Congressional Research Service
Informing the legislative debate since 1914

The Regional Greenhouse Gas Initiative: Lessons Learned and Issues for Congress

(name redacted)
Specialist in Environmental Policy

April 27, 2016

Congressional Research Service
7-....
www.crs.gov
R41836

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

The Regional Greenhouse Gas Initiative (RGGI) is the nation's first mandatory cap-and-trade program for greenhouse gas (GHG) emissions. RGGI involves nine states—Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The RGGI cap-and-trade system applies only to carbon dioxide (CO_2) emissions from electric power plants with capacities to generate 25 megawatts or more—approximately 168 facilities. The RGGI emissions cap took effect January 1, 2009, based on an agreement signed by RGGI governors in 2005.

The results of the RGGI program may be instructive to policymakers. Several of RGGI's design elements generated considerable interest during the development and debate of federal proposals to address GHG emissions. In particular, the program's emissions cap has received particular attention. When the original cap took effect in 2009, it did not compel regulated entities to make internal emission reductions or purchase emission credits from other sources. Several factors led to this outcome: RGGI's cap design, an economic downturn, and a substantial shift to less carbon intensive fuels. For instance, in 2005, RGGI states generated 33% of their electricity from coal and petroleum, sources of energy with relatively high carbon intensity. In 2015, these sources generated 8% of RGGI's electricity.

To address the disparity between the cap and actual emissions, RGGI states agreed (in 2013) to reduce the existing cap (by 45%) so that the cap level would match actual emissions. The revised cap took effect in January 2014. RGGI's new, more-binding cap may have vastly different effects than its predecessor. It is uncertain how this new development may impact electricity use and prices in the RGGI region and, in turn, the perception and support for the program.

Although actual emissions were ultimately well below the original emissions cap, the cap's existence attached a price to the regulated entities' CO_2 emissions. Because the cap level was above actual emissions, the allowance price acted like an emissions fee or carbon tax. Although the cap likely had limited *direct* impact on the region's power plant emissions, the revenues generated from the emission allowance sales likely had some impact on emission levels in the region.

Through 2015, RGGI states, as a group, have sold 91% of their emission allowances through quarterly auctions. The auction proceeds—over $2.4 billion to date—have provided a new source of revenue, which has been used to support various policy objectives. RGGI states (as a group) have contributed the vast majority of the emission allowance value to support energy efficiency, renewable energy, other climate-related efforts, or electricity consumer assistance. Several RGGI studies indicate that supporting energy efficiency provides multiple benefits: emission reduction, consumer savings via lower electricity bills, and job creation.

As a group, the total CO_2 emissions from the nine RGGI states account for approximately 7% of U.S. CO_2 emissions (and 16% of U.S. gross domestic product). RGGI's aggregate emissions rank in the top 20 among all nations. But from a practical standpoint, the RGGI program's contribution to *directly* reducing the global accumulation of GHG emissions in the atmosphere is arguably negligible. However, RGGI's activities may stimulate action in other states or at the federal level: When confronted with a growing patchwork of state/regional requirements, industry stakeholders may support a singular national policy. To that end, experiences in RGGI may be instructive for policymakers seeking to craft a national program.

Contents

Introduction ... 1
RGGI Overview ... 2
Emissions Cap ... 4
First Emissions Cap: 2009-2013 ... 4
RGGI Emissions and Electricity Generation ... 5
Impacts of the Original Emissions Cap ... 6
Revised Emissions Cap (2014-2020) ... 7
Emission Allowance Value Distribution ... 8
Allowance Auctions ... 8
Emissions Leakage ... 13
Offsets ... 14
Cost Containment ... 14
Interaction with Federal GHG Emission Regulations ... 15
Final Observations ... 16

Figures

Figure 1. Observed Emissions Compared to the Original Emission Cap ... 4
Figure 2. RGGI Emissions Compared with Electricity Sales ... 5
Figure 3. RGGI States Electricity Generation by Energy Source ... 6
Figure 4. Observed Emissions Compared to the Original and Revised Emission Cap ... 8
Figure 5. RGGI Auctions Proceeds and Clearing Prices ... 10

Tables

Table 1. Estimated Allocation of Auction Revenues by Category ($ millions) ... 12
Table 2. Top-Ranked Nations and U.S. States for CO_2 Emissions from Energy Consumption (2012 Data) ... 16

Contacts

Author Contact Information ... 17

Introduction

A number of states and local governments have taken actions to address greenhouse gas (GHG) emissions. These efforts cover a wide spectrum, from developing climate action plans to setting mandatory GHG emission standards.[1] One of the most significant climate change developments at the state level is the Regional Greenhouse Gas Initiative (RGGI, pronounced "Reggie"), which is based on an agreement signed by RGGI governors in 2005.[2] RGGI is the nation's first mandatory cap-and-trade program for GHG emissions, which went into effect January 1, 2009 (see text box, "What Is a Cap-and-Trade System?").[3] RGGI currently involves nine states—Connecticut, Delaware, Maine, Maryland,[4] Massachusetts,[5] New Hampshire, New York, Rhode Island, and Vermont.[6]

Several of RGGI's design elements generated considerable interest during the development and debate of federal proposals to address GHG emissions. The initial results of the RGGI program may be instructive to policymakers, because RGGI may serve as a possible test case for a federal cap-and-trade program, providing insights into implementation complexities, the mechanics of various design elements, and lessons of potential design pitfalls.

The first section of this report provides an overview of the RGGI cap-and-trade program and the participating RGGI states. The subsequent sections discuss selected issues raised by RGGI that may be of interest to Congress. The final section provides some final observations that may be instructive to policymakers.

[1] For example, California is implementing regulations that address GHG emissions on multiple fronts, including a cap-and-trade program that began in January 2013. For more information on the California cap-and-trade program, see the California Environmental Protection Agency and Air Resources Board website at http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm.

[2] Seven states signed the Memorandum of Understanding (MOU) in 2005: Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont.

[3] Prior to the starting date of the emissions cap (January 1, 2009), RGGI held its first emission allowance auction on September 25, 2008.

[4] Maryland Governor Martin O'Malley signed RGGI's MOU on April 20, 2007, making Maryland the first state that was not an original RGGI participant to join the regional initiative.

[5] Massachusetts and Rhode Island were involved in RGGI's development from the beginning. However, both states' governors declined to sign the MOU in 2005. Massachusetts (different governor) and Rhode Island (same governor) joined RGGI as participants in January 2007.

[6] New Jersey participated in the program from 2009 through the end of 2011. For information on New Jersey's withdrawal from RGGI, see http://rggi.org/design/history/njparticipation.

What Is a Cap-and-Trade System?

A GHG cap-and-trade system creates an overall limit (i.e., a cap) on GHG emissions from the emission sources covered by the program. Cap-and-trade programs can vary by the sources covered. The covered sources, also referred to as covered or regulated entities, often include major emitting sectors (e.g., power plants and carbon-intensive industries), fuel producers/processors (e.g., coal mines or petroleum refineries), or some combination of both.

The emissions cap is partitioned into emission allowances. Typically, in a GHG cap-and-trade system, one emission allowance represents the authority to emit one (metric) ton of carbon dioxide-equivalent (tCO_2-e). This term of measure is used because GHGs vary by global warming potential (GWP)—an index of how much a GHG may contribute to global warming over a period of time, typically 100 years. GWPs are used to compare gases to CO_2, which has a GWP of 1. For example, methane's GWP is estimated between 28 and 36, because a ton of methane is 28-36 times more potent than 1 ton of CO_2 over a 100-year period.[7]

Under an emissions cap, covered entities with relatively low emission-reduction costs have a financial incentive to make reductions beyond what is required, because these further reductions could be sold (i.e., traded) as emission credits to entities that face higher costs to reduce their facility emissions. At the end of each established compliance period (e.g., a calendar year or multiple years), covered sources surrender emission allowances to an implementing agency to cover the number of tons emitted. If a source did not provide enough allowances to cover its emissions, the source would be subject to penalties. Other mechanisms, such as banking or offsets, may be included to increase the flexibility of the program.

The emissions cap creates a new currency—the emission allowance. Policymakers may decide to distribute the emission allowances to covered entities at no cost (based on, for example, previous years' emissions), sell the allowances (e.g., through an auction), or use some combination of these strategies. The distribution of emission allowance value is typically a source of significant debate during a cap-and-trade program's development.

A cap-and-trade program is one policy tool for reducing GHG emissions. It is often described as a market-based mechanism because, like an emissions fee or carbon tax, it allows the marketplace to determine the economically efficient solution for GHG emission reduction. Compared to more traditional approaches—for example, requiring specific performance standards or technologies at particular facilities—market-based mechanisms are generally considered more cost effective. Perhaps the most successful market-based program in the environmental policy arena is the sulfur dioxide emissions trading system (known as the Acid Rain Program) established by the 1990 amendments to the Clean Air Act.

RGGI Overview

RGGI is a sector-specific cap-and-trade system that applies to CO_2 emissions from electric power plants[8] with capacities to generate 25 megawatts or more[9]—163 facilities in the nine RGGI states.[10] RGGI's history began with discussions and meetings that date back to at least 2003. These activities eventually led to a 2005 Memorandum of Understanding (MOU)[11] that outlined

[7] For more details, see the Environmental Protection Agency's (EPA) website at http://www.epa.gov/climatechange/ghgemissions/gwps.html.

[8] CO_2 emissions account for approximately 99% of all GHG emissions from power plants. In 2013, emissions from the electricity power sector accounted for 31% of all U.S. GHG emissions. EPA, 20*15 U.S. Greenhouse Gas Inventory Report*, April 2015.

[9] Electricity generating units that consume on-site more than 10% of the electricity they generate (on an annual basis) are not subject to the emissions cap. This provision applies to facilities that may generate electricity for their own use (e.g., some refineries).

[10] For more details, see RGGI's website at http://www.rggi.org/design/overview/regulated_sources.

[11] Seven states signed the MOU in 2005: Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont.

the basic framework of the program.[12] In 2008, the RGGI states issued a model rule of cap-and-trade regulations that participating states could use to establish and implement their programs.[13]

RGGI designers expected the initial program to be a foundation for emissions trading and possibly expanded in future years by covering other emission sources/sectors, GHGs, or states. The CO_2 emissions from covered entities in the RGGI states account for approximately 20% of all GHG emissions in the RGGI states.[14] The vast majority of the remaining GHG emissions come from fossil fuel combustion in the industrial, commercial, residential, and transportation sectors.

RGGI's cap-and-trade program includes many of the design elements that were proposed and debated in federal legislative proposals. Highlights include the following:

- **Three-year compliance periods.** At the end of a compliance period, covered entities submit one emission allowance for each ton of CO_2 emissions generated. A three-year compliance period should mitigate potential emission allowance price swings brought on by short-term market volatility.
- **Emission allowance banking.** RGGI allows covered entities to bank an unlimited number of emission allowances for future use. The opportunity to bank emission allowances instills a substantial amount of flexibility into a trading program, effectively making annual emissions caps flexible over time, and reduces the absolute cost of compliance.
- **Emission allowance auctions.** With some variance among the states, particularly in the early years, a substantial percentage (91%) of emission allowances have been distributed through quarterly auctions (discussed below). The auctions include a reserve price, which sets a price floor for emission allowances.
- **Consumer benefit allocation.** RGGI states agreed that at least 25% of the emission allowance value would be distributed "for a consumer benefit or strategic energy purpose."[15] Allowance value distributions from RGGI states have exceeded this minimum requirement (discussed below).
- **Cost containment.** In 2014, RGGI states established a "cost containment reserve" (CCR),[16] which provides additional allowances to be sold at auction if certain price thresholds are met.
- **Offsets use.** An offset is a measurable reduction, avoidance, or sequestration of GHG emissions from a source not covered by an emission reduction program. To a limited degree (discussed below), covered entities may submit offsets in lieu of the emission allowances needed to satisfy compliance obligations.

---

[12] For details of the MOU development, see this RGGI website: http://www.rggi.org/design/history/mou.

[13] For details of the model rule's development, see this RGGI website: http://www.rggi.org/design/history/model_rule.

[14] Based on 2012 CO_2 emissions data from RGGI (http://rggi.org/), excluding emissions from New Jersey, and 2012 GHG data from the World Resources Institute, Climate Analysis Indicators Tool (CAIT US), at http://cait2.wri.org.

[15] RGGI MOU, Section 2 (G)(1), December 5, 2005. Subsequent amendments were made to the MOU but not to this section.

[16] The CCR replaced other cost containment mechanisms: Initially, RGGI provided an additional year to demonstrate compliance if emission allowance prices reach a certain level, and covered entities were able to cover a greater proportion of their emissions with offsets.

Emissions Cap

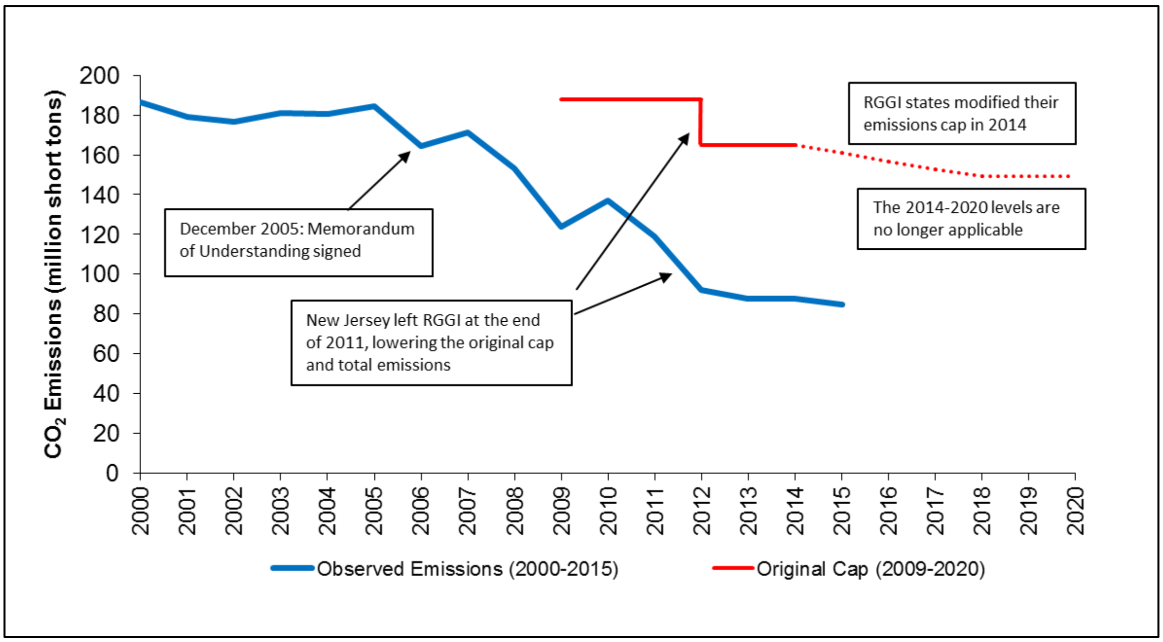
Although RGGI is one of the more aggressive state programs addressing GHG emissions, the program's first emission cap exceeded actual emissions since its inception in 2009. As discussed below, this result was unintentional. The first cap never *compelled* regulated entities to make internal emission reductions or purchase emission credits (or offsets).

After a program review in 2012, RGGI states agreed to lower the emissions cap by 45%. This change took effect in January 2014. This section includes a discussion of both the initial emissions cap and the revised emissions cap.

First Emissions Cap: 2009-2013

The initial objective of the first emissions cap was to stabilize CO_2 emissions for several years (2009-2014) at the expected 2009 levels (based on assumptions made in 2005) and then require gradual reductions, achieving a 10% decrease from the 2009 emission cap level by 2019. During the emissions cap construction in 2005,[17] RGGI designers set the 2009 emissions cap about 4% above the average emission levels observed between 2000 and 2002. RGGI designers anticipated that power plant CO_2 emissions would gradually increase so that actual levels would approximately match the cap set for 2009—188 million short tons of CO_2 ($mtCO_2$). As illustrated in **Figure 1**, actual emissions did not meet these projections but decreased substantially.

Figure 1. Observed Emissions Compared to the Original Emission Cap



Source: Prepared by CRS; observed state emission data (2000-2013) provided by RGGI at http://www.rggi.org.

[17] States from the Northeast and Mid-Atlantic regions began to discuss a cooperative effort to reduce carbon dioxide emissions in 2003. Subsequent meetings and workshops culminated in a MOU that was signed by most RGGI state governors in December 2005.

RGGI Emissions and Electricity Generation

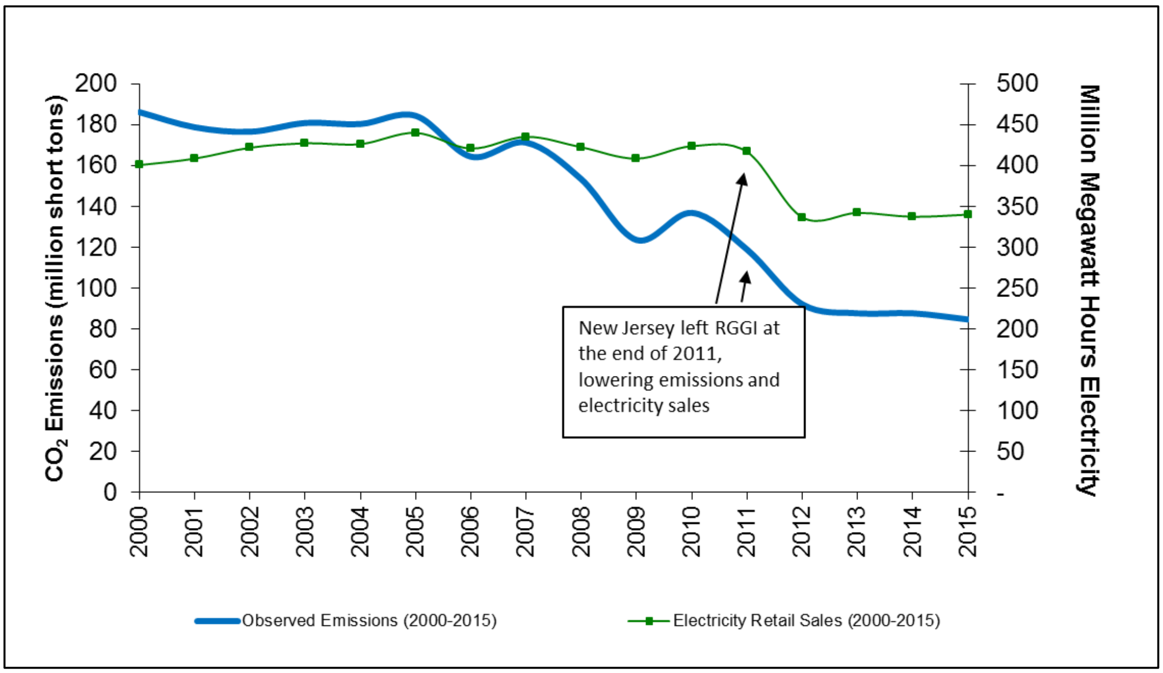
Several studies indicated that the RGGI CO_2 emission decreases were due (to some degree) to long-term structural changes, such as changes in RGGI's electricity generation portfolio and energy efficiency improvements.[18] A comparison between the emission decline and electricity use in the RGGI states supports this notion.

As **Figure 2** indicates, RGGI electricity retail sales (a proxy for electricity use) decreased by 5% between 2005 and 2011, while CO_2 emissions from in-state electricity generation decreased by 36% during the same period. This disparity suggests that factors other than temporal economic conditions were the primary influence for the CO_2 emissions decrease.[19]

A comparison of more recent years indicates that, between 2012 and 2015, CO_2 emissions from in-state electricity generation decreased by 8%, while electricity sales increased by 1%.

Figure 2. RGGI Emissions Compared with Electricity Sales

2000 - 2015



Source: Prepared by CRS; observed state emission data (2000-2015) provided by RGGI at http://www.rggi.org; electricity sales from Energy Information Administration.

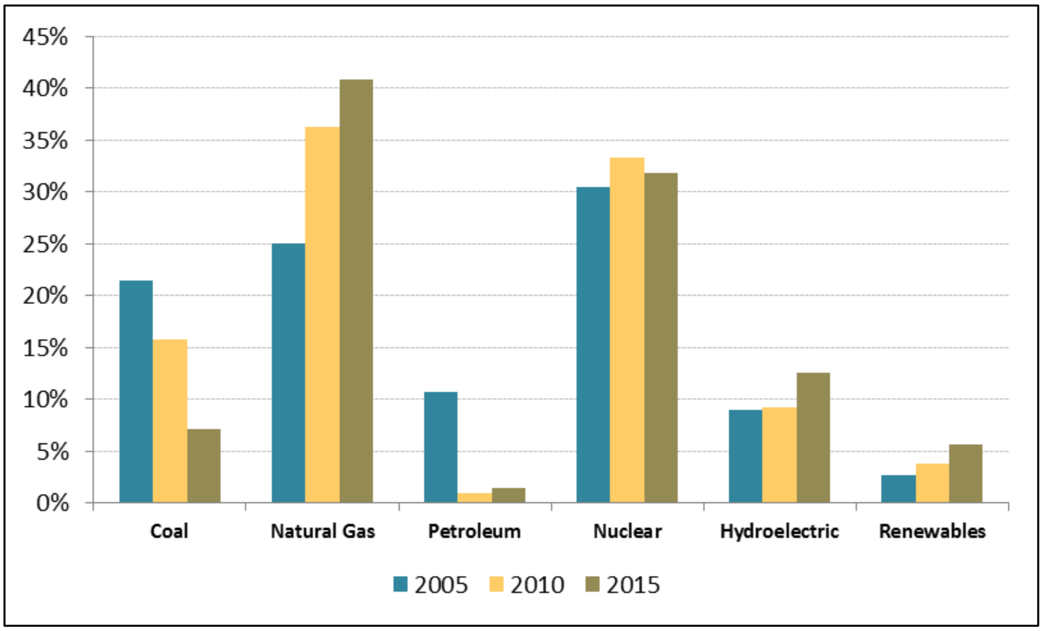
Figure 3 compares RGGI's electricity generation portfolio between 2005, 2010, and 2015. The figure depicts a substantial decline in carbon-intensive electricity generation, particularly coal, over that time frame. Electricity is generated from a variety of energy sources, which vary

[18] See RGGI modeling results and analysis at http://www.rggi.org/design/program_review/materials-by-topic/modeling; Environment Northeast, *RGGI's Past and Future: Emissions Trends and Potential Reforms*, 2012. Prior analyses include New York State Energy Research and Development Authority, *Relative Effects of Various Factors on RGGI Electricity Sector CO2 Emissions: 2009 Compared to 2005*, November 2010; and Environment Northeast, *RGGI Emissions Trends*, June 2010.

[19] A comparison using the most recent data (i.e., 2005 vs. 2013) is more complicated because New Jersey left RGGI at the end of 2011. Regardless, such a comparison indicates a similar trend: Electricity sales decreased by 24%, while emissions decreased by 53%.

significantly by their ratio of CO_2 emissions per unit of energy. For example, a coal-fired power plant emits almost twice as much CO_2 (per unit of energy) as a natural-gas-fired facility.[20] Some energy sources (e.g., hydropower, nuclear, wind, or solar) are generally considered to be zero-emission sources. In 2005, RGGI states generated 33% of their electricity from coal and petroleum, sources of energy with relatively high carbon intensity. In 2015, these sources generated 8% of RGGI's electricity. During that time, sources with relatively lower (or zero) carbon intensities—natural gas, nuclear, and renewables—increased their contributions to RGGI's electricity portfolio. In particular, electricity generation from natural gas increased from 25% to 41% over that time frame.

Figure 3. RGGI States Electricity Generation by Energy Source



Source: Prepared by CRS; data from Energy Information Administration, "Net Generation for Electric Power."

Notes: Renewables include wind, solar, geothermal, and biomass sources. Some sources, including other gases and waste heat, are not included in the above figure, but these account for less than 1% of electricity generation. New Jersey's generation is included in 2005 and 2010 but not 2015.

Impacts of the Original Emissions Cap

Although RGGI's original emission cap did not *directly* require emission reductions (due to unexpected emission levels, discussed above), the cap, and the overall RGGI program, still had impacts. First, the cap's existence attached a price to the regulated entities' CO_2 emissions. The price was relatively low (as discussed below), because of the abundance of emission allowances.

Second, the cap's emission allowances were a new form of currency. The emission allowance value can be used to support various policy objectives, including (as is the case with RGGI) energy efficiency and renewable energy investments. Some would argue that RGGI's greatest

[20] The Energy Information Administration website provides a table listing the amount of CO_2 generated per unit of energy for different energy sources at http://www.eia.doe.gov/oiaf/1605/coefficients.html. For more details, see CRS Report R44090, *Life-Cycle Greenhouse Gas Assessment of Coal and Natural Gas in the Power Sector*, by (name redac ted) .

impact, particularly under the original emission cap, was to provide a relatively reliable funding source for such efforts.

A 2010 analysis of the RGGI program found that the emission allowance price accounted for approximately 3.4% of the change in the price difference between natural gas and coal in the RGGI region between 2005 and 2009.[21] Another study found that the RGGI program as a whole (i.e., the allowance price, distribution of allowance value, and related complementary effects) was the dominant factor in the emissions decrease.[22]

In addition, several RGGI studies indicate that supporting energy efficiency provides multiple benefits: emission reduction, consumer savings via lower electricity bills, and regional job creation.[23] One of these studies argues this allowance value distribution strategy (e.g., use of RGGI auction revenue) "creates wider benefit than any other use of allowance value."[24] As discussed below, such efforts play a role in determining the effectiveness of the program.

Revised Emissions Cap (2014-2020)

Following a 2012 design review of the RGGI program,[25] the RGGI states amended the RGGI model rule (in February 2013) to substantially reduce the emissions cap from 165 mtCO_2 to 91 mtCO_2. RGGI designers based the new cap level on their projection of 2012 emissions. The emission projection turned out to be fairly accurate, as actual 2012 emissions were 92 mtCO_2.

The revised cap took effect in January 2014. The emissions cap will decrease each year by 2.5% between 2015 and 2020. RGGI states have not established a cap beyond 2020.

In addition, RGGI states decided to adjust the new cap further to account for the substantial amount of banked emission allowances held by RGGI entities between 2009 and 2013.[26] In 2014, RGGI designers determined that these banked emissions accounted for 140 mtCO_2, a considerable amount when compared to the 91 mtCO_2 emission cap of 2014. Thus, the cap adjustments, which are applied each year between 2014 and 2020, are considerable. In some years, the adjustments lower the cap more than 20 mtCO_2, equating to 28% decrease.

As **Figure 4** illustrates (1) the observed emissions between 2000 and 2015; (2) the original emissions cap (2009-2020); and (3) the revised emissions cap (2014-2020), which includes the 2014 adjustments. The figure suggests that the revised (and adjusted) emissions cap will likely have a different impact on the RGGI states than the original emissions cap. For example, the more stringent cap has led to substantially higher emission allowance prices, as discussed below.

As mentioned above, RGGI entities banked a considerable number of emission allowances during the original emissions cap. This allows for the 2015 emissions to be higher than the revised emissions cap, as illustrated in **Figure 4**.

---

[21] New York State Energy Research and Development Authority, *Relative Effects*.

[22] Brian C. Murray and Peter T. Maniloff, "What Have Greenhouse Emissions in RGGI States Declined?" *Energy Economics*, September 2015.

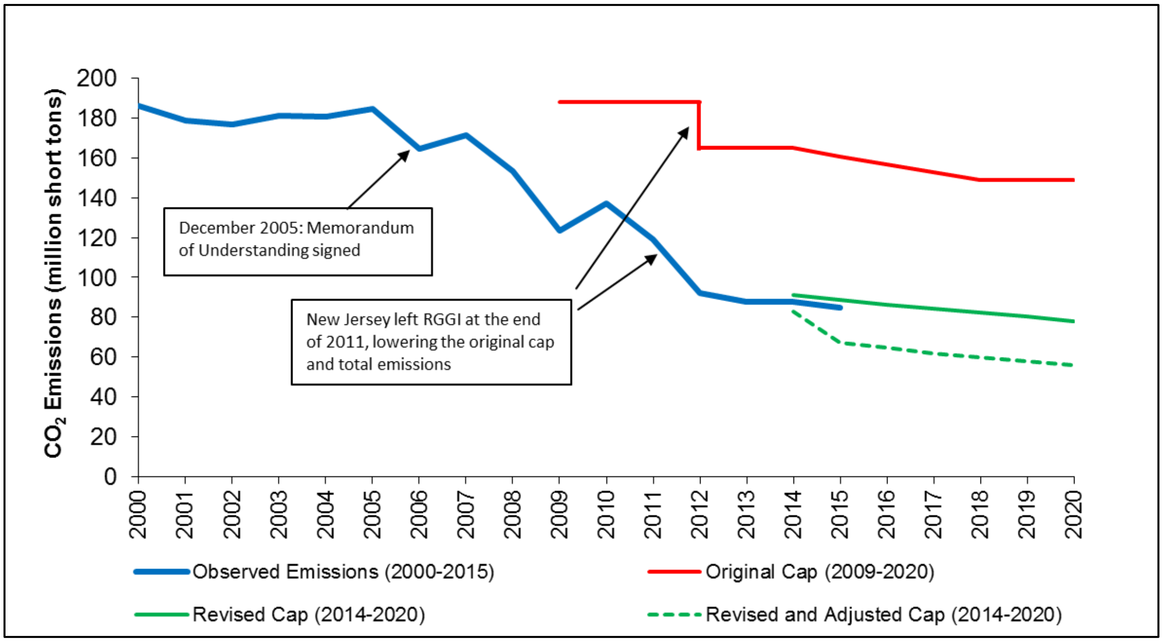
[23] See RGGI, *Investment of Proceeds from RGGI CO_2 Allowances*, February 2011; and Environment Northeast, *Economy-Wide Benefits of RGGI: Economic Growth through Energy Efficiency*, March 2011.

[24] Environment Northeast, *Economy-Wide Benefits*.

[25] In its original MOU (December 20, 2005), RGGI states agreed to conduct a "comprehensive review" of the RGGI program in 2012.

[26] Between 2009 and 2013, the emissions cap exceeded actual emissions, providing an opportunity for entities to obtain more allowances than they need to meet current compliance obligations. These allowances can be purchased and held (i.e., banked) for future use.

Figure 4. Observed Emissions Compared to the Original and Revised Emission Cap



Source: Prepared by CRS; observed state emission data (2000-2015) provided by RGGI at http://www.rggi.org and revised emission cap data from RGGI at http://www.rggi.org/design/overview/cap.

Notes: RGGI entities banked a considerable number of emission allowances during the original emissions cap (2009-2013). This allows for the 2015 emissions to be higher than the revised emissions cap.

Emission Allowance Value Distribution

One of the more controversial and challenging questions for policymakers when designing a cap-and-trade program is how, to whom, and for what purpose to distribute the emission allowances. In general, RGGI states have answered the "how" question by employing auctions to distribute the vast majority of allowances.[27] Perhaps the more important question for policymakers is what to do with the emission allowance value: In the case of RGGI, allowance value predominately means auction revenues.

Allowance value includes revenues generated through allowance auctions or by giving the allowances away at no charge to either covered or noncovered entities. A covered entity recipient could use the allowances for compliance purposes, sell the allowances in the marketplace, or bank the allowances for future use. To realize the value of allowances received, a noncovered entity recipient would need to sell the allowances in the marketplace, either through a broker or directly to a covered entity.

Allowance Auctions

As a group, the RGGI states have offered 91% of their budgeted emission allowances at auction between 2008 and 2015. Some of the offered allowances were not sold and were subsequently

[27] The percentage of allowances sold at auction has varied by state, particularly in the early years when some states chose to provide a proportion of free allowances to covered entities.

retired. Other allowances were sold at fixed prices or distributed to various entities to support a variety of objectives.[28]

RGGI's auctions may be of particular interest to Congress, because this approach was part of several proposed cap-and-trade systems from former Congresses. Each RGGI auction is conducted in one round with a sealed-bid, uniform price format.[29] Participants may submit multiple, confidential bids for a certain number of allowances at a specific price. The price paid by all bidders is the highest rejected bid (i.e., the second-highest bid). For example, consider a hypothetical auction in which the supply of allowances is 20 units. The highest bidder offers $10 per allowance for 15 allowances. The second highest bidder offered $9 per allowance for 10 allowances. Under RGGI's auction structure, the highest bidder would receive 15 allowances at $9 per allowance, and the second-highest bidder would receive 5 allowances at $9 per allowance. The price paid by all successful bidders is known as the clearing price.

In addition, RGGI auctions include a reserve price, below which the seller refuses to part with the item for sale (i.e., emission allowance). The reserve price started at $1.86 in 2008, increasing to $2.10 in 2016.[30] In a large volume, multi-unit auction that is expected to have substantial participation (i.e., high demand for emission allowances), a reserve price would all but guarantee a revenue stream. A reserve price may address certain logistical concerns, such as bidder collusion, that may be associated with auctions. In addition, a reserve price may provide assurance to parties making emission reductions that the reductions will have a minimal value in the allowance market.

The RGGI program has held 31 auctions as of the date of this report. In general, many have viewed the auctions as successful in terms of price discovery,[31] transparency, transaction costs, and other logistical issues.

Another typical measure of auction success is revenue generation. After 31 auctions, the cumulative proceeds total over $2.4 billion (including proceeds from New Jersey's allowances and proceeds from the cost containment reserve).

Figure 5 illustrates the auctions' results. As the figure indicates, the clearing price equaled the reserve price in auctions conducted between June 2010 and December 2012, reflecting the abundance of emission allowances in the market. Moreover, during this time period, approximately 40% of the allowances offered for sale were not purchased. RGGI states retired the vast majority of these unsold allowances.[32] During this period, the reserve price ($1.86-$1.93 per ton) acted like an emissions fee or carbon tax.[33]

However, in 2013, the auction results changed dramatically, most likely reflecting upcoming changes in the RGGI program. Following the February 2013 proposal to substantially reduce the emissions cap in 2014, the clearing prices began to exceed the reserve prices (**Figure 5**). The past

---

[28] See RGGI, "Allowance Allocation," http://rggi.org/market/tracking/allowance-allocation.

[29] For information on other auction formats, see Charles Holt et al., *Auction Design for Selling CO2 Emission Allowances Under the Regional Greenhouse Gas Initiative*, 2007, prepared for RGGI Working Group staff.

[30] RGGI states decided to increase the reserve price by 2.5% each year after 2014.

[31] In a cost-effective emissions trading program, the allowance price should mirror (or closely follow) the marginal cost of emission reduction—that is, the cost of reducing the last, most expensive ton. An effective auction should help identify the allowance price that is near to the marginal cost of reduction. See, for example, Holt et al., *Auction Design*.

[32] See RGGI allowance allocation data at http://www.rggi.org/market/co2_auctions/allowance_allocation.

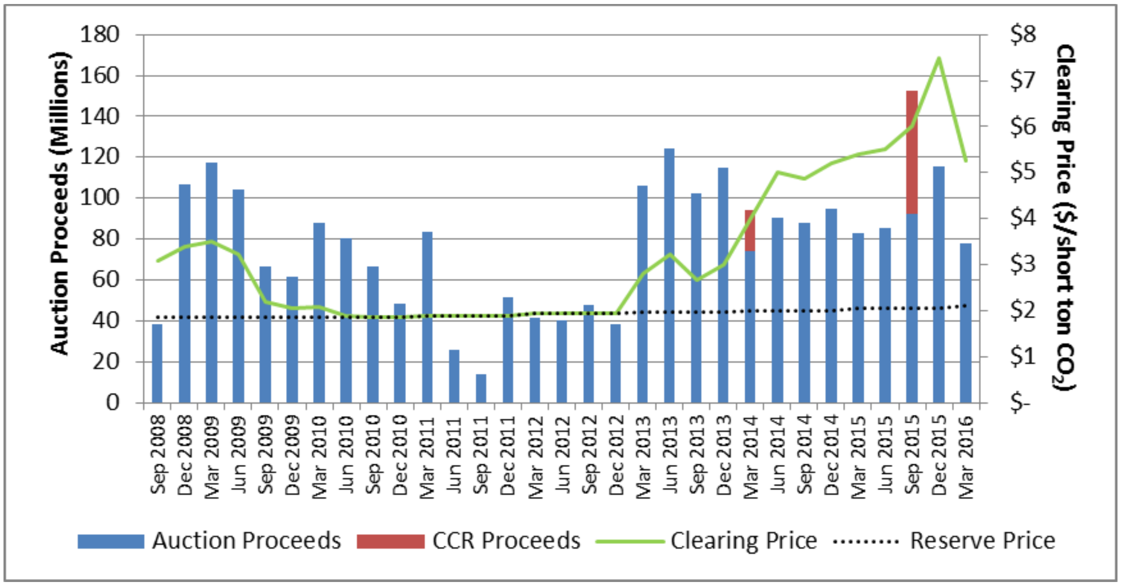
[33] See CRS Report R42731, *Carbon Tax: Deficit Reduction and Other Considerations*, by (name redacted), (name redacted), and (name redacted) .

three auctions have resulted in clearing prices over $5 per ton, a dramatic increase from prices in 2012. The clearing price in the December 2015 reached $7.50, an almost four-fold increase compared to 2012 prices. However, the clearing price in the March 2016 auction dropped to $5.25.

The figure also indicates the proceeds generated from the cost containment reserve (CCR) allowances. The CCR was added to RGGI in 2014 and is discussed below (see "Cost Containment" section).

Figure 5. RGGI Auctions Proceeds and Clearing Prices

2008 - 2016



Source: Prepared by CRS; data from RGGI at http://www.rggi.org/.

Note: The reserve price has risen from $1.86 in 2008 to $2.10 in 2016.

When deciding to whom or for what purpose to distribute the emission allowance value, policymakers face trade-offs that could have considerable consequences.[34] In both RGGI's 2005 MOU and subsequent model rule,[35] states agreed that at least 25% of emission allowance value would be allocated for a "consumer benefit or strategic energy purpose."[36] The RGGI states (as a group) have more than doubled this commitment.

Table 1 provides estimates of auction revenue distribution by state from 2008 to 2013. As mentioned above, RGGI auction revenues have accounted for approximately 91% of the emission allowance value created by the emissions cap. As the table indicates, RGGI states allocated approximately 67% of the auction revenues to energy efficiency, GHG abatement, renewable energy activities, and electricity bill assistance. At the time these estimates were collected, an additional 19% of auction revenue remained to be invested. Some portion of this value will likely be used to support similar objectives.

[34] For more discussion of these issues, see CRS Report RL34502, *Emission Allowance Allocation in a Cap-and-Trade Program: Options and Considerations*, by (name redacted) .

[35] RGGI documents are available at http://www.rggi.org/.

[36] See RGGI model rule, issued August 15, 2006, p. 42; and RGGI MOU, Section G(1), signed by participating state governors December 20, 2005.

The values in the table also demonstrate that allowance value distribution decisions are subject to change. For example, after initially allotting auction proceeds to energy efficiency efforts, several states (New Jersey and New York) transferred auction proceeds to address state budget deficits. Environmental groups criticized the actions of these states, but the state policymakers argued that the transfers were necessary.

These developments highlight a cap-and-trade design issue for federal policymakers: How much flexibility (if any) should be built into a strategy to distribute emission allowance value? For example, should crafters include provisions that authorize modifying (without legislation) an enacted distribution approach, perhaps based on specific criteria?

Table 1. Estimated Allocation of Auction Revenues by Category ($ millions)

2008 - 2013

State	Energy Efficiency	Direct Bill Assistance	GHG Abatement	Clean and Renewable Energy	Administration	RGGI, Inc.	State Budget Deficit Reduction	Committed to 2014 and Future Programs	Total
Connecticut	61			17	7	1		14	99
Delaware	13	2	2	2	2	<1		24	46
Maine	27				1	<1		14	41
Maryland	59	139	9	14	9	2		42	277
Massachusetts	230		12		5	1		6	253
New Hampshire	40	10			2	1	3	8	62
New Jersey (2008-2011)	44		10		5		65		125
New York	183		65	52	20	7	90	167	583
Rhode Island	11				1	<1		13	25
Vermont	11				<1	<1		<1	12
Total	679	151	98	85	52	12	158	288	1,523

Source: Prepared by CRS; data from RGGI, *Investment of RGGI Proceeds Through 2013*, April 2015, http://www.rggi.org/docs/ProceedsReport/Investment-RGGI-Proceeds-Through-2013.pdf; New Jersey data from Environment Northeast, *RGGI Auction Tracker: State Allocations and Spending Plans*, June 2013. New Jersey left RGGI at the end of 2011.

Notes: The above estimates are based on percentages in the RGGI document multiplied by the total proceeds for each state (and rounded to the nearest million). Due to rounding, the combined estimated totals for each category may not match the total amount provided in the RGGI document. The category names come from the RGGI document.

Emissions Leakage

A critical design detail—electricity imports from non-RGGI states—remains unresolved, presenting an opportunity for "emissions leakage." Emissions leakage could undermine the effectiveness of the RGGI program. Leakage can occur when an emissions reduction program does not include all sources contributing to the environmental problem. Increases in emissions from uncovered sources may reduce emission achievements from covered sources. This is a concern with the RGGI program, because the RGGI regime does not regulate emissions from electricity generated outside the region (e.g., in Pennsylvania) and then used within the region (i.e., "imported electricity").

Emissions leakage could occur if imported electricity replaces RGGI in-state electricity generation, because emissions from in-state electricity are covered under the cap; emissions from imported electricity are not. In such a scenario, the quantity of leakage would depend on the sources of electricity generation involved in the tradeoff. For example, maximum leakage would occur if imported electricity from a coal-fired power plant replaced in-state electricity generated from a zero-emission source.

RGGI states have been monitoring electricity generation and CO_2 emission levels from both RGGI and non-RGGI sources[37] since the emissions cap took effect in 2009. In RGGI's most recent monitoring report (August 2015),[38] the authors compared activity between 2011 and 2013 to a pre-RGGI baseline period (2006 through 2008). The report found that electricity generation from all non-RGGI sources increased by about 9%, due largely to a 30% increase in imported electricity. However, the report also found that the CO_2 emission levels from non-RGGI sources decreased by 0.5%. This is likely related to (1) RGGI state increases in electricity generation from hydropower and renewable sources (**Figure 3**) and (2) increases of imported electricity from hydropower, primarily from Quebec.[39]

After its 2012 program review, RGGI participants stated:

> [T]he states commit, over the course of the next year, to engage in a collaborative effort ... to identify and evaluate potential imports tracking tools, conduct further modeling to ascertain energy and price implications of any potential policy on emissions associated with imported electricity, and pursue additional legal research necessary, leading to a workable, practicable, and legal mechanism to address emissions associated with imported electricity.[40]

Emissions leakage will likely remain a topic of discussion going forward, particularly with the onset of the revised emissions cap in 2014 and recent increased emission allowance prices.

---

[37] Electricity from non-RGGI sources includes fossil-fuel-fired and non-fossil-fuel-fired generation in RGGI states, as well as imported electricity.

[38] RGGI, CO_2 Emissions from Electricity Generation and Imports in the Regional Greenhouse Gas Initiative: 2013 Monitoring Report, August 2015, http://www.rggi.org/documents.

[39] See EIA, "New England Relying More on Natural Gas Along with Hydroelectric Imports from Canada," 2014, https://www.eia.gov/todayinenergy/detail.cfm?id=17671.

[40] RGGI, *RGGI 2012 Program Review: Summary of Recommendations to Accompany Model Rule Amendments*, February 2013, http://www.rggi.org/design/program-review.

Offsets

Federal policymakers may be interested in RGGI's treatment of offsets. An offset is a measurable reduction, avoidance, or sequestration of GHG emissions from a source not covered by an emission reduction program.[41] RGGI limits offsets to 3.3% of a source's allowance submission, a relatively low percentage compared to California's cap-and-trade system[42] and some federal proposals.[43] Under RGGI's original model rule (2009-2013), the offset ceiling percentage could increase to 5% or 10% if the market price of an allowance exceeds $7 or $10 (in 2005 dollars, adjusted annually), respectively. However, as part of the design review in February 2013, RGGI states replaced this provision with the new Cost Containment Reserve, discussed below.

RGGI uses a standards approach—as opposed to performance-based system—for developing offsets: A project must satisfy a set of detailed requirements (specific to a project type) and be certified by a third party. In contrast to recent federal proposals, which often allow a wide array of project types, RGGI limits offset projects to five types, which must be located in RGGI states:

1. Landfill methane reduction;
2. Sulfur hexafluoride reductions from specific industrial activities;
3. Forest sequestration projects,[44] including afforestation,[45] reforestation,[46] improved forest management, and avoided forest conversion;
4. Specific energy efficiency projects; and
5. Avoided methane from manure management practices.

Some offset projects raise concerns, because they may not represent real emission reductions. For offsets to be credible, a ton of CO_2-equivalent emissions from an offset project should equate to a ton reduced from a RGGI power plant. If illegitimate offset credits flow into an emissions trading program, the program would fail to achieve its primary goal—emission reduction.

Regardless, according to the RGGI offsets tracking database, no offset projects have been developed under the RGGI program.[47]

Cost Containment

As part of the 2012 design review, RGGI states decided to alter the cost containment provisions in the RGGI program. Under the original model rule (2009-2013), potential cost concerns were addressed by allowing for the use of additional offsets if emission allowance prices reached

[41] If allowed as a compliance option in a cap-and-trade system, offsets have the potential to provide considerable cost savings and other benefits. However, offsets have generated considerable controversy, primarily over the concern that illegitimate offsets could undermine the ultimate objective of a cap-and-trade program: emission reduction. For more discussion see CRS Report RL34436, *The Role of Offsets in a Greenhouse Gas Emissions Cap-and-Trade Program: Potential Benefits and Concerns*, by (name redacted) .

[42] California's cap-and-trade program allows entities to use offsets to cover up to 8% of their allowance submission. (See §95854 of California's cap-and-trade regulations at http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm.)

[43] For example, H.R. 2454 ("Waxman-Markey") in the 111th Congress would have allowed offsets to satisfy 27% of a facility's compliance obligation in 2016.

[44] Under the original model rule, only afforestation projects were allowable.

[45] In general, this activity refers to planting trees where none were previously growing.

[46] In general, this activity refers to planting trees on former forest sites that were recently cleared.

[47] See RGGI's website at http://www.rggi.org.

specific levels. The revised model rule, which took effect in 2014, eliminated this approach and added a cost containment reserve (CCR) to the cap-and-trade system. The CCR provides additional allowances—5 million in 2014 and 10 million each year thereafter—if certain price thresholds are met during one of the quarterly allowance auctions:

- $4 per ton in 2014;
- $6 per ton in 2015;
- $8 per ton in 2016; and
- $10 per ton in 2017, increasing 2.5% each year thereafter.

The CCR was triggered in 2014 and 2015 (**Figure 5**), allowing for the sale of 5 million and 10 million additional allowances, respectively. In each instance, all of the additional allowances were purchased. Unlike some allowance reserve systems in other programs and proposals,[48] allowances from CCR are not borrowed from future years, thus effectively increasing the cap if triggered.

Interaction with Federal GHG Emission Regulations

An issue for both federal and state policymakers is how RGGI's emission program would interact with the Clean Power Plan, the Environmental Protection Agency's (EPA's) regulations that apply to existing power plants. The rule establishes CO_2 emission guidelines for states to use when developing plans that address CO_2 emissions from existing fossil-fuel-fired electric generating units.[49] The final rule appeared in the *Federal Register* on October 23, 2015.[50]

On February 9, 2016, the Supreme Court stayed the rule for the duration of the litigation. The rule therefore currently lacks enforceability or legal effect, and if the rule is ultimately upheld, at least some of the deadlines would have to be delayed.

EPA's Clean Power Plan allows states considerable flexibility in meeting their CO_2 emission rates or emission targets. For example, states can establish new programs to meet their goals or use existing programs and regulations. Moreover, states can meet their goals individually or collaborate with other states to create (or use existing) multistate plans.

It is uncertain whether the scope and stringency of the RGGI program would be sufficient to meet the targets in EPA's final rule. RGGI's existing emission cap stops at 2020; the Clean Power Plan's requirements begin in 2022 and continue through 2030. Second, the new CCR has the potential to provide up to 10 million tons of additional allowances each year, making an analysis more challenging.

[48] For example, H.R. 2454 ("Waxman-Markey") in the 111^{th} Congress included a "strategic reserve" of allowances borrowed from future years. The reserve would be triggered at particular price points. California's cap-and-trade system has a similar mechanism. More information is available at http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm.

[49] For more background on the statutory authority, history, and legal and administrative processes involving this rulemaking, see CRS Report R44341, *EPA's Clean Power Plan for Existing Power Plants: Frequently Asked Questions*, by (name redacted) et al.

[50] EPA, "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units," Final Rule, 80 *Federal Register* 64661, October 23, 2015.

Final Observations

The nature of the RGGI program changed significantly in 2014. Comparing the first five years of RGGI (2009-2013) to the existing program is an apples-to-oranges exercise. The RGGI states significantly altered their emissions cap in 2014, and this new cap may have vastly different effects than the original emissions cap. Note, for example, the most recent emission allowance auction clearing prices cited above. It is uncertain how this new development may impact electricity use and prices in the RGGI region and, in turn, the perception and support for the program.

As a group, the nine RGGI states account for approximately 7% of U.S. CO_2 emissions from energy consumption and 16% of the U.S. gross domestic product (GDP).[51] **Table 2** indicates that RGGI's aggregate CO_2 emissions from energy consumption rank in the top 20 among nations. But from a practical standpoint, the RGGI program's contribution to directly reducing the global accumulation of GHG emissions in the atmosphere is arguably negligible.

However, when business and industry have confronted a growing patchwork of state requirements, these sectors have historically preferred a national policy. RGGI and other state programs, particularly developments in California, may have some influence on federal policymakers. Note that the combination of RGGI and California CO_2 emissions (707 million metric tons) would rank above South Korea (**Table 2**).

In addition, RGGI's activities may create examples and/or models that could prove instructive for federal policymakers crafting more widespread applications. The program has provided a training ground for personnel from multiple states and various professions to develop a specific expertise in emissions trading issues. This knowledge base could be useful if a federal system were developed.

Table 2. Top-Ranked Nations and U.S. States for CO_2 Emissions from Energy Consumption (2012 Data)

Country or State	CO_2 Emissions (million metric tons)	Country or State	CO_2 Emissions (million metric tons)
China	8,106	Canada	551
United States	5,270	Brazil	500
India	1,831	United Kingdom	499
Russian Federation	1,782	South Africa	473
Japan	1,259	Indonesia	456
Germany	788	Mexico	454
South Korea	657	Australia	421
Texas	656	Italy	386
Iran	604	France	365
Saudi Arabia	583	9 RGGI states	362

[51] Calculated by CRS using 2013 data from the Bureau of Economic Analysis at http://www.bea.gov/newsreleases/regional/gdp_state/gsp_newsrelease.htm.

Source: Prepared by CRS with data from EIA, "International Energy Statistics," "Total CO_2 Emissions from the Consumption of Energy," and "State CO_2 Emissions," at http://www.eia.gov.

Author Contact Information

(name redacted)
Specialist in Environmental Policy
[redacted]@crs.loc.gov, 7-....