RGGI Inc.

ANNUAL REPORT ON THE MARKET FOR RGGI CO_2 ALLOWANCES: 2015

Prepared for:

RGGI, Inc., on behalf of the RGGI Participating States

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POTOMAC ECONOMICS

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The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort of Northeast and Mid-Atlantic states to reduce emissions of carbon dioxide (CO_2) from the power sector.

RGGI, Inc. is a non-profit corporation created to provide technical and administrative services to the states participating in the Regional Greenhouse Gas Initiative.

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I. EXECUTIVE SUMMARY

The Regional Greenhouse Gas Initiative ("RGGI") became the first mandatory cap-and-trade program to limit CO_2 emissions in the United States in 2009. Electric power generators located in the states participating in RGGI are required to obtain a number of CO_2 allowances equal to the number of tons of CO_2 they emit. RGGI distributes CO_2 emissions allowances to the market primarily through auctions, making it distinctive among existing cap-and-trade programs. Ninety-four percent of the CO_2 allowances that have entered into circulation initially entered the market through one of the auctions. Through the end of 2015, RGGI has conducted 30 successful auctions, selling a total of 801 million CO_2 allowances for $2.4 billion.

Following the 2012 Program Review, the participating states announced changes to the Model Rule, including a new CO_2 emissions cap.[1] The new CO_2 emissions cap was set at 91 million tons for 2014, and is being reduced by 2.5 percent per year until it reaches approximately 78 million tons for 2020. The Model Rule also included further interim adjustments to the cap to account for the surplus of CO_2 allowances that accumulated from 2009 to 2013.[2] The participating states are now conducting the 2016 Program Review.

This report evaluates activity in the market for RGGI CO_2 allowances in 2015, focusing on the following areas: allowance prices, trading and acquisition of allowances in the auctions and the secondary market, participation in the market by individual firms,[3] and market monitoring. For reporting purposes, firms are often broken up into the following categories:

- *Compliance-Oriented Entities*, which includes compliance entities that appear to acquire and hold allowances primarily to satisfy their compliance obligations, and

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1 The new emissions cap and other updates to the Model Rule were announced on February 7, 2013. See http://www.rggi.org/docs/PressReleases/PR130207_ModelRule.pdf. Subsequently, each of the Participating States revised its CO_2 Budget Trading Program to be consistent with the updated Model Rule. See http://www.rggi.org/docs/PressReleases/PR011314_AuctionNotice23.pdf.

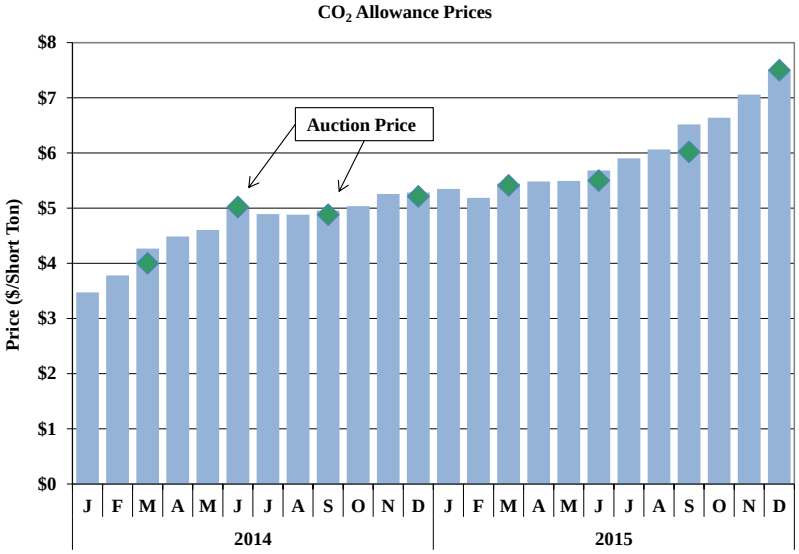
2 These program changes are described in more detail in Section II.A.

3 Throughout this report the term "firms" is used to refer to all participants in the CO_2 allowance market, including individuals.

- *Investment-Oriented Entities*, which includes:
  - Firms without any compliance obligations, and
  - Some firms that have compliance obligations but which hold a number of allowances that exceeds their estimated compliance obligations by a margin that suggests they are also buying for re-sale or some other investment purpose.[4]

CO_2 Allowance Prices

The average auction clearing price increased 29 percent from $4.72 in 2014 to $6.10 in 2015. Secondary market prices were generally consistent with auction clearing prices, holding around $5.50 during the first five months of 2015 and then increasing in each of the last seven months of the year (see figure). Volume-weighted average prices in the secondary market increased approximately 34 percent to an average of $6.48 in 2015.[5]



The expected demand for CO_2 allowances began to rise in June and prices steadily increased through the end of the year. Several factors may have put upward pressure on CO_2 allowance prices beginning in June 2015, including expectations about the effects of the Clean Power Plan on RGGI; nuclear retirements that were announced in the fourth quarter of 2015; and potentially low natural gas prices, which tend to reduce profitability of zero-emitting generation. . The Cost Containment Reserve ("CCR") may have helped to limit price volatility: (a) directly by providing for the sale of ten million additional allowances during

[4] The assessment of whether a compliance entity holds a number of allowances that exceeds its compliance obligations by a margin that suggests they are also buying for re-sale or some other investment purpose is based on: (a) the entity's forecasted share of the total compliance obligations for the entire RGGI footprint through 2020 and (b) the total number of allowances in circulation.

[5] Allowance prices are summarized in more detail in Section III.A.

2015 and (b) indirectly since the potential for CCR allowances to be sold in future auctions limits upward speculative pressure on prices.[6]

Trading of CO_2 Allowances

Firms initially acquire CO_2 allowances in the primary market, mainly by purchasing them in the quarterly auctions. Firms can also buy and sell CO_2 allowances in the secondary market. Secondary market activity consists mainly of trading of futures and options contracts on the public exchange and transfers of ownership recorded in COATS ("CO_2 Allowance Tracking System").

Compliance-oriented entities accumulated a substantial quantity of CO_2 allowances through the secondary market during 2015, while many investment-oriented entities were also active in the secondary market. Consequently, the volume of futures trading increased significantly, rising 98 percent from 104 million CO_2 allowances in 2014 to 206 million in 2015. Trading activity was highest in the fourth quarter, which accounted for 46 percent of the annual volume.[7]

The secondary market performed competitively in 2015, and this was particularly evident in the two months before the March compliance deadline for the second control period. During this period, some of the compliance-oriented entities collectively acquired 22 million CO_2 allowances and there was no significant increase in prices or other indication that firms had difficulty acquiring allowances in the secondary market in the final month leading up to the deadline.

Acquisition and Holdings of CO_2 Allowances

The large private bank of surplus CO_2 allowances (which accumulated primarily between 2008 and 2012) declined modestly during 2015.[8] The surplus number of CO_2 allowances fell from

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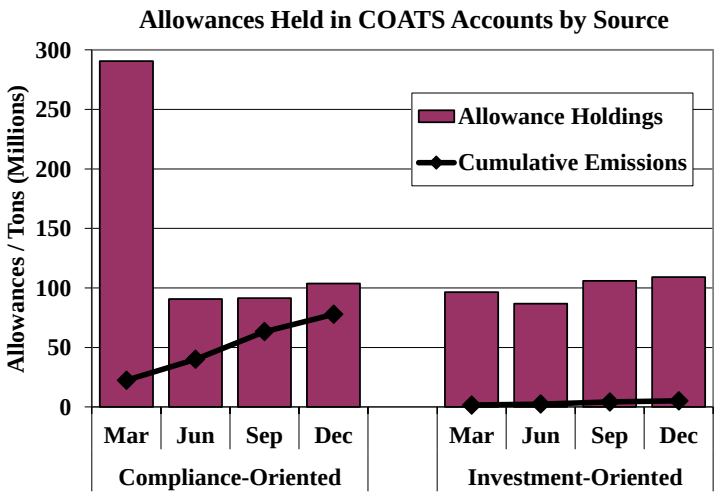
6 Allowance price volatility is evaluated in Section III.B.

7 Trading volumes and open interest are summarized in Sections IV.B and IV.C.

8 We define the private bank of allowances as the number of allowances in circulation (i.e., in Compliance Accounts or in General Accounts). We define the private bank of *surplus* allowances as the number of allowances in circulation minus the compliance obligations for which allowances have not been surrendered.

138 million[9] at the beginning of 2015 to 130 million at the end of 2015. Surplus allowances fell because the number of allowances sold in the auctions was significantly reduced by the FCPIA and SCPIA, although this was partly offset by the sale of all ten million allowances from the CCR.[10] As a result of the interim downward adjustments to the cap, the current surplus of allowances is expected to wind-down over the remainder of the decade.

The figure below summarizes the holdings of CO_2 allowances at the end of each quarter in 2015 for two categories of firms.[11] The number of allowances held fell after the first quarter because a large number of allowances were surrendered for second control period compliance, including 249 million by compliance-oriented entities and 17 million by investment-oriented entities with some compliance obligations. After the surrender of allowances, compliance-oriented entities still held substantially more CO_2 allowances than needed to satisfy compliance obligations. These entities held 104 of the 213 million allowances in circulation at the end of 2015 (49 percent) while accounting for 78 of the 83 million of emissions for the third control period.



Although the auctions are still the primary means by which firms acquire CO_2 allowances, many individual firms relied primarily or exclusively on the secondary market in 2015. Fifty-nine percent of the CO_2 allowances in circulation at the end of 2015 were held by firms that had held them since the beginning of the year, 15 percent were held by firms that acquired them through

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9 At the beginning of 2015, 403 million CO_2 allowances were in circulation, while the cumulative compliance obligations for the second control period was 266 million.

10 The First Control Period Interim Adjustment ("FCPIA"), the Second Control Period Interim Adjustment ("SCPIA"), and the Cost Containment Reserve ("CCR") are described in Section II.A.

11 Monthly totals are provided with additional detail in Section IV.D.

auctions or state allocations during 2015, and 26 percent were held by firms that purchased them in the secondary market during 2015.

Participation in the Market by Individual Firms

Participation by many firms promotes competition and helps ensure that CO_2 allowance prices are determined efficiently. Over time, firms that need CO_2 allowances for compliance should be able to acquire them through the auctions and/or the secondary market, and the holdings of individual firms should be relatively consistent with their potential uses for allowances.[12]

In 2015, we found broad participation in the RGGI market. The demand for CO_2 allowances is dispersed relatively widely across firms as the three largest compliance-oriented entities accounted for just 38 percent of the total projected demand, a small decrease from 2014. The average number of auction participants increased from 45 in 2014 to 50 in 2015 because of increased participation by investment-oriented firms. The holdings of allowances were generally distributed across firms consistent with their compliance obligations, although the significant surplus of allowances in circulation led many individual firms to hold large surpluses. The top ten compliance-oriented entities accounted for 40 percent of total holdings and smaller compliance-oriented entities accounted for 9 percent. The top ten investment-oriented entities (by surplus holdings) accounted for 48 percent. These levels are consistent with competitive expectations given that the current private bank of allowances far exceeds the compliance obligations of firms in the third control period.

Market Monitoring

As the RGGI Market Monitor, we evaluate the conduct of market participants in the auctions and in the secondary market to identify potential anti-competitive conduct. We also assess whether the auctions were administered properly by EnerNOC.

[12] Participation in the auctions and the secondary market by individual firms is evaluated in Section V.

In our reviews of the four auctions in 2015, we found no material concerns regarding the auction process, barriers to participation in the auctions, or the competitiveness of the results. Large numbers of firms participated in the offerings of CO_2 allowances. Further, we found that the auctions were administered in accordance with the noticed rules and bids received.

We find no evidence of anti-competitive conduct in the secondary market for CO_2 allowances, and we find that firms have generally purchased quantities of allowances that are consistent with their expected needs.

II. BACKGROUND ON THE CO_2 ALLOWANCE MARKET

RGGI began full operation in 2009, becoming the first mandatory market-based program to limit CO_2 emissions in the United States. Market-based cap-and-trade programs work by setting an aggregate emissions limit for a particular class of emitters, and requiring them to acquire a number of allowances sufficient to cover their emissions. Firms that own allowances can decide whether it is more profitable to use them to cover their emissions or to sell them to an emitter that can use them more efficiently. In this manner, the goal of market-based programs is to use market forces to reduce overall emissions in the most cost-effective ways.

RGGI is a collaborative effort of Northeast and Mid-Atlantic states to reduce overall CO_2 emissions.[13] Electricity generating plants with more than 25 MW of capacity ("CO_2 budget sources") must acquire a number of CO_2 allowances sufficient to cover their CO_2 emissions by the end of each control period. Firms that own budget sources ("compliance entities") can acquire CO_2 allowances through a variety of means, including by purchasing them in the quarterly RGGI auctions or in the secondary market for allowances.

The market for RGGI CO_2 allowances has several key elements, which are discussed in this section: compliance obligations, the CO_2 Allowance Tracking System ("COATS"), the primary market for allowances, and the secondary market for allowances.

A. Regional CO_2 Emissions Cap

Following a 2012 Program Review, each of the Participating States announced changes to the RGGI program, including a reduced RGGI CO_2 cap for the period from 2014 to 2020.[14] The

[13] The full set of rules for the RGGI program (known as the "Model Rule") may be found at http://www.rggi.org/docs/ProgramReview/_FinalProgramReviewMaterials/Model_Rule_FINAL.pdf.

[14] The current emissions cap and other changes to the Model Rule were announced on February 7, 2013. See http://www.rggi.org/docs/PressReleases/PR130207_ModelRule.pdf. Subsequently, each of the Participating States revised its CO_2 Budget Trading Program to be consistent with the updated Model Rule. See http://www.rggi.org/docs/PressReleases/PR011314_AuctionNotice23.pdf. See also www.rggi.org/design/overview/cap.

new CO_2 cap was set at 91.0 million tons for 2014 and is being reduced by 2.5 percent per year until it reaches approximately 78.2 million tons for 2020. So, the cap was 88.7 million tons for 2015.

Interim Adjustments to Account for Banked Allowances

Further adjustments were made to the cap to account for the surplus of allowances that was banked from allocation years 2009 to 2013.[15] Although many of the CO_2 allowances from allocation years 2009 to 2013 were not distributed, 690 million allowances were put in circulation compared to total compliance obligations of 550 million tons for the period from 2009 to 2013.[16] Unused CO_2 allowances can be banked by the holder, so the private bank of allowances exceeded the total expected compliance obligations by 140 million tons at the beginning of 2014. Consequently, two interim adjustments were used to adjust the RGGI CO_2 cap to account for the private bank of allowances that had accumulated by the first quarter of 2014.

First Control Period Interim Adjustment for Banked Allowances ("FCPIABA") – This is a reduction in the number of CO_2 allowances that is being sold over the seven-year period from 2014 to 2020. The amount of the reduction is equal to the private bank of first control period CO_2 allowances (i.e., allocation years 2009, 2010, and 2011) that were in circulation after compliance was completed for the first control period. The FCPIABA is approximately 8.2 million CO_2 allowances per year from 2014 to 2020.[17]

Second Control Period Interim Adjustment for Banked Allowances ("SCPIABA") – This is a reduction in the number of CO_2 allowances that is being sold over the six-year period from 2015 to 2020. The amount of the reduction is equal to the private bank of 2012 and 2013 allocation

[15] The emissions cap was reduced from 188 million tons to 165 million tons in 2012 to account for the departure of New Jersey at the end of the first control period.

[16] This includes 53 million tons of compliance obligations for New Jersey from 2009 to 2011.

[17] See www.rggi.org/design/overview/cap.

year allowances that are in excess of 2012 and 2013 emissions. The SCPIABA is approximately 13.7 million CO_2 allowances per year from 2015 to 2020.[18]

Given the new CO_2 cap and the interim control period adjustments for banked allowances, the adjusted CO_2 cap fell from approximately 82.8 million in 2014 to 66.8 million in 2015 and will eventually fall to 56.3 million in 2020. Overall, the number of CO_2 allowances distributed for the adjusted CO_2 cap for the period from 2014 to 2020 will be approximately 449 million. These will be in addition to the 140 million surplus allowances that were already in circulation at the end of 2013 for a total supply of 589 million from 2014 to 2020.

Cost Containment Reserve

As part of the 2012 Program Review, RGGI implemented a provision known as the Cost Containment Reserve ("CCR") in 2014.[19] The CCR allows for the sale of a fixed number of allowances in addition to the cap when the clearing price in the quarterly auction reaches the CCR Trigger Price. The CCR is replenished at the start of each calendar year. In 2014, the CCR had a withdrawal limit of five million allowances, and the CCR Trigger Price was $4.00. In 2015, the CCR had a withdrawal limit of ten million allowances, and the CCR Trigger Price was $6.00. From 2016 to 2020, the annual withdrawal limit will be ten million allowances, and the CCR Trigger Prices will rise to $8.00 in 2016, to $10.00 in 2017, and it will rise 2.5 percent in each year thereafter. All 15 million allowances were sold from the CCR for 2014 and 2015. These are in addition to the 589 million allowances already planned to be available for the period from 2014 to 2020, raising the total supply to 604 million allowances.

B. Compliance Obligations

CO_2 budget sources are fossil fuel-fired electricity generating plants with greater than 25 MW of capacity. Shortly after the end of each control period, compliance entities must submit a sufficient number of CO_2 allowances to cover their CO_2 emissions during the control period.

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[18] *ibid.*

[19] See http://www.rggi.org/docs/ProgramReview/_FinalProgramReviewMaterials/Model_Rule_Summary.pdf.

The first control period ran from January 1, 2009 to December 31, 2011, the second control period ran from January 1, 2012 to December 31, 2014, and the third control period will run from January 1, 2015 to December 31, 2017.

In 2015, RGGI completed the compliance process for the second control period. By January 30, compliance entities were required to submit all CO_2 emissions data for CO_2 budget sources for the second control period to the Environmental Protection Agency's ("EPA's") Clean Air Markets Division ("CAMD") Business System. By March 2, the Compliance Account for each CO_2 budget source was required to hold first or second control period CO_2 allowances) sufficient to satisfy its compliance obligation. Each CO_2 budget source was also required to submit a Compliance Certification Report certifying that it was in compliance with its state's CO_2 Budget Trading Program. [20]

In early 2016, RGGI completed the new interim compliance process for 2015. Interim compliance differs from the triennial compliance process because compliance entities are only required to surrender CO_2 allowances for 50 percent of their compliance obligations.

C. CO_2 Allowance Tracking System ("COATS")

COATS is the registry for RGGI CO_2 allowances. Each CO_2 allowance has a unique serial number and can be used to satisfy one short ton of compliance obligations. When firms trade CO_2 allowances in the secondary market, the seller must record the transfer of ownership in COATS before the buyer is recognized as the owner.[21]

[20] The Compliance Summary for the first and second control periods may be found at https://rggi-coats.org/eats/rggi/index.cfm?fuseaction=reportsv2.final_compliance_summary_rpt&clearfuseattribs=true

[21] Public information related to the COATS registry may be found at http://www.rggi.org/market/tracking/public_reporting.

D. Primary Market for RGGI CO_2 Allowances

The participating states have taken the approach of using auctions rather than free allocations as the primary means for distributing RGGI CO_2 allowances to the market. Accordingly, the primary market for CO_2 allowances consists mainly of the quarterly auctions.

Auctions – Through the end of 2015, 94 percent of the CO_2 allowances that have been put into circulation initially entered the market through one of the 30 auctions that have taken place on a quarterly basis since September 2008.

Offset Projects – Additional CO_2 allowances can also be awarded for approved CO_2 emissions offset projects (project-based greenhouse gas emissions reductions or carbon sequestration that occurs outside the capped electricity generation sector), although no such allowances have been awarded thus far.

Early Reduction Allowances – In 2009, there was a one-time award by certain participating states of 2.4 million early reduction allowances (ERAs), which were awarded for qualifying CO_2 emissions reductions achieved at CO_2 budget sources during 2006 through 2008, prior to the start of the first control period.

Allocations & Sales by States – Approximately 29.7 million CO_2 allowances for the first control period were allocated by individual states through either fixed-price sales or free allocations. Approximately 16.0 million CO_2 allowances for the second control period were allocated by individual states. Approximately 1.5 million CO_2 allowances for the third control period were allocated by individual states.

Regardless of how CO_2 allowances initially enter the market, they can be traded to other firms in the secondary market.

E. Secondary Market for RGGI CO_2 Allowances

The secondary market is important for several reasons. First, it gives a firm the ability to obtain CO_2 allowances at any time during the three months between the RGGI auctions. Second, it provides a way for a firm to protect itself against the potential volatility of future auction clearing

prices. Third, it provides price signals that can assist a firm in making investment decisions in markets affected by the cost of RGGI compliance.

The secondary market for RGGI CO_2 allowances comprises the trading of physical allowances and financial derivatives, such as futures, forwards, and options contracts. A physical CO_2 allowance trade occurs when the parties to the transaction register the transfer of ownership in COATS. Financial derivatives include any contracts whereby parties agree to exchange funds and/or allowances at some future date, depending in many cases on factors such as the price of allowances at some future date. Many financial derivatives eventually result in the transfer of physical CO_2 allowances (i.e., the transfer is registered in COATS), but this may occur months or years after the parties enter into a financial transaction. These include the following types of transactions:

- *Futures* – Under these contracts, two parties agree to exchange a fixed number of CO_2 allowances of a certain vintage year at a particular price at a specific point in the future (called the "delivery month"). At the end of the delivery month, the contracted number of CO_2 allowances must be physically transferred to the buyer's account in the COATS registry and funds must be transferred to the seller. The vintage year refers to the allocation year of the CO_2 allowance that is to be transferred. One standard futures contract equals 1,000 RGGI CO_2 allowances.

- *Forwards* – These are like futures contracts, but a forward contract typically requires that all financial settlement occur at expiration.

- *Call Options* – Call options give the purchaser the option to buy a fixed number of CO_2 allowances of a certain vintage year at a particular strike price at any time prior to the expiration date. For example, suppose a firm holds a call option with $7 strike price and December 2015 expiration date. If the price of the corresponding forward contract rose to $7.75, the firm could exercise the option to buy CO_2 allowances at $7 and immediately sell them at $7.75. Alternatively, if the price of the forward contract stayed below $7, the firm would let the option expire without exercising it. One standard options contract can be exercised for 1,000 RGGI allowances.

- *Put Options* – Put options are similar to call options but they give the purchaser the option to *sell* a certain number of CO_2 allowances of a particular vintage year at a specified strike price any time prior to the expiration date.

Futures, forwards, and options contracts allow firms to manage risks associated with unforeseen swings in commodity prices. Futures and forwards allow firms to lock-in the prices of future purchases or sales. Options allow firms to limit their exposure to price volatility. Call options

protect the purchaser if the price of the commodity increases, while put options protect the purchaser if the price of the commodity decreases. Although options provide less certainty than futures and forward contracts, they usually require less financial security, which could make them more attractive to some firms.

The terms of futures, forward, and option contracts vary in the degree to which they are standardized. "Exchange-traded" contracts typically have the most standardized provisions, while the term "over-the-counter" ("OTC") is applied to contracts with less standardized provisions. However, OTC contracts, once entered into, are often settled through a clearinghouse in order to protect the parties from the risk that the counterparty defaults.

The amount of *open interest* is the net amount of futures, forwards, or options contracts that have been traded for a contract with a particular set of specifications (i.e., vintage year, delivery month, etc.), but have not reached the time of delivery, expired, or been exercised. For example, if Firm A sells 100 contracts of a particular type to Firm B, Firm A will have a short position of 100 contracts, Firm B will have a long position of 100 contracts, and the total open interest for the particular type of contract will be 100 contracts. Hence, the total open interest can be determined by summing across all of the long positions of market participants or by summing across all of the short positions.

III. CO_2 ALLOWANCE PRICES

The market for RGGI CO_2 allowances consists primarily of purchases in the quarterly auctions and trading of allowances and allowance futures and options contracts in the secondary market. The clearing prices from quarterly auctions provide public information about the market value of CO_2 allowances four times per year, while the prices of futures and forwards trades on public exchanges and transaction prices recorded in COATS provide price information more frequently. This section of the report evaluates prices in the markets for RGGI CO_2 allowances in 2015.

Key observations regarding RGGI CO_2 allowance prices:

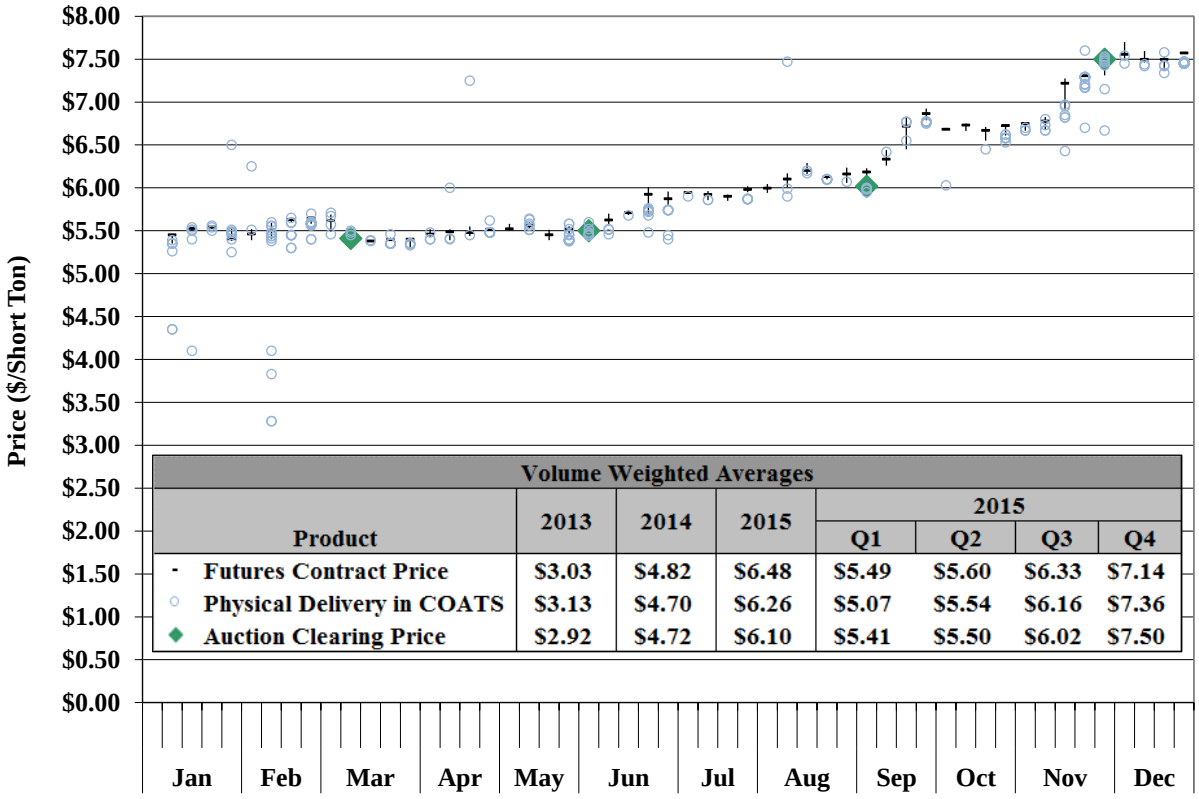
- *Auction Clearing Prices* – The volume-weighted average auction clearing price increased 29 percent from $4.72 in 2014 to $6.10 in 2015. Auction prices increased throughout the year and peaked in the fourth quarter, when Auction 30 cleared at $7.50 on December 2.
- *Price Trends in the Secondary Market* – Secondary market prices were generally consistent with auction clearing prices, trading around $5.50 throughout the first five months of 2015 and then increasing thereafter, eventually reaching $7.50 in December. Several factors may have put upward pressure on CO_2 allowance prices beginning in June 2015, including expectations about the effects of the Clean Power Plan on RGGI; nuclear retirements that were announced in the fourth quarter of 2015; and potentially low natural gas prices, which tend to reduce profitability of zero-emitting generation.
- *Option-Implied Price Volatility* – The volatility of futures prices fell steadily during 2014 and the first half of 2015. Option-implied volatility began rising in the third quarter of 2015 during a period of steadily increasing CO_2 allowance prices. The CCR may have helped limit price increases and price volatility in 2014 and 2015, both directly by allowing the sale of additional allowances and indirectly since the potential for CCR allowances to be sold in future auctions limits speculative pressure on prices.

A. Prices in the Auctions and the Secondary Market

Figure 1 summarizes prices in the auctions and in the secondary market on a weekly basis from January to December 2015. Futures contract prices are summarized for each week by a black vertical line from the minimum transaction price to the maximum transaction price in the week and by a black horizontal tick mark at the volume-weighted average price for each week. The volume-weighted average price of physical deliveries of CO_2 allowances recorded in COATS are shown by blue circles for each day when a transaction took place at a price that was recorded by

the transacting parties.[22] The figure also shows the auction clearing prices of CO_2 allowances in the four quarterly auctions held during 2015, which are represented by the green diamonds.

Figure 1: CO_2 Allowance Prices in the Auctions and Secondary Market 2015



Volume Weighted Averages

Product	2013	2014	2015	2015 Q1	2015 Q2	2015 Q3	2015 Q4
Futures Contract Price	$3.03	$4.82	$6.48	$5.49	$5.60	$6.33	$7.14
Physical Delivery in COATS	$3.13	$4.70	$6.26	$5.07	$5.54	$6.16	$7.36
Auction Clearing Price	$2.92	$4.72	$6.10	$5.41	$5.50	$6.02	$7.50

Observations regarding prices in auctions and the secondary market:

- *General Price Levels* – The prices of CO_2 allowances were stable around $5.50 throughout the five months of 2015, then prices began an upward trend after the June auction. Although there were outliers, secondary market prices were generally consistent with auction clearing prices. Allowance prices rose to around $7.50 by the end of the year. Volume-weighted average prices increased in each quarter of 2015, and the fourth quarter saw prices at their highest levels since the inception of the RGGI market.
- *Futures Contract Prices* – These were generally consistent with the prices of physical deliveries in COATS throughout the year. The volume-weighted average futures price for all vintages and control periods reached a quarterly high of $7.14 in the fourth quarter.

[22] Parties must report the transaction price if there is an underlying financial transaction related to the transfer.

For the calendar year 2015, the average futures price of $6.48 was 34 percent greater than in 2014, and it has more than doubled in the past two years.

- *Physical Deliveries in COATS* – The volume-weighted average transaction price of CO_2 allowances increased 33 percent from $4.70 in 2014 to $6.26 in 2015. The pricing of transactions was generally consistent with futures trades and auction clearing prices throughout the year. However, on some days transactions involving small volumes were recorded at levels substantially above or below the prevailing price levels indicated by futures prices and most other COATS transactions.
- *Auction Clearing Prices* – The volume-weighted average auction clearing price increased 29 percent from $4.72 in 2014 to $6.10 in 2015.[23] Similar to futures contract prices and CO_2 allowance transfers in COATS, auction prices increased throughout the year and peaked in the fourth quarter, when Auction 30 cleared at $7.50 on December 2.

B. Volatility of CO_2 Allowance Prices

Cap-and-trade markets are designed to give firms efficient incentives to reduce or offset emissions. In the short-term, high-emitting generators will operate less frequently in favor of low-emitting generators. In the long-term, the market will affect the decisions of firms to develop offset projects, to retire older inefficient generation, to retain existing zero-emissions generation, and to perform maintenance that increases fuel efficiency and lowers carbon-intensity. Predictable CO_2 allowance prices decrease the risks associated with making long-term investments in reducing CO_2 emissions. Since CO_2 allowance prices can be volatile, the availability of futures and options contracts allows firms to protect themselves from the risks of such investments. This subsection evaluates two measures of price volatility in the market for RGGI CO_2 allowances.

One measure of the volatility of CO_2 allowance prices is known as *historic volatility*,[24] which is a measure of volatility based on day-to-day price variations over a recent period (e.g., several months or one year). This is a useful measure when factors influencing the volatility of prices in

[23] Volume-weighted average auction prices include ten million CCR allowances that were sold at $6.02 as part of Auction 29.

[24] Historic volatility is a measure of the standard deviation of the day-over-day percentage change in price. Volatility is normally expressed as an estimated standard deviation for a one year period, even if it is calculated from a shorter period of time.

the recent period are likely to be the same as the factors influencing the volatility of prices in the future.

Observations regarding historic volatility of CO_2 allowance prices:

- *Historic Volatility in 2015* – The historic volatility of futures prices dropped to 8 percent in the second quarter of 2015 — the lowest level since 2012. Volatility increased in the second half of the year and averaged 13 percent in the fourth quarter during a sustained period of increasing prices.
- *Historic Volatility Long-Term Trend* – Historic volatility was very low from 2010 to 2012 because there was a substantial surplus of CO_2 allowances and prices remained very close to the auction reserve price, which functions as a price floor since allowances are never sold for less than the auction reserve price. Volatility increased from 5 percent in 2012 to 35 percent in 2013 after the announcement of planned changes following the 2012 Program Review. As prices began to level-off in the second half of 2014, the volatility of allowance prices also decreased considerably. Those conditions generally remained until the second half of 2015.

Another measure of the volatility of CO_2 allowance prices is known as *option-implied volatility*,[25] which measures the volatility that is implied by the trading of option contracts for CO_2 allowances. If a firm perceives that CO_2 allowance prices are volatile, the firm may be willing to pay a high price for an option contract that protects it from unforeseen allowance price fluctuations. Likewise, if a firm perceives that CO_2 allowance prices are relatively stable, the firm will be willing to pay relatively little for the same option contract.[26]

The volatility of a CO_2 allowance refers to the expected standard deviation of the distribution of allowance prices one year in the future. For example, if the expected value of the price one year in the future is $1 and the option-implied volatility is 25 percent, this implies that the probability

[25] The option-implied volatility of a CO_2 allowance refers to the expected standard deviation of the distribution of allowance prices one year in the future. For example, if the expected value of the price one year in the future is $1 and the option-implied volatility is 25 percent, this implies that the probability that the price will be within 25 percent of $1 (i.e., between $0.75 and $1.25) is 68.2 percent assuming that the price is distributed log-normally.

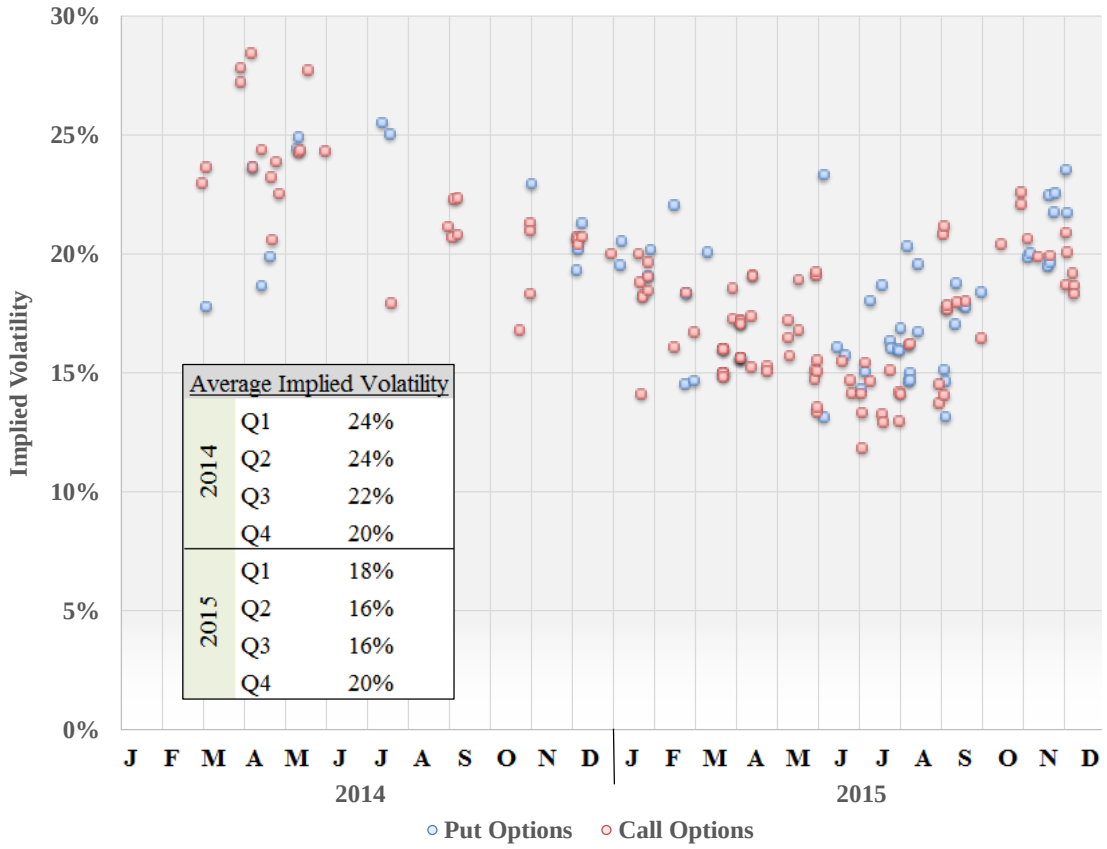
[26] The price of an option contract depends primarily on two factors: (i) the expected value of a CO_2 allowance relative to the strike price of the option, and (ii) the expected volatility of an allowance over the period until the expiration date. When call option prices and put option prices move in opposite directions, it signals a change in the expected price of allowances. Conversely, when call option prices and put option prices move in the same direction, it signals a change in the expected volatility of allowance prices.

that the price will be within 25 percent of $1 (i.e., between $0.75 and $1.25) is 68.2 percent assuming that the price is distributed log-normally. Option-implied volatility refers to volatility estimates that are derived by analyzing the price and other terms of an option contract compared with the price of CO_2 allowances.

The following scatter plot reports the option-implied (i.e., expected) volatility of RGGI CO_2 allowance futures contracts, which can be inferred from the trading of options contracts in 2015.[27] The vertical axis shows the option-implied (expected) volatility of CO_2 allowance futures prices, and the horizontal axis shows the trade date. The figure excludes contracts if the trade date is fewer than 90 days from the contract expiration date. This is because historical pricing patterns suggest that CO_2 allowance prices become more volatile around the time of each quarterly auction. Therefore, excluding contracts with short times to maturity reduces variations in implied volatility that are driven by the timing of the trades within a particular quarter.

[27] Black's model for valuing futures options is used to estimate the option-implied volatilities of RGGI allowance futures prices.

Figure 2: Option-Implied Volatility of CO_2 Allowance Futures Prices 2015



Observations regarding the option-implied volatility of CO_2 allowance prices:

- *General Patterns of Volatility* – Option-implied volatility varied considerably during 2014 and 2015, but was broadly consistent with the pattern of historic price volatility. Both volatility metrics reflect that uncertainty regarding allowance prices decreased considerably throughout 2014. As allowance prices stabilized in the first half of 2015, there was an increase in the certainty regarding the value of CO_2 allowances as a percentage of allowance prices. Volatility levels, as well as the number of options trades, increased in the second half of the year as allowance prices rose in response to factors discussed earlier in this section.
- *Cost Containment Reserve* – Since the program changes announced in February 2013, the CCR has been significant in reducing the volatility of allowance prices. The CCR reduces volatility by making additional supply available if allowance prices rise to the prescribed levels, but the CCR also has a significant effect on expectations. For example, since market participants knew that if prices rose to $6.00 in the auctions during 2015, as many as ten million allowances would become available, it limited speculative pressure that would otherwise have caused prices to rise above that level sooner. Volatility levels increased significantly in 2015 after the CCR allowances were sold in Auction 29 on September 9.

IV. TRADING AND ACQUISITION OF CO_2 ALLOWANCES

This section evaluates the trading and acquisition of CO_2 allowances in the primary and secondary allowance markets. Firms initially acquire CO_2 allowances in the primary market, mainly by purchasing them in the quarterly auctions. Firms then buy and sell CO_2 allowances in the secondary market. Secondary market activity can be observed from information about the trading of futures and options contracts on public exchanges and in the OTC market as well as from the transfers of ownership recorded in COATS. This section analyzes the movement of CO_2 allowances from their initial introduction to the market and in the secondary market.

The figures in this section evaluate the activity of firms in the CO_2 allowance market in 2015, including the acquisition of allowances in the quarterly auctions and trading in the secondary market.

Key observations regarding trading and acquisition of CO_2 allowances:

- *Surplus CO_2 Allowances in Circulation* – As a result of the surrender of CO_2 allowances for second control period compliance, the number of allowances in circulation decreased from 403 million at the end of 2014 to 213 million at the end of 2015. Over the same period, compliance obligations were 83 million allowances. Thus, the amount of surplus holdings (in excess of the amount needed for current control period emissions) was 130 million at the end of 2015. The current private bank of surplus of allowances is expected to fall in each year from 2016 to 2020 because of annual reductions in the emissions cap and because of the interim adjustments for banked CO_2 allowances.
- *Participation by Compliance-Oriented Entities* – Of the 213 million allowances in circulation at the end of 2015, 104 million (49 percent) were held by compliance-oriented entities. Since 78 million of these are needed to satisfy their compliance obligations for 2015, compliance-oriented entities collectively held 26 million of the 130 million surplus CO_2 allowances in circulation at the end of 2015.
- *Participation by Investment-Oriented Entities* – 108 million (51 percent) of the CO_2 allowances in circulation were held by investment-oriented entities at the end of 2015. The small number of these entities with compliance obligations surrendered 17 million allowances to satisfy their obligations for the second control period. Overall, these firms collectively held 104 million of the 130 million surplus CO_2 allowances in circulation at the end of 2015. A high level of participation by investors is expected given the large current surplus of CO_2 allowances, and investor participation will reduce overall volatility as the CO_2 emissions cap tightens over the remainder of the decade. However,

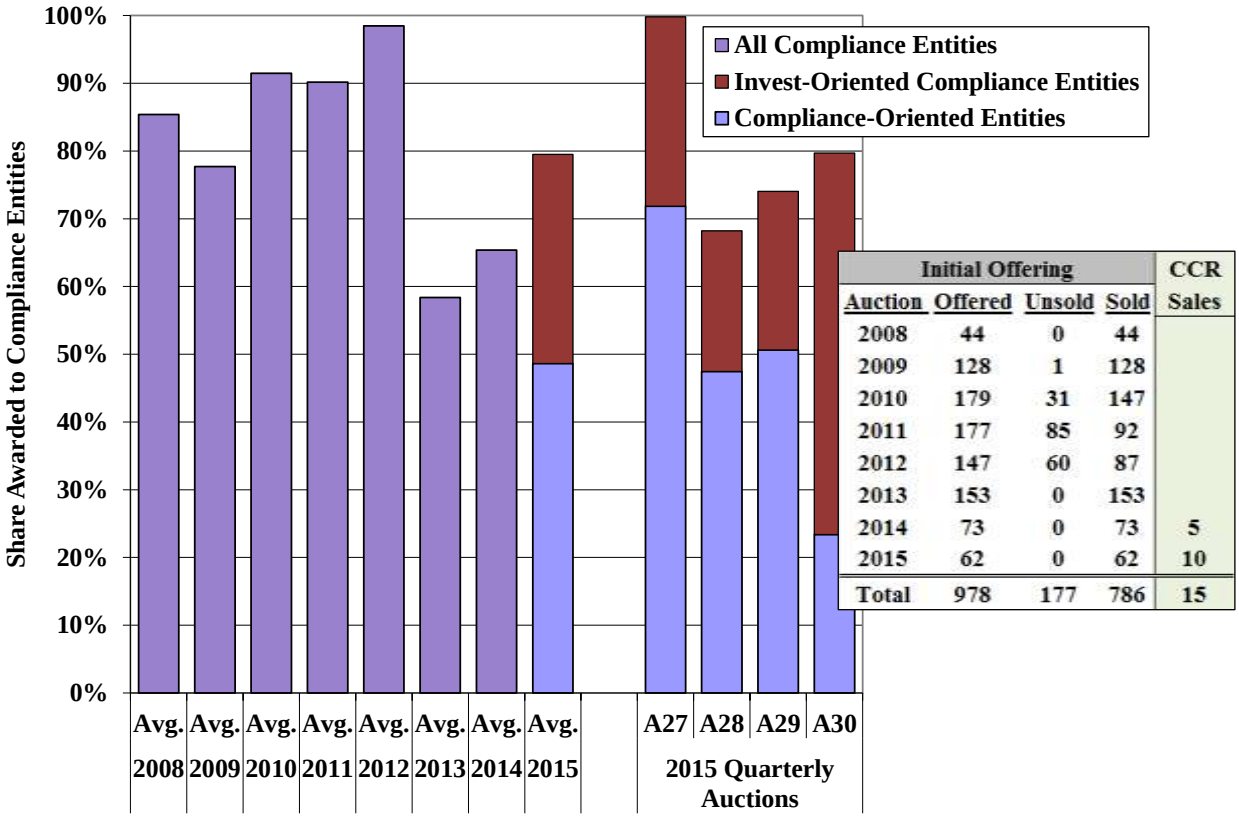
the increased participation by these entities contributed to increased prices in the second half of 2015.

- *Trading Activity in the Secondary Market* – The volume of futures trading increased significantly, rising 98 percent from 104 million CO_2 allowances in 2014 to 206 million in 2015. The volume of allowance transfers between unaffiliated firms in COATS also increased significantly, rising 23 percent from approximately 113 million CO_2 allowances in 2014 to 139 million in 2015. Some compliance-oriented entities purchased a significant number of allowances in the secondary market before the second control period compliance deadline in March, illustrating that a liquid secondary market is important for some compliance entities to satisfy their compliance obligations. Although compliance entities purchased a large number of allowances shortly before the compliance deadline, allowance prices did not rise significantly, indicating that the secondary market was relatively liquid and competitive.
- *Patterns of CO_2 Allowance Acquisition* – Approximately 59 percent of the CO_2 allowances in circulation at the end of 2015 were held by firms that had held them since the beginning of the year, 15 percent were held by firms that acquired them through auctions or state allocations during 2015, and 26 percent were held by firms that purchased them in the secondary market during 2015.

A. Distribution of Auction Awards

The following figure reports the quantity of CO_2 allowances that were offered and sold in each of the four auctions that were held in 2015 (i.e., Auctions 27 through 30) and in each year from 2008 to 2015. The height of each bar represents the percentage of CO_2 allowances (as a share of allowances sold) that was purchased by compliance entities, while the remaining share was purchased by investment-oriented entities without compliance obligations. Before 2015, all compliance entities are shown together. Beginning in 2015, compliance entities are divided into two categories: blue bars showing the percentage of allowances purchased by compliance-oriented entities, and red bars showing the percentage of allowances purchased by investment-oriented compliance entities. The table in the figure shows the numbers of offered, unsold, and sold allowances in each calendar year since 2008.

Figure 3: Distribution of Auction Awards
Auctions 27 to 30 [28]



	Initial Offering			CCR
Auction	Offered	Unsold	Sold	Sales
2008	44	0	44	
2009	128	1	128	
2010	179	31	147	
2011	177	85	92	
2012	147	60	87	
2013	153	0	153	
2014	73	0	73	5
2015	62	0	62	10
Total	978	177	786	15

Observations regarding distribution of auction awards:

- *All Compliance Entities* – The share of CO_2 allowances purchased in the auctions by all compliance entities decreased to a low of 58 percent in 2013, and then increased to 65 percent in 2014 and 79 percent in 2015. In 2015, when compliance entities were tracked separately based on whether they were compliance-oriented or investment-oriented, the share of CO_2 allowances purchased in the auctions by compliance-oriented entities averaged 49 percent.
- *Investment-Oriented Entities* – The share of CO_2 allowances purchased in the auctions by investment-oriented compliance entities averaged 31 percent in 2015 and reached a high of 57 percent of the allowances offered in Auction 30. The share of allowances purchased by other investment-oriented entities averaged 21 percent in 2015.
- *Unsold CO_2 Allowances* – For the third year in a row, 100 percent of the allowances offered in auctions was sold. In addition, all available CCR allowances were sold for the second year in a row. The sale of all available allowances reflects that firms anticipated

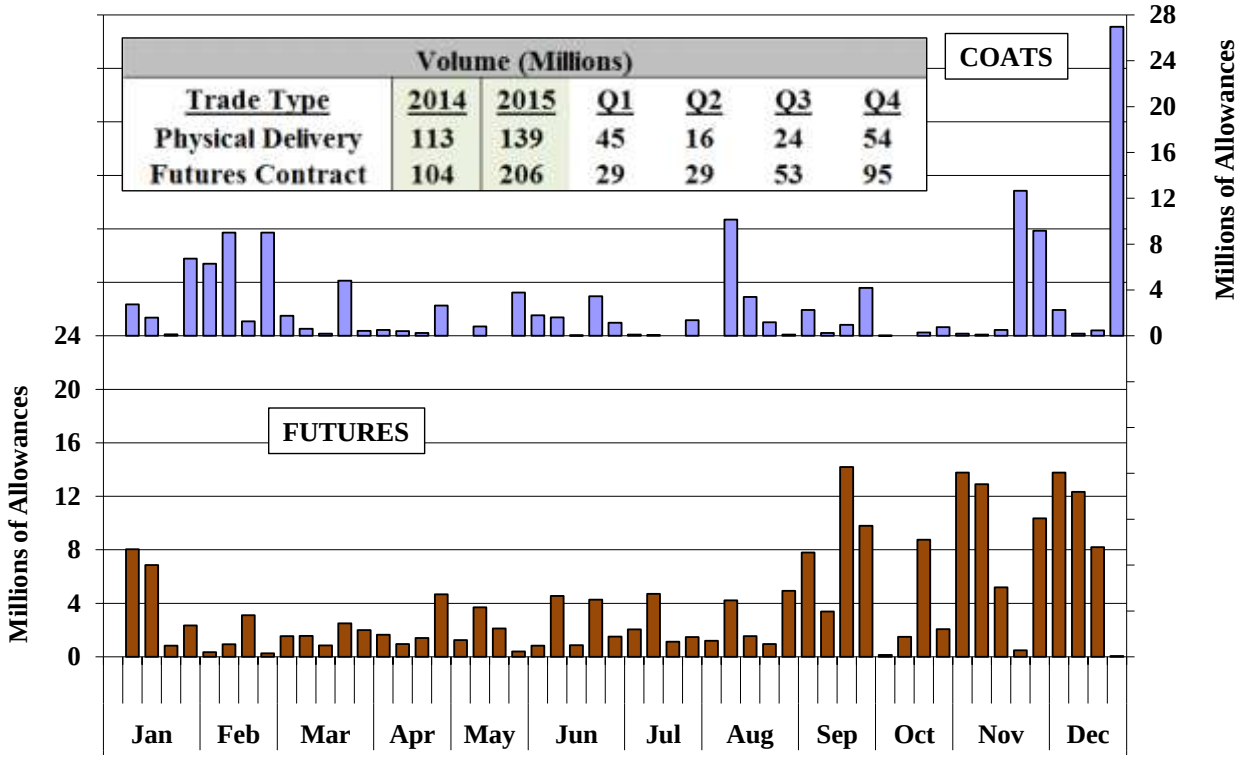
[28] All ten million allowances in the 2015 CCR were sold in Auction 29. These allowances are included the figure.

that allowance prices were likely to remain above the level of the 2015 CCR (i.e., $6/ton) in the future.

B. CO_2 Allowance Trading Volumes

The following figure summarizes the volume of trading of futures and forward contracts on the Intercontinental Exchange ("ICE") as well as transfers of CO_2 allowances between unaffiliated parties that were recorded in COATS on a weekly basis in 2015. The bottom portion of the figure is plotted against the left vertical axis, and shows the weekly volume of futures trading of CO_2 allowance contracts. The top portion of the figure is plotted against the right vertical axis, and shows the weekly volume of CO_2 allowance transfers between unaffiliated firms that are reported in COATS. The table shows quarterly volumes in 2015 as well a year-over-year comparison of the total volume of futures trading and CO_2 allowance transfers in COATS.

Figure 4: Volume of Trading of CO_2 Allowances and Allowance Futures 2015



Observations regarding CO_2 allowance trading volumes:

- *Volume of Futures Trading* – The volume of futures trading totaled approximately 206 million CO_2 allowances in 2015, up 98 percent from 104 million in 2014. Forty-six

percent of the yearly volume occurred in the fourth quarter of 2015, when nearly 95 million CO_2 allowances were traded.

- *CO_2 Allowance Transfers* – The volume of CO_2 allowance transfers between unaffiliated firms totaled approximately 139 million in 2015, up 23 percent from approximately 113 million in 2014.[29] Allowance transfers were elevated in January and February as compliance entities acquired allowances needed to satisfy their second control period obligations before the March 2 deadline. Allowance transfers rose significantly in the last week of December as a result of the settlement of the benchmark futures contract.
- *Trading Activity* – Trading of futures and allowance transfers generally picked-up from August through the end of the year, coincident with the period of increasing prices.

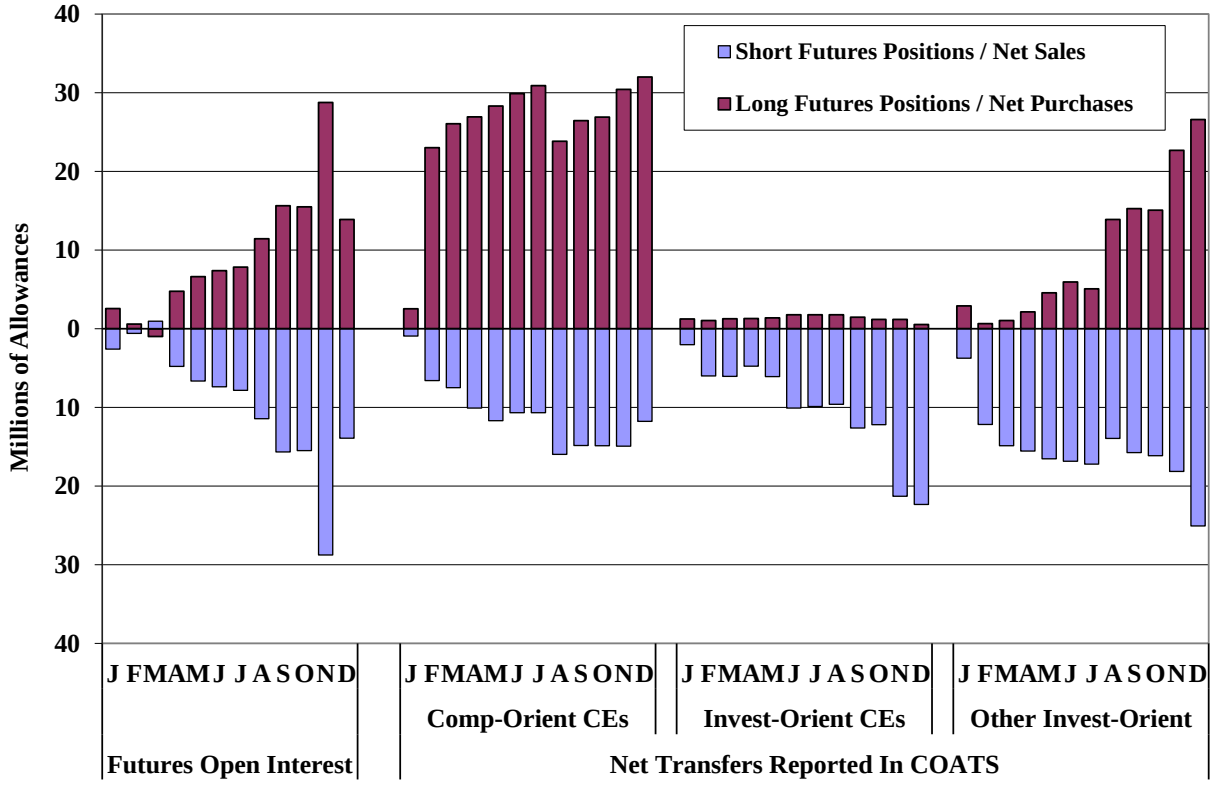
C. Acquisition of CO_2 Allowances in the Secondary Market

This section evaluates how the ownership of CO_2 allowances has changed as a result of trading in the secondary market. Changes in the ownership of CO_2 allowances are quantified in Figure 5 using two measures: the open interest in RGGI futures contracts and the net purchases and sales of CO_2 allowances by individual firms.[30] Figure 5 summarizes net changes in ownership through the secondary market in 2015. Futures open interest is based on futures positions at the end of the last business day of each month, while net purchases and sales are based on registered holdings in COATS at the end of the last business day of each month.

[29] The total volume of 2014 transfers in COATS is higher than reported last year due to the lag time in the recording of some transactions.

[30] Open interest is defined in Section II.E. Net purchases/sales of CO_2 allowances by a particular firm include the net change in the amount of CO_2 allowances in a firm's COATS account that has resulted from trading (rather than the auctions or allocations). For example, if a firm purchases 100,000 CO_2 allowances from another firm, and then sells 30,000 allowances, the firm's net purchase of allowances would be 70,000.

Figure 5: Net Changes in Futures Open Interest and Net Transfers of CO_2 Allowances [31]
2015



Observations regarding the acquisition of CO_2 allowances in the secondary market:

- *Open Interest in Futures* – Open interest fell in the first three months of 2015 as futures contracts were settled to enable firms to surrender allowances for second control period. After March, open interest increased steadily throughout the year and then rose considerably in November and December. The net change in open interest of futures contracts from the beginning of 2015 peaked at nearly 41 million allowances on December 24, before falling to 14 million after the settlement of the benchmark contract.
- *Net Transfers Reported by Compliance-Oriented Entities* – Many compliance-oriented entities used the secondary market to acquire CO_2 allowances before the second control period compliance deadline on March 2. Overall, these entities used the secondary market to increase their holdings by 32 million allowances in 2015, with 64 percent of the net purchase occurring in February. A small number of compliance-oriented entities were net sellers in 2015, reducing their holdings by 12 million CO_2 allowances.

[31] The figure reports the net change in futures open interest that has occurred since January 1, 2015. The total open interest in RGGI futures products is 23 million greater than the net change reported in Figure 5. Net transfers of CO_2 allowances include transfers that occurred since January 1, 2015.

- *Net Transfers Reported by Investment-Oriented Compliance Entities* – Investment-oriented entities with compliance obligations are reported separately from compliance-oriented entities because they exhibited different transaction patterns in 2015. These entities sold a significant number of allowances into the market before the second control period compliance deadline in March. Overall, investment-oriented entities with compliance obligations used the secondary market to reduce their holdings by 22 million allowances during 2015.
- *Net Transfers Reported by Other Investment-Oriented Entities* – Investment-oriented entities without compliance obligations continued to be active in the secondary market in 2015. Collectively, these entities sold a net of 11 million CO_2 allowances in January and February, but they purchased a net of 13 million allowances over the remainder of the year.
- *Total Net Acquisition Reported in COATS* – The total net purchase of CO_2 allowances in 2015 (59 million) is less than half of the gross volume of transactions between unaffiliated firms (139 million as shown in Figure 4). This is because some firms have both purchased and sold CO_2 allowances in the secondary market such that the net change in their position is smaller than the total volume of their transactions. Although the total net purchase of CO_2 allowances was substantial, it was still smaller than the 62 million CO_2 allowances that were acquired in the auctions in 2015. The auctions were the principal means by some compliance entities acquired CO_2 allowances in 2015, while others relied primarily or exclusively on the secondary market.

D. Patterns of CO_2 Allowance Holdings

The following figure combines information on the acquisition of CO_2 allowances from the auctions and state allocations with information on the purchase and sale of allowances in the secondary market and the initial holdings of allowances on January 1, 2015. Together, this information provides a summary of the holdings of CO_2 allowances in COATS accounts according to whether the allowances were acquired: (i) prior to 2015, (ii) through the primary market, or (iii) through the secondary market. Figure 6 reports several categories of CO_2 allowances that are described below.

Net Sales in the Secondary Market includes CO_2 allowances that were held at the end of 2014, purchased in an auction in 2015, or acquired through an allocation in 2015 and then subsequently sold in the secondary market.

Net Purchases in the Secondary Market includes CO_2 allowances that were held in the COATS account of a firm that purchased them in the secondary market after January 1, 2015.

Awards and Allocations – Retained in COATS Account includes CO_2 allowances that were still held in the COATS account of the firm that purchased them in an auction or acquired them through an allocation in 2015. If a firm was a net seller of CO_2 allowances at any point in 2015, then the CO_2 allowances were first deducted from this category.

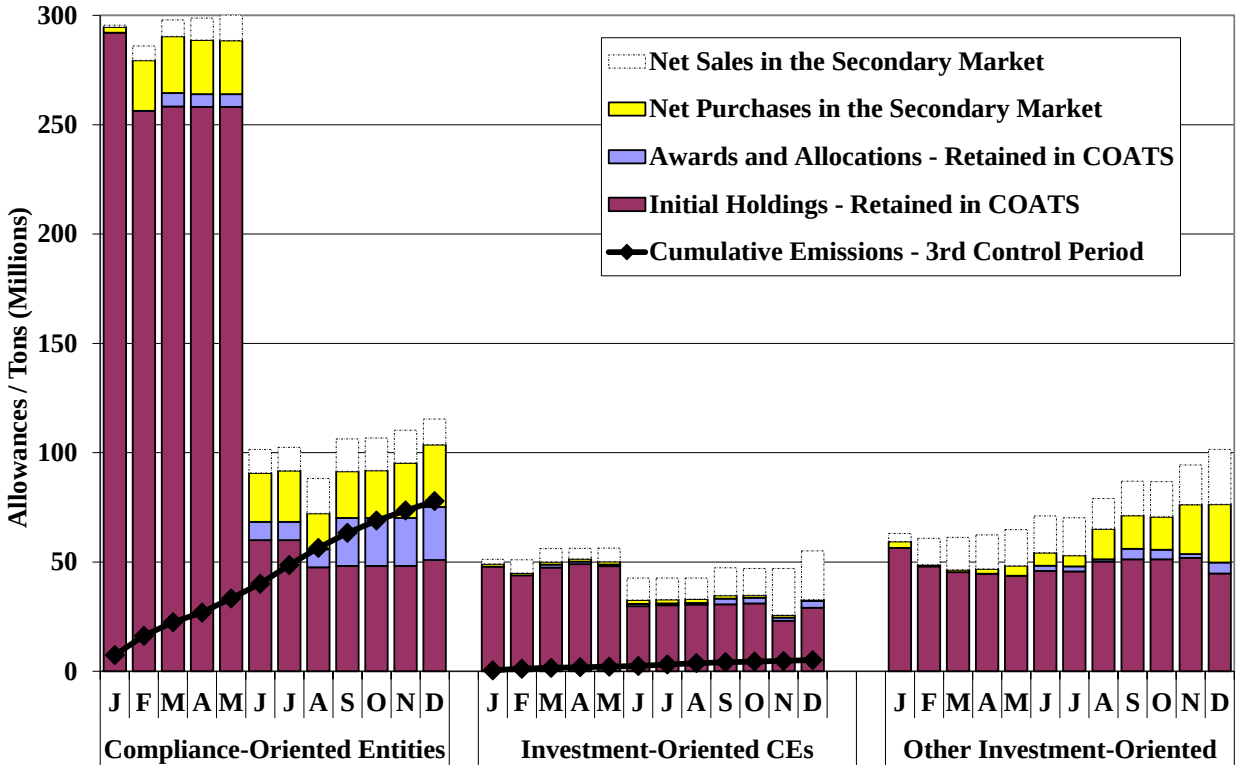
Initial Holdings – Retained in COATS Account includes CO_2 allowances that were held in the COATS account of the firm from the beginning of 2015. If a firm sold CO_2 allowances in 2015, those allowances were deducted from this category after any awards and allocations were exhausted.

For each firm, its holdings of CO_2 allowances in COATS are equal to the sum of three categories: *Initial Holdings – Retained in COATS Account, Awards and Allocations – Retained in COATS Account,* and its *Net Purchases in Secondary Market*.[32] Figure 6 shows the four categories of CO_2 allowances at the end of each month in 2015. The figure also shows the cumulative CO_2 emissions for compliance entities in the third control period. The information is aggregated separately for compliance-oriented entities, investment-oriented compliance entities, and for other investment-oriented entities (i.e., those without compliance obligations).

[32] If a firm initially held 15,000 allowances at the beginning of the year, purchased 50,000 allowances in an auction, purchased 100,000 allowances in the secondary market, and then sold 130,000 allowances in the secondary market, the firm would contribute:

- 30,000 allowances to *Net Sales in Secondary Market*. The calculation does not consider the serial numbers of individual allowances. Hence, in the example, it would not matter whether the 130,000 allowances sold had originally been acquired in the auction or in the secondary market.
- 20,000 allowances to *Awards and Allocation – Retained in COATS Account.*
- 15,000 allowances to *Initial Holdings – Retained in COATS Account.*

Figure 6: Sources of CO_2 Allowances Held in COATS Accounts 2015



Observations regarding registered CO_2 allowance holdings:

- *Holdings by Compliance-Oriented Entities* – Four hundred and three million CO_2 allowances were in circulation at the beginning of January 2015. Of these, 293 million (73 percent) were held by compliance-oriented entities. These firms remained active in purchasing allowances throughout the year, but they surrendered significant numbers of allowances to satisfy their second control period obligations. At the end of 2015, the number of allowances held by compliance-oriented entities had decreased to 104 million (49 percent).
- *Holdings by Investment-Oriented Compliance Entities* – Approximately 50 million of the CO_2 allowances in circulation at the beginning of 2015 were held by investment-oriented compliance entities. These firms surrendered 17 million allowances to satisfy their second control period compliance obligations and were generally net sellers in the secondary market. These entities held 33 million of the allowances in circulation at the end of 2015 (15 percent).
- *Cumulative CO_2 Emissions in the Third Control Period* – Cumulative third control period CO_2 emissions rose from zero at the beginning of 2015 to 83 million at the end of the year. Allowances that remained in circulation after second control period compliance was complete can be compared to the cumulative third control period emissions to calculate the level of surplus holdings (i.e., allowances in excess of the amount needed

for third control period emissions). The level of surplus holdings was 130 million allowances at the end of 2015. Because of the interim adjustments for banked CO_2 allowances, emissions will exceed the number of additional allowances introduced into circulation in each year from 2016 to 2020, so the current surplus of allowances will be largely depleted over the remainder of the decade.

- *Holdings by Other Investment-Oriented Entities* – Entities without compliance obligations were generally net sellers in the first two months of 2015 when some compliance entities were still seeking allowances to satisfy their second control period obligations. In the second half of the year, investment-oriented entities without compliance obligations collectively increased their holdings during the period of increasing allowance prices. The share of allowances held by these entities increased from 15 percent at the beginning of 2015 to 36 percent at the end of the year, reflecting that these entities increased their holdings while the number of allowances in circulation fell. At the end of 2015, entities without compliance obligations held 78 million of the allowances in circulation.

V. PARTICIPATION IN THE CO_2 ALLOWANCE MARKET

This section evaluates participation by individual firms in the CO_2 allowance market. Participation by many firms promotes competition and helps ensure that CO_2 allowance prices are determined efficiently. Over time, firms that need CO_2 allowances for compliance should be able to acquire them through the auctions and/or the secondary market, and the holdings of individual firms should be relatively consistent with their potential uses for allowances.

This section evaluates the level of participation by individual firms in four ways: (i) the demand for allowances by individual firms, (ii) the breadth of participation in the quarterly auctions, (iii) the holdings of individual firms relative to their demand for allowances, and (iv) the breadth of participation in the trading of allowance futures contracts.

Key observations regarding participation in the CO_2 allowance market:

- *Demand for CO_2 Allowances* –The demand for CO_2 allowances is dispersed widely across firms, resulting in participation in the auctions by large number of firms. The three largest compliance entities account for 38 percent of the total projected demand and the top ten compliance entities account for 71 percent. Overall, the concentration of demand for allowances has decreased slightly from the estimates in 2014.
- *Participation in the Auctions* – Large numbers of bidders participated in the quarterly auctions. The number of compliance-oriented entities submitting bids fell slightly to an average of 37, while the number of investment-oriented entities submitting bids increased from an average of 7 in 2014 to 13 in 2015.
- *Distribution of CO_2 Allowances Awarded* – Auction awards were widely distributed across different types of firms as the top ten compliance-oriented entities received 39 percent, while the top ten investment-oriented entities received 50 percent. Aggregating across all 2015 auctions, the largest number of CO_2 allowances awarded to a single firm went to an investment-oriented entity that purchased approximately 19 percent of the allowances.
- *Distribution of CO_2 Allowance Holdings* – Holdings are distributed widely across firms and the current private bank of allowances far exceeds emissions to date. The top ten compliance-oriented entities accounted for 40 percent of the total holdings and smaller compliance-oriented entities accounted for 9 percent of holdings at the end of 2015. The share of allowances held by the top ten investment-oriented entities increased from 18 percent at the end of 2014 to 48 percent at the end of 2015. This share increased both because the investment-oriented entities acquired additional allowances during 2015 and

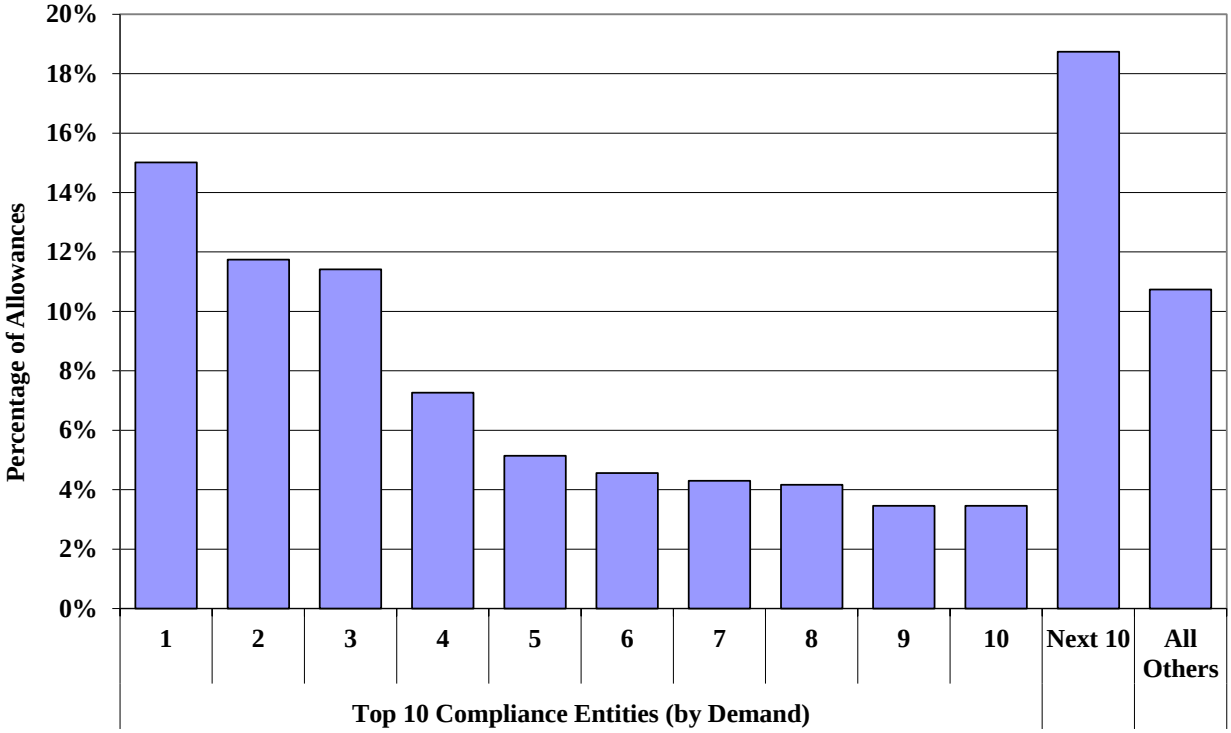
because the number of allowances in circulation fell after the completion of the second control period compliance process.

- *Concentration of Futures Holdings* – Many firms have open interest in RGGI CO_2 allowance futures and options, but a small number of firms account for large shares of the net long and short positions futures contracts. The net long positions of the top four firms accounted for an average of 41 percent of the total long positions for the weeks that were published, while the net short positions of the top four firms accounted for an average of 51 percent of the total short positions.

A. Demand for CO_2 Allowances

The following figure summarizes the projected demand for CO_2 allowances of individual compliance entities at the end of 2015. We project the demand of each compliance entity for CO_2 allowances based on historical CO_2 emissions patterns and expected changes in future market conditions. The projected demand is shown for each of the top ten compliance entities (i.e. the ten firms with the highest projected demand), the second ten compliance entities as a group, and all other compliance entities as a group. The projected demand is reported in Figure 7 as a percentage of the total projected market demand.

Figure 7: Estimated Demand for CO_2 Allowances By Compliance Entity



Observations regarding demand for CO_2 allowances:

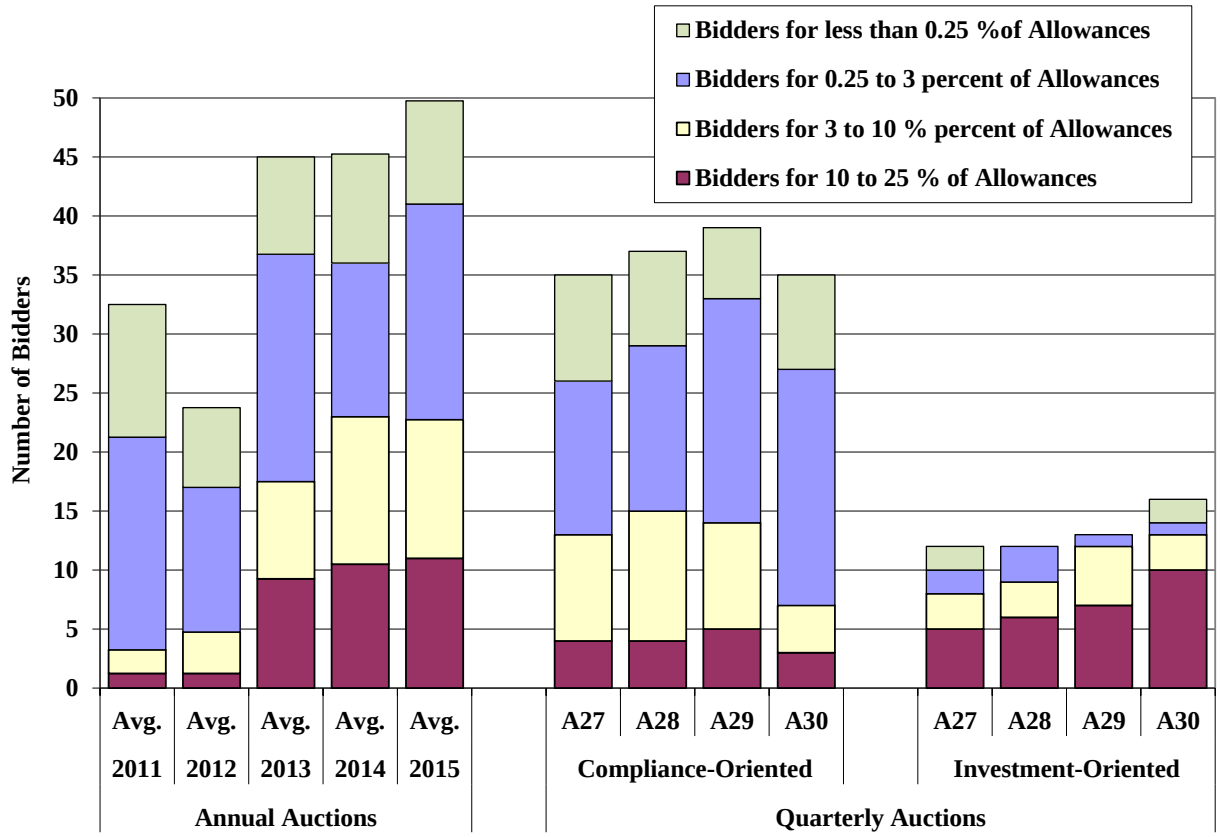
- *Demand for CO_2 Allowances* – The demand for CO_2 allowances is dispersed relatively widely across firms. The three largest compliance entities account for 38 percent of the total projected demand, while the top five compliance entities account for 51 percent. The top ten compliance entities account for 71 percent of the total projected market demand, while the next ten compliance entities account for 19 percent, and all compliance entities that are not among the top 20 firms account for 11 percent.
- *Concentration of Demand* – The concentration of demand by compliance entities decreased slightly from 2014. The demand for allowances by the top compliance entity decreased 13 percent, the demand by the top five compliance entities as a group decreased by approximately 2 percent, and the demand for all compliance entities outside the top 20 as a group increased 15 percent. Reductions in demand for the largest entities resulted primarily from changes in expected consumption patterns for existing generators in the third control period (rather than from the sale of generation assets to a smaller entity).

B. Participation in RGGI Auctions

The following figure summarizes the breadth of participation in the four auctions during 2015. The figure reports the number of firms that submitted bids in each auction. The number of

bidders is shown separately based on whether the bidder was a compliance-oriented entity or an investment-oriented entity. The figure shows these quantities averaged across the auctions in each year from 2011 to 2015.[33]

Figure 8: Number of Bidders According to the Quantity of Bids Submitted Auctions for Current Control Period Allowances



Observations regarding participation in the RGGI auctions:

- *Participation by Compliance-Oriented and Investment-Oriented Entities* – In the 2015 auctions, the number of bidders ranged from 47 to 52 and averaged 50 firms, an increase of 10 percent from an average of 45 bidders in both 2013 and 2014 auctions. The number of compliance-oriented entities submitting bids decreased from an average of 38 in 2014 to 37 in 2015, while the number of investment-oriented entities submitting bids increased from an average of 7 in 2014 to 13 in 2015.

[33] For example, in Auction 27, approximately 15.3 million CO_2 allowances were offered. So, a firm that submitted bids for 200,000 allowances would be counted in the "0.25 to 3 percent" category, since 200,000 ÷ 15.3 million = 1.3 percent.

- *Participation by Large and Small Bidders* – The number of large bidders (i.e., firms submitting bids for more than three percent of the allowances in a current control period offering) averaged 23 in 2015, which was unchanged from 2014. The average number of small bidders (i.e., firms submitting bids for up to three percent of allowances offered for sale) increased from 22 in 2014 to 27 in 2015.
- *Competition* – Participation by a large number of firms promotes competition and helps ensure that the auction clearing price reflects the market value of CO_2 allowances. The levels of participation in the 2015 auctions remain healthy, and we found no material evidence of anti-competitive conduct or significant barriers to participation in our reviews of the bids and the qualification process of each auction.

C. Acquisition of CO_2 Allowances by Individual Firms

In a well-functioning market, we expect each firm to purchase a number of CO_2 allowances that is generally consistent with its demand. Individual firms may purchase a larger or smaller share according to how the current price of CO_2 allowances compares to their expectations of allowance prices in the future. Firms that believe CO_2 allowances are currently undervalued can be expected to purchase a larger share, while firms that believe allowances are overvalued can be expected to purchase a smaller share. Thus, competition by many firms helps ensure that the current price of CO_2 allowances in the auctions and in the secondary market reflects reasonable expectations.

The following two figures examine the distribution of CO_2 allowances across individual firms following the seventh full year of the RGGI market's operation. Figure 9 illustrates how broadly CO_2 allowances were distributed in the auctions, while Figure 10 illustrates how the holdings of allowances in COATS accounts were distributed after the close of 2015. The figures show that CO_2 allowances have generally been acquired by firms in quantities that are consistent with their demand, which is a positive indicator regarding the competitiveness of the market.

Figure 9 reports the average quantities of CO_2 allowances that were awarded to firms in the auctions in 2014 and 2015. The awards are shown for each of the top ten compliance-oriented entities (i.e. the ten firms with the highest projected demand) and for each of the top ten investment-oriented entities (i.e., the ten firms with the largest total awards). Compliance-oriented entities are ranked in descending order based on total awards rather than demand. The

table also shows the level of awards given to remaining (not included in the top 10) compliance-oriented entities and remaining investment-oriented entities as a group.

Figure 9: Distribution of Auction Awards
2014 - 2015

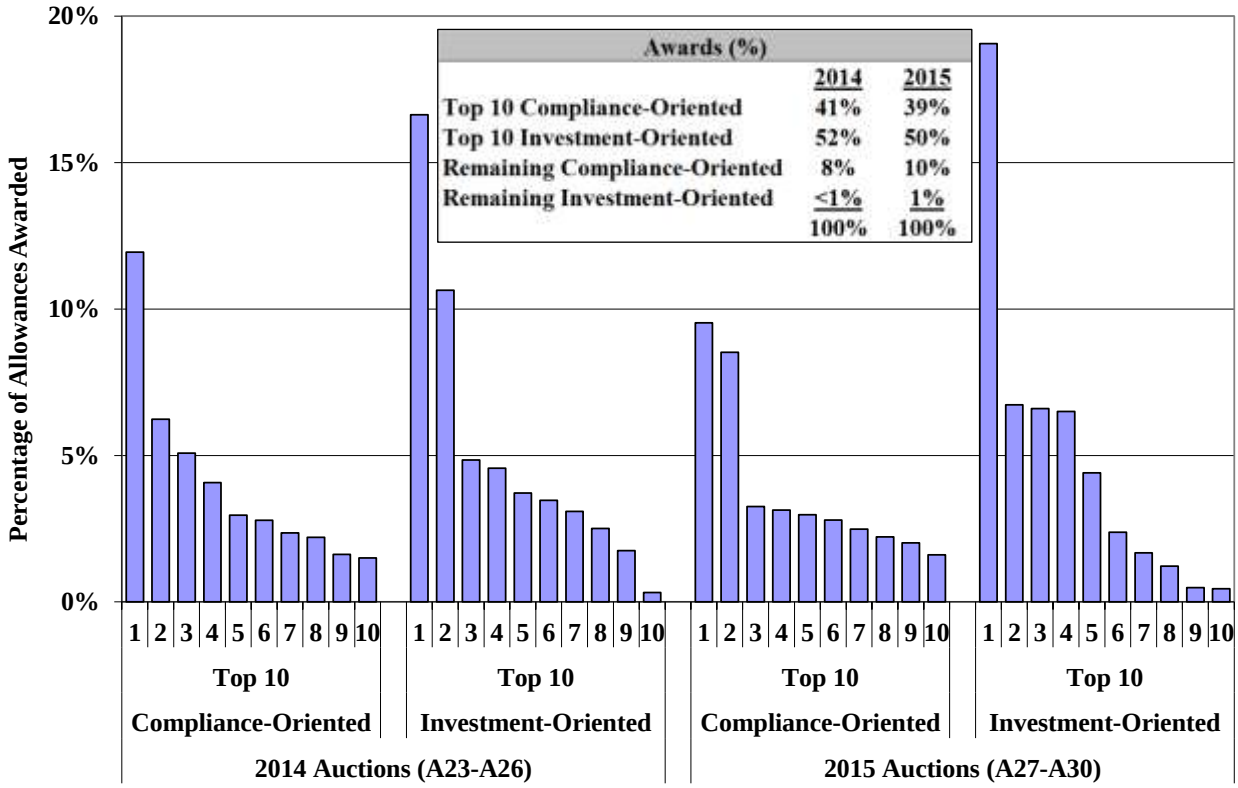
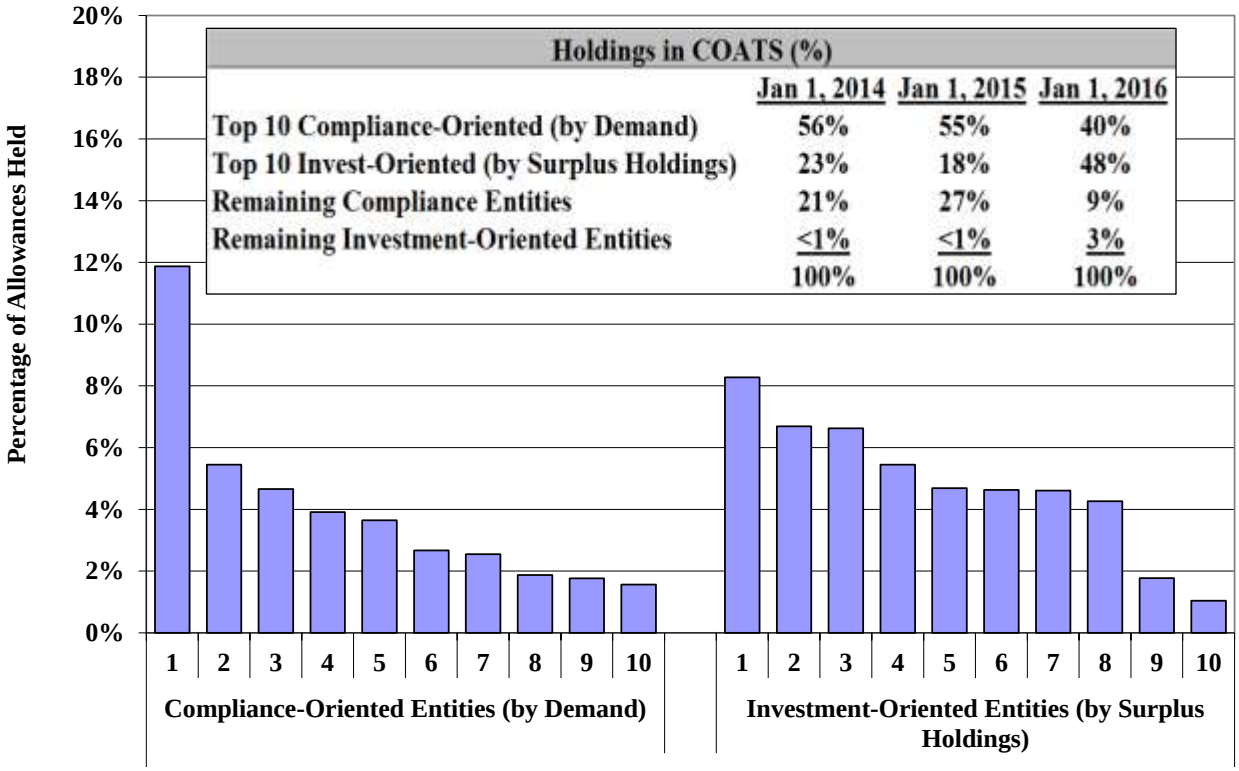


Figure 10 reports the quantities of CO_2 allowances that were held in the COATS accounts of individual firms at the beginning of January 2016, following the delivery of contracts for December 2015 delivery. The holdings are shown for each of the top ten compliance-oriented entities (i.e. the ten firms with the highest projected demand) and for the top ten investment-oriented entities. The top ten investment-oriented entities are ranked in descending order based on total holdings rather than demand. The table also shows the level of holdings of the remaining (not included in the top ten) compliance-oriented entities and remaining investment-oriented entities as a group.

Figure 10: Distribution of CO_2 Allowance Holdings
January 1, 2016



Observations regarding the distribution of CO_2 allowances:

- *Distribution of CO_2 Allowances Awarded* – The share of awards allocated to the top ten compliance-oriented entities decreased from 41 percent in 2014 to 39 percent in 2015, while the share of awards allocated to the top ten investment-oriented entities decreased from 52 percent in 2014 to 50 percent in 2015. Aggregating across all 2015 auctions, the largest number of CO_2 allowances was awarded to a single investment-oriented entity that purchased 19 percent of the allowances.
- *Distribution of CO_2 Allowance Holdings* – The holdings of CO_2 allowances were distributed across compliance-oriented entities at the close of 2015 at levels that were generally consistent with their demand, and a small number of these entities owned a moderate surplus. The share of holdings of the top ten compliance-oriented entities decreased from 55 percent at the end of 2014 to 40 percent at the end of 2015, while the share of holdings of smaller compliance-oriented entities decreased from 27 percent to 9 percent. The share of holdings by the top ten investment-oriented entities increased from 18 percent at the end of 2014 to 48 percent at the end of 2015. These levels of holdings do not raise competitive concerns given that the current private bank of allowances far exceeds the compliance obligations of firms thus far in the third control period. The large surplus makes it more difficult for one firm or a small number of firms to hoard allowances.

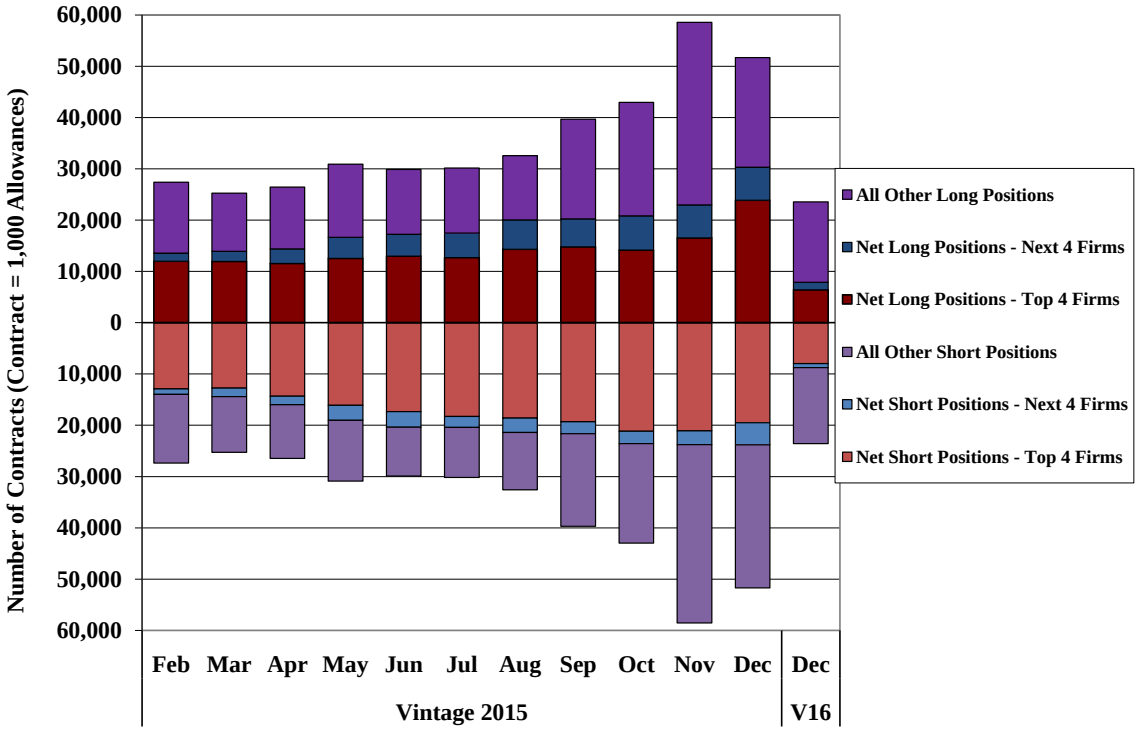
D. Participation in the CO_2 Allowance Futures Market

Additional information about the trading of futures, forwards, and options is available in the weekly Commitments of Traders ("COT") reports, which are published by the Commodity Futures Trading Commission ("CFTC") [34] for each week when greater than 20 firms have reportable positions in a particular product.

Figure 11 summarizes the concentration of open interest in Vintage 2015 and Vintage 2016 ICE futures and options contracts when information was available from the CFTC. The figure reports the average monthly net long positions in three categories: (i) the four firms with the largest long positions (see "Top 4 Firms"), (ii) the four firms with the largest long positions not including the Top 4 (see "Next 4 Firms"), and (iii) all other long positions. The figure also reports the average monthly net short positions in three categories: (i) the four firms with the largest short positions (see "Top 4 Firms"), (ii) the four firms with the largest short positions not including the Top 4 (see "Next 4 Firms"), and (iii) all other short positions.

[34] Each day, firms with an open interest of 25 contracts or more are required to report their positions to the CFTC. Each Tuesday, the CFTC publishes the COT report, which is a summary of the long and short positions of participants in the market.

Figure 11: Concentration of Open Interest in CCFE Futures and Options[35]



Observations regarding the concentration of open interest in futures and options contracts by individual firms:

- *Number of Participants* – The number of participants in the market for RGGI CO_2 allowance derivatives increased in 2015, and the COT report was published 47 weeks of the year as compared to 34 weeks in 2014 and just four weeks in 2013. For the weeks that were reported, up to 31 firms had significant positions in RGGI Vintage 2015 futures contracts and up to 20 firms had significant positions in Vintage 2016 contracts.[36]
- *Concentration of Ownership* – Many firms have open interest in RGGI CO_2 allowance futures and options, although a small number of firms account for large shares of the net long and short positions in Vintage 2015 contracts. The net long positions of the top four firms accounted for an average of 41 percent of the total long positions for the weeks that were published, while the net short positions of the top four firms accounted for an average of 51 percent of the total short positions.

35 Source: The CFTC's Commitment of Traders reports which are available at "www.cftc.gov/MarketReports/CommitmentsofTraders/HistoricalCompressed/index.htm".

36 The COT report only published RGGI Vintage 2016 contracts in the last two weeks of December 2015.

VI. DISCUSSION OF MARKET MONITORING

As the RGGI Market Monitor, we evaluate the conduct of market participants in the auctions and in the secondary market to identify potential anti-competitive conduct. We also assess whether the auctions were administered properly by the auction administrator.

Participation in the auctions by a large number of firms promotes competition and helps ensure that the auction clearing price reflects the market value of allowances. Hence, the participation by a substantial number of firms as observed in Figure 8 is a positive indicator regarding the competitiveness of the first 30 auctions. We have found no material evidence of anti-competitive conduct or significant barriers to participation in our reviews of the bids and the qualification process for each product in each auction. We also found that the auctions were conducted in accordance with the noticed rules and bids received.

In our monitoring of the secondary market, we evaluate whether firms could potentially hoard a substantial share of the supply of allowances to influence prices or to prevent a competitor from obtaining allowances. Based on our review of the holdings of individual firms, we find no evidence that hoarding is a significant concern, and that the holdings of individual firms are generally consistent with their expected need for allowances over the current control period. Figure 6 shows that compliance-oriented entities as a group hold a comfortable surplus of allowances, while Figure 10 demonstrates that the allowances are adequately distributed across the COATS accounts of individual compliance-oriented entities.

Another potential concern is that a firm expecting to purchase CO_2 allowances in the auction might sell a large number of futures contracts in an effort to push prices in the secondary market below the competitive level. Such a firm might profit from buying a large number of CO_2 allowances in the auction at a discount if the bidding in the auction were influenced by the depressed futures price. For this to be a profitable strategy, the firm would need to be able to substantially depress the futures price with a relatively small amount of sales—an amount smaller than the amount of CO_2 allowances it planned to buy in the auction. The best protection against this strategy is a market where other firms respond by making additional purchases.

Firms that are looking for an opportunity to reduce their short positions or to purchase CO_2 allowances for their future compliance needs help limit the effectiveness of a strategy to depress prices below the competitive level. Such firms have a strong incentive to make additional purchases if a firm deliberately attempts to depress the futures price.

We have found no material evidence of anti-competitive conduct or significant barriers to participation in the auctions and in the secondary market, and we have found that price variations are generally driven by reasonable expectations related to the long-term supply and demand for allowances.