Chapter 24. Adopt Market-Based Emissions Reduction Programs

1. Profile

One of the ways to reduce greenhouse gas (GHG) emissions is to effectively put a price on emissions, and then rely on market forces that incent and reward innovation, competition, and customized solutions to reducing costs. A price can be directly imposed through a tax (as discussed in Chapter 25), or indirectly imposed through a market-based program such as those described in this chapter.

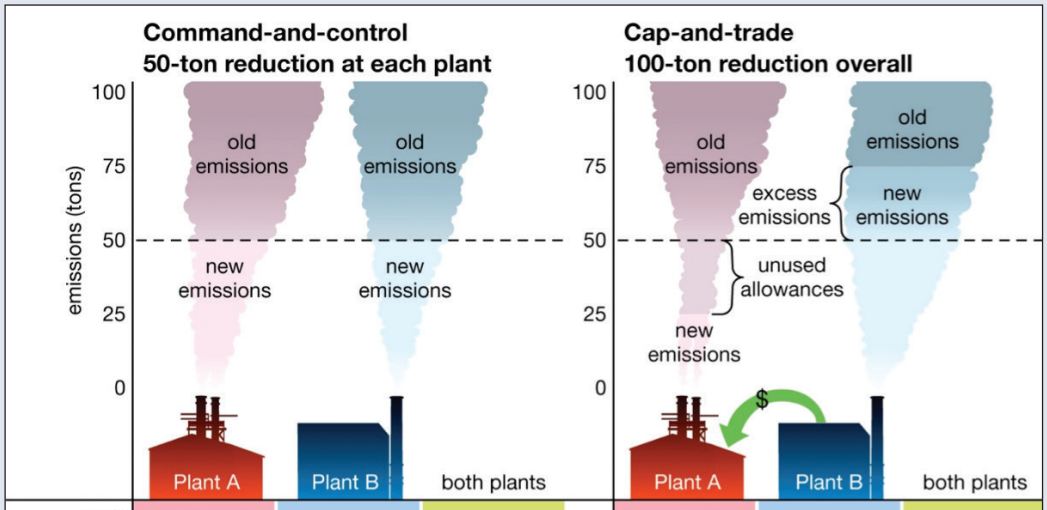
The most familiar market-based program is the cap-and-trade system. Cap-and-trade systems have been successfully used for two decades to control air pollution from electric power plants in the United States. These systems can be simple, transparent, and relatively straightforward to implement.

A cap-and-trade system indirectly puts a price on carbon (i.e., carbon dioxide [CO_2] emissions) by setting caps (i.e., limits) on the total quantity of emissions that all regulated polluters may produce, and creating a commodity (called an allowance) for each allowable unit of emissions (generally one ton of emissions) under the cap. Allowances are initially distributed through an auction mechanism, direct allocation to regulated entities or other parties, or a combination of auction and allocation. Allowances can then be bought, sold, and traded privately or in commodity markets. At the end of each compliance period, regulated entities must surrender a number of allowances equal to their actual emissions. The cap can decline over time, in effect requiring polluters to reduce their aggregate levels of pollution.[1]

A cap-and-trade system is more flexible than prescriptive, command-and-control approaches to regulation that individually impose a technology standard or a unit-specific performance standard on each regulated entity. This is why a cap-and-trade mechanism incents low-

Figure 24-1

How Cap-and-Trade Reduces Compliance Costs[2]



	Command-and-control 50-ton reduction at each plant			Cap-and-trade 100-ton reduction overall		
	Plant A	Plant B	both plants	Plant A	Plant B	both plants
tons reduced	50	50	100	75	25	100
cost per ton reduced	$100	$200	—	$100	$200	—
cost of reduction	$5,000	$10,000	$15,000	$7,500 – payments from Plant B	$5,000 + payments to Plant A	$12,500

1 For a more thorough treatment of this topic, see: Johnston, L., & Wilson, R. (2012, November). *Strategies for Decarbonizing the Electric Power Supply.* Montpelier, VT: The Regulatory Assistance Project. Global Power Best Practice Series. Available at: http://www.raponline.org/document/download/id/259.

2 Encyclopaedia Britannica. (2012). *How Emissions Trading Works.* Available at: http://www.britannica.com/media/full/167322. In this limited example, both Plant A and Plant B would come out ahead if Plant A's unused allowances were sold to Plant B for any price between $2500 and $5000.

cost compliance solutions. Although this approach creates a disincentive for pollution by putting a price on emissions, it puts no limits on the various and combined compliance approaches that regulated entities can pursue, including the purchase of allowances, installation of emissions controls, or emissions avoidance through retirement or fuel switching. Each regulated entity can pursue its own best option for complying at the least cost. The better performers under this approach — those with lower emissions — will be able to benefit economically from their performance, which spurs innovation and competition. Figure 24-1 illustrates how an allowance trading system can reduce costs for individual entities and reduce the aggregate cost of compliance for all covered entities.

In addition to providing a lower-cost means of achieving air pollution objectives, cap-and-trade systems compare favorably to some other regulatory approaches in the way that they provide certainty about the total amount of pollution that will occur. The same cannot be said of technology standards, performance standards, or carbon taxes (see Chapter 25). On the other hand, despite providing certainty about the level of expected emissions reductions, a "simple" cap-and-trade system provides less certainty about compliance costs, which is one of the arguments used in favor of carbon taxes and technology standards.[3]

In the last ten years the cap-and-trade model has undergone significant modifications in recognition of the value of a coordinated effort to both discourage the use of carbon-intensive resources and encourage investment alternatives. "Cap-and-invest" programs provide one example of these kinds of modifications. The idea behind a cap-and-invest model is that the government initially distributes allowances through an auction, and then invests the auction revenues in activities that also reduce emissions but are not covered by the trading program or are not sufficiently incented solely by a carbon price mechanism.

2. Regulatory Backdrop

There are numerous examples of cap-and-trade programs from around the United States and the world. In the United States, following the Clean Air Act Amendments of 1990 that authorized the use of market-based regulatory approaches, a number of federal, and later state, cap-and-trade programs were developed. Examples of federal cap-and-trade regulations include the Acid Rain Program, the Nitrogen Oxides (NO_X) Budget Trading Program, the Clean Air Interstate Rule, and the as yet unimplemented Cross State Air Pollution Rule. At the state level, examples include California's Assembly Bill (AB) 32 cap-and-trade program, the Regional Greenhouse Gas Initiative (RGGI), and Texas' Emissions Banking and Trading Programs. Each trading program sets limitations on the emissions of certain pollutants (e.g., sulfur dioxide [SO_2] and NO_X for the federal programs, CO_2 for AB 32 and RGGI, and NO_X and volatile organic compounds for the Texas programs) and imposes those standards on certain classes of emitters. For example, the Acid Rain Program and RGGI apply to fossil generation units with rated capacities of at least 25 megawatts (MW).

To date, all of the federal cap-and-trade regulations in the United States have focused on criteria pollutants rather than carbon.[4] However, the concept and design of cap-and-trade programs has evolved to meet other regulatory needs, most recently in the form of state programs to address CO_2 emissions. The RGGI program started as a collaboration of nine Northeastern and Mid-Atlantic states in 2003, and is the only US example of a regional carbon cap-and-trade effort. California's AB 32 cap-and-trade program, which is linked with a similar program in the Canadian province of Quebec and will encompass energy producers and transportation, started in 2012. A number of other countries have also adopted cap-and-trade programs for

3 The emphasis here is on a "simple" cap-and-trade approach. Cap-and-trade programs built on extensive modeling of carbon allowance prices, with mechanisms such as a "cost containment reserve," an allowance auction "reserve price," or an allowance "price collar" can address and largely overcome the price uncertainty argument traditionally raised by carbon tax supporters against cap-and-trade. Examples are cited later in this chapter.

4 The US Environmental Protection Agency (EPA) proposed an allowance trading program for mercury emissions in the 2005 Clean Air Mercury Rule. 70 Fed. Reg. 28,606 (May 18, 2005). The Clean Air Mercury Rule was challenged in court, ultimately vacated, and never implemented. New Jersey v. EPA, 517 F.3d 574, 583-84. (DC Cir. 2008). The court rejected the proposed trading program because the EPA inappropriately "delisted" fossil generators as mercury emitters under Section 112 of the Clean Air Act (regulating hazardous air pollutants). The legality of the proposed trading system within the context of New Source Performance Standards was not addressed in the court decision.

GHG emissions; refer to the text box: *Selected Examples of Carbon Emissions Trading Systems Outside the United States*.[5]

Cap-and-trade programs can vary extensively in scope, coverage, and execution. For example, programs can vary in the pollutants they address, such as SO_2, which is the focus of the federal Acid Rain Program, or CO_2, the focus of RGGI, AB 32, and many international programs. The programs can also vary in the types of entities that are covered by the regulations, such as energy-producing entities regulated under RGGI, the Acid Rain Program, the European Union's Emissions Trading System (EU ETS), and so forth; transport sectors, which will be covered by an extension of California's AB 32 cap-and-trade program in 2015; and buildings and industrial facilities, which are covered by the Tokyo Metropolitan Government program. Programs can make further distinctions within the categories that they cover, such as focusing on emitters of a certain size. RGGI and the Acid Rain Program apply to generators with rated capacities of 25 MW and larger. Another critically important variable in program design relates to the way allowances are initially distributed. Under the Acid Rain Program, allowances are initially allocated for free to regulated entities. Under the RGGI program, allowances are initially auctioned. The EU ETS and the linked California/Quebec programs currently use a combination of allocations and auctions. In programs in which allowances are auctioned, there is variability in what happens to the auction revenues. Revenues can be used by the government for complementary, emissions-reducing purposes (cap-and-invest), for other government programs, or for tax relief or budget balancing. And finally, some cap-and-trade programs include "cost containment" mechanisms that seek to limit the economic impact of the policy.

Selected Examples of Carbon Emissions Trading Systems Outside the United States

European Union (EU) – The EU's Emissions Trading System (ETS) has been in operation since 2005, and currently covers CO_2 emissions in 30 countries representing about 45 percent of all EU GHG emissions – mainly electricity generators and energy-intensive industries.

China – China's central government in 2011 asked seven regional governments to develop "pilot" carbon emissions trading schemes covering large emitters in several major industrial sectors as well as electricity generation with caps unclearly defined but described as supportive of provincial energy intensity goals (energy per unit of gross domestic product) that the central government has allocated to the regions.

New Zealand – The New Zealand ETS first took effect in January 2008; initially covering only the forestry sector, it has expanded to include industry, transportation, and the power sector.

Tokyo – The Tokyo Metropolitan Government initiated a cap-and-trade program in 2010, targeting "downstream" instead of "upstream" energy use, covering large buildings (both commercial and noncommercial) and large industrial facilities, together comprising about 20 percent of Tokyo's carbon emissions.

3. State and Local Implementation Experiences

Although the federal Acid Rain Program is often cited as the first application of the cap-and-trade concept, it is important to recognize that the US Environmental Protection Agency (EPA) and a few states had experimented with aspects of market-based alternatives to command-and-control regulation before Congress authorized the program via the Clean Air Act Amendments of 1990. The lessons that the EPA and states learned from these earlier efforts informed the debate and opened the door to a full-fledged, market-based Acid Rain Program.

For example, the EPA introduced an emissions offset concept in the 1970s as a way of allowing new sources of emissions to locate in nonattainment areas. Under this approach, any source (new or existing) seeking permission to increase emissions above a threshold amount in a nonattainment area was required to more than offset its emissions by acquiring emissions reductions credits from existing sources in that area. With this approach, the EPA first put a price on (some) emissions. At roughly the same time, the EPA started to allow facilities to treat their existing emissions sources as though they were under a giant enclosure or "bubble," allowing reduced controls relative to a defined benchmark rate of emissions on some smokestacks in ex-

5 For more information on the European Union's ETS, see: http://ec.europa.eu/clima/policies/ets/index_en.htm; for China's "pilot" carbon emissions trading schemes, see: http://www.wri.org/blog/2014/01/emissions-trading-china-first-reports-field; for the New Zealand Emissions Trading System, see: http://www.epa.govt.nz/e-m-t/Pages/default.aspx; and for the Tokyo cap-and-trade program, see: http://www.kankyo.metro.tokyo.jp/en/climate/cap_and_trade.html.

change for compensating higher-than-benchmark controls on other stacks. This would allow a source within a bubble, or what might be considered a "limited geographic cap," to reduce emissions and get credit elsewhere within its system (i.e., allow emissions from another source). One example of an early market-based program implemented by a state can be found in Wisconsin's 1986 Acid Rain law, which (like the later federal program) created a cap on SO_2 emissions in the power sector and allowed trading of emissions reduction credits among regulated utilities.

As noted previously, market-based programs now exist in many jurisdictions. In order to explore the concepts more fully, the following discussion first focuses in some detail on the major aspects of three well-established examples of cap-and-trade: the federal Acid Rain Program, the RGGI, and the linked California/Quebec cap-and-trade programs. The Acid Rain Program is noteworthy, even though it does not regulate GHG emissions, because it is the only US cap-and-trade program that is nearly nationwide in scope. The RGGI program is included here because it is the longest-running GHG cap-and-trade program in the United States. The California AB 32 cap-and-trade program is included because it is an economy-wide program that is linked with a subnational program outside of the United States. Following those three detailed examples, a very brief summary of Texas' Emissions Banking and Trading Programs is presented to give an even broader sense of the variety of programs currently in existence. The section concludes with a description of rate-based trading programs, a potentially interesting alternative to mass-based cap-and-trade programs that has not yet been implemented in any jurisdiction.

The Acid Rain Program

When authorized by Congress in 1990, the Acid Rain Program represented an historic change in regulatory approach from traditional command-and-control regulatory methods. Instead of establishing specific emissions limitations with which each individual affected source must comply, the Acid Rain Program introduced an allowance trading system intended to reflect market incentives to reduce pollution at lowest cost. It also reflected a new understanding about the appropriate point of regulation. Details of the program design and results are summarized below.

Applicability

The Acid Rain Program uses allowances and an SO_2 emissions cap that applies to new utility units and to existing utility units serving generators with an output capacity of greater than 25 MW. Each year an emitter subject to the program is required to surrender a number of SO_2 "allowances" equal to its annual emissions. Although all the emitters covered by the program are subject to a single cap, each individual may emit whatever amount it wants, so long as it obtains and surrenders a number of allowances that corresponds to the tons of pollutant it emits.

Phases

The Clean Air Act Amendments of 1990 set a goal of reducing annual SO_2 emissions by ten million tons below 1980 levels, requiring a two-phase tightening of the restrictions placed on fossil fuel-fired power plants. Beginning in 1995, reductions were required from 263 "Phase I" electric generating units (EGUs) at 110 mostly coal-burning power plants located in 21 Eastern and Midwestern states. The list of covered sources under Phase I ultimately grew to 445 EGUs. In Phase II, starting in 2000, the program expanded to regulate more than 2000 fossil-fueled EGUs across the continental United States.[6] Today the Acid Rain Program is fully implemented with regulated EGUs in each of the 48 continental states and an annual cap on SO_2 emissions of 8.95 million tons, approximately a 50-percent reduction from 1980 levels.[7]

Initial Allowance Distribution

Each affected EGU is allocated a number of allowances each year for free, but if the owner of the EGU needs more, he or she must buy allowances from a willing seller in a national market. Thus each emitter has an incentive to reduce emissions to avoid having to buy additional allowances, and to be positioned to sell excess allowances.[8]

Evaluation, Measurement, and Verification

The Acid Rain Program requires coal-fired EGUs to install and operate continuous emissions monitoring systems (CEMS). The Act requires the EPA to specify

6 Based on EPA Acid Rain Program data available at: http://www.epa.gov/airmarkets/progsregs/arp/basic.html.

7 EPA. (2010). *SO_2 Emission Reductions from Acid Rain Program Sources and Improvements in Air Quality.* Available at: http://www.epa.gov/captrade/maps/so2.html.

8 The Acid Rain Program also established SO_2 and NOx emissions limitations for covered sources, and a nationwide NOx reduction goal, separate from the SO_2 cap-and-trade program. The emissions limitations and the NOx goal are not discussed in this chapter.

the requirements for such equipment and to specify any alternative monitoring system that is demonstrated as providing information with the same precision, reliability, accessibility, and timeliness as CEMS.

The EPA has also developed recordkeeping and reporting requirements for CEMS. The emissions monitoring rules for this program are found in federal regulations at 40 C.F.R. Part 75, and the data produced pursuant to these regulations are often referred to as "Part 75 data." Each source must continuously measure and record its emissions of SO_2, NO_X, and CO_2, as well as heat input, volumetric flow, and opacity.[9]

Enforcement

Unlike command-and-control programs in which individual emitters have to demonstrate compliance with a specified emissions limitation for each pollutant, under a cap-and-trade program compliance is determined differently. It is structured to ensure that emitters have the requisite allowances at the end of the compliance period, and so there are no economic benefits associated with not having sufficient allowances.

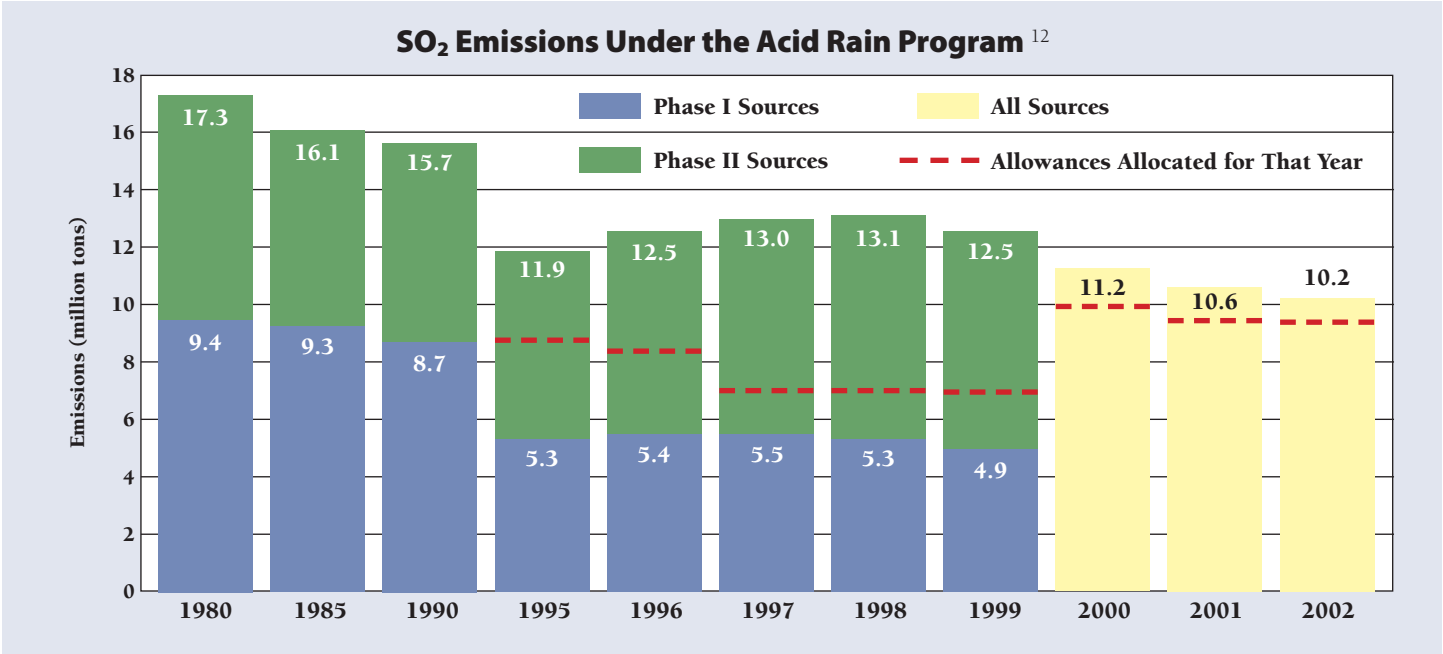
If an emitter fails at the end of a compliance period (one year in the Acid Rain Program) to surrender the number of allowances that corresponds to its emissions, the EPA imposes an automatic excess emissions penalty for each ton of excess SO_2 emissions. The penalty is currently $3754 per ton, but it is adjusted for each compliance year based on changes in the Consumer Price Index.

The Act also imposes an "excess emissions offset"[10] requiring the emitter to compensate for its excess emissions from the current compliance period by surrendering an equal amount of emissions allowances in the next compliance period, in addition to its normal compliance obligation.

Results

The purpose of the Acid Rain Program is to address acid rain problems by reducing SO_2 and NO_X emissions, and it has been very successful. For example, in 2002 the EPA reported that SO_2 emissions had decreased 5.5 million tons from 1990 levels and more than 7 million tons from 1980 under the federal Acid Rain Program, as shown in Figure 24-2.[11]

Figure 24-2



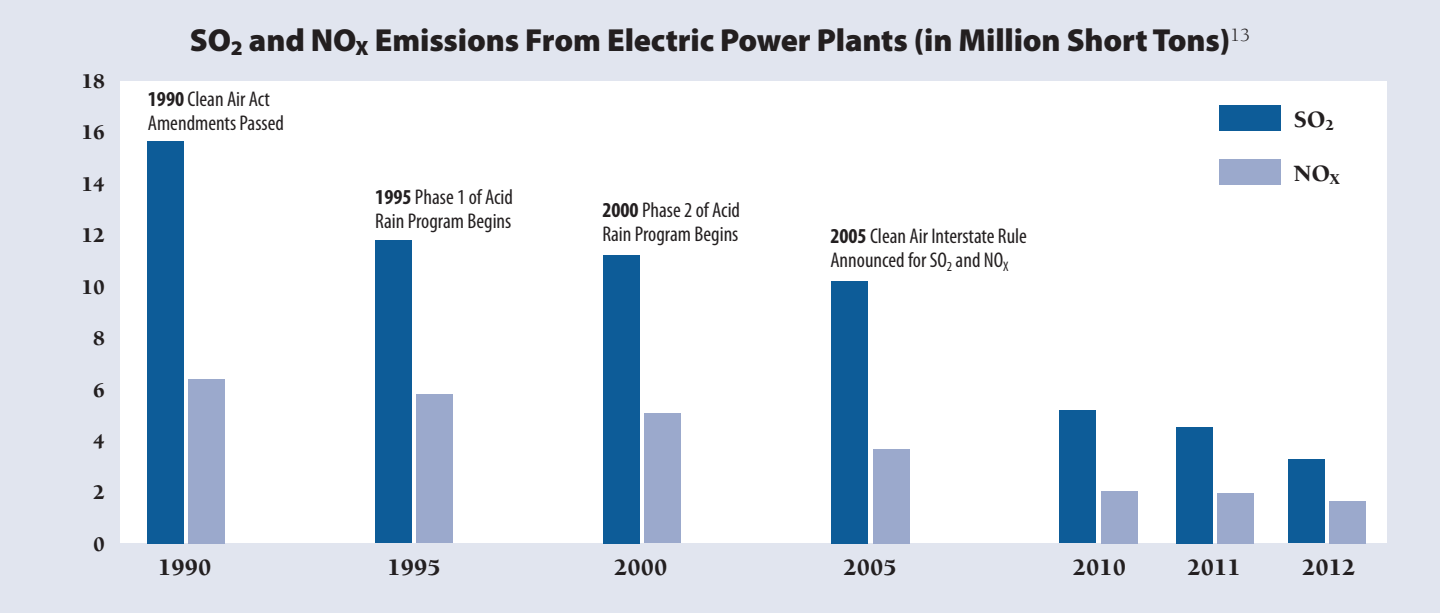
9 As described by the EPA, under this program, which is coordinated between the federal government and state environmental agencies, there are provisions for "initial equipment certification procedures, periodic quality assurance and quality control procedures, recordkeeping and reporting, and procedures for filling in missing data periods." Refer to the EPA Continuous Emissions Monitoring Fact Sheet at: http://www.epa.gov/airmarkets/emissions/continuous-factsheet.html.

10 Not to be confused with RGGI "offset allowances" discussed below.

11 EPA. (Undated). *Cap and Trade: Acid Rain Program Results.* Clean Air Markets Division. Available at: http://www.epa.gov/capandtrade/documents/ctresults.pdf.

12 Ibid.

Figure 24-3



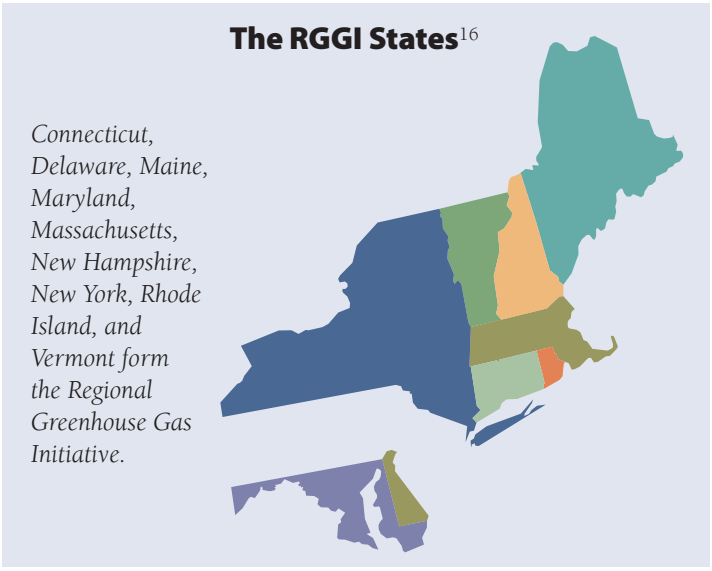
In 2013, the US Energy Information Administration (EIA) reported that emissions of SO_2 and NO_X from the electric power sector in 2012 declined to their lowest level since the passage of the Clean Act Amendments of 1990, as shown in Figure 24-3.

Although these declines occur concurrently with the phasing in of the program, it is important to remember that, despite the cap, there is other economic activity that can contribute to achieving the program's goals. Consequently, it is difficult to separate the SO_2 and NO_X declines resulting from the program and those that could be attributed to, for example, an increasing number of coal-fired power plant retrofits with flue-gas desulfurization (scrubbers), fuel switching to low-sulfur coal and natural gas, and investment in selective catalytic reduction and selective non-catalytic reduction to limit NO_X emissions.[14]

Regional Greenhouse Gas Initiative

RGGI is our second example of the evolution of market-based cap-and-trade mechanisms. RGGI is a cooperative effort of nine Northeast and Mid-Atlantic states to reduce CO_2 emissions from EGUs, and was developed pursuant to each state's independent legal authority.[15] The participating

Figure 24-4



13 US EIA (2013). *Power plant emissions of sulfur dioxide and nitrogen oxides continue to decline in 2012.* Available at: http://www.eia.gov/todayinenergy/detail.cfm?id=10151.

14 Ibid. The EIA also recognizes that additional major reductions in these two pollutants can be attributed to lower overall electricity generation with coal and historically low gas prices that have contributed to a shift from coal- to gas-fired generation.

15 The nine states are Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New York, Rhode Island, and Vermont. New Jersey previously participated but withdrew from RGGI in 2011.

16 Regional Greenhouse Gas Initiative, Inc. (2014, February). *Regional Investment of RGGI CO_2 Allowance Proceeds, 2012.* Available at: http://www.rggi.org/docs/Documents/2012-Investment-Report.pdf.

states are depicted in Figure 24-4.

The program is based on provisions agreed to by the RGGI member states in a Memorandum of Understanding (MOU) signed in December 2005.[17] The program is structured largely on a Model Rule developed by the states to provide guidance and consistency to signatory states.[18] States agreed in the MOU to "propose the Program substantially as reflected in the Model Rule." States also agreed to revisit all elements of the program design in 2012.

RGGI's Model Rule was based on the EPA's Part 96 rule, also known as the "NO_X Budget Rule."[19] The EPA rule served as the structure for RGGI's basic cap-and-trade program administrative functions, including the process for establishing authorized account representatives, compliance certification, the allowance tracking system, and allowance transfers.

The Model Rule was developed by the RGGI Staff Working Group, composed of staff members from the environmental and energy regulatory agencies in each signatory state. This effort was supported by an extensive regional stakeholder process that engaged the regulated community, environmental nonprofits, and other organizations with technical expertise in the design of cap-and-trade programs.

Applicability

RGGI applies to fossil fuel-fired EGUs serving a generator of 25 MW or larger, and relies on CEMS data made available through the Acid Rain Program. RGGI determined that units of that size in the RGGI region were responsible for approximately 95 percent of the electric generation sector's CO_2 emissions. RGGI defined the term "fossil fuel-fired" depending on a unit's in-service date.[20] RGGI also excluded "eligible biomass" from the list of applicable sources.[21]

In order to establish a region-wide list of affected sources, RGGI states conducted an inventory of all units and relied on established data sources.[22] To fill in data gaps in its inventory, the RGGI states revised unit lists to add missing units and remove units that shouldn't be included, used additional unit-level state data (where available), incorporated stakeholder feedback, and also obtained generation data from wholesale market independent system operators.

Compliance Periods

RGGI's first three-year compliance period started in January 1, 2009. The RGGI MOU established a stable

17 This discussion is based on RGGI "Program Overview" materials available at: http://www.rggi.org/design/overview. The MOU was signed by the Governors of the participating states and outlines the program in detail, including the framework for a Model Rule. The states made substantial revisions to the draft Model Rule in response to public comments. As a result, amendments to the MOU were agreed to and signed by the heads of the energy regulatory and environmental agencies in each participating state. The MOU and amendments are available at: http://www.rggi.org/design/history/mou.

18 The Model Rule was not intended to supplant any state regulatory or legislative efforts, but instead seeks to facilitate them by including the types of provisions necessary to implement RGGI. RGGI notes that the Model Rule seeks to "preserve state sovereignty and provides certainty and consistency to the regulated community and to the public." More information about RGGI's Model Rule is available at: http://www.rggi.org/design/history/model_rule.

19 The NOx budget rule was developed as part of the Acid Rain Program. 40 C.F.R. Part 96, NO_X Budget Trading Program and Clean Air Interstate Rule, and NO_X, and SO_2 Trading Programs for State Implementation Plans. See: http://www.access.gpo.gov/nara/cfr/waisidx_06/40cfr96_06.html.

20 If a unit commenced service on or after January 2005, it would be considered fossil fuel-fired provided that fossil fuel comprised more than five percent of its total annual heat input. If a unit commenced service on or before January 2005, it would be considered fossil fuel-fired provided that fossil fuel comprised more than 50 percent of its total annual heat input.

21 This definition includes sustainably harvested woody and herbaceous fuel sources that are available on a renewable or recurring basis (excluding old growth timber), including dedicated energy crops and trees, agricultural food and feed crop residues, aquatic plants, unadulterated wood and wood residues, animal wastes, other clean organic wastes not mixed with other solid wastes, biogas, and other neat liquid biofuels derived from such fuel sources. RGGI preserved determinations as to what constitutes sustainably harvested biomass to the applicable regulatory agencies in each participating state.

22 These sources included the US EIA's Form EIA-767 data: Annual Steam-Electric Plant Operation and Design Data (http://www.eia.gov/electricity/data/eia767/); the EPA's Air Markets Program Data (http://ampd.epa.gov/ampd/); the EPA's Emissions & Generation Resource Integrated Database (http://www.epa.gov/cleanenergy/energy-resources/egrid/); and state emissions inventories and fuel consumption data where available.

cap for the ten states' electric sector CO_2 emissions of approximately 188 million tons per year from 2009 through 2014. The cap was to then decline at a rate of 2.5 percent per year for four years from 2015 through 2018. This approach was intended to result in a 2018 annual emissions budget that would be ten percent lower than the initial 2009 annual emissions budget.[23] At the end of the first compliance period, in 2011, the State of New Jersey ended its membership in RGGI. More recently, in 2014, the nine remaining RGGI states reset (lowered) the cap at 91 million tons per year (to reflect current emissions), while retaining a declining trajectory of 2.5 percent per year from 2015 through 2020.[24]

Use of Offsets

RGGI allows limited use of CO_2 offset allowances, which it defines as "project-based greenhouse gas emission reduction outside of the capped electric power generation sector."[25] RGGI developed offset protocols primarily as a cost-containment mechanism. The ability to increase the number of allowances through limited development of offset projects was considered to be a way in which to mitigate price increases associated with capping CO_2 emissions.[26] RGGI states limit the award of offset allowances to five project categories, each of which is designed to reduce or sequester emissions of CO_2, methane, or sulfur hexafluoride within the nine-state region. RGGI recognizes five offset categories:

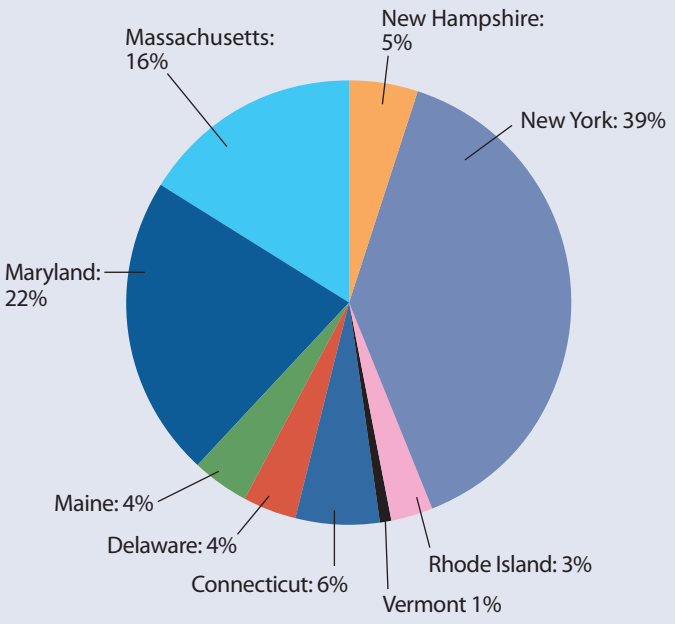
- Landfill methane capture and destruction;
- Reduction in emissions of sulfur hexafluoride in the electric power sector;
- Sequestration of carbon attributable to US forest projects (reforestation, improved forest management, avoided conversion) or afforestation (for Connecticut and New York only);
- Reduction or avoidance of CO_2 emissions from natural gas, oil, or propane end-use combustion attributable to end-use energy efficiency in the building sector; and
- Avoided methane emissions from agricultural manure management operations.[27]

Initial Allowance Distribution

The RGGI cap covers aggregated emissions from all of the participating states, and each allowance permits a regulated source to emit one ton of CO_2. Allowances are first apportioned among the states based on proportional CO_2 emissions, as shown in Figure 24-5.

Figure 24-5

RGGI 2014 CO_2 Allowance Allocation by State[28]



Rather than following the model established by the Acid Rain Program and allocating allowances to affected EGUs for free, RGGI states chose to distribute the majority of allowances through regional auctions. RGGI auctions follow a single-round, uniform-price, sealed-bid auction format. They are conducted in accordance with the statutory and/or regulatory authority of each state offering CO_2 allowances for sale in that auction, and each state retains its authority

23 RGGI's initial regional cap was 188 million short tons of CO_2 per year, which RGGI indicated was approximately four percent above annual average regional emissions during the period of 2000 through 2004.

24 Refer to: RGGI 2012 Program Review: Summary of Recommendations to Accompany Model Rule Amendments. Available at: http://www.rggi.org/docs/ProgramReview/_FinalProgramReviewMaterials/Recommendations_Summary.pdf. RGGI's Program Review is discussed further below.

25 For more on the RGGI approach to CO_2 offsets, refer to: http://www.rggi.org/market/offsets.

26 Offsets, by definition, are out-of-sector GHG reductions. Encouraging offsets is one way to mitigate price effects without reducing the program impact.

27 Supra footnote 25.

28 Supra footnote 16.

to make regulatory determinations related to the conduct of the auction.[29] Auction proceeds are then returned to the states based on the proportion of the allowances they contributed to the auction.

RGGI adopted this approach because, in a competitive wholesale market, electric generators will reflect the market value of free allowances in the price they bid into the market. The RGGI region contains three wholesale electricity markets operated by independent system operators, depicted in Figure 24-6. RGGI reasoned that, because "allowances can be traded to other parties," they have market value:

> Generators expend an asset – emission allowances – when generating electricity. As such, the use of freely allocated allowances has an "opportunity cost" since revenue from the potential sale of the allowance is foregone. In a competitive wholesale market, generators therefore pass on the cost of allowances as a cost of generating electricity, whether allowances were received for free or were purchased. RGGI is being implemented in a region with deregulated wholesale electricity markets, which warrants a design approach that includes the auctioning of allowances.[30]

Figure 24-6

Independent System Operators in the RGGI Region[31]

In its 2011 study, *The Economic Impacts of the Regional Greenhouse Gas Initiative,* the Analysis Group observed that "[a]uctioning allowances and distributing allowance proceeds to states in this way had an important impact on program outcomes since it meant, in effect, that the public benefitted by transferring the value of allowances to market at market prices (rather than for free, as was done in the SO_2 and NO_X allowance programs)."[32]

Between September 2008 and December 2013, the RGGI states held 22 auctions in which they sold current and future compliance period (also called "control period") allowances. First control period (January 1, 2009 to December 31, 2011) allowances sold at a weighted average price of $2.31, with prices ranging from $3.51 to $1.86. Second control period (January 1, 2012 to December 31, 2014) allowance prices ranged from $3.21 to $1.86 and sold at a weighted average price of $2.52.[33] Through 2012, the RGGI raised just under $1 billion for the participating states, as noted in Table 24-1.

Table 24-1

Cumulative RGGI Auction Proceeds[34]

State	Reporting Basis	Cumulative Auction Proceeds Received Through 2012 Reporting Period
Connecticut	Calendar Year	$65,167,703
Delaware	Calendar Year	$29,690,897
Maine	Calendar Year	$34,246,622
Maryland	Fiscal Year	$197,434,494
Massachusetts	Calendar Year	$178,921,781
New Hampshire	Calendar Year	$42,452,629
New York	Calendar Year	$410,586,620
Rhode Island	Calendar Year	$17,977,845
Vermont	Calendar Year	$8,284,461
Total Nine-State RGGI Region		**$984,763,052**

29 For further information on RGGI auction processes and results, see: http://www.rggi.org/market/co2_auctions.

30 Regional Greenhouse Gas Initiative. (2007, October). *Overview of RGGI CO_2 Budget Trading Program.* Footnote 6. Available at: http://www.rggi.org/docs/program_summary_10_07.pdf.

31 More information about ISOs is available at: http://www.isorto.org/about/default.

32 Hibbard, P., Tierney, S., Okie, A., & Darling, P. (2011, November). *The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States.* Analysis Group. Page 31. Available at: http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Economic_Impact_RGGI_Report.pdf.

33 Supra footnote 16 at page 6.

34 Supra footnote 16 at page 7.

Allowance Tracking

The RGGI's CO_2 Allowance Tracking System or "COATS" is an electronic platform that records and tracks data for each state's CO_2 Budget Trading Program. RGGI COATS enables the public to view, customize, and download reports of CO_2 allowance market activity and RGGI program data. COATS enables the public to view program and market data reports regarding:

- CO_2 allowance transactions (the date, price, and type of transaction);
- RGGI COATS accounts, showing a list of every account registered in RGGI COATS;
- RGGI COATS account representatives, showing individual contact details for all accounts;
- RGGI sources, listing each regulated power plant and its location;
- Owners/operators of RGGI sources, showing the corporate affiliation of owners and operators for each regulated power plant;
- Special approvals, detailing allowance allocations made by states;
- Offset project applications and approvals; and
- CO_2 emissions from RGGI sources, showing emissions for each regulated power plant and summary CO_2 emissions for the nine-state region.

Evaluation, Measurement and Verification

As previously noted, under the existing federal Acid Rain Program, fossil-fueled EGUs 25 MW and larger are required to report their CO_2, NOx, and SO_2 CEMS data to the EPA and the states each quarter. The EPA maintains the data system and performs quality assurance and quality control (QA/QC) tests on the CEMS data to ensure its accuracy. States also perform QA/QC tests.[35] Because RGGI units are also fossil-fueled EGUs 25 MW or larger, the program can use CEMS data to track emissions from RGGI jurisdictional units. Furthermore, because the program is mass-based, regulators need ultimately only check the bottom line (i.e., the overall emissions, and the regulated entities' progress in achieving them) at the end of each compliance period.

Enforcement

RGGI has established enforcement rules for various aspects of its program including emissions reporting, allowance tracking, and auction participation. No RGGI provisions excuse RGGI jurisdictional units from compliance with any other provisions of applicable state and federal laws or regulations.

For example, states can take direct enforcement action for failure of the source to perform QA/QC tests each quarter and more robust tests (measured against a stack test) each year. Enforcement can also be taken for emissions exceedances or the absence of backup proxy data for periods when the CEMS is not operating or available.

The RGGI program uses a market monitor to protect and foster competition, and to increase the confidence of the states, participants, and the public in the allowance market. RGGI contracts with Potomac Economics for independent monitoring of the competitive performance and efficiency of the RGGI Allowance Market. The market monitor:

- Identifies attempts to exercise market power, collude, or otherwise manipulate prices in the auction and/or the secondary market;
- Assesses whether the auctions are administered in accordance with the noticed auction rules and procedures; and
- Makes recommendations regarding proposed market rule changes to improve the economic efficiency of the market for RGGI Allowances.

Use of Allowance Revenues

The RGGI states initially agreed that RGGI member states would have full discretion on how to use the revenues raised from allowance auctions. However, based on modeling, stakeholder input, and the recognition that state clean energy programs could deliver more CO_2 emissions reductions than would result from the modest price on carbon created by the RGGI cap, the RGGI states agreed to use allowance value to provide incentives for end-use energy efficiency and other clean energy measures, thus lowering the impact of the program on electricity consumers. This decision was consistent with third-party research indicating that end-use energy efficiency measures provide by far the greatest potential for GHG emissions reductions at least cost, as depicted in Figure 24-7.

Signatories to the RGGI MOU agreed to allocate a minimum of 25 percent of allowance value to support what they called "consumer benefit programs." The RGGI MOU defines

35 The CEMS procedures are modeled after the EPA's NO_X budget program, another market-based cap-and-trade program created to reduce the regional transport of NO_X emissions from power plants and other large combustion sources that contribute to ozone nonattainment in the Eastern United States.

Figure 24-7

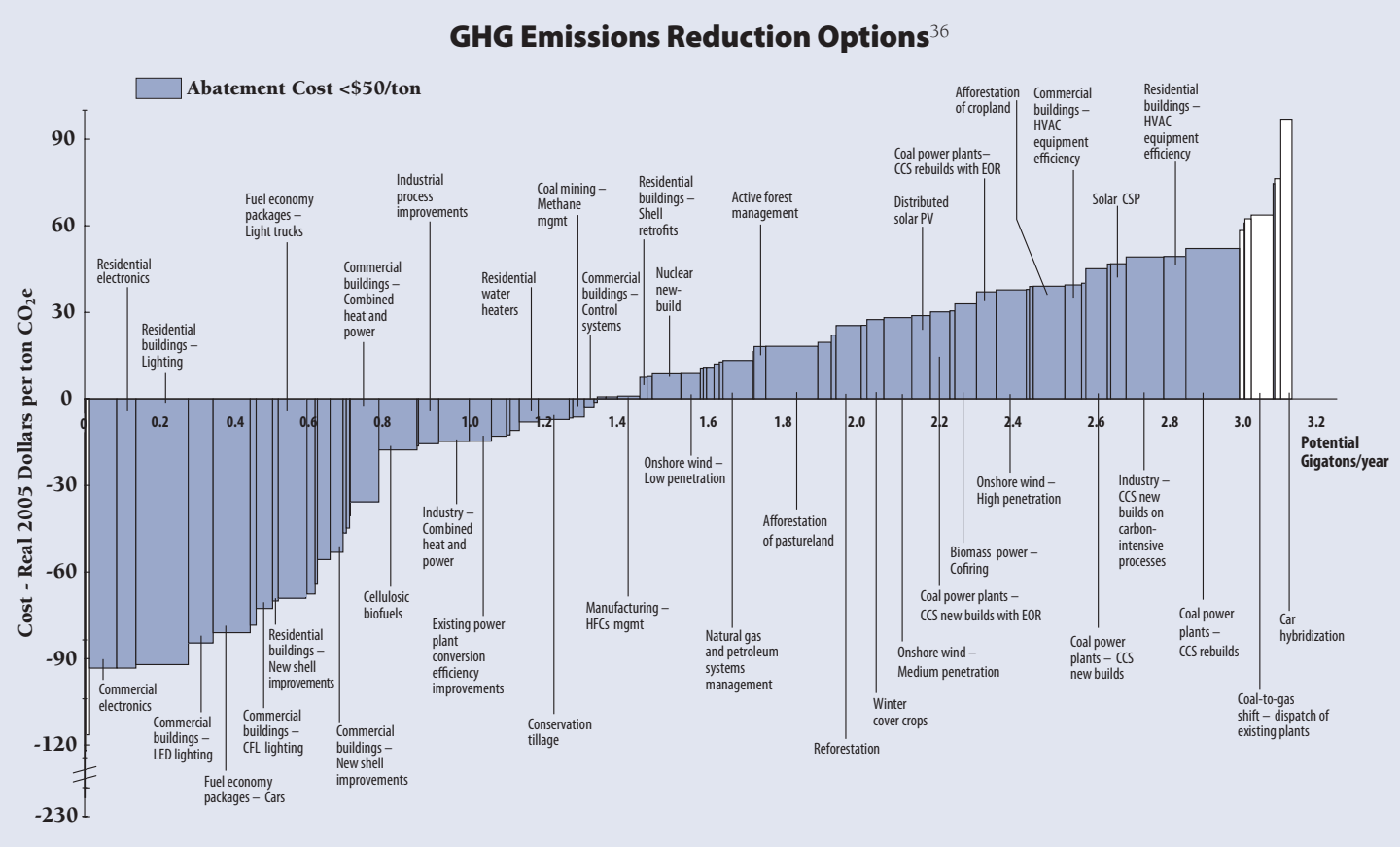
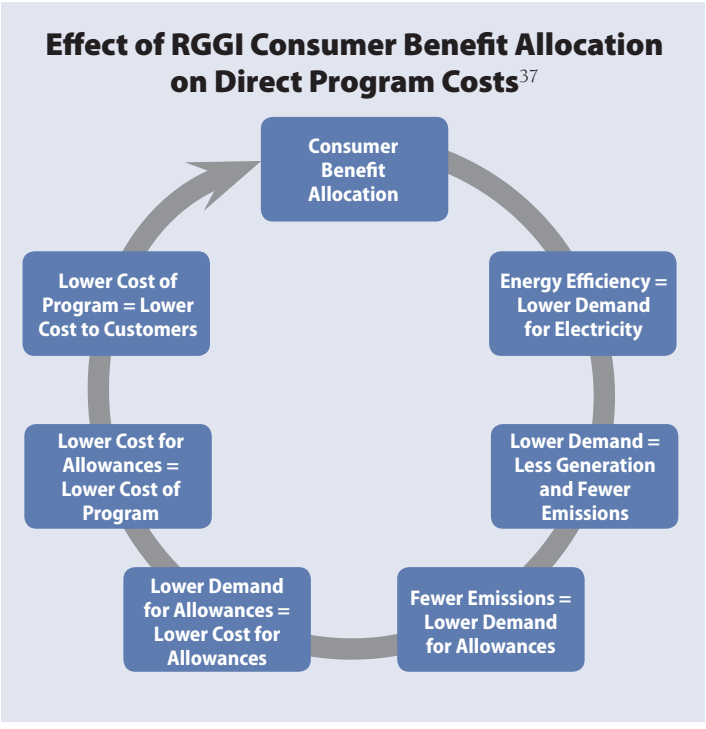


Figure 24-8



"consumer benefit or strategic energy purposes" as the:

> …use of allowances to promote energy efficiency, to directly mitigate electricity ratepayer impacts, to promote renewable or non-carbon emitting energy technologies, and to stimulate or reward investment in the development of innovative carbon emissions abatement technologies.[38]

The RGGI states further concluded that, "allocating allowances to support consumer benefits leads to lowering of electricity demand, reducing the overall compliance costs of the RGGI program and its impact on electricity

36 McKinsey & Company. (2007, December). *Reducing US Greenhouse Gas Emissions: How Much at What Cost?* Exhibit 11. Available at: http://www.mckinsey.com/client_service/sustainability/latest_thinking/~/media/mckinsey/dotcom/client_service/sustainability/pdfs/reducing%20us%20greenhouse%20gas%20emissions/us_ghg_final_report.ashx.

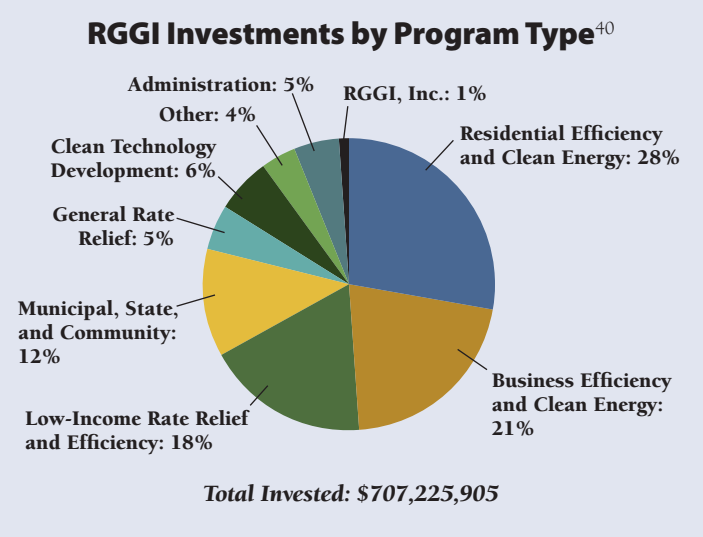
37 Farnsworth, D., D'Antonio, B., & Pike-Biegunska, E. (2009, September). *Climate Policy and Affordability: Advocacy Opportunities in the Northeast.* Montpelier, VT: The Regulatory Assistance Project. Available at: http://www.raponline.org/docs/RAP_Farnsworth_ClimatePolicyinNortheast_2009_09_18.pdf.

38 Supra Footnote 17.

ratepayers." This virtuous cycle is illustrated in Figure 24-8.

From 2009 through 2012, the RGGI states raised over $984.7 million in auction proceeds, $707.2 million of which was invested largely in state clean energy programs, as shown in Figure 24-9.[39]

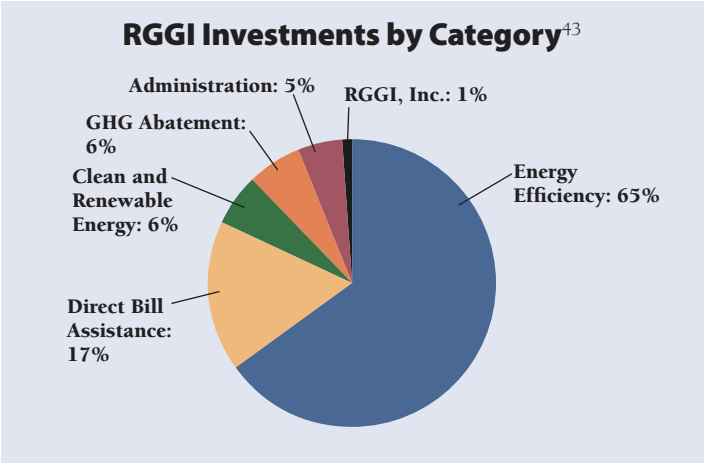
Figure 24-9



RGGI further reports that "more than 73 percent of 2012 RGGI investments, and approximately 65 percent of cumulative RGGI investments to date, fund energy efficiency programs in the region." More than six percent of RGGI investment in 2012, and six percent to date, funds clean and renewable energy programs, including grants and low-interest loans.[41] Figure 24-10 shows the portion of total RGGI auction proceeds directed toward different categories of investment.

Using state projections of cumulative and lifetime benefits of RGGI investments, RGGI reports that investments to date of auction proceeds in state clean energy programs will avoid "the release of approximately 8 million short tons of CO_2 pollution into the atmosphere over their lifetime."[42]

Figure 24-10



2012 Program Review

As called for in the MOU, the RGGI states conducted a program review at the end of the first three-year compliance period (2012/2013) to correct any faults and to consider changes to improve the program.[44] The review revealed that there was a "significant excess supply of allowances relative to actual emission levels in the region," and recommended that the program consider cost-control measures other than those that had been developed based on the availability of offset allowances. RGGI states, in response, revised the program cap to reflect lower regional emissions levels while accounting for allowances already held. Furthermore, in an effort to put in place a mechanism to control program costs expected from lowering the emissions cap, the RGGI states established a "cost-containment reserve," which would make available an additional amount of allowances for the market if a defined allowance trigger price is exceeded. Finally, in order to continually monitor program effectiveness, the RGGI states agreed to conduct another program review no later than 2016.[45]

39 RGGI reports that a total of $984.7 million in auction proceeds was received by the RGGI states through the period covered by this report. Of that, $707.2 million was invested in state clean energy programs and $93.1 million was transferred to state general funds by acts of state legislatures. The remaining $184.4 million was committed to 2013 and future programs.

40 Supra footnote 16. RGGI Investments by Program Type are cumulative to date (2009-2012).

41 Ibid.

42 Ibid.

43 Ibid.

44 Refer generally to the RGGI 2012 Program Review at: http://www.rggi.org/design/program-review.

45 In addition to lowering the cap, the RGGI states agreed to address the bank of unused allowances held by market participants with two interim adjustments for banked allowances from the two compliance periods. The cost containment reserve would make available five million short

continued on page 24-13

Results

The results achieved by the RGGI program to date are highlighted in Sections 4 through 6.

California Cap-and-Trade Program

In 2006 California enacted AB 32, the California Global Warming Solutions Act. AB 32 was the first statutory obligation in the country to take a comprehensive, long-term approach to addressing climate change across all GHG-emitting sectors. This legislation required the state's Air Resources Board (ARB) to plan and implement measures that would return California to 1990 levels of GHG emissions by 2020.

In December 2008, the Board approved an initial planning document, known as the AB 32 Climate Change Scoping Plan, that identified a suite of measures to cut GHG emissions.[46] AB 32 authorized market-based measures but did not require them. The Scoping Plan process determined that a cap-and-trade program and a portfolio of other complementary policies should be developed. In the electric sector, significant complementary policies for California include a 33-percent renewable portfolio standard and energy efficiency programs. In May 2014, the Board approved the First Update to the Scoping Plan, which builds on the initial Scoping Plan with new strategies and recommendations.[47]

Between 2009 and 2012 the Board undertook a series of rulemakings to develop and implement the cap-and-trade program.[48] In 2014 California linked its program with a very similar program in the Canadian province of Quebec.

Applicability

The AB 32 cap-and-trade program covers approximately 85 percent of the GHG emissions in California. Major sectors include electricity, industry, and distributed use of natural gas, propane, gasoline, and diesel fuels. For the electric sector, California's program accounts for both imported electricity and electricity produced instate. The threshold for direct inclusion in the program is 25,000 metric tons of CO_2 equivalent (CO_2e) GHG emissions per year. Emissions generated from the use of eligible biomass fuels are not assessed an obligation.

Compliance Periods

California, like RGGI, established multiyear compliance periods to increase flexibility with respect to annual variation in emissions. The first period, from 2013 through 2014, covers only electricity and industry, and has a declining annual program cap of approximately 160 million metric tons of CO_2e. The second period covers 2015 through 2017. The third period runs from 2018 through 2020. The program expands in the second period to cover distributed fuel use. The cap covering this broader scope begins at 395 million metric tons CO_2e in 2015 and declines to 334 million metric tons CO_2e in 2020. Allowances are fully bankable between periods.

Price Containment

California's program contains both a floor and a soft ceiling on allowance prices. This "price collar" approach gives greater investment certainty that allowance prices will remain within a specified band. The floor is enforced through a reserve price at auction in a fashion similar to RGGI's system. High price protection is provided by a reserve of allowances set aside from future year caps and only made available for sale by the state at higher prices. This mechanism ensures that additional allowance supply is available if demand to emit is greater than expected.

Use of Offsets

Similar to RGGI, California allows limited use of offset credits as a cost-containment mechanism. All compliance offset projects must be developed according to approved Compliance Offset Protocols.

Footnote 45, continued from page 24-12

tons in 2014, and ten million short tons per year each year thereafter. The next program review will consider "program successes, impacts, potential additional reductions to the cap post-2020, and other program design elements." Refer to: Regional Greenhouse Gas Initiative. (2013, February). *RGGI 2012 Program Review: Summary of Recommendations to Accompany Model Rule Amendments.* Available at: http://www.rggi.org/docs/ProgramReview/_FinalProgramReviewMaterials/Recommendations_Summary.pdf.

46 Refer to the California Air Resources Board (ARB) website at: http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm.

47 Refer to the ARB website at: http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm.

48 Refer to the ARB website at: http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm.

Table 24-2

California Offset Volumes as of September 10, 2014[50]

Project Type	ODS	Livestock	US Forest	Urban Forest	MMC
Compliance	1,343,588	—	3,378,928	—	—
Early Action	3,954,477	474,657	2,618,389	—	—

One offset credit = one metric ton CO_2e
MMC, mine methane capture; ODS, ozone-depleting substances.

The eligible offset project types are currently

- US Forest Projects;
- Urban Forest Projects;
- Livestock Projects;
- Ozone-Depleting Substances Projects; and
- Mine Methane Capture Projects.[49]

Because of historically higher allowance prices in the AB 32 program than in the RGGI system, California has seen more offset project activity. Offsets generated to date are shown in Table 24-2.

Unlike any other regulatory cap-and-trade program, California's offset program includes provisions for offset buyer liability. This means that any offset used for compliance that is later found to be fraudulent or not generated in accordance to the Board-approved protocols must be replaced by another valid compliance offset or allowance. This ensures the environmental integrity of the program and promotes due diligence in the regulated entities that choose to pursue the use of lower-cost offsets for compliance.

Initial Allowance Distribution and Use of Allowance Revenues

Similar to RGGI and the EU ETS, California relies on auctions to distribute allowances to EGUs. California arrived at this approach after a stakeholder process that recognized the monetary value of the allowances, opportunity cost arguments, and the benefits of an auction-based distribution for smooth functioning of wholesale electric markets.[51] Like RGGI, California AB 32 cap-and-trade program auctions follow a single-round, uniform-price, sealed-bid auction format.

California also took the unique step of freely allocating allowances to the regulated electric utilities in the state on behalf of customers. The largest utilities are required to sell these allowances at the auction and use the proceeds on behalf of their customers, as specified by the California Public Utilities Commission. This allows the state utility regulators to consider both the carbon cost and the value of the allowances when determining retail rate impacts, funding for efficiency programs, and customer dividends. California utility customers now receive biannual "climate credits" funded through utility auction proceeds on their April and October electric bills.[52] These credits, shown in Table 24-3, are non-volumetric, meaning they are independent of how much electricity a customer uses. This approach to returning allowance value to customers maintains the conservation incentive created by carbon pricing.

Table 24-3

Climate Credits Returned to California Electricity Customers[53]

California Electric Utility	Biannual Climate Credit in 2014
Pacific Gas and Electric	$29.81
Southern California Edison	$40.00
San Diego Gas and Electric	$36.24

49 Refer to the ARB website at: http://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm.

50 Supra footnote 45.

51 Refer to the ARB website at: http://www.arb.ca.gov/regact/2010/capandtrade10/capv4appj.pdf and http://www.arb.ca.gov/regact/2010/capandtrade10/candtappa2.pdf.

52 Refer to the California Public Utilities Commission website at: http://www.cpuc.ca.gov/PUC/energy/capandtrade/climate-credit.htm. Also refer to: http://www.energyupgradeca.org/en/learn/energy-impact-on-our-climate/what-is-california-climate-credit.

53 Supra footnote 52.

Allowance Tracking

California's Compliance Instrument Tracking System Service or "CITSS" is an electronic platform that records and tracks data for California and Quebec with functionality similar to RGGI's COATS. CITSS is used to:

- Register entities participating in the California cap-and-trade program;
- Track the ownership of compliance instruments;
- Enable and record compliance instrument transfers;
- Facilitate emissions compliance; and
- Support market oversight.

Evaluation, Measurement, and Verification

AB 32 required that, prior to the beginning of any market system, a robust reporting program be developed to help establish accurate emissions inventories. California's power plants began reporting their GHG emissions beginning with the 2008 data year under California's Mandatory Greenhouse Gas Reporting Program.[54] CEMS installed for the federal Acid Rain Program are used by many facilities but are not explicitly required by California's program. Third-party verification is required to ensure data quality and that state staff perform QA/QC tests and check verifier work. California's third-party verification program is consistent with international standards and procedures similar to those used in the EU ETS.

Enforcement and Market Monitoring

California recognized that a well-functioning market was fundamental to the implementation of the California AB 32 cap-and-trade program. As one component of the AB 32 approach to ensure that the markets are free from abuse and disruptive activity, the California ARB conducts market surveillance and analysis.[55] The Board's trained surveillance staff work closely with an independent market monitor, Monitoring Analytics, to monitor the auctions and all holding and trading of compliance instruments for the program. Activities in related markets are also tracked and analyzed.

The ARB works with several California state and federal agencies to ensure robust oversight, including the California Attorney General's Office, the California Independent System Operator, the Commodity Futures Trading Commission, and the Federal Energy Regulatory Commission.

The ARB can also take direct enforcement action for failure to properly report or verify emissions each year. The Board has already taken such enforcement action for those who failed to meet reporting and verification deadlines.[56]

In addition to the active surveillance, the program has a fundamental design to ensure that the ability to exercise market power is limited through the use of position limits, referred to as holding limits in the regulation. All compliance instruments, both allowances and compliance offsets, have unique serial numbers and are created, tracked, and retired within CITSS. Anyone registering for an account in CITSS must pass know-your-customer requirements.

Results

Because California's program is still in the midst of the first compliance period, it is too early to report on results.

Texas Emissions Banking and Trading Programs

The State of Texas provides some final examples of market-based approaches, which we will mention but not describe in significant detail. Texas has various Emissions Banking and Trading programs overseen by the Texas Commission on Environmental Quality.[57] For example, its Mass Emissions Cap and Trade and Highly-Reactive Volatile Organic Compound Emissions Cap and Trade Programs apply to the Houston-Galveston-Brazoria 2008 eight-hour ozone nonattainment area.[58] Program allowances are used to satisfy the offset requirements for new or modified facilities subject to federal nonattainment new source review requirements under Texas and federal law.[59] Mass Emissions Cap and Trade allowances are used to satisfy NO_X offset requirements for facilities in the geographic area subject

54 Refer to the ARB website at: http://www.arb.ca.gov/cc/reporting/ghg-rep/ghg-rep.htm.

55 Refer to the ARB website at: http://www.arb.ca.gov/cc/capandtrade/market_oversight.pdf.

56 For examples, see: http://www.arb.ca.gov/enf/casesett/sa/pge_sa.pdf or http://www.arb.ca.gov/enf/casesett/sa/chev_nea_sa.pdf.

57 See generally the Mass Emissions Cap and Trade Program website at: http://www.tceq.texas.gov/airquality/banking/mass_ect_prog.html.

58 For more details, refer to: http://www.tceq.texas.gov/assets/public/implementation/air/banking/guidance/allowances-offsets.pdf.

59 Refer to: 30 Texas Administrative Code Chapter 116, Subchapter B, Division 7.

to the emissions requirements. Likewise, Highly-Reactive Volatile Organic Compound Emissions Cap and Trade allowances are used to satisfy volatile organic compound offset requirements for facilities in specified areas.

Rate-Based Trading Programs

Examples of cap-and-trade programs that have already been implemented have been described in detail. All of those programs focus on capping the mass of emissions and allowing trading of mass-based emissions allowances. However, alternative versions of cap-and-trade have been proposed by some environmental groups. These alternatives have not been implemented in any jurisdiction, but are sufficiently different and interesting as to merit mention here.

Western Resource Advocates has proposed an alternative to cap-and-trade programs that focuses on the trading of credits based on emissions rates rather than the trading of allowances based on mass emissions.[60] Its *Carbon Reduction Credit Program* is intended to offer states another option for use in implementing the Clean Power Plan that the EPA proposed in June 2014 to regulate CO_2 emissions from existing power plants pursuant to section 111(d) of the Clean Air Act. The program is designed to be flexible, technology-neutral, and market-based.

Under the proposed *Carbon Reduction Credit Program*, for each megawatt-hour (MWh) of electricity produced by a regulated generator, air pollution regulators would award one carbon reduction credit (CRC) for each pound of emissions less than that permitted under the Clean Power Plan. For example, if the applicable Clean Power Plan emissions rate were 1200 pounds per MWh in a particular year, and a regulated generator produced 1000 MWh with an emissions rate of 1000 pounds per MWh, the generator would receive 200,000 CRCs for that year.

Regulated generators that emit CO_2 at a rate greater than the Clean Power Plan standard for that year would receive negative credits, using the same approach. Zero-emissions resources (e.g., renewable energy, nuclear energy, or energy efficiency) could also be awarded CRCs; for every MWh produced by an eligible zero-emissions generator or saved by eligible energy efficiency measures in a given year, the program could provide credits equal to the applicable Clean Power Plan emissions for that year. For example, assuming again that the applicable emissions rate were 1200 pounds per MWh in a particular year, if an eligible renewable resource produced 1000 MWh or an eligible efficiency measure reduced consumption by 1000 MWh, it would be awarded 1,200,000 CRCs.

The CRC Program would accommodate trading, either intrastate or interstate, to enable excess reductions from one facility to be used for compliance at a deficient facility. Demonstrating compliance under the CRC Program would require a regulated generator to retire an amount of credits equal to the amount of negative credits, if any, that it has accumulated during a compliance period. For example, if a generator receives 100,000 negative CRCs, the generator would need to acquire 100,000 CRCs from some other party and retire those credits.

The CRC Program is designed to be developed incrementally, starting with individual state programs that over time would be able to link together into multistate and regional efforts (if states decided to pursue that outcome). An alternative compliance payment feature could be added to the program design if necessary to protect electricity customers from excessive rate impacts.

Resources for the Future has also proposed a similar rate-based trading program, which the group calls a "tradable standard."[61] Given the similarities, the details of the tradable standard concept will not be presented here. Interested readers are encouraged to review Resources for the Future's discussion paper. Other observers have suggested that a "fleet average emission rate" approach could be applied to power plants in specific state or regional jurisdictions. This approach would establish and enforce an overall target carbon dioxide emission rate for EGUs based on the model implemented for motor vehicle corporate average fuel economy standards. Covered individual plants might emit at a level significantly higher or significantly lower than the target rate, but as a group they would be required to meet the target rate.

4. GHG Emissions Reductions

The foundational premise underlying market-based emissions trading programs is that regulators determine *a priori* the aggregate level of emissions (or emissions reductions) that is to be achieved by the policy. Market

60 Michel, S. and Neilsen, J. (2014) *Carbon Reduction Credit Program: A State Compliance Tool for EPA's Clean Power Plan Proposal*. Western Resource Advocates.

61 Burtraw, D., Fraas, A., & Richardson, N. (2012, February). *Tradable Standards for Clean Air Act Carbon Policy.* Resources for the Future. Discussion Paper RFF DP 12-05. Available at: http://www.rff.org/rff/Documents/RFF-DP-12-05.pdf.

mechanisms are then unleashed as the means of achieving the expressed goals at least cost. And although it is certainly possible that regulators could establish a cap-and-trade policy that includes caps that prove to be unattainable, this hypothetical problem has not been observed with respect to existing programs. Instead, the record to date for existing GHG cap-and-trade programs is one in which policy goals of fairly modest ambition have proven to be achievable, and the costs of compliance have consistently been less than was forecasted before the programs were implemented. The most notable examples can be found in the EU ETS and RGGI programs.

In phase one of the EU ETS (from 2005 through 2007), the cap (and thus the number of allowances distributed) turned out to be so unambitious that regulated sources had little trouble complying. Very few sources needed to buy allowances, and the market value of allowances eventually fell to zero. In phase two (from 2008 through 2012), the cap was reduced by 6.5 percent, but once again compliance proved to be easier than expected for most regulated sources. This led to a glut of unused allowances and, once again, a drop in allowance prices. Ironically, the minimal value attached to EU ETS allowances in the first two phases was described by many observers as evidence that the program was not changing energy market fundamentals and thus had fallen short of its goals. Reforms were introduced for phase three, which will run from 2013 through 2020, that are intended to bolster short-term allowance prices and motivate more significant and faster changes in emissions. During phase three, the cap will decline by 1.74 percent per year.

Like the European nations participating in the EU ETS, the RGGI states have also experienced the need to adjust their emissions cap. As previously noted, the ten-state RGGI cap for the period from 2009 through 2014 was set at 188 million tons per year, and then the cap was to decline at a rate of 2.5 percent per year for four years from 2015 through 2018. Compliance with the cap turned out to be far easier than expected, a large amount of unused allowances accumulated, and the prices bid for allowances in the regional auctions fell to minimal levels. In 2012, actual emissions from regulated sources in the nine RGGI states plummeted to 91 million tons. Consequently, the RGGI states, in the context of their planned 2012 program review, agreed to reforms for 2014 that reset (lowered) the cap to 91 million tons per year, while retaining and extending the 2.5-percent annual decline in the cap from 2015 through 2020.

One aspect of the RGGI cap-and-invest approach that is not always sufficiently appreciated is that the program achieves GHG reductions separate from and additional to the reductions in the capped sector by reinvesting some of the auction revenues in other sectors. For example, some of the energy efficiency investments that states have made with RGGI auction proceeds have been targeted to reducing the consumption of oil, propane, and natural gas for space heating. This reduces GHG emissions outside of the electricity sector without in any way relaxing the cap. It is a promising result and one that cannot be achieved if allowances are allocated for free, as in other cap-and-trade programs.

5. Co-Benefits

There are two different ways to think about the co-benefits of market-based GHG emissions reduction programs. If one assumes that the desired emissions reductions must happen *by some means* and then compares the results of a market-based approach to command-and-control alternatives, the co-benefits are virtually all economic benefits. Economic theory (and the demonstrated record to date) suggests that a market-based approach will achieve results at a lower cost, generating direct and indirect economic and employment impacts. On the other hand, one could focus on the actions taken by regulated entities to reduce GHG emissions and comply with an emissions cap. Almost any action that will help sources comply with a GHG cap will simultaneously reduce emissions of other air pollutants and other environmental impacts, and contribute to public health improvements.

The two cap-and-trade examples illustrated in this chapter have a proven record of providing significant co-benefits. Throughout all of the chapters of this document, we have considered "co-benefits" to be the non-GHG benefits that derive from a GHG emissions reduction technology or policy. Because the Acid Rain Program is not a GHG reduction program, we don't consider its tremendous impact on criteria air pollutant emissions to be a "co-benefit" but we will briefly note some of the public health benefits associated with the program. The EPA reports that the Acid Rain Program "reduced SO_2 emissions faster and at far lower costs than anticipated, yielding wide-ranging health and environmental improvements."[62]

62 Refer to the EPA's website, *SO_2 Emission Reductions from Acid Rain Program Sources and Improvements in Air Quality,* at: http://www.epa.gov/captrade/maps/so2.html.

A 2003 Office of Management and Budget study found that the program "accounted for the largest quantified human health benefits – over $70 billion annually – of any federal regulatory program implemented in the last ten years, with annual benefits exceeding costs by more than 40:1 – for every dollar spent on implementing this cap and trade program, 40 dollars are returned in health and environmental benefits."[63]

The RGGI program offers a better illustration of the co-benefits that can be achieved with a market-based GHG emissions reduction program. In February 2014, RGGI reported that investments of RGGI proceeds "to date are projected to return more than $2 billion in lifetime energy bill savings to more than 3 million participating households and more than 12,000 businesses in the region."[64] "These programs are projected to offset the need for approximately 8.5 million MWh of electricity generation, [and] save more than 37 million MMBTU[65] of fossil fuels…."[66]

Conducting an independent study in 2011 of the economic effects of the RGGI's program, the Analysis Group reported that over 16,000 new job-years were being "created as a result of investments made during the first three years of the program."[67] It concluded:

> Based on the initial three years of experience from the nation's first mandatory carbon control program, market-based programs are providing positive economic impacts while meeting emission objectives. The pricing of carbon in Northeast and Mid-Atlantic electricity markets has been seamless from an operational point of view and successful from an economic perspective.[68]

The full range of co-benefits that can be realized through market-based GHG reduction programs is summarized in Table 24-4. Most of the potential co-benefits are only likely to be achieved if a market-based program generates revenues that are invested in energy efficiency or other clean energy programs.

Table 24-4

Types of Co-Benefits Potentially Associated With Market-Based Programs

Type of Co-Benefit	Provided by This Policy or Technology?
Benefits to Society	
Non-GHG Air Quality Impacts	Yes
Nitrogen Oxides	Yes
Sulfur Dioxide	Yes
Particulate Matter	Yes
Mercury	Yes
Other	Yes
Water Quantity and Quality Impacts	Maybe
Coal Ash Ponds and Coal Combustion Residuals	Maybe
Employment Impacts	Maybe
Economic Development	Maybe
Other Economic Considerations	Maybe
Societal Risk and Energy Security	Maybe
Reduction of Effects of Termination of Service	Maybe
Avoidance of Uncollectible Bills for Utilities	Maybe
Benefits to the Utility System	
Avoided Production Capacity Costs	Maybe
Avoided Production Energy Costs	Maybe
Avoided Costs of Existing Environmental Regulations	Maybe
Avoided Costs of Future Environmental Regulations	Maybe
Avoided Transmission Capacity Costs	Maybe
Avoided Distribution Capacity Costs	Maybe
Avoided Line Losses	Maybe
Avoided Reserves	Maybe
Avoided Risk	Maybe
Increased Reliability	Maybe
Displacement of Renewable Resource Obligation	Maybe
Reduced Credit and Collection Costs	Maybe
Demand-Response-Induced Price Effect	Maybe
Other	Maybe

6. Costs and Cost-Effectiveness

In general, cap-and-trade programs have proven to be cost-effective mechanisms for decreasing pollutants including carbon. They allow regulated entities to weigh all available options and choose the least-cost means of compliance. They also allow differential costs of emissions reduction between two regulated entities to be exploited to

63 Supra footnote 62.

64 RGGI. (2014). RGGI Investments Provide Region's Families and Businesses with $2 Billion in Lifetime Energy Bill Savings. [Press release]. Retrieved from: http://www.rggi.org/docs/PressReleases/PR022414_2012ProceedsReport.pdf.

65 MBTU stands for one million BTUs, which can also be expressed as one decatherm (10 therms). MBTU is occasionally expressed as MMBTU, which is intended to represent a thousand thousand BTUs.

66 Supra footnote 63.

67 Supra footnote 32 at page 6.

68 Ibid.

the benefit of both parties.

The Acid Rain Program has been rigorously analyzed, and has enough of a track record to determine the cost-effectiveness of the program. Entities subject to the Acid Rain Program have successfully used least-cost approaches including lowering emissions by fuel switching from high-sulfur content Illinois Basin and Appalachian coal to low-sulfur coal produced in the Powder River Basin.[69] In addition to fuel switching, entities also can acquire allowances and install emissions controls to comply with the program. Before the electric industry restructuring in the mid 1990s, generators were able to rely on integrated utilities with utility commission approval to pay for these investments.

One study estimated the program's benefits at $122 billion annually in 2010, while cost estimates were approximately $3 billion annually (in 2000 dollars).[70] The study also recognized that these benefits included additional mercury reductions and health benefits attributable to reduced fine particle and ozone pollution. In 2007, annual ecological and health benefits resulting from the Acid Rain Program emissions reductions were estimated at $142 billion (2006 dollars) by 2010, compared with annual compliance costs of $3.5 billion.[71]

In 2011, the Analysis Group produced a comprehensive evaluation of the costs and benefits (and thus the cost-effectiveness) of the RGGI cap-and-invest program through the first three years:

> Our analysis tracks the path of RGGI-related dollars as they leave the pockets of generators who buy CO_2 allowances, show up in electricity prices and customer bills, make their way into state expenditure accounts, and then roll out into the economy in one way or another. Our analysis is unique in this way – it focuses on the actual impacts of economic activity: known CO_2 allowance prices; observable CO_2 auction results; dollars distributed to the RGGI states; actual state government decisions about how to spend the allowance proceeds; measurable reductions in energy use from energy efficiency programs funded by RGGI dollars; traceable impacts of such expenditures on prices within the power sector; and concrete value added to the economy.[72]

The Analysis Group found that power plant owners spent $912 million to purchase CO_2 allowances in the first three years of RGGI, but the reinvestment of these revenues by states added $1.6 billion in *net* economic value to the region.[73]

7. Other Considerations

Market-based approaches to electric sector carbon management should not be disruptive of electric system reliability because they open the door to a broad range of flexible compliance options. These approaches allow states to consider various emissions reduction options and can drive compliance from actions taken within the power plant fence-line, including improvements in heat rate, fuel switching, and other operational efficiencies, as well as actions taken beyond the fence such as energy efficiency, renewable resources, and changes in dispatch. Because market-based programs do not impose a standard that must be met solely by actions taken at individual units, they can avoid outcomes that could threaten system reliability reminiscent of command-and-control regulation, in which significant amounts of generating capacity are put in the position where they are unable to produce power owing to being out of service to install control equipment.

Emissions sources subject to cap-and-trade programs also have the flexibility to avoid a group of regulatory issues that sometimes arise in relation to compliance with federal New Source Review preconstruction permitting requirements or New Source Performance Standards, each of which could impose significant compliance costs. A command-and-control approach that imposes technology standards or unit-specific performance standards requiring plant modifications and new construction could trigger

69 Refer to Chapter 9 of this document for more information on fuel switching under the Acid Rain Program.

70 Chestnut, L., & Mills, D. (2005). *A Fresh Look at the Benefits and Costs of the US Acid Rain Program.* Journal of Environmental Management, Vol. 77. Pages 252–266. Available at: http://www.epa.gov/airmarkt/presentations/docs/jemarpbenefitsarticle.pdf.

71 Napolitano, S., Schreifels, J., Stevens, G., Witt, M., LaCount, M., Forte, R., & Smith, K. (2007). *The US Acid Rain Program: Key Insights From the Design, Operation, and Assessment of a Cap-and-Trade Program.* The Electricity Journal, Vol. 20, Issue 7. Available at: http://www.epa.gov/airmarkets/resource/docs/US%20Acid%20Rain%20Program_Elec%20Journal%20Aug%202007.pdf.

72 Supra footnote 32.

73 Ibid.

these additional regulatory requirements. A cap-and-trade program, as noted earlier, affords sufficient flexibility to emissions sources, allowing them to avoid triggering compliance obligations with these other programs.[74]

In developing a regulatory program and choosing a startup date, policymakers often have to make concessions for early action, that is, efforts made that are consistent with the program that has yet to get underway. The rationale behind recognizing early action is that a program should not discourage early action by regulated entities simply because they might not get credit before a program begins, nor should it penalize actors for having taken positive steps before a program's startup. There are examples of air programs recognizing and accommodating consistent early actions by related pollution control programs.

The NO_X Budget Trading Program credited early actions, as did RGGI.[75] The NOx Budget Trading Program allowed states to receive compliance allowances for distribution to emissions sources during the startup phase of the program for the purpose of rewarding early NO_X reduction for actions that had taken place before the start of the NO_X budget program.[76] RGGI likewise made provisions to recognize CO_2 early reductions that took place in the two years before the 2009 program startup date in member states. RGGI adopted a two-part approach in which in order to get credit one had to demonstrate both a reduction in mass emissions (total tons reduced), and a reduction in emissions rate (pounds of CO_2 per MWh). The two-part test ensured that early reduction credits would not be awarded simply for a reduction in capacity utilization (i.e., lower emissions resulting from an economic downturn) or conversely for reducing one's emissions rate while increasing capacity utilization. To the extent that emissions increased from capacity utilization, RGGI required those amounts of emissions to be subtracted from the overall emissions number for which the emitter sought credit.

In addition to the two-part test for early action credits, RGGI also accommodated the State of Massachusetts, which had a CO_2 reduction regulation (310 CMR 7.29) in place before the RGGI program's inception. The accommodation essentially allowed Massachusetts emissions sources that had invested in the 7.29 Program to exchange program "credits" for RGGI allowances. This was done with a "set-aside" account, which ensured that these emissions came out of the state's total allowance budget.

It is also important to recognize that market-based solutions are imposed on markets that can be very dynamic and subject to various factors that affect how markets operate. As noted, in the case of the Acid Rain Program and RGGI, there are many factors that can affect power markets. Railroad deregulation and the subsequent availability of low-sulfur Powder River Basin coal disrupted the Eastern market for higher-sulfur content Illinois Basin and Appalachian coal. The availability of industry-proven compliance technology affected generators' choices. Similar compliance technology driven by New Source Performance Standards affected new capacity that displaced older, higher-emitting units.

The RGGI states were able to lower their cap considerably in response to lower emissions in the region, owing in part to greater availability of natural gas-fired generation replacing coal-fired units. Weather and an underperforming economy characterized by reduced demand for electricity were other factors. Foresight by the RGGI states to conduct a 2012 review, after the initial three-year compliance period, allowed them to take stock of their program and the relevant market conditions, and to reset the RGGI cap to better reflect regional emissions.

74 For example, where a unit engages in construction that exceeds 50 percent of the capital cost that would be required to construct a comparable new facility, the unit could become subject to a determination that the modification resulted in it being effectively a new unit, thereby triggering New Source Performance Standards requirements.

75 See, e.g., NOx SIP Call Final Rule, 63 Fed. Reg. 57,356, 57,428–29 (October 27, 1998).

76 The allowances issued were for use only within a limited time. Refer to: Foster, J., & Tarr, J. (2014). *Promoting Innovative and Clean Energy Technology Deployment in Conjunction With GHG Regulation of Stationary Sources Under Section 111 of the Clean Air Act.* NI R 14-01. Durham, NC: Duke University.

8. For More Information

Interested readers may wish to consult the following reference documents for more information on market-based programs.

- Burtraw, D., Fraas, A., & Richardson, N. (2012, February). *Tradable Standards for Clean Air Act Carbon Policy.* Resources for the Future. Discussion Paper RFF DP 12-05. Available at: http://www.rff.org/rff/Documents/RFF-DP-12-05.pdf.
- California Air Resources Board. (2011, October). *Overview of ARB Emissions Trading Program.* Available at: http://www.arb.ca.gov/newsrel/2011/cap_trade_overview.pdf.
- European Commission. (2013, October). *The EU Emissions Trading System* (EU ETS). Available at: http://ec.europa.eu/clima/publications/docs/factsheet_ets_en.pdf.
- Hibbard, P., Tierney, S., Okie, A., & Darling, P. (2011, November). *The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States.* Analysis Group. Available at: http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Economic_Impact_RGGI_Report.pdf.
- Regional Greenhouse Gas Initiative. (2013). *Model Rule.* Available at: http://www.rggi.org/docs/ProgramReview/_FinalProgramReviewMaterials/Model_Rule_FINAL.pdf.
- US Environmental Protection Agency. (2003, June). *Tools of the Trade: A Guide to Designing and Operating a Cap and Trade Program for Pollution Control.* Office of Air and Radiation. EPA 430-B-03-002. Available at: http://www.epa.gov/airmarkt/resource/docs/tools.pdf.
- Michel, S. and Neilsen, J. (2014) *Carbon Reduction Credit Program: A State Compliance Tool for EPA's Clean Power Plan Proposal.* Western Resource Advocates.

9. Summary

The use of a market-based regulatory approach like a cap-and-trade model by the EPA and the states provides policymakers with important insights into the effectiveness and limitations of such a mechanism as part of a GHG reduction strategy for the electric sector. The cap-and-trade approach demonstrates the value of allowing regulated entities the flexibility to meet requirements in a manner that best suits their specific needs. As noted, Acid Rain units have used various approaches or combinations of approaches to reduce their emissions in the most cost-effective manner. At a program design level, the Acid Rain Program has demonstrated that giving emissions sources a choice in the manner in which they comply can lead to cost-effective solutions without compromising environmental goals.

The use of the cap-and-invest variant of cap-and-trade by the RGGI states provides policymakers with important insights into the effectiveness of this mechanism as part of a GHG reduction strategy for the electric sector. The cap-and-invest approach demonstrates the value of a coordinated effort to both discourage the use of carbon-intensive resources and to encourage alternatives. Complementary policies that reduce the cost of achieving emissions reduction goals under the cap are able to spur emissions reductions from activities that are not covered or are not sufficiently incentivized solely by a carbon price mechanism.

At a program design level, the RGGI experience demonstrates the importance of getting the cap and the baseline right, and a willingness to make necessary adjustments mid-course in a fashion that results in a carbon price that can be expected to affect operational and investment decisions in the electric sector. The emissions limit should reflect actual emissions levels in order to create a clear and sustained incentive to reduce emissions.

Because of the significance of complementary policies in a cap-and-invest framework, auctioning allowances, instead of freely allocating them, has emerged as a key component in an effective carbon cap mechanism. Auctioning creates a level playing field for program participants and new entrants, as well as the critical funding source for complementary policies, such as those that promote energy efficiency and renewable energy — programs that lower the overall program price and provide economic benefits in the region in which they operate.

In reviewing results of RGGI's first three-year compliance period, the Analysis Group reached the following conclusions:

> The use of RGGI allowance revenues has produced positive economic impacts while administration of the RGGI program has proceeded smoothly. Thirteen auctions have been held, and the auctions resulted in the distribution of the majority of available allowances. Allowances have been traded in the secondary market throughout the first compliance period, and the market monitor has found no evidence of market power in the RGGI auctions or the secondary market. Allowance revenues were quickly and efficiently distributed to states, and states have disbursed nearly all of the allowance revenues for various uses. The carbon cap established by RGGI has been met (in part because of

stagnant economic conditions). RGGI, Inc. and the states have effectively tracked the use of allowance proceeds, and states continue to work cooperatively towards evolution of the program.

In short, based on a review of RGGI's first three years, it would seem that the design, administration, and implementation of a market-based carbon control mechanism can be an effective way to control carbon emissions, while potentially providing additional economic and policy benefits.[77]

77 Supra footnote 32.