO and to transfer ownership of the associated RPS attributes to NYSERDA. The RPS attributes acquired by NYSERDA are held by NYSERDA on behalf of the ratepayers funding the program. NYS uses this central procurement model to encourage increased reliance on renewable electricity within the state in a manner that does not disrupt the competitive wholesale power market. This differs from most other states' RPS designs, which typically place the responsibility of procuring a certain percentage of renewable electricity on the load serving entities (investor-owned utilities and/or ESCOs).

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[23] PSC Order Establishing New RPS Goal and Resolving Main Tier Issues. January 8, 2010. When incorporating the reduced load projection from energy efficiency programs, the newly adopted 30 percent by 2015 target translates to 10.4 million MWhs, or an approximate 5% increase in absolute MWhs from the original target of 9.9 million MWhs (25% of previous load projections by 2013). Available at: http://documents.dps.state.ny.us/public/Common/ViewDoc.aspx?DocRefId={30CFE590-E7E1-473B-A648-450A39E80F48}

[24] PSC Order Authorizing Customer-Sited Tier Program Through 2015 and Resolving Geographic Balance and Other Issues Pertaining to the RPS Program, April 2, 2010. Available at: http://documents.dps.state.ny.us/public/Common/ViewDoc.aspx?DocRefId={C05CD0D6-8EA5-4CB9-A9FA-6ADD3AECB739}

[25] Of NYSERDA's total obligation under the RPS, more than 94% of the RE MWhs will be acquired via the Main Tier, with the balance under the Customer Sited Tier. In addition, LIPA and NYPA, state agencies under Executive Order 111, and a 1% voluntary market will all contribute to the macro "30 x 15" RPS target.

1.3.2 What is the commodity being traded?

The instrument used to comply with the requirements of a mandatory RPS program—or, alternatively offered for sale in a voluntary renewable-energy program—is commonly called a "Renewable Energy Certificate," or REC. The precise nomenclature varies between states. For example, New York State uses the phrase "RPS Attributes" rather than RECs; however, to avoid confusion, this Report will use the term "RECs" rather than "RPS Attributes."

RECs represent one or more specific attributes of the electricity produced by renewable resources. In NYS, RECs include any reductions in pollutants and/or avoided emissions associated with each MWh of RPS-eligible renewable energy, including PM, NO_X, SO_X, CO, CO_2, and any other toxics such as mercury.

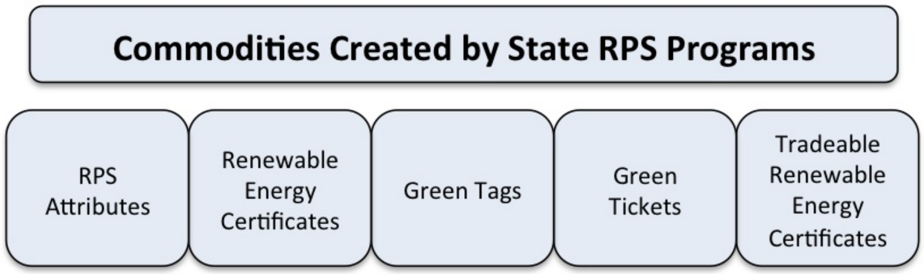

Figure 1-10. Commodities Created by State RPS Programs

The attributes included in RECs depends on the state statute or regulation that created it. Many states leave the definition of REC somewhat ambiguous. Delaware and North Carolina, for example, specifically state that a REC does not include an emission reduction credit. In other states, including NYS, RECs include all non-power attributes, including carbon emission reduction.[26] As a result, when NYSERDA buys RECs, it also claims the rights to all resulting reductions in pollutants. Essentially, this means that generators selling RECs to NYSERDA cannot simultaneously participate in other emissions markets.

1.3.3 How is the Commodity Created and Certified?

In most cases the property rights to these attributes exist independently of the electricity itself. As a result, RECs can be bought and sold independently of the electricity that initially created it. If the physical electricity and the associated RECs are sold to separate buyers, the electricity is no longer considered "renewable" or "green." A REC confers ownership to the environmental and other non-power attributes of one MWh of electric power produced from renewable energy. This delineation between the electricity itself and the environmental attributes of that electricity is the key mechanism to avoid violating provisions in the Federal Power Act that prohibit regulators from setting "unjust or preferential rates" for electricity.[27] Thus, by compensating the renewable generator for the "value" of these environmental attributes via a REC payment, that generator is able to receive a revenue stream for the pollution reduction benefits of the power, while still selling the actual electricity into the wholesale markets at the prevailing clearing price.

[26] In the following states, CO, NY, WA, AZ, RECs include all non-power attributes, including those from carbon emission reduction.
[27] 16 U.S.C. §824e Power of Commission to fix rates and charges; determination of cost of production or transmission

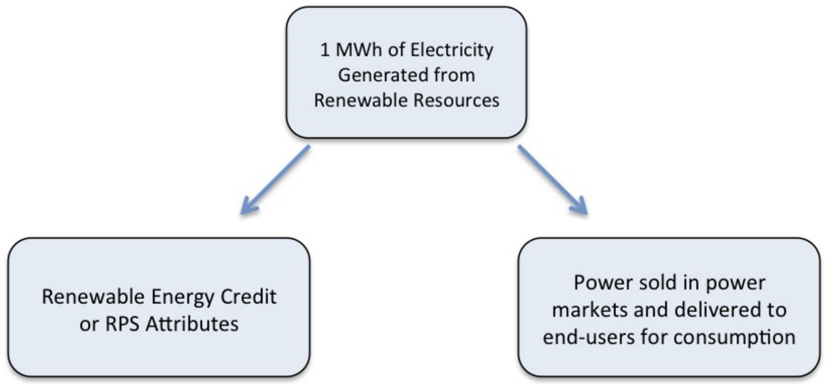

Figure 1-11. What is a Renewable Energy Credit?

As mentioned, under the NYS RPS program, a renewable generator enters into a contract with NYSERDA stating that NYSERDA will provide monetary production incentives for every MWh of renewable electricity sold in the NYS market. Once NYSERDA acquires the REC, it is held by NYSERDA.

1.3.4 What are the Rules Regarding Ownership, Transfer, Environmental Claims and Disclosure?

In other states, RECs may be traded privately for a limited term before they must be retired. By contrast, in NYS, the vast majority of RECs created under the RPS are not traded by private brokers because NYSERDA is typically the sole purchaser of the almost all the attributes created by a project developer.[28] There is a relatively small voluntary market, which is expected to contribute 1% of the overall "30% by 2015" goal. A bilateral contract between a high volume electricity consumer and a renewable project developer that meets the NYS RPS criteria is one example of how this market segment may be filled. The voluntary market will include independent brokers offering the sale of RECs to retail customers independent of their electricity (i.e., to offset the pollution attributable to their consumption) and ESCOs that can offer varying degrees of "green supply" (including up to "100% wind"). It is important to note that some of these firms may purchase RECs generated by facilities outside of the geographic or programmatic scope of the NYS RPS—such purchases would not be eligible to count towards the NYS RPS target.

NYSERDA procures RECs through the competitive RFP process as noted above. Following selection through the RFP process, the generator is contracted to sell a percentage of the environmental attributes from the electricity it produces to NYSERDA for the duration of the contract term, which is typically ten years. Because NYSERDA gains ownership rights of all environmental attributes associated with electricity generation under the RPS, none of these attributes may be used for compliance with other programs while under contract.[29] However, renewable generators may request that some or all of its output be removed from the RPS agreement, either temporarily or for the entire outstanding balance

[28] NYSERDA will only accept bids from renewable generators for up to 95% of their projected output, thereby ensuring some portion of their RECs will remain for the voluntary market. *New York State Renewable Portfolio Standard Performance Report*, December 2010. Available at: http://www.nyserda.org/rps/2011%20RPS%20Annual%20Report.pdf

[29] For example, the definition of "sustainably harvested biomass" that would be exempt from a requirement to hold allowances for its attributable emissions under RGGI is currently being promulgated by NYSDEC. Depending on the outcome of that rulemaking, there may be discrepancies between the biomass criteria under the RPS and RGGI. Regardless, if a facility enters into an RPS contract with NYSERDA, they forfeit the rights to any potential offset value that facility may have otherwise held. Still, under current and near-term projections of the RGGI market, low allowance prices have rendered the offset market largely irrelevant. Until allowance prices rise, the economics of RGGI offsets projects will remain unprofitable.

of the originally contracted time period. These opt-out provisions contain a number of conditions that vary by technology type.[30]

As mentioned, the vast majority of the NYS renewable energy goal is to be satisfied through the Main Tier program, which seeks to develop larger scale projects through a centralized competitive procurement process. To date, there have been six Main Tier Solicitation awards: January 2005, December 2006, November 2007, October 2009 and March 2010, and June 2011; four more future solicitations have been tentatively scheduled through October 2013 (NYSERDA).

The tracking of RECs is currently handled through NYS's Environmental Disclosure Label (EDL) conversion transaction system established via NYS Public Service Commission (PSC) Order and administered by the New York State Department of Public Service (NYS DPS).[31] Unlike many other states and regions, NYS does not have an electronic attribute tracking system. Renewable electricity generators must competitively bid into the NYISO. If their power is purchased, then a REC is generated for every MWh hour purchased. The NYS DPS, with assistance from the NYISO, tracks and verifies each renewable MWh sold in the NYISO region from renewable generators under an RPS contract.

The NYS DPS requires utilities to provide customers with periodic statements providing information on the source of their electricity through the EDL program to ensure consumers are aware of the nature of the electricity they are consuming. As applied by NYSERDA to the RPS, customers are made aware of the characteristics of the renewable energy they have supported through the surcharge. The adoption of a REC tracking system similar to surrounding regions of New York has been under consideration by NYSERDA, PSC, NYISO, and other New York policymakers for some time,[32] and legislation mandating that such a system be established has been introduced but not enacted.[33] If established, such a system could potentially provide greater transparency and information to consumers regarding the nature of their electricity supply, as well as increase the liquidity of the voluntary market. [34]

1.3.5 What is the Lifetime of the Commodity?

RECs that are transferred directly from a renewable generator to NYSERDA in accordance with contractual terms have no "lifetime" on the open market. These RECs are never traded, but rather are retained or retired by NYSERDA in order to demonstrate progress towards the RPS goals. In NYS, privately traded RECs are currently limited to the voluntary market, consisting primarily of output that NYSERDA does not procure under contract, as well as any independent bilateral contracts between a developer and large electricity consumer that may be negotiated.

The RPS rules do not allow banking or borrowing, but require renewable generators to reconcile REC sales with electricity delivery into NYISO on an hourly basis.[35]

1.3.6 What is the Geographic Scope of the Market? To what Extent is there a Common Currency Tradable Across Jurisdictional Lines? What are the Barriers to Development of a Common Currency?

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[30] NYSERDA Standard RPS Contract. Available at: http://www.nyserda.org/Funding/916attf.pdf
[31] http://www3.dps.state.ny.us/W/PSCWeb.nsf/All/502EF210A0D15B2885257687006F39D8?OpenDocument
[32] Available at: http://www.dps.state.ny.us/rps/NYSERDA_REACTS_CRS.pdf; http://www.dps.state.ny.us/rps/NYSERDA_REACTS_APX.pdf
[33] A.6114b/S.3872b of 2011. Available at: http://assembly.state.ny.us/leg/?default_fld=&bn=S03872&term=&Summary=Y&Actions=Y&Text=Y
[34] NYS PSC has requested funds for the development of an electronic tracking system (Wiser & Holt 2007).
[35] In-state generators match up hourly in the spot market, while out-of-state generators recently switched from a monthly matching requirement to hourly, to level the playing field with in-state generators.

The geographic scope of the NYS RPS market is limited, compared to some other states. Some states accept RECs from anywhere in the country to satisfy their RPS requirements (e.g. Colorado), and some states accept RECs from other states within a defined region. The NYS RPS market is limited to generators that deliver their electricity into the NYS grid. This is an effort to localize the benefits from renewable generation and to better ensure that New Yorkers reap the environmental benefits offered by renewables. This also ensures that NYS customers reap the unique benefits associated with funding projects that sell into the NYISO markets—including but not limited to the wholesale price suppression effect that renewable resources provide.[36] In addition, economic benefits to NYS are considered in the bid evaluation process for Main Tier solicitations.

The market is not strictly limited to in-state generators. RECs may be generated beyond the borders of NYS, as long as the associated electricity is delivered to in-state customers (NYS DPS 2009).

1.3.7 What are the Barriers to Development?

The major barrier to development is the unavailability of long term purchase power agreements in the de-regulated environment, which is partially mitigated by the RPS program as designed. The major barrier to voluntary market growth is both the inability of voluntary marketing efforts to support financing of projects, the high overhead cost of marketing and selling REC to retail consumers, and the lack of recognition for REC as a tradable commodity in NYS for the purposes of environmental disclosure. Other barriers for renewable project developers include transmission constraints, siting and permitting, local opposition, interconnection delays, equipment cost, and uncertainty regarding federal incentive programs.

1.3.8 What are the Barriers to Development of a Common Currency?

NYSERDA retains all rights to the RECs produced and NYSERDA may not purchase RECs from out-of-state sources unless that power is being sent into the NYISO market. Other states or regions have similar RPS requirements that limit the transfer of RECs across RPS program boundaries.

The Environmental Tracking Network of North America (ETNNA) is convening a national dialogue, the goal of which is to address the technical issues associated with interregional REC trading. If successful, ETNNA's efforts will create a foundation where it will be possible to trade RECs among regions; the actual practice will likely depend on states' rules for eligible renewable resources for their respective RPS requirements (not addressed by ETNNA).

The creation of a federal renewable electricity standard would likely facilitate interaction between state and local RPS programs. At the federal level, both the House and the Senate have considered proposals that would establish a national RPS. More recent discussions in Congress have centered on a national Clean Energy Standard (CES) that would include both renewables and energy efficiency in a single macro target. Among these various federal proposals both the magnitude and timeline for the targets, as well as eligible technologies, have varied greatly. Of particular importance for states such as NYS is how any such federal program would handle existing state RPS goals, projects, criteria, etc. Nevertheless, at the time of writing no such legislation seemed near enactment.

1.3.9 Assessment of the Financial Markets for Tradable Emission Rights

[36] Renewable technologies such as wind and solar power have very low operating costs because they have zero fuel costs. In deregulated wholesale electricity markets, these costs drive the bids of generators. As more MWhs of low bid renewable electricity penetrate the market, the marginal price of electricity (clearing price paid to all generators) decreases. This is in part because the less efficient, more expensive fossil units that would have otherwise been needed to meet demand may not be called on. The 2009 NYS Energy Plan estimated that this wholesale price suppression effect from the fully implemented RPS would result in approximately $93-$262 million of savings annually to NYS ratepayers.

The volume being purchased by NYSERDA increases as the scale of the RPS elevates over time. There is no enacted statutory compliance requirement, meaning that there is no legal or financial imperative to meet the standard without regard to costs. Furthermore, there is no annual target but rather the single end goal for 2015, so the actual number of RECs acquired by NYSERDA fluctuates from RFP to RFP, depending upon a number of market factors that influence the bids submitted.

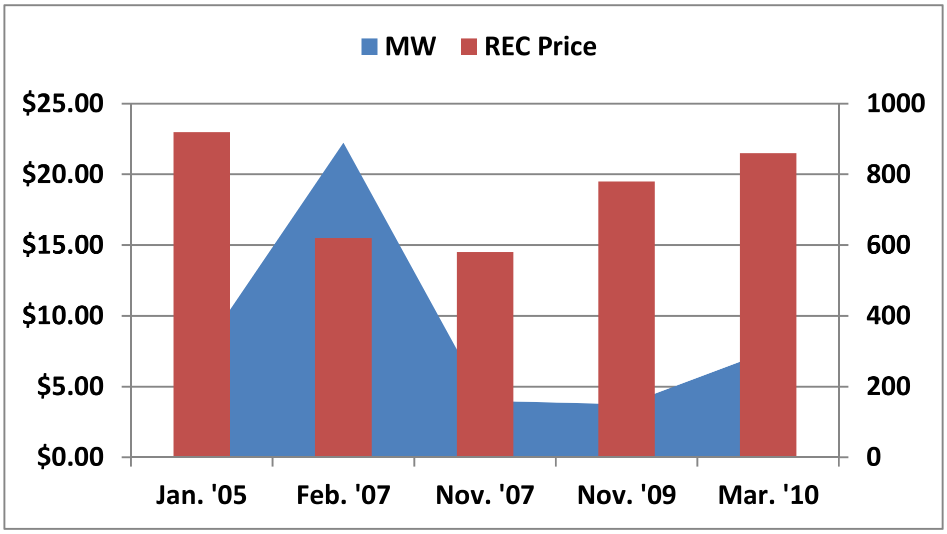

Figure 1-12. Renewable Energy (MW) Produced Compared to REC Pricing (2005-2010)

The competitive bid process ranks bidders based on a weighted criterion of 70% bid price and 30% economic benefit. The latter is based on an economic benefits report that NYSERDA, NYS DPS staff, and other outside experts rank according to the degree that the project will contribute positively to the economy of NYS. Those bidders with the highest score receive contracts and must supply RECs at the price they offered in their bid. After each Main Tier solicitation has been completed, NYSERDA publishes an average, weighted price for the RECs procured for that round, but the actual per REC price per project varies due to the "pay as bid" structure approved by the PSC.

The average cost of an RPS attribute in NYS is lower than in most of the surrounding states. By comparison, RPS compliance markets have been higher in many New England States, though the difference may be attributable to a different RPS market structure,[37] and NYS's relative abundance of wind resources. According to Stern et al (2009), wind resources have dominated the RPS market in NYS. The average RPS attribute price has fallen as the price of wind RECs has fallen, despite increases in prices for non-wind RECs (hydroelectric and biomass). Additionally, Stern et al. 2009 identified the use of long-term contracts as a key force pushing down the cost of RECs. On the reverse side, the State's vintage requirement mandating REC procurement from new sources alone is a key feature preventing further price decline.[38]

[37] Other states, such as New Jersey and Massachusetts, have an alternative compliance payment (ACP) mechanism for load serving entities (LSE) that are unable to purchase their required amount of renewable energy from the market. This effectively works as a price ceiling in these states and when LSEs are unable to find enough renewable energy in the market, REC prices will tend to hover around the ACP price (Stern et al. 2009).
[38] The NYS RPS only permits projects that commenced commercial operation on or after January 1, 2003 to participate. If, for example, large scale hydroelectric facilities that had commenced operation before that date (and thus had already recovered most or all of its costs) were able to participate, those projects would be able to bid in at very low levels and still receive a profitable revenue stream.

1.3.10 What Were The Desired Program Outcomes, and Have They Met Expectations?

The desired outcomes for the NYS RPS included meeting the growing demand for electricity, increasing fuel diversity, reducing risk from volatile fossil fuel prices, reducing environmental impacts from electricity generation, and increasing economic development. The administration and execution of the RPS was intended to operate cost effectively with transparency, and produce a competitive and objective selection of projects.

As of April 2010, 38 projects have been awarded contracts through five Main Tier solicitations, with 26 in operation and the remainder under construction or other stages of development.[39] Modeling analysis by Stern et al. (2009) would indicate that NYS can expect lower electricity prices as a result of increased renewable generation in the state. The Mid-term report's (NYS DPS 2009) analysis showed overall favorable cost-benefit ratios for the RPS program.

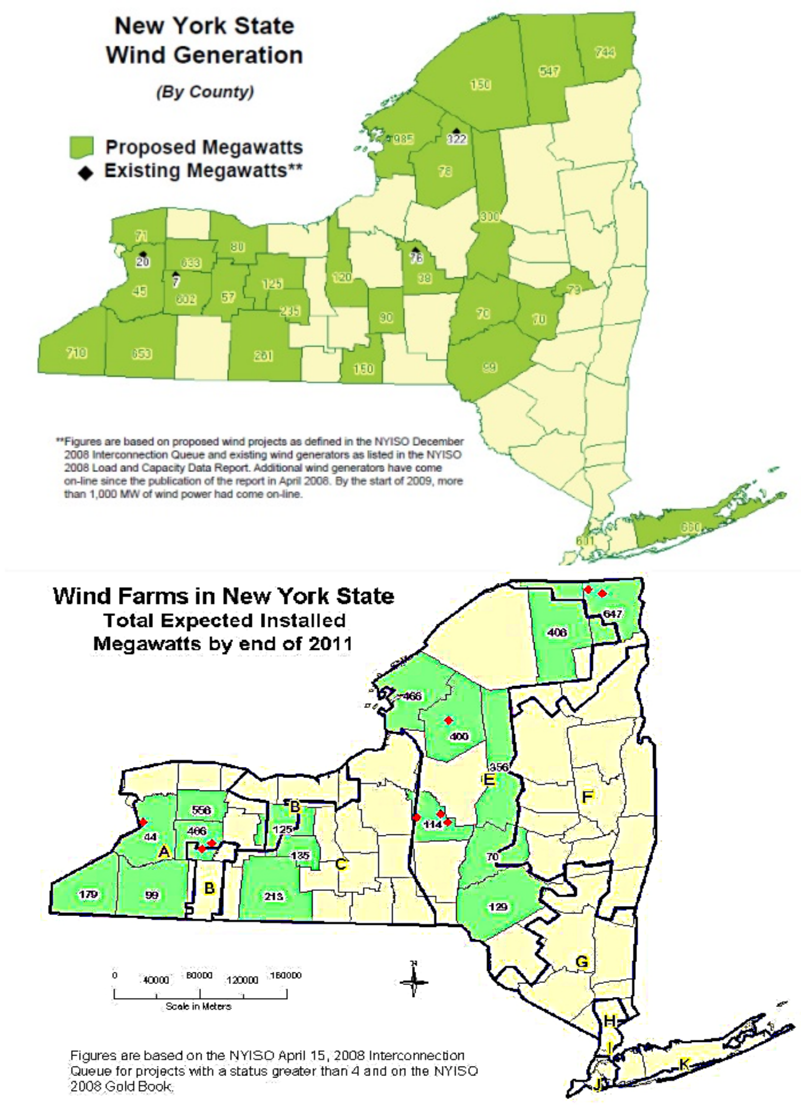

Figure 1-13. Wind RECs have generally been cost-effective in NYS, due primarily to the state's relative abundance of wind generation.

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[39] *NYS RPS Performance Report.* NYSERDA, April 2010. Available at: http://www.nyserda.org/publications/2010_rps_report.pdf

1.4 Carbon Dioxide Allowances and the Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) is a mandatory CO_2 emissions reduction program established by ten Northeastern and Mid-Atlantic States. RGGI caps CO_2 emissions from fossil fuel-fired electricity generating units (EGUs) of 25 MW or greater capacity, known as CO_2 budget units. The CO_2 emissions cap was established using available emissions data and considering a public stakeholder-driven modeling exercise that estimated what the region's emissions would be in 2009. The cap is held constant through 2014, and then is lowered 2.5% annually for a net reduction of 10% by 2018.[40] CO_2 budget units must acquire and submit an allowance for each ton of CO_2 they emit. Allowances are auctioned and may be traded by the owners.[41] The RGGI Memorandum of Understanding (MOU) commits each participating state to allocate at least 25% of its allowances to consumer benefit and strategic energy purposes, including promotion of energy efficiency (EE) and renewable energy (RE) projects (RGGI 2005).

The NYSERDA RGGI Operating Plan, which has undergone a number of changes since the program began, describes how CO_2 auction proceeds are invested across different programs that advance the clean energy economy.[42] Other states have followed suit, with most committing to fund clean energy well beyond the initially agreed minimum of at least 25% of the allowances.

At this writing, twelve RGGI auctions have been held.[43] RGGI participating states plan to continue to hold quarterly auctions for the life of the program, with each state offering a quarter of its allowances at each auction for any given year, as well as a small volume of future vintages.

1.4.1 What is the Commodity Being Traded?

The commodity being traded is an allowance to emit one ton of CO_2. The first two compliance periods for RGGI are 2009-2011, and 2012-2014. At the conclusion of each compliance period, CO_2 budget units must hold one allowance for each ton of CO_2 emitted during that three year period. If, at the conclusion of a compliance period, a unit owner holds an insufficient number of allowances to cover the unit's emissions, the owner will be assessed a monetary penalty, with each ton shortfall over each day of the compliance period representing a separate violation. RGGI allowances are fully regulated by the CO_2 Budget Trading Programs established by each participating state.

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[40] Due to a number of factors, including weather patterns and the recent severe economic recession and its impact on electricity demand, it is estimated that emissions have fallen significantly, approximately 34% in 2010. The RGGI states are currently undertaking a comprehensive program review as directed in the RGGI Memorandum of Understanding. One possible outcome of this review is a recalibration of the cap to reflect *actual* 2009 emissions baseline and updated emissions projections, programmatic policy objectives, among other things. See ENE report on RGGI emissions trends and drivers at: http://env-ne.org/resources/open/p/id/1072, and NYSERDA report for RGGI, Inc. http://rggi.org/docs/Retrospective_Analysis_Draft_White_Paper.pdf

[41] NYS auctions 95% of their allowances. The balance is allocated at no cost to certain generators holding long-term contracts, early reduction allowances, and a 700,000 allowance voluntary renewable energy market set aside. The total number of allowances held by NYS for the initial years of the program is 64.3 million annually.

[42] The original three- year budget estimate of $525 was adjusted downward as a result of a $90M sweep of RGGI proceeds into the state's General Fund as part of the November 2009 Deficit Reduction Package, the $7.6 million settlement of the Indeck Corinth RGGI lawsuit, other administrative costs, as well as downward trends in forecasted allowance prices. Further detail available at: http://www.nyserda.org/RGGI/Files/2011-rggi-operating-plan-amendment.pdf

[43] Available at: http://rggi.org/home

1.4.2 How is the Commodity Created and Certified?

The RGGI regional cap limits the combined emissions from affected sources of all participating states in the region to approximately 188 million tons per year, divided up into proportional apportionments for each state.[44] By 2018, the regional cap will be reduced to 169 million tons per year. Each participating RGGI state awards allowances in numbers equivalent to the state's portion of the regional cap. Each allowance has a unique serial number in order to prevent double counting and to be able to track ownership.

The platform for recording and tracking data for each state's CO_2 Budget Trading Program is the RGGI CO_2 Allowance Tracking System (COATS). COATS is the administrative clearinghouse where the award and transfer of RGGI CO_2 allowances take place, and where offset projects are registered, monitored and verified.

Projects eligible for offset allowances under RGGI include landfill methane capture and destruction; reduction in sulfur hexafluoride (SF_6) emissions in the electric power sector; afforestation; reduction or avoidance of CO_2 emissions from end-use natural gas, oil, or propane combustion due to energy efficiencies in the building sector; and avoided methane (CH_4) emissions from manure management operations in the agricultural sector.

NYS sells the great majority of its allocation of allowances through quarterly auctions, conducted together with the other RGGI states, in lot sizes of one thousand. The auction format to date has been run in single rounds, with uniform prices and sealed bids. If the RGGI states determine that an alternative auction design is more effective, they can agree to any revisions and direct RGGI, Inc.—the 501(c)(3) non-profit corporation created to support implementation of the 10-state program—to institute such changes.[45]

[44] The size and structure of the cap is described in the RGGI Summary (RGGI 2007).
[45] Details regarding RGGI, Inc. available at: http://rggi.org/rggi

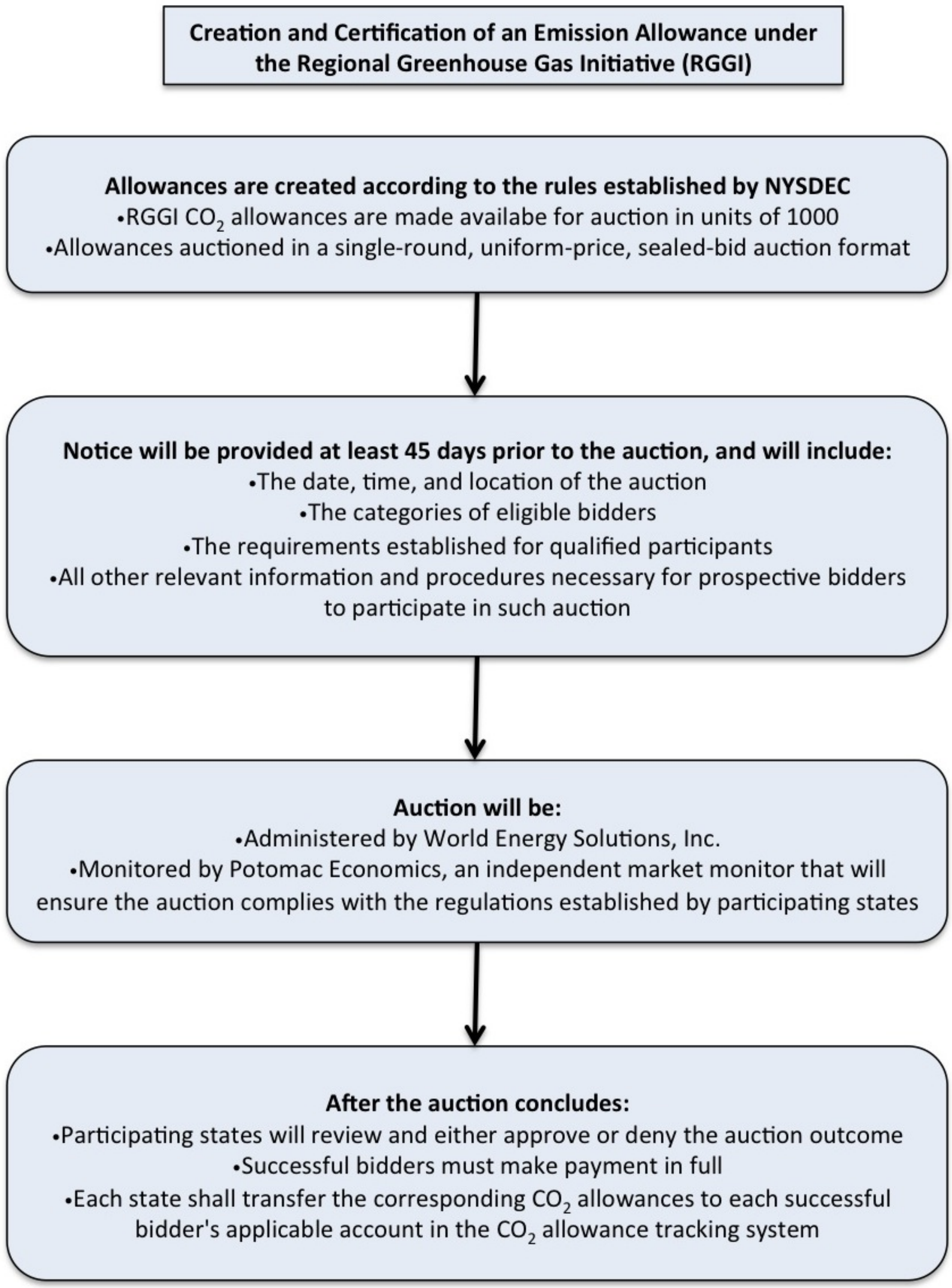

Figure 1-14. Creation and Certification of an Emission Allowance under the Regional Greenhouse Gas Initiative

1.4.3 What are the Rules Regarding Ownership, Transfer, Environmental Claims and Disclosure?

RGGI allowances can be bought and sold in the secondary market by any entity, but official ownership of record is determined by registration in a COATS account.[46] There are two kinds of COATS accounts: compliance accounts, used by CO_2 budget units to hold allowances needed to meet their emissions requirements; and general accounts, for non-compliance use by entities wishing to purchase, hold and/or trade allowances, such as speculators, hedge funds, environmental groups, and individuals.[47]

Under the RGGI program, owners of CO_2 budget units must install and certify monitoring equipment to quantify CO_2 mass emissions from each unit. If a RGGI CO_2 budget unit is also subject to the Acid Rain Program (which requires annual CO_2 mass emissions reporting), it may use the same data to comply with RGGI.

1.4.4 What is the Lifetime of the Commodity? Are there Opportunities for Banking, Borrowing, or Conversion, or Other Flexibility Provisions?

Under the CO_2 Budget Trading Program, allowance compliance periods are three years. As noted above, the first compliance period is from January 1, 2009 to December 31, 2011. Each source must cover its emissions with CO_2 allowances for the current compliance period by the allowance transfer deadline, which falls on March 1 after the compliance period ends. Allowances for future compliance periods are also available at auctions, but these future allowances cannot be used until the compliance period for which they were issued. Nevertheless, allowances purchased but not used in the current compliance period may be banked indefinitely for use in a future compliance period.[48] RGGI compliance periods may be extended an additional year if triggered by certain allowance price levels.[49]

At the allowance transfer deadline, any generators not holding enough allowances to cover their carbon emissions for that period must surrender allowances equal to three times the number of excess tons of CO_2 emitted.[50] Individual states may also levy additional penalties for noncompliance within their borders consistent with state law.

1.4.5 What is the Geographic Scope of the Market? To what Extent is there a Common Currency Tradable Across Jurisdictional Lines? What Barriers Exist to the Establishment of a Common Currency?

Each RGGI member state has established its own CO_2 Budget Trading Program. However, reciprocity agreements allow CO_2 budget units to use allowances issued by any of the 10 participating states, thus creating a single regional compliance market.

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[46] Anyone can buy or sell the allowances in the secondary market; however that is just a right or option to the allowances since the allowances only "exist" in the COATS system (they circulate with a registered number only electronically and do so only with COATS). Nonetheless, legal rights to them can still be held outside of COATS.
[47] The group Village Green, for example, supports the opportunity to voluntarily purchase RGGI permits.
[48] CO_2 Allowance Auctions: Frequently Asked Questions, RGGI, Inc. 12 (July 13, 2010) http://www.rggi.org/docs/RGGI_%20CO2_%20Allowance_%20Auction_%20FAQs_Jul_13_2010.pdf.
[49] NYCRR Sub Part 242: http://www.dec.ny.gov/regs/47181.html
[50] RGGI CO_2 Allowance Tracking System Fact Sheet, http://www.rggi.org/docs/RGGI_COATS_in_Brief.pdf.

Figure 1-15. RGGI States

In the absence of comprehensive national climate change legislation that would put a uniform price on carbon, other regions besides the Northeast have undertaken multi-state approaches to address GHG emissions. The Western Climate Initiative (WCI) and the Midwestern Greenhouse Gas Reduction Accord (MGGRA) have both issued reports describing the design of their proposed cap-and-trade programs and other approaches to reducing GHG emissions.[51] As illustrated in Figure 1-16, RGGI, WCI and MGGRA all have several members and observers, including several Canadian provinces.

The WCI is scheduled to begin covering emissions from both electric generators and industrial sources in 2012, and then expand to other sectors in 2014, with a reduction target of 20% by 2020. The MGGRA has no set timeline yet for implementation, but does have an established, comprehensive program design recommendation document that contains many provisions similar to the WCI, with the inclusion of a longer term target of an 80% reduction by 2050. Unlike RGGI—which targets only CO_2 and only the power sector—both of these programs aim to cover all GHGs across a wider range of sectors. As these various regional programs establish allowance trading markets of their own, and possible actions to link or harmonize the programs are explored, it would have substantial impacts on allowance prices and mechanics. As these developments are only in their nascent stages, however, it is outside the scope of this report to delve too deeply into specific impacts they might have on market based mechanisms.

[51] Western Climate Initiative, "Design for the WCI Regional Program" (July 2010), http://westernclimateinitiative.org/the-wci-cap-and-trade-program/program-design; Midwestern Greenhouse Gas Reduction Accord, "Midwestern Greenhouse Gas Reduction Accord: Advisory Group Final Recommendations" (May 2010), retrieved July 2010 from http://www.midwesternaccord.org/Accord_Final_Recommendations.pdf.

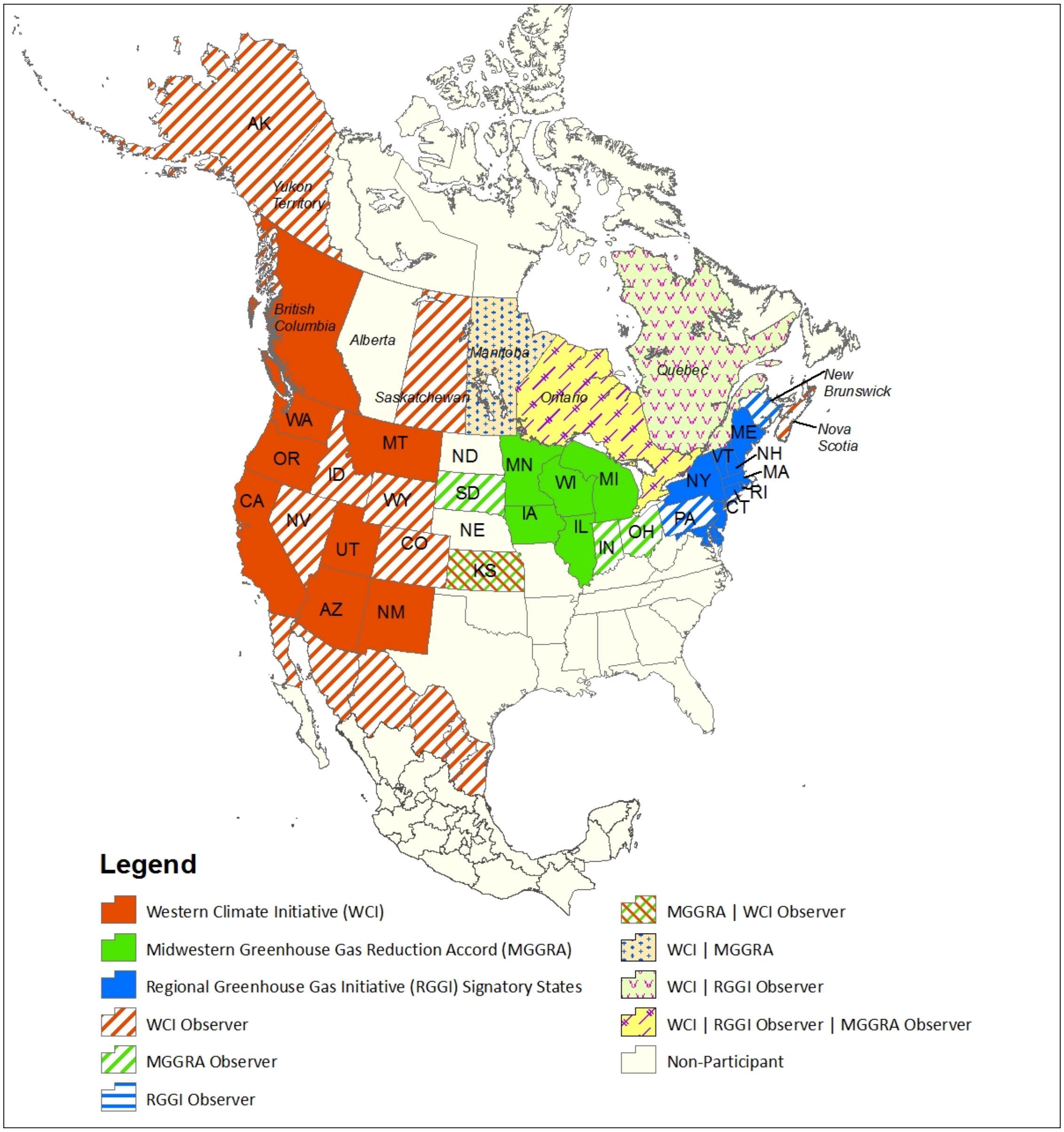

Figure 1.16. Emissions trading programs in the United States and Canada

1.4.6 What are the Owner Responsibilities, Market and Operating Risks?

Market risks include reserve prices, safety valves/offsets, futures markets, leakage, and economic impacts. Operating risks include legal challenges to the program, the possibility of a national program eliminating the regional program, or the institution of another regional program. These are discussed below.

1.4.6.1 Market Risks

Reserve Price. A reserve price is the lowest price at which a commodity will be sold at auction. RGGI provides an initial reserve price of $1.86/allowance. Going forward, the reserve price will be the higher of $1.86 per allowance, adjusted for inflation based on the Consumer Price Index, or 80% of the current market price of the vintage being auctioned, and if reliable market data exist, a reserve price will be developed using those data.

Offsets. Offsets are CO_2 reductions from outside the electric sector that can be used to reduce upward pressure on price. In order to maximize the emissions reductions that will actually occur at covered EGUs, RGGI limits the volume of a source's emissions that can be covered through offsets rather than allowances to 3.3%.[52] If allowance prices exceed specified "trigger" levels (see below), that percentage is increased. The reality, however, is that the high prices have not materialized, and there are no offsets available at this time that meet the strict RGGI criteria.

In the case of a stage-one trigger event (allowance prices are equal to or greater than $7.00 in 2005 dollars, adjusted for inflation), sources would be permitted to use offsets for up to 5% (of the 10% total reduction). In the case of a stage-two trigger event (allowance prices are equal to or greater than $10.00 in 2005 dollars, adjusted up or down for inflation plus 2%), sources would be permitted to use offsets for up to 10% of their compliance obligation (i.e., for the entire reduction obligation). International offsets may be used only if a stage-two trigger event occurs. In this way, the adjustable offset percent cap acts as a safety valve of sorts to help control compliance costs.

Offsets are limited initially to the following categories:[53]

5. Landfill methane capture and destruction:
6. Methane that would otherwise escape from a landfill into the atmosphere is captured and destroyed on site through combustion. Methane has a 24 times higher global warming potential (GWP) than CO_2, so reduction of methane emissions can be a significant offset to CO_2 emissions.
7. Reduction in emissions of sulfur hexafluoride (SF_6) in the electric power sector:
8. SF_6 has a very long lifetime and GWP. This gas is emitted by equipment during the transmission and distribution of electricity. It can instead be captured and destroyed, recycled, or stored.
9. Sequestration of carbon due to afforestation:
10. As trees grow, they capture CO_2 from the atmosphere, sequestering the carbon within woody biomass. Increasing forest growth on previously unforested or understocked areas can result in a net reduction in atmospheric carbon. Any increases in carbon capture beyond a baseline (set by either the previous period's carbon inventory or a base-year estimate) can be considered an offset in the current period.
11. Reduction or avoidance of CO_2 emissions from natural gas, oil, or propane end-use combustion due to end-use energy efficiency in the building sector:
12. End-users may reduce their emissions from combustion of fuel for heating buildings and water by employing more efficient methods of heating and energy distribution or switching to a lower-emission fuel (other than electricity).
13. Avoided methane emissions from agricultural manure management operations:
14. Methane that would otherwise be released during anaerobic digestion of animal manure can be captured and destroyed through combustion, similarly to the capture done on landfills.

All of these offset categories have specific state regulations governing eligibility and requirements. Each individual offset project must be verified and accepted by the state and monitored by state-accredited verifiers (RGGI Offsets fact sheet). Largely due to low allowance prices rendering such projects uneconomic, no offsets have been approved by any RGGI state as of October 1, 2010.

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[52] Use of offsets is often opposed because of concerns about the quality of offsets. RGGI's offset criteria are extremely strict/rigorous, much more so than those allowed under the Kyoto Protocol's troubled Clean Development Mechanism program. WCI and MGGRA have recognized the value in such rigorous offset standards, as exhibited by the joint release of a white paper on the subject for the three programs. Available at: http://www.westernclimateinitiative.org/news-and-updates/110-three-regions-release-joint-offset-quality-white-paper

[53] RGGI, CO_2 Budget Trading Program—CO_2 Offsets (last accessed Sept. 27, 2010) http://www.rggi.org/market/offsets

Futures market. When the Chicago Climate Exchange first started selling futures in August 2008, futures were selling in excess of $6.00. The price for 2008 gradually decreased and by September 4, 2008, a few days before the first auction, the price had dropped to $4.63. The drop was probably attributable to the greatly increased supply of allowances from RGGI's first auction as well as a growing awareness that the initial RGGI cap was above business- as-usual emissions. The price for RGGI allowances, traded on both the Chicago Climate Exchange and the New York Mercantile Exchange, fluctuated during late 2008 as high as a little over $4. During the course of 2009 both the auction clearing price and the futures market gradually lowered to around $2. During 2010 it has moved consistently lower and cleared at $1.86 (the reserve price) for both the auction of current compliance period allowances as well as future compliance period allowances.

Leakage. "Leakage" refers to the potential increase of emissions from fossil-fueled generators located outside the RGGI region that results from increased sales of electricity (i.e., imports) into the RGGI region. Leakage is a concern because the ten RGGI states are adjacent to states that do not have a CO_2 cap, and these uncapped states export electricity into the RGGI region. Initiation of the RGGI program is estimated to have resulted in a $.93 to $2.00 per MWh increase in electricity prices (based on allowance prices in the $1.86-$4.00 range, and gas units setting the prices).[54] This price differential is revealed through bids submitted by generators in the region's hourly electricity markets. These higher prices create incentives for generators outside of RGGI to export additional electricity into RGGI, since the non-RGGI sources could receive the benefits of the higher hourly market prices, but would not have the expense of acquiring CO_2 allowances incorporated into their operating costs for bidding purposes.

The topic of leakage has been extensively discussed by the RGGI staff working group and agency heads. RGGI has published a report that explores the potential for leakage, and recommends alternative actions that RGGI member states could take to reduce or eliminate this potential (RGGI 2005(a)). The report recommended that each of the three independent system operators in the RGGI region—ISO-NE, NYISO and PJM—adopt or amend its operating rules and improve its recordkeeping to better track the sale of and export/import of electricity within and across the three systems. The recommended changes include enhanced reporting of electricity sales, identification of the type of generating unit, and the quantity of MWhs sold within the region and imported/exported to/from adjacent power pools. ISO-NE and PJM agreed to these changes beginning in January 2008. NYISO has also committed to enhanced reporting procedures, but has not yet adopted the same rules as the other two transmission organizations.

New Jersey is the only state within RGGI that required its public service commission and environmental agency to work together to address potential causes of leakage and to take action if such leakage occurred. New Jersey's Board of Public Utilities (BPU) was required to adopt such rules by July 31, 2008. The BPU issued a docket during 2008[55], but as of the date of this report, has yet to issue a final rule.

Because of the very low price of RGGI allowances relative to transmission costs, it is difficult to conclude that RGGI is causing increased imports of electricity from outside the region. Other economic factors, such as differences in fuel prices and availability of less expensive units, are more likely to influence whether and to what degree imports occur. Still, if allowance prices were to increase significantly, the situation could be different.

[54] Since gas generators emit less carbon per MWh than oil and coal facilities, and these units are typically on the margin in NE-ISO, NYISO and PJM, the impact on the ultimate clearing price is less than it would be if coal or oil were on the margin. The price of electricity in NYS almost never reflects a coal unit's "per-MWh" price for carbon, but rather a gas "per-MWh" price—which is roughly half what the price would be if coal were the marginal fuel.
[55] New Jersey Department of the Public Advocate, BPU Docket No. EO08030150.

1.4.6.2 Operating Risks

Legal challenges. Among the future operating risks are legal challenges to RGGI.[56] For example, Indeck, a power generator subject to RGGI compliance obligations, filed a complaint against Governor Paterson, NYSDEC, NYSERDA, and NYSDPS in January 2009 seeking redress for injuries it claims it would suffer as a result of RGGI. Indeck asserted that then-Governor Pataki entered into the RGGI agreement without proper state and federal authority; that the State Legislature should have authorized NYS participation; and that RGGI did not receive Congressional authorization for a multi-state compact. Pursuant to a settlement approved by the court in October 2010, the suit was dismissed. Under the settlement, the power producers received free RGGI carbon emission allowances worth $7.7 million for the remaining period of their contracts. Consolidated Edison would buy allowances from NYSDEC and give them to the power producer. Consolidated Edison, in turn, would be reimbursed by collecting the $7.7 million it pays for the allowances from its electric customers through increased rates approved by the PSC. An equivalent amount of money held by NYSERDA from the challenged RGGI auction proceeds would be paid to Consolidated Edison for new “smart grid” projects to offset the perceived harm to customers from paying for the allowances.

In June of 2011, a second lawsuit was filed by three NYS residents (represented and funded by Americans for Prosperity and Competitive Enterprise Institute) against Governor Cuomo, NYSDEC, and NYSERDA challenging the state’s implementation of RGGI on a number of grounds. While the nature of this second lawsuit is significantly different, at the heart of the plaintiffs’ argument is a contention that NYS unlawfully entered into RGGI because the state did so without legislation signed into law. At time of writing this case remains unresolved.

National Program. A second operating risk—which was a key consideration in the process of establishing RGGI—is the potential emergence of a national cap-and-trade program. While the House of Representatives passed a comprehensive cap-and-trade climate bill in June 2009, any progress in the U.S. Senate has since stalled, and chances of enacting such legislation in the next few years appear less likely. Instead, as a result of the Supreme Court’s decision in *Massachusetts v EPA* and the subsequent endangerment finding for CO_2, the nation appears to be headed down a path of addressing carbon via regulation rather than legislation. Nevertheless, there remains the potential for EPA to allow regional cap-and-trade programs to act as an alternative compliance mechanism for federal GHG regulations that are being rolled out in 2011-2012.

While any action on climate policy by Congress appears stalled for the near-term, a brief discussion of the lone piece of federal climate legislation to pass one house provides a useful comparison with existing sub-national efforts. The legislation that passed the House, sponsored by Congressmen Waxman and Markey (American Clean Energy and Security Act, or ACES), would put a cap on greenhouse gas (GHG) emissions nationwide. ACES would require GHG emissions to be reduced to 3% below 2005 levels by 2012; 17% by 2020; 42% by 2030; and 83% by 2050 (EDF 2009).[57]

A key difference between ACES and RGGI is that ACES provides for the free distribution of most emission allowances rather than requiring that they be auctioned. In its current form, ACES would distribute 85% of the allowances for free, reserving 15% for auction; the free distribution of allowances would not end until 2030.

[56] RGGI is not a program that was implemented to comply with federal regulation and was promulgated without legislative involvement. As such, RGGI is susceptible to legal challenge.
[57] A similar bill—The Clean Energy Jobs and American Power Act—was introduced in the Senate in September 2009 by Senators Kerry and Boxer, but did not progress any further.

ACES would preempt RGGI and other regional programs for the time period 2012-2017 (Environment Northeast 2009). ACES provides that holders of RGGI allowances will receive an equal share of federal allowances once the federal program is effective. This provision helps to support the value of RGGI currency, and provides stability for entities with RGGI compliance obligations. Still, ACES does not directly address the loss of state funds for energy efficiency and renewable energy that have been enabled by the auction of RGGI allowances.

1.4.7 Assessment of the Financial Markets for Tradable Emission Rights with Respect to Performance Attributes Such as Liquidity, Volume of Trades, Price Volatility, and Strategic Behavior

The auctioning and trading of RGGI allowances has been one of RGGI's greatest successes. RGGI has pioneered the first major auction or sale of EA (SO_2, NO_X or CO_2)—heretofore allowances have been largely "grandfathered" to existing emitters. Great concern was expressed by affected sources (especially regarding foregoing free allocations of allowances), that the auction would not work, nor would the secondary markets created around it. RGGI hired an auction design team to analyze alternatives and to create plans for the auctions. The resulting guidelines have been largely followed with excellent results to date. (The report is available at: http://rggi.org/docs/rggi_auction_final.pdf).

RGGI also hired a market monitor (Potomac Economics) to review all auctions as well as the treatment of the allowances in the secondary markets.[58] The Potomac Economic Reports are all available at: http://rggi.org/market/market_monitor

There is one report for each of the nine quarterly auctions as well as seven quarterly reviews of the secondary markets. In addition, the federal Commodity Futures Trading Commission has examined the RGGI secondary markets. To date, all aspects of the auctioning, selling and reselling of allowances have evidenced no significant exercise of market power:

> "In summary, the results of our monitoring of RGGI Auction 9 raise no material concerns regarding the auction process, barriers to participation in the auction, or the competitiveness of the auction results." (Market Monitor Report for Auction 9, p.3)

This is essentially the ninth (consecutive auction) restatement of that conclusion.

One of the notable concerns expressed by the affected sources during the design stage was whether non-regulated financial interests, or even "financially well-heeled" environmentalists, would accumulate a sizeable share of the allowances, forcing the price upwards or making the allowances unavailable. Several states responded by making provisions for special set-asides for regulated entities. NYS, like most states, did not. Approximately 80% of the allowances have been acquired by the compliance entities in auctions:

> "…compliance entities or their affiliates purchased 92% of the allowances in the offering of 2009 vintage and 2010 vintage allowances and 100% of the allowances in the offering of 2013 vintage allowances."[59]

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[58] The selection of Potomac Economics had an added benefit since Potomac Economics was also the market monitor consultant to both the NYISO and the ISO-NE.
[59] "RGGI Market Monitor Report for Auction 9", p. 7.

Similarly, the market monitor's conclusions about the operation of the secondary market have been singularly positive:

> "As in previous reports on the secondary market, we find no evidence of anti-competitive conduct."[60]

Potomac Economics carefully reviews prices on the secondary market for reasonable conformity with the auction prices. Further, they examine who is active in the secondary market (regulated entities or other parties), and especially examine how many active participants there are, and whether a small number of them dominate the market. The Market Monitor has found no basis for concern—a rather sweeping conclusion that they have arrived at each time they have examined this market over the past two years.

1.4.8 What were the Desired Program Outcomes, and Have they Met Expectations?

The overall objectives of RGGI are to reduce GHG emissions in the Northeast, to serve as a model and catalyst for development of other regional climate programs and/or a federal program, and to invest auction proceeds in programs that advance implementation of energy efficiency, and development of renewable resources and low-carbon technologies.

From 2005 to 2009, RGGI regional annual CO_2 emissions have decreased from 184.4 million tons to 123.7 million tons, a reduction of 60.7 million tons, or 33%. This amount of emissions reduction far exceeds the initial goal of RGGI, which was to stabilize emissions at 188 million tons through 2014 and then to reduce emissions by 10% to 169 million tons by 2018. While the observed emissions reduction exceeds the RGGI goals, results of a NYSERDA study commissioned by RGGI, Inc. indicate that the reduction is largely due to economic and market factors that are not directly attributed to RGGI. For example, as shown in the figure below, it is estimated that 31.2% of the emissions reduction was due to the unexpected and substantial decrease in natural gas prices that resulted in many dual-fuel generation units switching from oil to natural gas and some coal-fired units reducing their output. It is also estimated that 48.1% of the emissions reduction is attributed to reduced electricity load due to cooler summer weather, reduced economic activity, implementation of end-use energy efficiency and customer-sited generation, and other load impacts.[61]

The NYSERDA study commissioned by RGGI, Inc. did not purport to explicitly evaluate the estimated impact on CO_2 emissions of compliance with the RGGI CO_2 cap-and-trade program. Likewise, the study did not attempt to estimate the relative contribution of the RGGI program to the reduction in CO_2 emissions from 2005 to 2009. The study stated, however, that it is expected that the impact of RGGI, implemented in 2009, is embedded in some of the factors identified in the figure below. For example, lower electricity load may be partially due to the use of RGGI CO_2 allowance auction proceeds to fund state energy efficiency programs. Fuel switching may be partially due to CO_2 allowance costs further narrowing the fuel price differentials between fuels with different carbon content. Coal plant retirements may be partially due to consideration of projected future CO_2 allowance costs in the economic evaluation of the plants that preceded their closure. .[62]

[60] RGGI Inc. "Report on the Secondary Market for RGGI CO_2 Allowances: First Quarter 2010," (Prepared by Potomac Economics), p.23.
[61] http://rggi.org/docs/Retrospective_Analysis_Draft_White_Paper.pdf
[62] http://rggi.org/docs/Retrospective_Analysis_Draft_White_Paper.pdf

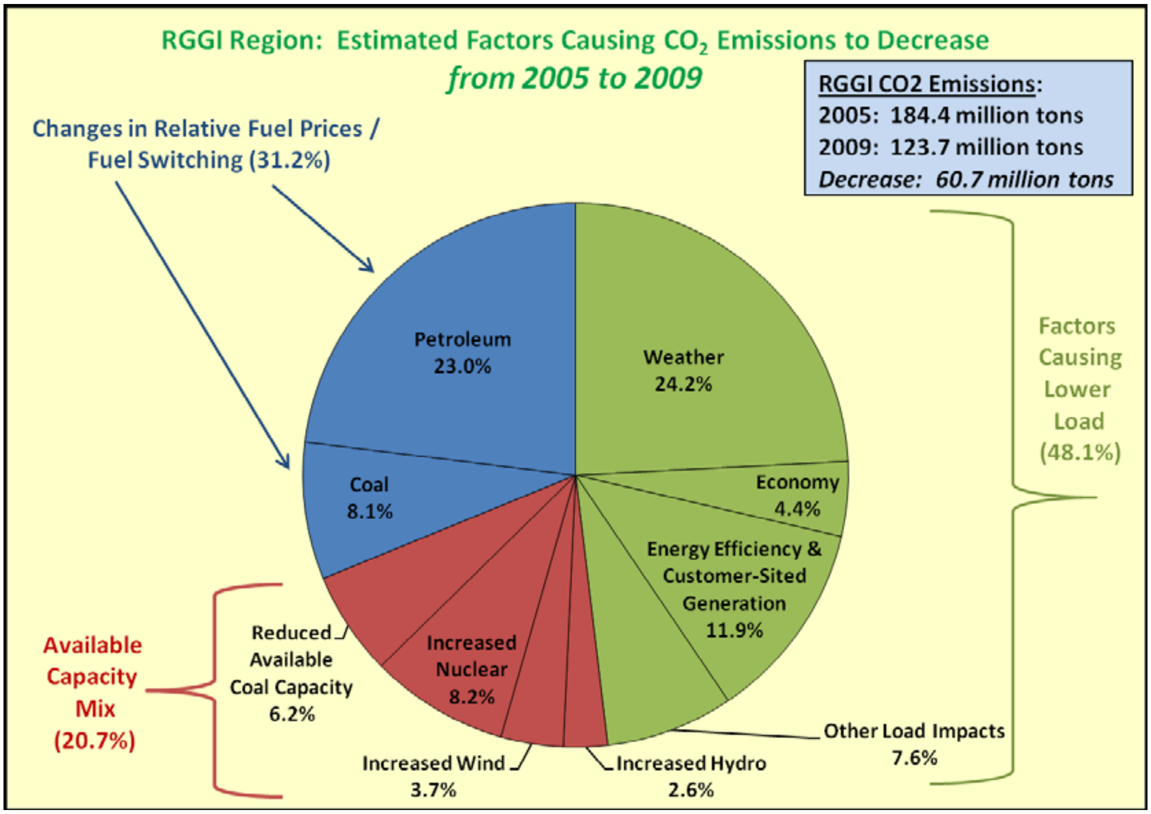

Figure 1-17. Estimated Factors Causing CO_2 emission decreases in the RGGI Region (2005-2009).

RGGI has provided an operating model of cap-and-trade program design for CO_2 regulation, EA auctions, and administration of an offsets program. RGGI has succeeded in demonstrating that auctions can be conducted without any significant problems of market power or hoarding behavior detected. Covered entities have not had any difficulty obtaining sufficient EAs to comply.

There was a threshold issue of whether to sell EAs to emitters or, as in the past, allocate them to emitters for free. Beyond that, there was the technical question of whether an administrative system could be designed for selling the EAs in a fair and efficient way that would not cause, or fall prey to, market disruptions. Using an auction platform was the natural approach, and it has worked extremely well, with no known problems of significance yet. Likewise, the secondary markets for EAs have worked effectively—also with no known problems of significance to date.

The RGGI offset program has been very carefully designed to avoid the many problems that have plagued the European Union Emissions Trading Scheme. There is no practical experience to date with the actual administration of offsets as none have yet been formally accepted into the program, discouraged in part by the low prices for RGGI allowances.

Investments of the RGGI proceeds in energy efficiency, renewable energy, and low-carbon technologies are providing significant benefits to the residents of the RGGI states, as illustrated by the following table.[63]

[63] http://www.nyserda.org/RGGI/Files/RGGI_Annual_Report_2010_Final.pdf

Table 1-3. Summary of Cumulative RGGI Program Benefits through December 2010. (NYSERDA)

Summary of Cumulative Program Benefits

Benefits	Results through December 31, 2010
Net Greenhouse Gas Emission Savings [1] (Annual Tons CO_2e[2])	9,310
Net Electricity Savings (Annual MWh) [3]	838
Renewable Energy Generation (Annual MWh)	4,316
Net Natural Gas Savings (Annual MMBtu)	3,926
Net Fuel Oil Savings (Annual MMBtu)	74,691
Net Propane Savings (Annual MMBtu)	301
Net Steam Savings (Annual MMBtu)	12,553
Net Gasoline Savings (Annual MMBtu)	
Net Diesel Savings (Annual MMBtu)	
Annual Energy Bill Savings to Participating Customers ($ Million) [4]	**2.9**

[1] These emission reductions are associated with both electric and fossil-fuel saving measures. Under a cap-and-trade system, the total number of emission allowances is determined by regulation. Regulated entities can purchase allowances and collectively emit up to the cap that is currently in place. Therefore, in the near term, electric efficiency projects may not decrease the overall amount of emissions going into the atmosphere. Nevertheless, electric efficiency projects will reduce end-users' responsibility or footprint associated with emissions from electricity production. [2] CO_2e stands for carbon dioxide equivalent and describes the amount of CO_2 that would have the same global warming potential as a given mixture of gases based on factors published by the Intergovernmental Panel on Climate Change. [3] In previous reports, MWh of electricity produced photovoltaic systems was reported as net electricity savings. Going forward, these MWh will be reported as renewable energy generation. [4] This total excludes bill savings associated with steam for the Multifamily Performance Program.

2. Relationships Between Market-Based and Related Programs

The four market-based mechanisms discussed in this report overlap to some degree in the pollutants that are reduced. This overlap is shown graphically in Figure 2-1.

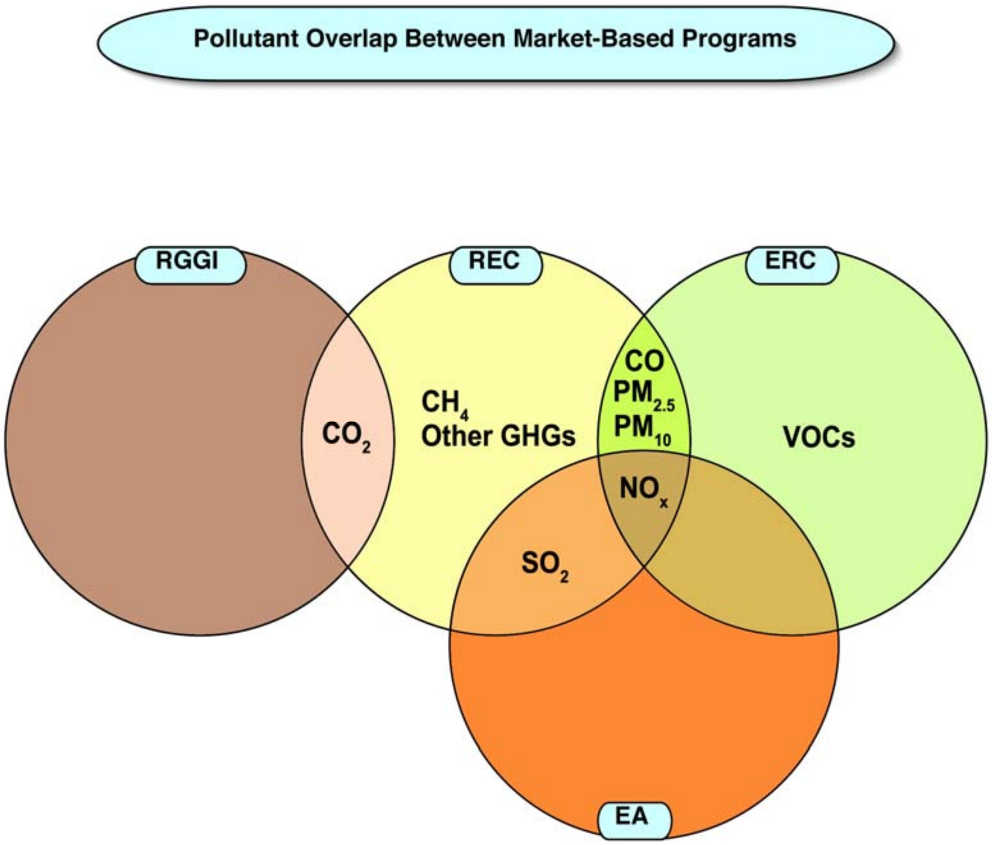

Figure 2-1. The pollutants are displayed here, including those that are covered under each of the market-based programs, and how those pollutants overlap between programs.

While this emissions-based view of program interactions can be useful, it can also be misleading. For example, the diagram shows that the RPS and RGGI programs both affect CO_2 emissions. Nevertheless, RGGI limits CO_2 emissions from EGUs through a regional cap-and-trade system, while the RPS purchases RECs, which include CO_2 credits, as part of its support for in-state renewable energy development. Thus, from the State's perspective, the two programs operate very differently regarding CO_2, despite their common goal of reducing carbon emissions from NYS's electricity sector.

Still, RGGI also supports methane reduction programs, because landfill gas capture and manure management methane capture projects qualify as RGGI offsets. For this reason, the coexistence of RGGI and the RPS can present something of a dilemma to some developers, since both market-based programs offer revenue streams to support qualifying biomass-based renewable energy projects. Due to double counting prohibitions, any given project can qualify under only one of these programs; the developer must decide which is likely to provide the greatest monetary benefit. The RPS is funded through 2015, and the prices received by winning bidders through the five Main Tier solicitations are known. Barring any major restructuring of RGGI (cap correction, other sectors, linking to other markets), allowance prices will remain very low. When considering the low price, the NYSDEC-proposed definition for RGGI-eligible biomass,[64] and the fact that there is no offset market, it is likely that a biomass facility would not pursue the RGGI offset project, but would instead use the less stringent RPS criteria. The same premise holds true for biogas.

This chapter discusses some of the ways in which the programs addressed in this report do, or could, interact. Potential interactions between command and control programs and market-based programs are also discussed.

2.1 Interactions Between Market-Based Programs

2.1.1 RECs and RGGI Allowances

2.1.1.1 Direct Interactions. NYS prohibits developers receiving RECs through the State's RPS program from offering the same environmental attributes for sale in RGGI. This prohibition ensures that the same value, benefit, or attribute associated with producing power from renewable energy is not counted twice. For example, although certain types of biomass projects[65] are technically eligible to participate in either program, the source owner or developer must choose between the two.

2.1.1.2 Indirect Interactions. Most forms of renewable generation—with the exception of biomass—have lower marginal operating costs than fossil-fired power plants because the fuel is free. Generating units bid into the wholesale market at their marginal cost. With an increase in the amount of renewable power being bid into the system, the marginal and more expensive generating units are displaced, and the price for electricity in a given hour declines. RECs provide incentives for more renewable generators to enter the market. When RECs are coupled with policies that put a price on emissions allowances, particularly for CO_2, the external environmental costs of fossil-fired generation are partially captured, which helps to equalize costs between the two generating types. Capturing external costs can help to overcome barriers that have precluded renewable energy development, by pricing fossil-fueled generation at levels that reflect its impacts upon public health and the environment. In this way, EA and RECs may work together to spur renewable development while reducing the use of fossil-fired units in the NYS electricity market. This synergy works, however, only when CO_2 allowance prices remain in a middle range. If CO_2 allowance prices become too low or too high, renewables cease to benefit from RECs.

Based on modeling completed for EPRI (Niemeyer, 2008)[66], and replicated by electricity planning exercises in the Western US (PacifiCorp 2008 IRP and E3 model for CA PUC), if CO_2 prices are less than $45-$50/ton, the result is transfer payments to fossil-fueled generators, with little to no change in the dispatch order. When CO_2 prices rise beyond this threshold, fossil generation is dispatched later by the NYISO, and renewables receive the benefits of higher electricity prices under a uniform market clearing price combined with lower marginal production costs. Nevertheless, as the market for CO_2 becomes more robust and emissions caps tighten, allowances prices may rise. If prices for CO_2 allowances get high enough, REC prices may fall. This is because, as CO_2 prices rise and fossil generation becomes more expensive, renewable generation becomes less expensive by comparison, even without RECs, and the value of a REC will decline. The price of a CO_2 allowance thus determines the economics.

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[64] As of this writing, a new biomass policy is under consideration by the NYSDEC (Draft Policy DAR-12 regarding the "Sustainably Harvested" determination for purposes of "Eligible Biomass" under Part 242). If passed, this policy might restrict use of biomass by RGGI facilities by limiting the eligibility of this fuel source.

[65] An example of such a project includes coal-biomass co-firing in a large combined heat and power facility.

[66] It should be noted that the analysis was conducted in 2007 when natural gas prices were ranging from $8 to over $10. At current $5/MMBtu prices dispatch changes would be at much lower CO_2 prices. The paper makes the point that results are sensitive to natural gas prices.

2.1.2 Relationship of Emission Reduction Credits to Emission Allowances

ERCs and EAs function in a complementary manner to regulate criteria pollutants. The ERC program addresses new sources or major modifications at existing sources. This mechanism ensures that nominal emissions levels are not increased. Furthermore, the offset ratio provision for nonattainment areas is designed to lower emissions over time. Therefore in areas of severe nonattainment, a 1.3: 1.0 offset ratio is designed to reduce the total criteria pollutant loading in that particular non-attainment area, and thereby move that area into compliance over time.

The EA program targets existing sources to ensure that a regional or national emissions budget is not exceeded in any given year, or control period. The EA programs target SO_2, seasonal NO_X and annual NO_X. ERCs are available for NO_X, SO_2, PM, VOCs and CO.

Activities in the ERC market may have some overlap with the EA market and vice versa. An example of an intersection between the two markets comes from the Project Team's interviews with market experts. One expert pointed out that an affected source might have a choice between certifying an ERC versus selling EAs. If the affected source were to create an emissions reduction that was real, permanent, quantifiable and surplus, it could qualify for an ERC. The same source could take the emission reduction and sell EA.

The sale of an ERC in the amount of one ton is for one ton of emissions per year in perpetuity. In contrast, the sale of an EA in the amount of one ton is for one ton of emissions in one year only. If there were no market inefficiencies, the sale price of an ERC should be equal to the discounted net present value of the EA over the expected period for which that EA would have value.

Still, trading areas for ERCs differ markedly from trading areas for EAs. There are potentially a greater number of affected sources required to hold ERCs as compared with sources encompassed by the EA programs. The demand for ERCs is driven by the major capital investments in new or modified facilities that will be sources of criteria pollutant emissions. The demand for ERCs is much more sensitive to economic cycles than is the demand for EAs.

One stakeholder observed that under current market conditions, there is no incentive for a site that can choose between ERCs and EAs to create and sell the ERC. The ERCs are not in demand except at a "firesale" price. The EA markets, though in turmoil, may recover as uncertainties are resolved about the future of the transition from CAIR to CATR. The future supply of ERCs for sources not covered by the EA program could be constrained, perhaps leading to future shortages. This situation, while not of concern today, could be problematic in the future.

In summary, the programs exhibit different operating outcomes due to non-homogeneous sector coverage between the programs, disparate trading regions among the programs, and a sensitivity to economic factors that is widely divergent between the affected sources covered. This leads to some market distortions in setting relative prices across the two markets.

2.2 Interactions Between Market-Based and Command and Control Programs

2.2.1 RACT/BACT and CAIR

NO_X and SO_2 allowances are allocated based on factors including historical emissions, or generation size. A market develops because some facilities are able to "over-control" for the regulated pollutants, thereby freeing up excess EAs that can be banked for future years' compliance, transferred internally to cover other units owned by the same company or sold on the market. The demand for EAs is derived from affected sources that cannot cover their emissions with their own EAs, and find it more cost-effective to buy EAs rather than to install new controls.

Under the provisions of Subpart 227-2 NO_x RACT, most of the existing coal plants in NYS will be required to install NO_X controls by July 1, 2014. At this point in time the Project Team is not aware of any new regulations that will affect investments in additional SO_2 controls. More stringent RACT rules for NO_X imply an excess supply of EAs will be available for NYS generators to sell into the market.

Under the CAIR rule, NYS facilities that must invest in new NO_X controls to meet the requirements of Subpart 227-2 NO_X RACT could have recouped some of the investment by selling excess NO_X allowances to those in other states that require them. This provides an incentive for early compliance. Affected sources that find it advantageous to invest in 2010, several years in advance of the 2014 deadline, could reap a monetary benefit from early compliance.

Nevertheless, the value of the EAs is likely to be markedly diminished under the terms of the EPA's proposed CATR rule. The CATR rule will restrict trading regions. NYS generators will have a much more limited market in which to sell excess EAs. Many states where generators are net buyers of EAs will no longer be able to trade with NYS generators that are net sellers of EAs.

RACT rules set a standard applied to every affected source. Facilities must respond by installing new control technologies. In this sense, the regulation is akin to a command and control approach. The required investment is likely to significantly lower site emission rates as compared with the historical baseline from which the allowance allocation was set. This will create an excess supply of EAs in the state that sets the new standard.

If there is a broad-based geographic trading market then there are likely to be buyers creating a demand for these excess EAs now available. Some NYS generators may wish to pursue an early compliance strategy. This is facilitated insofar as investors are confident that there is a stable, multi-year market for the EAs that such early investment would yield.

In the absence of such a market, however, there is little incentive for affected sources to comply early. When affected sources choose an early compliance strategy, society benefits by getting the reductions earlier in time. There are also market-smoothing efficiencies as the demand for new controls is not concentrated in time at the end period for compliance. If all affected sources comply at or around the same period in time, the marginal cost of supplying the controls is likely to be much higher than if the demand for controls was less concentrated in time.

A problem may arise in markets where there are both command-and-control compliance schemes and market-based mechanisms operating and, at the same time, the scope of the trading market is severely constrained. If all affected sources face the same control costs, then there are no gains from trade to be captured and the rationale and potential efficiency benefits of a trading market are largely negated.

3. The Effect of Market-Based Mechanisms on the Production and Use of Energy

3.1 Effects of Market Mechanisms on the Production of Energy

Despite the numerous substantial changes in the U.S. electricity markets over the past two decades, the NYS electricity market has remained relatively stable. To date, market mechanisms for environmental protection have produced the desired pollution reduction results and, while prices are likely higher than they would be in the absence of regulation, there has been little negative impact on energy production and reliability[67] in the state.

This task's emphasis was intended to analyze the effects of market-based mechanisms on the production and use of energy in NYS, and on the reliability of the electricity grid. That analysis required a review of electricity sales by zone, hourly data sets of what fuel is on the margin, sales and transfers of electricity between zones and adjacent power pools, and a review of the reliability events triggered under NYISO rules. Despite the Project Team's best efforts, and those of NYSERDA, these data were either not available, considered confidential and/or provided in a high level only, which could not inform any objective evaluation.

3.1.1 The Acid Rain Program

Cap-and-trade systems for SO_2 and NO_X were implemented in the 1990s, and as one of the most well-known and effective market mechanisms for environmental protection, it is possible to use historical data to assess their impact on energy markets over the last fifteen years.

The Acid Rain Program, which established the cap-and-trade system for SO_2, has historically had a much lower cost of compliance than was predicted by analysts. Prior to the inception of Phase I of the Program in 1995, analysts and economists predicted EA prices in the range of \$250 to \$500/ton. Actual EA prices for Phase I were generally between \$100 and \$200/ton of SO_2, with a low of \$65 per ton in 1996. EA prices were then predicted to rise to between \$500 and \$1,000/ton as Phase II of the Program began in 2000; however, even as the Phase II pollution control requirements became more stringent, prices generally remained less than \$200/ton until mid-2004 (EPA 2009). During the first decade of the Acid Rain Program, SO_2 compliance costs were lower than expected due to the fact that many generating sources chose to switch fuels, changing to inexpensive low-sulfur coal, and others chose to install scrubber technologies that had become much cheaper as a result of technological innovations (EPA, 2009). Prices began to rise in 2004 as the EPA introduced draft CAIR regulations, ultimately peaking at \$1,600/ton in December 2006. This increase was attributed to the changing nature of the emissions market, as the marginal cost of future CAIR compliance was added to EA prices, and current banked EAs increased in value as affected sources wanted to ensure that they would have enough allowances to meet obligations. Hurricane Katrina also played a role by increasing uncertainty in the natural gas market, contributing to a shift from gas- to coal-fired electricity production. Such high EA prices provided incentives for many generators to install pollution control equipment at a lower cost per ton, which led to a gradual decline in the price of EAs. As of mid-2010, SO_2 allowance prices were trading at just under \$30/ton. Figure 3.1 shows historical SO_2 allowance prices and trading volumes from January 2000 through January 2008.

[67] NYS has many rules designed to ensure reliability of the electric system in all of the zones in the state, in particular in the New York City zone. This report does not examine "reliability" in NYS with respect to these rules, but rather defines "reliability" as "keeping the lights on."

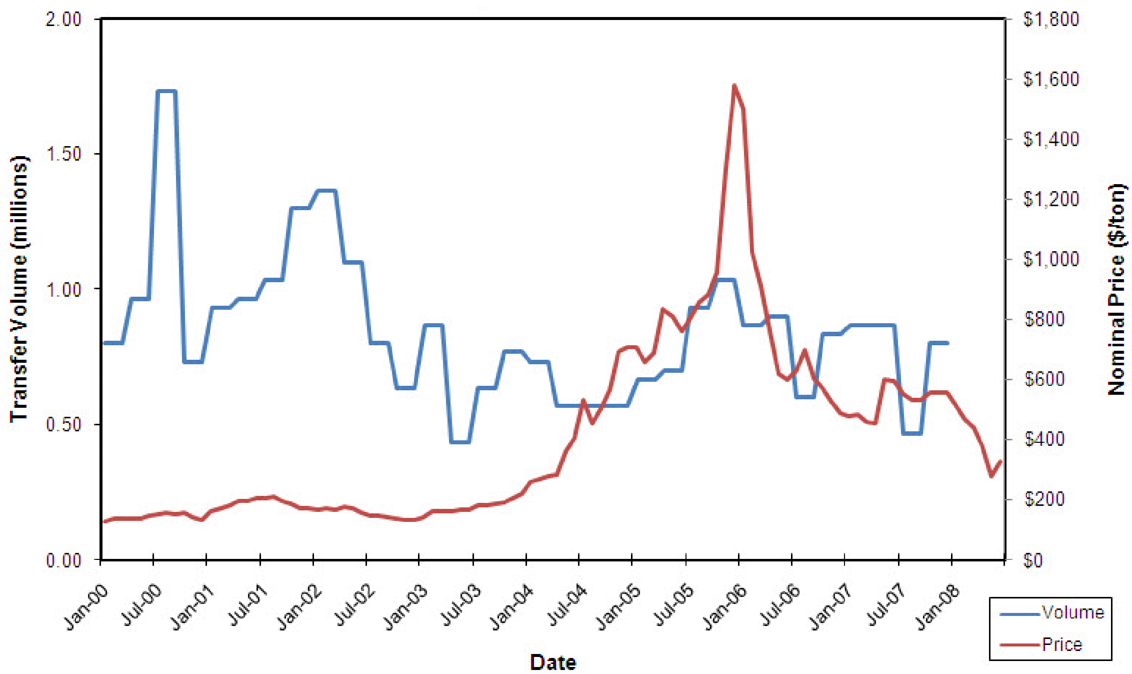

Figure 3-1. Historical SO_2 Allowance Prices and Transfer Volumes (EPA 2009)

EAs for NO_X followed a similar pattern. The NO_X market began in 1999 as a regional effort by the Ozone Transport Commission (OTC), and after an initial period of high prices, EA prices began to decline. The OTC program was replaced in 2003 with the seasonal cap-and-trade NO_X Budget Trading Program under the NO_X SIP call, and similar to the Acid Rain Program, EA prices increased as affected sources were required to meet more stringent emissions control requirements. Figure 3.2 shows EA prices for NO_X from January 2005 to November 2008.

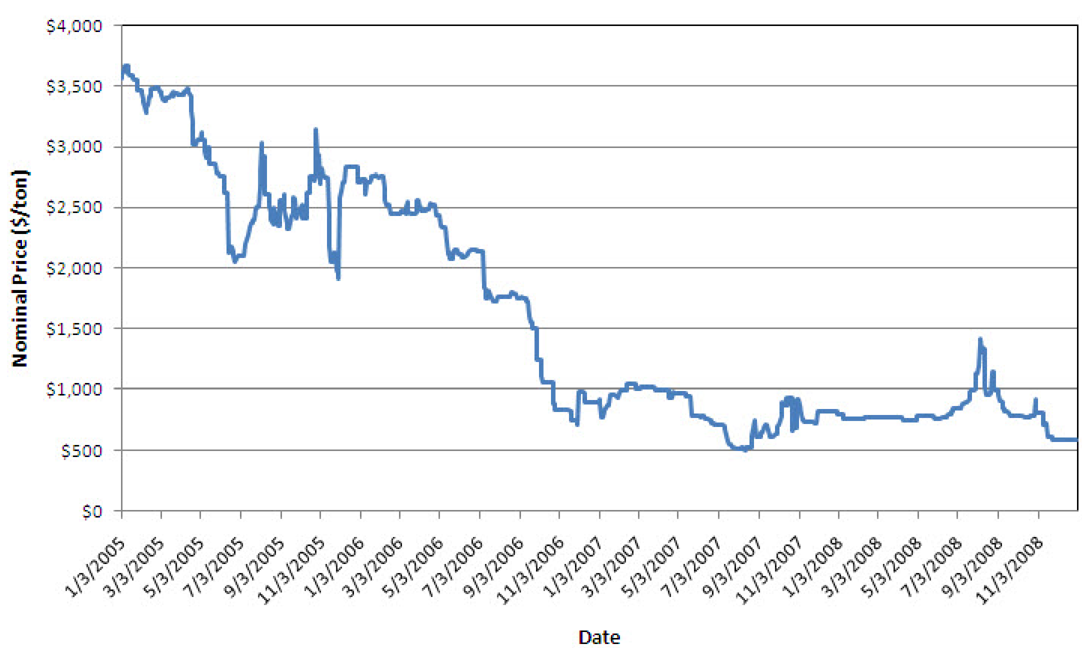

Figure 3-2. Historical NO_X Allowance Prices (USEPA 2009)

While it is true that EA prices under cap-and-trade regulations have at times been higher than anticipated, it is also true that prices have been lower than anticipated for much of the lifetime of the programs. Price spikes have typically occurred at times of great uncertainty as to the extent of environmental regulations, and the price of pollution control equipment and compliance with cap-and-trade programs. Uncertainty over environmental compliance costs in the early to mid-1990s may have made affected sources hesitant to commit to build new facilities during that period, and this hesitancy may have contributed to the capacity shortages and rising electricity prices in major hubs across the United States from 1997 to 2000 (Hunt and Sioshansi 2002). Private, independent power producers (IPPs) and merchant generators wanted to take advantage of these high electricity prices and believed they could profit from the construction of new capacity. Low natural gas prices combined with new environmental regulations led investors to the decision to construct primarily gas-fired power plants, and by the end of 2001, more than 400 GW of new capacity had been announced or was under construction (Hunt and Sioshansi 2002). Most of this new capacity would come online between 2002 and 2005.

NYS experienced similar capacity shortages and rising prices. Prices in eastern NYS rose 101% between 1997 and 2000, and prices in western NYS rose 138% over the same period (Hunt and Sioshansi 2002). NYS was similar to many other states and regions in that it also added gas capacity during this time period; however, it was unlike other regions in that it experienced two peaks in additions of gas capacity shown in Figure 3-3.

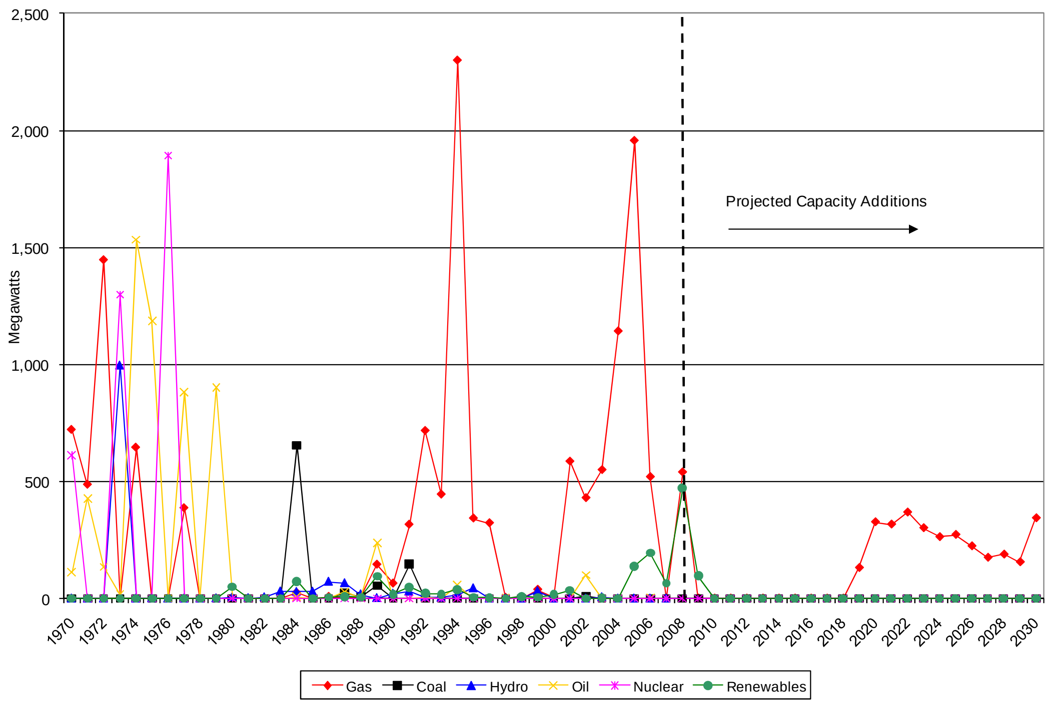

Figure 3-3. Annual Capacity Additions in New York State (EIA 2009)

Capacity additions of gas-fired generation increased between 1994 and 1996, and again between 2002 and 2006. It is unclear whether the first period of capacity additions showed some foresight about coming emissions costs or was prompted primarily by lower gas prices or other factors (e.g. electric restructuring, improved transmission, etc.). The second period of increasing gas additions may have been partly in response to analysts' projections of increased environmental compliance costs for other types of fossil-fueled generation, as it coincided with a period of increasing SO_2 allowance prices following the EPA announcement of draft CAIR regulations. RGGI discussions also began near the later part of this period, and anticipation of a price on CO_2 may have also contributed to the spike in gas additions.

These capacity additions led to reliance in NYS on natural gas fuel for electricity generation, and that has remained largely unchanged at least since NYISO began administering wholesale power markets in 1999. Table 3.1 shows that the percentage of electricity generation from natural gas in NYS has remained stable from 1999 through 2007, at approximately 30%. The state relied slightly less on coal and petroleum in 2006-2007, but slightly more on nuclear and conventional hydro sources.

Table 3-1. Comparison of Generation Mix in New York State (Analysis Group and NYISO 2008)

Average Generation Mix	1999-2000	2006-2007
Coal	17%	15%
Petroleum	10%	5%
Natural Gas	30%	30%
Nuclear	24%	29%
Conventional Hydro	17%	18%
All Other Renewables	2%	2%

Cap-and-trade regulations for SO_2 and NO_X do seem to have had an influence—albeit combined with fuel price and diversity considerations and transmission opportunities and/or constraints—on fuel choice in NYS and the resulting fuel mix over time.

Any influence of cap-and-trade regulation and resulting emissions allowance prices on the cost of generation in NYS is much more difficult to see. EA prices do influence the clearing price of energy in the market. The cost of EAs is one element of a generation owner's marginal cost of operating a fossil-fueled power plant and will therefore influence its generation supply bid into the market; it is therefore reasonable to suppose that EA prices would have some impact on the cost of generation. Still, the magnitude of that impact can be difficult to discern, especially when the cost of generation is influenced to a greater degree by other factors such as the price of construction materials, increasing labor costs, transmission bottlenecks, and most importantly, higher fuel prices.

It is possible to project potential outcomes for NYS energy markets if EA prices in NYS were to approach extremely high levels, such as occurred in California's RECLAIM market, the emissions trading program developed for the Los Angeles air basin. NO_X allowance prices in RECLAIM increased from a range of about $1,000-$4,000 per ton in 1994-1999 to more than $45,000 in 2000, with individual trades for more than $100,000 per ton reported. These extremely high EA prices occurred during, and contributed to, California's electricity crisis.

When making a projection for NYS, potential effects are differentiated by whether the period of high EA prices is short-term or occurs for an extended period (*e.g.*, longer than one ozone season). In the short-term, we would expect EA prices of $20,000 or higher to have significant economic impacts, in the form of much higher electricity prices, but not to compromise reliability. The dispatch order would also likely change, to favor operation by natural gas plants, followed by oil and then coal.

If the higher EA prices were sustained over a period of an ozone season or longer, we would expect that, in addition to the significant economic impacts described above, potential reliability effects could occur, as coal- and oil-fired generators might be unable to procure sufficient EAs to continue operating. Such a deficiency in regional generation would be filled by coal-fired generators to the south and west, who would sell power into NYS up to the carrying capacity of the transmission lines. Such a sequence would have the unfortunate result of increasing NYS's electricity bills and, at the same time, increasing the amount of transported pollution into the State from upwind states, hindering NYS efforts to attain compliance with NAAQS.

There are three reasons that any risk of such extremely high allowance prices over the long term in NYS is very unlikely. First, the factors that lead to the rapid EA price rise in RECLAIM are not likely to recur. Much of the increase in RECLAIM prices and unavailability of generation in Southern California was due to business decisions made by generators several years previously.[68] Second, the RECLAIM market was geographically small, and EAs could not be obtained from other areas. For the OTC and EPA NO_X Budget Programs, the geographic area extends to cover most of the Eastern United States. So, even if an affected source were unable to procure NYS EAs, it could procure EAs from other states. Finally, the reliability of electricity supply appears to be adequately ensured through the design of cap-and-trade regulations, and the "true-up mechanism" that allows generators to purchase EAs to cover any extra emissions at the end of every generation year.

3.1.2 CAIR

As shown in Figures 3.1 and 3.2, regulatory uncertainty surrounding CAIR and its implementation contributed to temporary price spikes for both SO_2 and NO_X allowances. If EA prices continued to rise, the effects on energy production and reliability could increase over time. Nevertheless, the EPA warns that "market observers should not confuse temporary high prices in the transition to new market dynamics as volatility" and goes on to state that experience has shown that "once emissions cap-and-trade programs are established, there is long term, relatively stable emission allowance market performance with gradually declining prices as significant emission reductions are achieved." (EPA 2009).

3.1.3 RGGI

In contrast to projections showing gradually declining SO_2 and NO_X allowance prices, modeling analyses of proposed federal legislation for capping CO_2 emissions has shown that EA prices are expected to rise over time.[69] This is because fewer proven technologies exist that can directly contribute to CO_2 reductions,[70] and the technologies being developed are expensive to implement. As carbon emission caps tighten, it will become more difficult to meet those caps, leading to a shifting upwards of the supply curve as the cap is reduced, resulting in higher prices.

Similarly, absent any technological innovations leading to cost-effective control technologies for CO_2, the costs of compliance with RGGI will be much greater than the costs for other cap-and-trade programs to date. Because costs will be higher, it is reasonable to expect a greater impact on the cost of energy production, decisions about construction of new electric generation, and system reliability in NYS.

3.1.4 Geographical Factors and Leakage

As shown above in Table 3.1 NYS as a whole has a relatively diverse mix of fuels used for the generation of electricity. When the state is divided into zones, however, one sees that compared to upstate NYS, New York City and Long Island are completely dependent on expensive fossil fuels for electricity generation. Transmission constraints between upstate and downstate make less-expensive generation in the upstate region less available to meet downstate load.

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[68] Personal knowledge of Christopher James, former Air Director for the Connecticut DEP, based on conversations with officials in the South Coast Air Quality Management District in 2000-01. SCAQMD officials informed Mr. James that Southern California generators knew about their compliance obligations more than five years in advance, and either ignored them or failed to install the necessary emissions controls.
[69] In the absence of modeling analyses and price forecasts for emissions allowances under RGGI, allowance forecasts under a federal climate change program will be used a proxy.
[70] As distinguished by *indirect* policies such as energy efficiency that are highly cost effective.

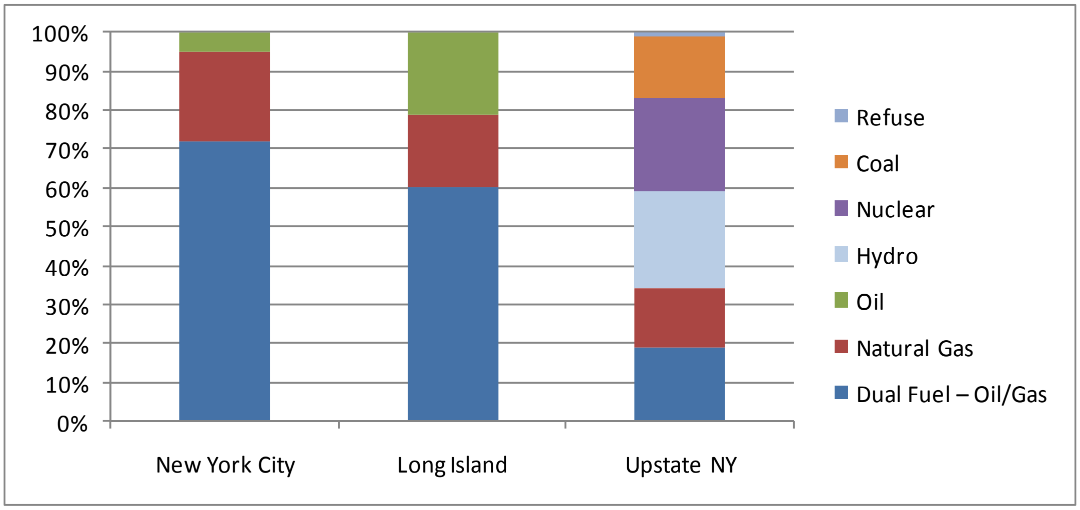

Figure 3-4. New York State Fuel Mix by Zone, 2007 (Analysis Group and NYISO, 2008).

Additionally, NYS is a net importer of electricity from New England, PJM,[71] Ontario, and Quebec, with Long Island and New York City, specifically, importing large portions of their consumption (NYISO 2007). Completion of the Neptune high-voltage transmission cable in July 2007, with 660 MW of electric capacity, has allowed Long Island to import power from the PJM region. NYISO's 2007 State of the Market report states that the "new import capability reduced the power flows and congestion on the transmission interfaces from up-state New York to New York City and Long Island. The reduced congestion contributed to a 3 percent decline in Long Island electricity prices in spite of the rise in fuel prices." (NYISO 2007).

As previously discussed, leakage, the import of electricity from one area to another due to differential economic factors, was a concern that was intensively discussed during the development of RGGI. It is unlikely that RGGI alone, with its low prices and over-allocated cap, could drive increased quantities of generation from the Midwest to be exported to the East. Furthermore, in the event that a national program was to be in place in the coming years, it would not be subject to leakage. In the event RGGI is continued and higher EA prices occur, then a legal means will have to be devised to prevent leakage—such as requiring allowances for imports to NYS. However, completion of the Neptune line and proposals to install new 745kV transmission lines from Ohio and West Virginia to Maryland and New Jersey will very likely create such opportunities. Despite recent subsidence in natural gas fuel prices, these prices remain higher than for coal. Moreover, given the nature of northeastern electricity markets—where all generators that operate in a particular hour receive the clearing price established by the marginal unit that operates—significant incentives are created for lower priced coal-fired generation to bid into and profit from these economic differences.

Many coal-fired units in the Midwest also have the capacity to increase their generation, especially during off-peak hours (UCS 2008). Completion of the new and upgraded transmission lines could create substantial profit potential for generators located west and south of NYS. Their operation could also influence the dispatch order and marginalize the operation of in-state natural gas plants. While NYS consumers might benefit from such an effect, in the form of slightly lower electricity bills (if such savings are passed along to consumers), if Midwestern coal plants are successful in gaining access to NYS electricity markets, the longer term economic and environmental effects could be significant. To the extent that natural gas units are marginalized and become uneconomic to operate, their closure or loss of book value would affect local property values and the tax base in the towns where the gas plants are located, along with any jobs at the plants. The increased coal generation would also increase the quantity of transported pollution into NYS, making it

[71] Pennsylvania-New Jersey-Maryland Interconnect.

more difficult for the state to attain NAAQS for ozone and $PM_{2.5}$. Due to the requirements of the Clean Air Act, NYS might be forced to impose more stringent requirements on local sources because of the pollution imported from upwind states.[72]

NYS can control the degree to which electricity is imported. The requirement to reduce electricity consumption 15 percent by 2015, as part of the PSC's Energy Efficiency Portfolio Standard, is a critical step to decrease the need to construct additional generation and/or to import power from the Midwest. NYS also has substantial renewable resource potential, as discussed below.

The current fuel mix in New York City and Long Island is not an indicator of potential generation resources in these areas, as off-shore wind, tidal, and municipal solid waste generation could be developed and used to meet local demand requirements. CO_2 allowance prices may spur this development as allowance prices rise and fossil-fuel generation becomes more expensive. Still, near term prices may be too low to provide much incentive for the addition of renewable generation, so RECs may have to provide such a near term incentive. Fuel prices make up a large portion of electricity generation costs, and so increased amounts of renewable generation in downstate NYS may actually improve cost and reliability in the region by allowing for some diversification of the fuel mix. The Long Island–New York City Offshore Wind Collaborative (LI-NYC Wind Collaborative), which consists of the New York Power Authority, Consolidated Edison, the Long Island Power Authority, the City of New York and other New York City and NYS governmental entities, is evaluating the development of between 350 megawatts (MW) up to total of 700 MW of offshore wind by 2016. Proposed generation additions are shown in Figures 3.5 and 3.6, below. (NYPA, 2010).

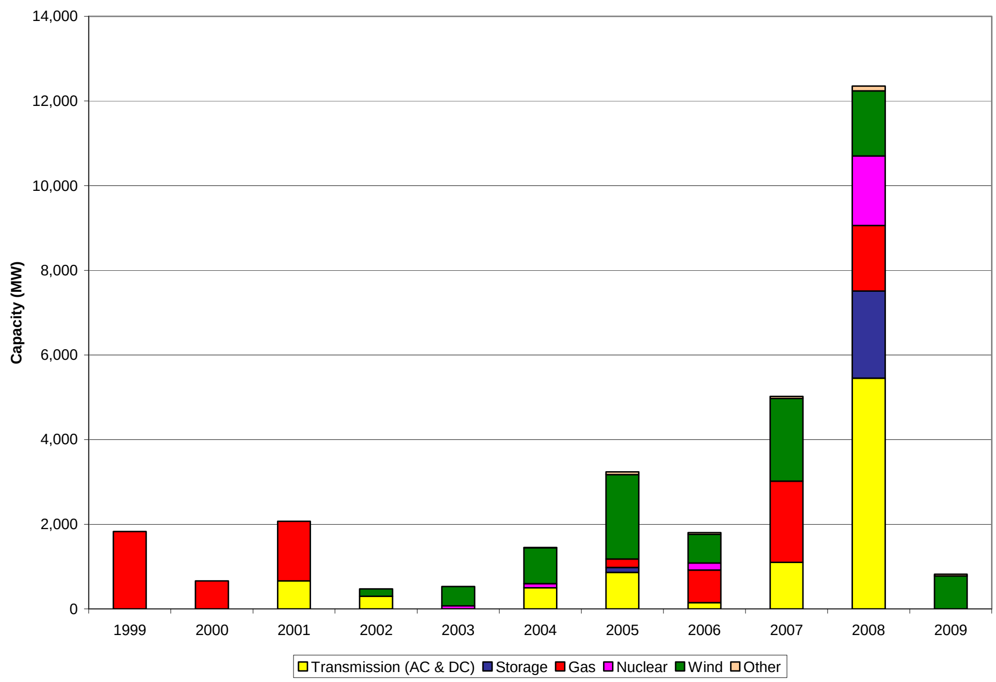

Figure 3-5. Historical NYISO Interconnection Requests, by Year Proposed (NYISO, 2009)

[72] NYS can also petition EPA to require upwind states to clean up their pollution (under Section 126 of the Clean Air Act), but such actions can require years to resolve, and EPA still requires local control measures to be imposed.

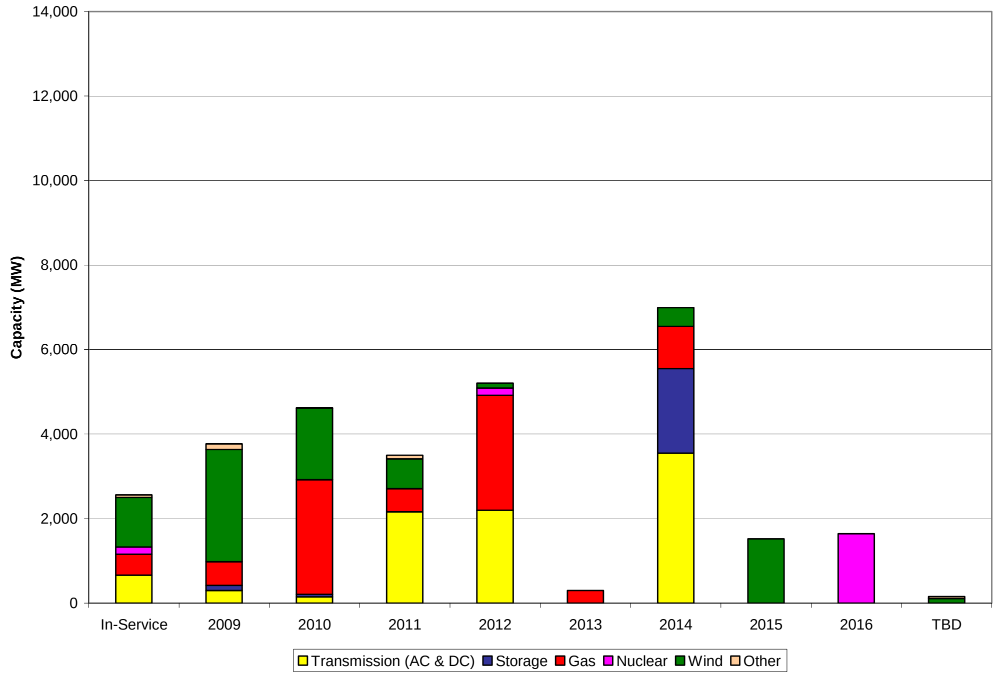

Figure 3-6. Historical NYISO Interconnection Requests, by Expected In-Service Year (NYISO 2009)

Figure 3-5, which shows interconnection requests by the year proposed, reflects that units proposed between 1999 and 2001 are primarily gas-fired units, with some requests for transmission projects. While gas-fired units and transmission lines continue to be proposed in sizeable amounts through 2009, large amounts of renewables also begin to be proposed. Requests to interconnect wind generation begin in 2002 and continue through 2009, for a total of 8,417 MW of wind generation in the NYISO Interconnection Queue as of June 24, 2009. The current combination of cap-and-trade regulation, EA prices, and saleable RECs are likely having a larger impact on decisions about future electric generation capacity than EAs alone have had on the mix of historical generating units. Power developers are also closely following national legislation to regulate greenhouse gases from the electric sector. Under proposed provisions as part of ACES, owners of CO_2 allowances from regional programs would receive the same number of federal allowances as they currently own under regional programs such as RGGI. Emissions regulations are providing a financial disincentive for the construction and operation of traditional fossil-fired generating units, while RECs are providing developers with financial incentives for investment in renewable generating units.

It is important to note that the number of proposed units does not translate directly to the number of new units that will be constructed. In fact, the bulk of the units that are proposed will not proceed to the construction phase. Nonetheless, the type of units proposed is an indication of the economics of the various types of generating units, and looking at the interconnection queue can give insights into how developers are thinking about the profitability of these different types of generation.

3.2 Effects of Market Mechanisms on Use of Electricity

New generation resources have been added over the past decade, with further additions proposed in the coming decade, because electricity use in NYS continues to grow. Electricity use in the state as a whole declined slightly from 2002-2003 and again from 2005-2006 and 2007-2008, as shown in Figure 3.7, but increased over the 11-year period at a compound annual growth rate of one percent.

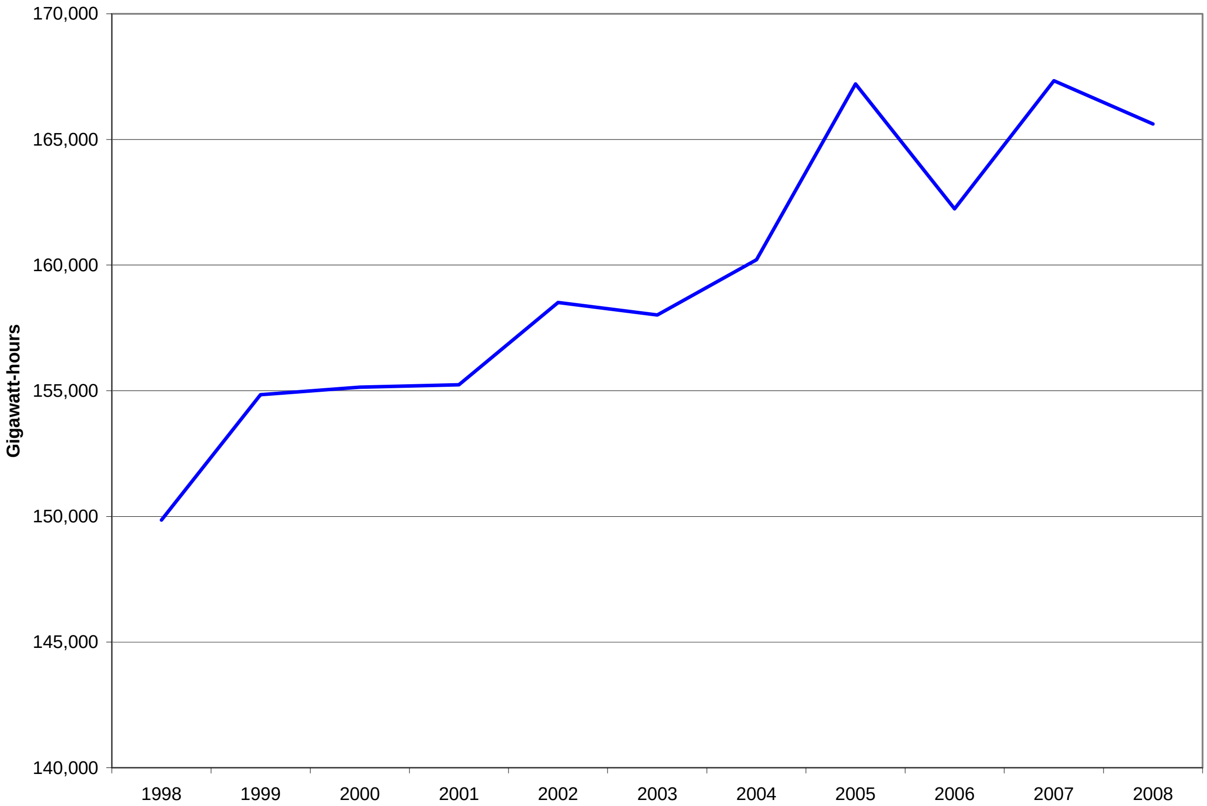

Figure 3-7. New York Control Area (NYCA) Historic Annual Electricity Use (GWh) (NYISO 2009)

Historical electricity use by zone, however, varies considerably, as shown in Figure 3-8. Certain zones experienced growth in electricity use that exceeded the state as a whole, while other zones experienced declining load over the ten-year period.

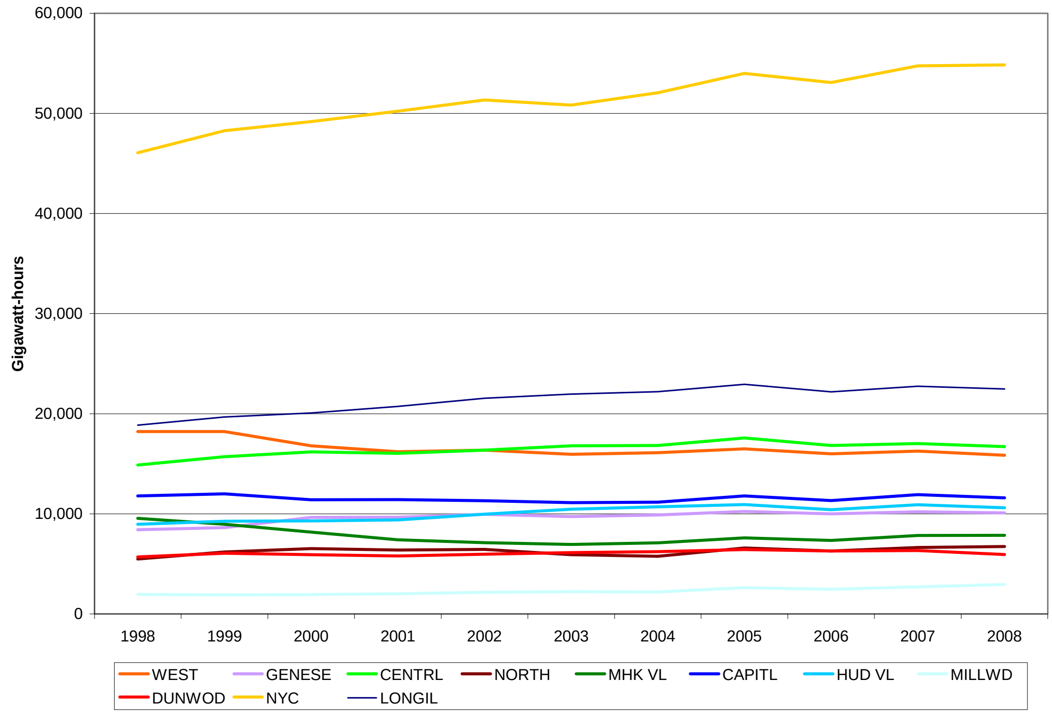

Figure 3-8. New York State Historic Annual Electricity Use (GWh), by Zone (NYISO 2009)

The West, Mohawk Valley, and Capital zones have experienced declining loads over the past decade, while the Millwood and North zones have experienced load growth that is greater than the average New York Control Area (NYCA) growth by more than one percentage point. Compound annual growth rates for each of the zones are calculated in Table 3-2.

Table 3-2. Compound Annual Growth Rates of Zonal Electricity Use in New York State

WEST	-1.39%
GENESE	1.84%
CENTRL	1.17%
NORTH	2.07%
MHK VL	-1.93%
CAPITL	-0.16%
HUD VL	1.71%
MILLWD	4.13%
DUNWOD	0.42%
NYC	1.76%
LONGIL	1.76%
NYCA	**1.00%**

Changes in population and economic growth are typical drivers of energy demand and may account for some of the changes (both increasing and decreasing) seen in Figures 3-7 and 3-8, and Table 3-2, above. Nevertheless, the State's electricity growth rates likely would have been much higher were it not for programs that encourage energy efficiency and demand response. Though it is difficult to determine the exact extent to which market-based emissions control mechanisms drive the decisions of generation owners, regulators, and policy makers, it seems they do play a role in encouraging programs designed to create energy savings. The cost of EAs increases the cost of existing fossil-fired generation and may discourage investment in certain types of new fossil-fired generation. Energy efficiency and demand response programs, by contrast, are often significantly cheaper and can displace more expensive fossil generation, resulting in significant savings. NYS's System Benefits Charge (SBC) program, which funds energy conservation programs across the state, is the chief source of funding for energy efficiency programs in NYS. According to data from NYSERDA's most recent *SBC Evaluation and Status Report*, the cost per lifetime kWh saved as a result of electric energy efficiency programs is $0.010 when only NYSERDA spending is included. The cost per lifetime kWh increases to $0.048 when customer co-funding costs are included (NYSERDA 2010). Through March 31, 2010, $307.9 million have been invested in energy efficiency programs, producing 4,050 annual GWh of savings (NYSERDA 2010).

4. Recommended Strategies, Procedures, and Practice Reforms

The suite of market mechanisms described in this report function independently to achieve particular goals, but, if operating with perfect synergies, they also can function together to encourage renewable energy development and energy efficiency measures in NYS. ERCs allow generators to meet load requirements using fossil-fuel technologies for generation without adding additional pollution to the system; however, the cost of EAs (SO_2, NO_X, and CO2) leads to an increase in the marginal cost of generating that fossil-fuel fired electricity. Conversely, the ability to sell RECs into the market makes renewable energy generation more cost-effective and therefore more attractive to developers.

Still, individual market mechanisms do not always function harmoniously, nor do they always produce the intended result. This is true whether mechanisms are considered individually or as a package.

4.1 Renewable Energy Credits (RECs)

Renewable energy technologies are currently priced such that it is difficult for them to be competitive with traditional fossil-fired technologies on a pure cost basis. RECs were designed in part to level the playing field between technologies in order to promote renewable generation. As greater numbers of RECs are demanded to meet state RPS targets and production and technology costs continue to decline, renewable energy will become more cost-effective per kWh in comparison to energy from fossil resources.

A defining characteristic of RECs is that they represent the environmental attributes of renewable energy, but not the power itself. The actual electricity generated by renewable sources may be sold to consumers in a region or state that is different from the one in which the RECs are sold.

This may present a problem for consumers participating in green pricing through their local utilities, however. Xcel Energy in Colorado offered its customers the option of participating in a voluntary green energy program called “Windsource,” which is in addition to Xcel’s compliance with the Colorado RPS. Windsource was designed to support in-state wind farm development by charging a premium for renewable electricity. It became oversubscribed between 2005 and 2007. The Public Utilities Commission in Colorado alleged that during this time Xcel was using RECs, but not the actual renewable electricity, to meet customer demand from the Windsource program. Xcel was also accused of double-counting some of its renewable energy, and “improperly co-mingl[ing] voluntary RECs with RECs used to comply with the state mandate.” (Westenshow, 2009). Similarly, Detroit Edison has a green pricing program called “GreenCurrents,” which offers blocks of renewable energy to consumers for a premium, but the city of Ann Arbor argues that the program does not actually purchase any renewable energy and does not spur renewable generation, as GreenCurrents only purchases certified RECs coming from in-state wind farms, biofuels production and methane digesters, while the actual energy is purchased by other utilities (Kahn 2008).

A popular incentive for the purchase of RECs, especially in the voluntary market, is to be able to claim that one’s electricity use is “carbon neutral.” But this is not necessarily the case, even when RECs are purchased. For example, consumers participating in Detroit Edison’s GreenCurrents program may believe that some of the coal and nuclear generation that would otherwise be supplying their electricity is being displaced. Still, because Detroit Edison only purchases RECs, and not the associated electricity, program participants are in fact purchasing the same type of electricity as before, but at a premium. Because no coal generation is being displaced by renewable in Detroit Edison service territory, emissions of air pollutants in that territory also remain constant. The ability to sell RECs to Detroit Edison could support development of future renewable generation resources, however.

Renewable generation, when combined with energy efficiency to keep load growth flat, may displace some fossil fuel-fired generation in NYS; however, it is likely to be gas-fired generation rather than the more heavily emitting coal-fired generation. As previously discussed, NYS's fuel mix is 30% gas and 15% coal. When divided into zones, New York City and Long Island are completely dependent on gas and oil, while gas dependency in upstate areas declines to 15%, and coal stays relatively steady at 16%. More importantly though is the fuel that is on the margin, as this is the generation that is likely to be displaced when renewables generators offer low-cost electricity into the market. Figure 4.1, below, shows the percentage of hours in which specific fuel types are on the margin in the State. This Figure shows the percent of hours in the year (8,760 hours) in which each fuel type is setting the day-ahead market clearing price in NYS's wholesale electricity markets.

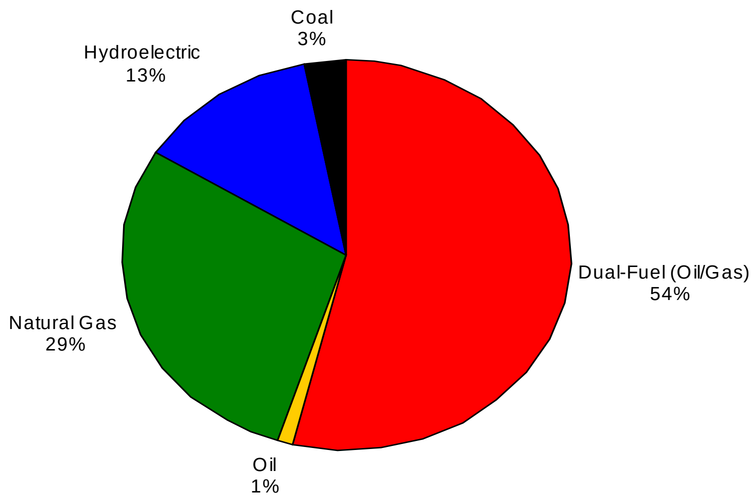

Figure 4-1. Percentage of Hours in Which New York State's Electricity Clearing Price is Set by Fuel Type (Analysis Group and NYISO 2008)

As shown in Figure 4-1, gas and dual-fueled units are on the margin an overwhelming 83% of the hours in a year, while coal is the marginal fuel only 3% of hours. Figure 4-2 shows the marginal fuel in each of NYS's zones.

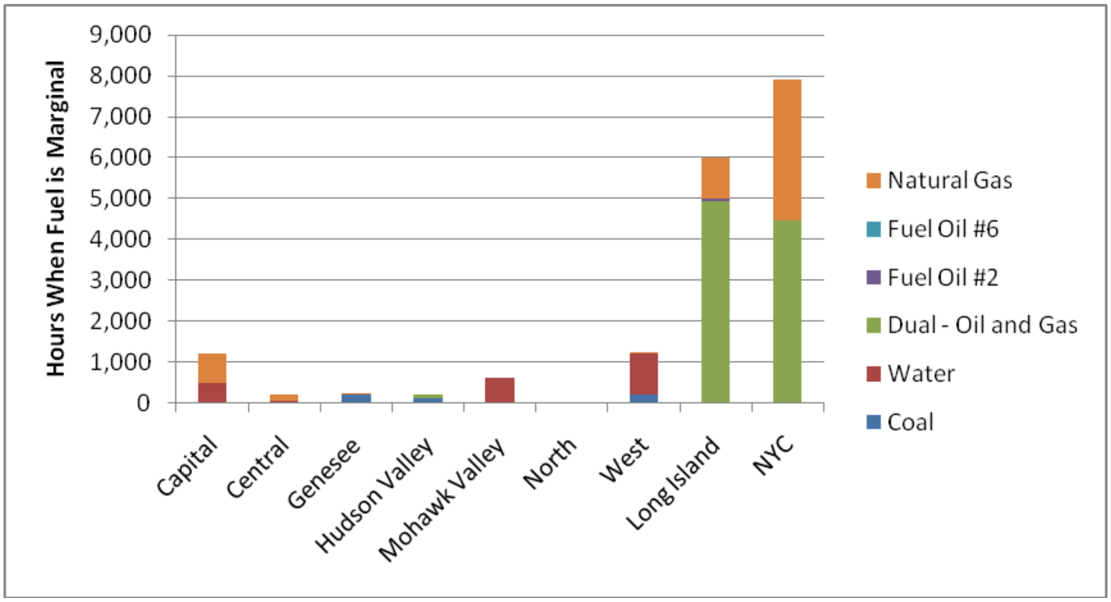

Figure 4-2. Percentage of Hours in Which New York State's Electricity Clearing Price is Set by Fuel Type, by Zone (Analysis Group and NYISO 2008)

The marginal fuel in each of the zones, in each hour of the day, is quite important as renewables that begin to come online start to displace current generating units. Many renewables are intermittent resources, meaning that they do not produce steady stream of energy and cannot be guaranteed to be available at a specific time. Wind typically blows harder overnight when electricity demand is low. New wind resources located in upstate NYS would be more likely to displace baseload coal or hydro resources, as these fuels would be on the margin during nighttime hours. Renewable resources that could operate at times of high electricity demand would be likely to displace peaking natural gas and oil units throughout NYS. Renewable resources coming online in New York City or Long Island would displace gas and oil units at any given hour in the day. Emissions benefits from the displacement of fossil resources by renewable generating units will therefore vary by zone and hour of the day.

In NYS, NYSERDA offers long-term REC contracts to renewable generators as a way to aid project development by providing a predictable revenue stream. Because all REC technologies participate in the same procurement process, competing for a limited amount of funds, the resulting price paid by NYSERDA for RECs may be lower than what certain renewable technologies need in order to be economically viable (Stern et al. 2009). In Connecticut, for example, existing out-of-state biomass facilities became eligible as a Class 1 renewable resource under the RPS in 2005. RECs had been trading at a price range of $35-$40 as of July of that year, but this new classification led to a flooding of the renewable market from Maine biomass, and by the end of 2005 REC prices had dropped to "no bid" at $2.50 per MWh (Kolchins 2006). While NYS has not had such a drastic case, average REC prices have declined over the past three procurements. Driving this trend is a decline in the price for RECs generated by wind, as non-wind REC prices (for hydroelectric and biomass) actually increased from RFP 1037 to RFP 1168, from $13.13 to $18.30 per MWh (Stern and Wobus 2008). Newer technologies, such as offshore wind energy and tidal power, may not be economically viable if they have to compete with less expensive generating technologies such as onshore wind.

Many other states have different classes of renewables with RECs that sell at different prices, depending on the class. For example, New Jersey, in an effort to encourage solar technologies, offers not only Class I and Class II RECs, but also Solar RECs. New Jersey is also considering a separate Offshore Renewable Energy Certificate (OREC) for new offshore wind facilities. In NYS, legislation establishing an SREC program independent and additional to the state's

RPS program was introduced and moved through committees in both houses during the 2010 session, and included a long term target of 5000 MW of solar PV by 2025.[73]

4.2 RGGI Allowances

NYS mandates that the proceeds from the auctioning of CO_2 allowances under RGGI be directed to NYSERDA to be used to fund energy efficiency initiatives. A breakdown of the auction proceeds and their designated programs is detailed in Table 4-1, below.

[73] A11004A/S7093-B, available at http://assembly.state.ny.us/leg/?default_fld=&bn=A11004&term=2009&Summary=Y&Text=Y

Table 4.1. RGGI Allowance Allocations and Use of Auction Proceeds for the State of New York (Environment Northeast 2009 and RGGI)

Program	Allowances	Allocation %
Auction	60,429,870	94.0%
Voluntary Clean Energy (set-aside for retirement)	700,000	1.1%
Limited Cogen Exemption	1,680,935	2.6%
Long Term Contracts	1,500,000	2.3%
Total (2009)	64,310,805	100%

		Auctions 2-8†		Auction 9		Totals to date	
		Allowances	Mean Price	Allowances	Price	Allowances	Mean Price
Control Period 1 (2009-2011):		79,280,178	$2.58	11,421,736	$1.86	90,701,914	$2.48
Control Period 2 (2012-2014):		3,933,128	$2.11	464,418	$1.86	4,397,546	$2.08
Projected Auction Proceeds Recipients							
Transfer to State Budget	33.9%		$90,000,000		$0		$90,000,000
Litigation Settlement with Indek and Con Edison	2.9%		$7,658,707		$0		$7,658,707
Residential, Commerical, Industrial and Municipal Sector Energy Efficiency*	34.2%		$78,742,178		$11,957,083		$90,699,260
Transportation Efficiency and R&D	6.2%		$14,396,424		$2,186,112		$16,582,536
Sustainable Agriculture & Bioenergy	0.8%		$1,877,794		$285,145		$2,162,939
Renewable and Low Carbon Power	9.2%		$21,281,670		$3,231,644		$24,513,314
Climate Research & Clean Technology	4.2%		$9,597,616		$1,457,408		$11,055,024
State and RGGI, Inc. Administrative Costs	8.5%		$19,695,977		$2,990,855		$22,686,831
Total	100%		$243,250,365		$22,108,246		$265,358,611

*Includes efficiency programs from NYSERDA's Revised Operating Plan and programs implemented under Green Jobs-Green NY, the statutorily mandated energy efficiency and workforce training program that will use $112 million in RGGI proceeds over a three year period (http://www.nyserda.org/GrreenNY/)

† NY did not contribute allowances to auction 1 as regulations were not finalized in time

4.3 ERCs

The NYS ERC market has very little activity, with few participants; this is largely a result of larger economic forces that have depressed the demand for ERCs. However, policy and operational changes could make ERCs easier to create, and an expansion of the geographical scope of the market could improve market liquidity, making ERCs easier to sell.

Currently, developers wishing to create ERCs face high, fixed transaction costs and the need to aggregate ERCs to meet buyers' needs. This creates a market that strongly favors larger over smaller developers.

Remedies for these problems are available. For example, it may be advantageous for project developers, rather than site owners, to hold title to the ERCs. Developers could then aggregate ERCs from several projects and bring them to the market in larger lots.

In addition, streamlining and standardization of procedures at each stage in the ERC certification process would result in lower certification costs.

The following are some proposed improvements to this process:

- States with letters of agreement (MOUs) for reciprocal trading should post ERCs available in the trading states as well as those certified within their own state. The ERC database should contain all pertinent information including states in which the ERC may be used, restrictions on usage within the certifying state and the trading states, depreciation of ERC value over time, and other information necessary to facilitate the purchase and sale of ERCs
- Increasing the number of reciprocity agreements—allowing the free flow of ERCs to and from NYS--would increase the geographic scope and, thus, the liquidity of the market. If a nonattainment area is interstate, there should be no reason to limit such interstate trading of ERCs (H. Klodowski, 2010)
- The State could provide a list of actions that would be considered permanent reductions. For each action on the list, a list of required submissions and a flow chart for the certification process would be available. Applicants could simply check a box to indicate the type of permanent emissions reduction proposed for their facility
- The State could create a spreadsheet template that applicants would use to demonstrate pre-reduction emissions, by filling in monthly fuel usage data from the site. The applicant would specify the type and quantity of fuel used for each baseline period month, and provide information on the type and age of boilers and control equipment. The spreadsheet would calculate emissions based on standardized assumptions about boiler efficiencies, the nitrogen and sulfur content of the fuel, and other key variables. In the case of special circumstances at a site, the applicant would be given the opportunity to demonstrate that the standard form and assumptions should not apply
- A standard form could be employed to determine whether proposed emissions reductions are surplus. A few questions should be sufficient to ascertain the applicability of any pending rules to the applicant's site; if a pending rule were found to be applicable, the applicant's baseline emissions level could be reset by formula, using the new rules for the calculations
- The determination of future emission levels could be simplified by using pre-certification of emissions. For example, the California Air Resources Board (CARB) has a program that pre-certifies emission rates of distributed generation technologies. If CARB has already certified certain reciprocating engine-driven generators and micro turbines, these test results should suffice for use in the ERC quantification process in NYS and reciprocating states. Other reliable sources of emissions profiles may also be found
- The State could establish and enforce timelines for ERC application processing. Applicants should be able to expect that the process will occur within a reasonable time frame. Since processing delays are frequently the result of insufficient documentation provided by the applicant, the State should be as specific and precise as possible when describing application data requirements.

Conclusions

- In general, market-based approaches to reducing air pollution from electricity generators are able to accomplish environmental goals at costs lower than less flexible command-and-control approaches
- Market-based mechanisms for environmental protection do have some effect on the price of wholesale electricity. There has been little to no effect on reliability in NYS due to existing market-based programs
- Market-based mechanisms affect the type and sources of electricity generation. The EA programs, for example, provide affected sources the flexibility to use compliance strategies that include fuel switching, switching from higher to lower emitting input fuels, changing unit dispatch and how existing controls are operated, or investing in new control equipment. The requirement to purchase RECs changes the composition of energy used by creating a purchase obligation for enumerated clean energy technologies
- Increases in electricity prices associated with the progressive tightening of emissions caps lead to increased demand for investments in energy efficiency. As marginal compliance costs increase there is also an incentive for retirement of older, less efficient, high emitting generating units. The cost of continuing to operate these units increases and as a consequence their economic viability and the future return on incremental investment in these units falls
- The market-based mechanisms described in this report function both independently and together to achieve particular policy goals such as increasing renewable energy development and offering greater compliance flexibility to sources meeting stipulated criteria pollutant and greenhouse gas reduction targets
- The cost of EAs (SO_2, NO_X, and CO2) leads to an increase in the marginal cost of generating fossil fuel-fired electricity. Conversely, the ability to sell RECs into the market makes renewable energy generation more cost-effective and therefore more attractive to developers
- EA prices in the regional CAIR and national SO_2 market are in part distorted by uncertainties in the future structure of the program that will supersede CAIR. Market prices should provide a better signal to affected sources once the uncertainties surrounding the future operation of the programs have been resolved
- The ERC market in NYS currently has a low level of activity. To a large degree this is due to a lack of demand for major investments in new or modified industrial or commercial sites that would be subject to NSR. While socio-economic trends are the primary factor affecting the market, certain steps could be taken to lower transaction costs for ERC certification, and increase liquidity in the market. Negotiating MOUs with other states, and establishing a set of uniform, streamlined procedures for certification, would help in this regard.

Areas Warranting Further Research and Policy Analysis

- Investigate capabilities of electricity dispatch models to accurately reflect market conditions in NYS and each of its zones, and utilize models to determine effects of market mechanisms on electricity wholesale costs, generation mix, and imports in each region of the state
- Explore the impact and interplay between pending federal regulations (NO_x, ozone, Boiler MACT, CO_2, etc.) and existing and/or future market-based mechanisms
- As EPA begins to promulgate, implement, and enforce CO_2 regulations in accordance with Part 111 (d) of the Clean Air Act, explore the potential for RGGI or other regional market-based programs to offer an alternative compliance mechanisms for states
- Analyze the impact of possible linking or harmonization between regional market-based climate markets (in the absence of a federal program)
- Conduct an analysis of various national RES proposals, and their impacts on NYS (and other state) RPS programs
- Establish a direct comparison of costs and benefits from the consumer/public interest perspective of cap-and-trade versus command-and-control for CO_2. One of the variables would be whether or not the allowances were sold, auctioned or given away. It would look at the impact on consumers of the increased market clearing price. Would direct restrictions on emissions from fossil plants be more or less costly, all things considered? The impact on electricity consumers of how the revenues are used would also be examined
- Conduct a precise study of the impacts of markets on power system reliability.

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Glossary

Allowance—An authorization to emit a fixed amount of a regulated pollutant

Allowance banking—abating more in early periods in order to save the allowances for use in later periods, thus allowing the source to abate less during those later periods.

Allowance trading—the act of buying or selling allowances in an open market

American Council for an Energy-Efficiency Economy (ACEEE)—a nonprofit organization dedicated to advancing energy efficiency as a means of promoting economic prosperity, energy security, and environmental protection.

Attainment area—a locality where air pollution levels are persistently in accordance with the National Ambient Air Quality Standards (NAAQS)

Attribute (as used in this report)—the environmental benefit gained through the production of one MWh from a renewable energy source

Best Available Control Technology (BACT)—required on major new or modified sources in attainment areas under EPA's New Source Review (NSR) Program.

Biomass—a renewable energy source composed of biological material such as wood or wood residues and.

Carbon monoxide (CO)—a colorless, odorless, and tasteless gas that consists of one carbon atom and one oxygen atom and is extremely toxic to human and animals. Carbon monoxide is produced from the partial oxidation of carbon-containing compounds. One of the six CAA criteria pollutants.

Clean Air Act (CAA)—the law that defines EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer.

Clean Air Interstate Rule (CAIR)—a rule issued by EPA in 2005 with the goal of permanently capping emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_X) in the eastern United States.

Clean Air Transport Rule (CATR) a rule currently proposed by EPA that would replace CAIR with the goal of capping emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_X) in the eastern United States at the state level

CO_2 Allowance Tracking System (COATS)—the administrative clearinghouse where the award and transfer of RGGI CO_2 allowances takes place, and where offset projects are registered, monitored, and verified.

Currency (as used in this report)—a medium for exchanging emission rights across jurisdictions through an established trading market.

Dispatch model—a mathematical representation of supply and demand on the NY ISO system that is run for a predetermined forecast period. The model may be run to generate assessments at hourly intervals for a forecast period of months or years.

Emission allowance (EA)—a commodity that grants the holder the right to emit one ton of the pollutant being regulated. Usually allocated in one-ton increments.

Emissions "cap"- A limit on the total amount of pollution that can be emitted (released) from all regulated sources (e.g., power plants); the cap is set lower than historical emissions in order to reduce emissions.

Emission offset—an emission reduction in one place that can be used to compensate for emissions elsewhere, and is usually measured in tons of emission reduced or megawatt hours of renewable energy produced.

Emission reduction credit (ERC)—represents a decrease in emissions of a nonattainment contaminant in tons per year that is surplus, quantifiable, permanent, and enforceable.

Greenhouse Gas (GHG)—Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), tropospheric ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Leakage—Emissions that occur outside the project boundaries as a result of the project activities themselves.

Maximum Achievable Control Technology (MACT)—The emission standard for sources of air pollution requiring the maximum reduction of hazardous emissions, taking cost and feasibility into account. Under the Clean Air Act Amendments of 1990, the MACT must not be less than the average emission level achieved by controls on the best performing 12 percent of existing sources, by category of industrial and utility sources.

National Ambient Air Quality Standards (NAAQS)—standards established by the EPA under the authority of the Clean Air Act that apply for outdoor air throughout the country. Primary standards are designed to protect human health, with an adequate margin of safety, including sensitive populations. Secondary standards are designed to protect public welfare from any known or anticipated adverse effects of a pollutant. NAAQS requires the EPA to set standards on six criteria air pollutants: ozone (O_3), particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and lead.

New Source Review (NSR) program—a preconstruction permitting program implemented by EPA in 1977 to ensure that air quality is not significantly degraded from the addition of new and modified factories, industrial boilers, and power plants, and to assure people that any large new or modified industrial source in their community will be as clean as possible.

Nitrogen oxide (NO_x)—any compound of oxygen and nitrogen, or a mixture of such compounds. Nitrogen oxides are pollutant gases produced by burning fossil fuels, motor-vehicle exhaust, decaying vegetation, and industrial sources. While high levels of NO_X are detrimental to human health, the main concern associated with NO_X is their role in the production of ozone and acid rain. One of the six CAA criteria pollutants.

Nonattainment area—a locality where air pollution levels persistently exceed National Ambient Air Quality Standards, or that contribute to ambient air quality in a nearby area that fails to meet standards.

NO_X State Implementation Plan (SIP) Call Program—A program implemented by EPA in 1997 under Section 110 of the 1990 Clean Air Act Amendments. The NO_X SIP Call Program called on states to revise their State Implementation Plans in order to impose restrictions on electricity generators and industrial sources of NO_X emissions to help downwind states comply with the ozone standard. The program was eventually subsumed by the CAIR in 2005.

Nominal dollars—[see page 44] a dollar price that has not been adjusted for inflation

NYISO—The New York Independent System Operator manages New York's electricity transmission grid and oversees wholesale electricity markets.

Office of Management and Budget (OMB)—a Cabinet-level office that evaluates the effectiveness of agency programs, policies, and procedures, assesses competing funding demands among agencies, and sets funding priorities.

Ozone (O_3)—a molecule consisting of three oxygen atoms. Ground-level ozone is an air pollutant with harmful effects on the respiratory systems of humans and animals, while the ozone layer in the upper atmosphere filters potentially damaging ultraviolet light from reaching the Earth's surface. One of the six CAA criteria pollutants.

Ozone precursors—chemicals including nitrogen oxides (NO_X) and volatile organic compounds (VOCs) that react to form ozone in the atmosphere.

Ozone Transport Region a region of states in the Northeast (including New York) that are required by the Clean Air Act to maintain a certain level of controls for the pollutants that cause ozone, even if the states meet the ozone standards

Particulate matter (PM)—a complex mixture of extremely small particles and liquid droplets. Particles are either directly emitted into the air by sources such as combustion processes and windblown dust, or formed in the atmosphere by transformation of emitted gases such as SO_2. One of the six CAA criteria pollutants.

Reasonably Available Control Technology (RACT)—the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.

Regional Greenhouse Gas Initiative (RGGI)—a ten-state cooperative effort to reduce greenhouse gas emissions from electric power plants by means of a cap-and-trade system. RGGI is the first market-based, mandatory program in the nation with the goal of reducing greenhouse gas emissions.

Renewable energy credit (REC)—Tradable instruments that can be used to meet voluntary renewable energy targets as well as to meet compliance requirements for renewable energy policies. A REC is a certificate that represents the generation of 1 megawatt-hour (MWh) of electricity from an eligible source of renewable energy. Each REC denotes the underlying generation energy source, location of the generation, and year of generation (a.k.a. “vintage”), environmental emissions, and other characteristics associated with the generator. RECs represent a claim to the environmental attributes associated with renewable energy generation, but purchasers should nevertheless ensure that their contracts are explicit about which environmental attributes are conveyed to them. RECs are also known as “green tags,” “green certificates,” and “renewable energy certificates.”

Renewable Portfolio Standard—a regulation that requires the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal. The RPS mechanism generally places an obligation on electricity supply companies to produce a fraction of their electricity from renewable energy sources.

Reserve price—the lowest price at which a commodity will be sold at auction.

Secondary market—the trading of allowances that have previously been bought through the primary market (in the case of RGGI, the primary market would be the RGGI auctions)

Set-asides—allowances that are drawn from the state’s allowance budget and are awarded to energy efficiency or renewable energy projects that reduce electricity generation

Stationary source—any fixed emitter of air pollutants, such as fossil fuel burning power plants, petroleum refineries, petrochemical plants, food processing plants, and other heavy industrial sources.

Sulfur dioxide (SO_2)—A chemical compound made up of one molecule of sulfur and two molecules of oxygen. It is produced by industrial sources during the combustion of coal and petroleum. Further oxidation of SO_2 results in the formation of acid rain.

Title V operating permit—legally enforceable documents that permitting authorities issue to air pollution sources after the source has begun to operate, as required under Title V of the Clean Air Act amendments of 1990. Most Title V permits are issued by state and local permitting authorities.

Vintage—the year in which an allowance can be used

Volatile organic compounds (VOCs)—organic compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere. A precursor of ozone.

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Final Report
October 2011

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