RGGI Inc.

REPORT ON THE SECONDARY MARKET FOR RGGI CO_2 ALLOWANCES: THIRD QUARTER 2014

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.

A. INTRODUCTION

The primary market for RGGI CO_2 allowances consists mainly of the auctions where allowances are initially sold. Once a CO_2 allowance is purchased in the primary market, it can then be resold in the secondary market. The secondary market for RGGI CO_2 allowances comprises the trading of physical allowances and financial derivatives, such as futures and options contracts.

The secondary market is important for several reasons. First, it gives firms an ability to obtain CO_2 allowances at any time during the three months between the RGGI auctions. Second, it provides firms a way to protect themselves against the potential volatility of future auction clearing prices. Third, it provides price signals that assist firms in making investment decisions in markets affected by the cost of RGGI compliance.

This report provides a summary of activity in the secondary market in the third quarter of 2014 and discusses the results of our market power screens. Several patterns have emerged in this period in the secondary market:

- *CO_2 Allowance Prices* – The average transfer price of CO_2 allowances in COATS during the third quarter of 2014 was $4.87, approximately 8 percent higher than in the previous quarter and 61 percent higher than the third quarter of 2013. The clearing price in Auction 25 (on September 3) was $4.88, which was consistent with secondary market prices leading up to the auction.
- *Secondary Market Activity* – Although volumes decreased from the previous quarter, volumes have risen considerably from the third quarter in 2013. Increased activity is a natural market response as compliance entities seek to manage the increased CO_2 allowance price volatility that is expected under the new CO_2 emissions cap.
  - ✓ The volume of CO_2 allowance transfers between unaffiliated firms was 13.1 million.
  - ✓ The open interest in RGGI futures reached a high of 28 million on August 26 and closed the third quarter at 25.4 million, which was up 15 percent from the end of the previous quarter.
- *CO_2 Allowance Holdings* – The share of CO_2 allowances that were held by compliance entities and their affiliates at the end of the third quarter of 2014 was approximately 80 percent out of 385 million allowances in circulation.

We evaluate information on the holdings of CO_2 allowances and allowance derivatives as well as the demand for allowances to identify firms that may have acquired a position that raises

competitive concerns. In the current study period, we find no evidence of anticompetitive conduct.

B. BACKGROUND

The secondary market for RGGI CO_2 allowances comprises the trading of physical allowances and financial derivatives, such as futures, forward, and option contracts. A physical allowance trade occurs when the parties to the transaction register the transfer of ownership in RGGI's CO_2 Allowance Tracking System ("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 compliance year of the CO_2 allowance that is to be transferred. One standard futures contract equals 1,000 RGGI allowances.[1]
- *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 $5 strike price, and December 2014 expiration date. If the price of the corresponding forward contract rose to $5.75, the firm could exercise the option to buy CO_2 allowances at $5 and immediately sell them at $5.75. Alternatively, if the price of the forward contract stayed below $5, the firm

[1] More precisely, a futures contract requires parties with an open interest to post financial assurance in an account with the exchange until the contract reaches expiration. The exchange continually withdraws and deposits funds according to changes in the prices of the contracts in which the party has interest. For example, if a firm buys a contract for 1,000 allowances at $3.50/allowance, the purchasing firm (firm with a long position) must put $3,500 in an account (or whatever share of the entire liability the exchange requires). If the futures price declines to $3/allowance, the exchange transfers $500 from the account of a firm with a long position to the account of a firm with a short position (firm that sold a contract), and the firm with a long position is only required to keep $3,000 in the account. At the end of the delivery month, allowances are exchanged for funds according to the closing price on the last day of the month.

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, forward, and option 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 forwards, they usually require less financial security, making 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 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.

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 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.

C. SUMMARY OF PRICES

This section summarizes prices in the secondary market for RGGI CO_2 allowances in the third quarter of 2014. Figure 1 summarizes transaction prices in the secondary market for CO_2 allowances, including the prices of allowance transfers registered in COATS[2] and the prices of futures contract trades on the Intercontinental Exchange ("ICE"). Figure 2 summarizes the option-implied (i.e., expected) volatility of RGGI CO_2 allowance prices based on an analysis of the trading of options contracts.[3]Key observations regarding RGGI CO_2 allowance prices:

- The average transfer price of CO_2 allowances in COATS during the third quarter of 2014 was $4.87, approximately 8 percent higher than in the prior quarter and 61 percent higher than the third quarter of 2013. Prices remained flat throughout the quarter, with 99 percent of the volume trading between $4.80 and $4.99.
- The clearing price in Auction 25, held on September 3 was $4.88, which was consistent with secondary market prices leading up to the auction.
- Option trading decreased in the third quarter of 2014, which coincided with the decrease in price volatility from the second quarter.
- Option-implied volatility ranged from 17 to 24 percent in eight option trades during the third quarter. Option-implied volatility has been trending-down during the second and third quarters.

Prices of CO_2 Allowances and Allowance Derivatives

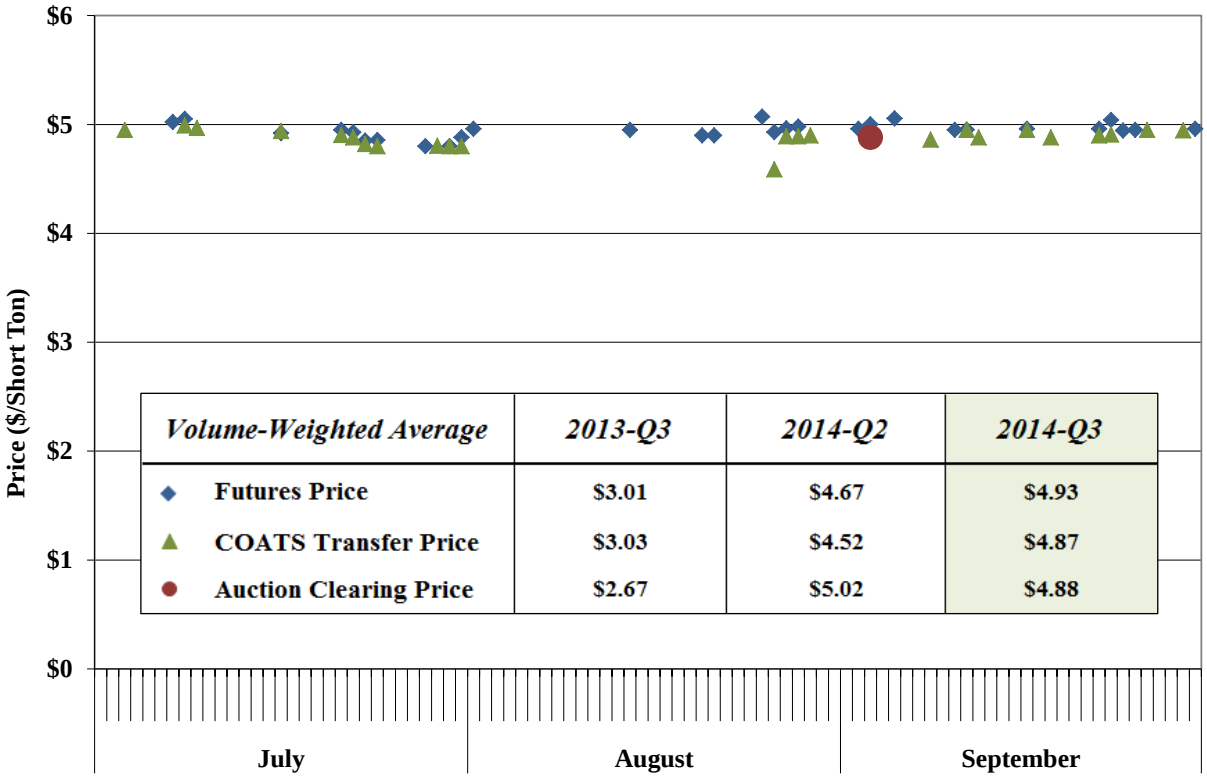
Figure 1 summarizes prices in the secondary market during the period. The blue diamonds show the prices of ICE futures trades on days with volume. The green triangles show the volume-weighted average prices of physical deliveries registered in COATS on days with transactions when the price was recorded ("COATS transactions"). The red circle shows the clearing price of the CO_2 allowances that were sold in RGGI Auction 25, which was held on September 3. Figure 1 also shows volume-weighted average prices for each category in the third quarter of 2014 compared to the previous quarter and the third quarter of the previous year. Volume-weighted

[2] Parties are required to report the transaction price if there is an underlying financial transaction related to the transfer of allowances between accounts.

[3] 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.

average prices for first and second control period CO_2 allowances are calculated together since the compliance deadline for the first control period has passed and all CO_2 allowances are essentially interchangeable for compliance purposes.

Figure 1: Prices in the Secondary Market for RGGI CO_2 Allowances[4]
July 1, 2014 to September 30, 2014



Volume-Weighted Average	*2013-Q3*	*2014-Q2*	*2014-Q3*
Futures Price	$3.01	$4.67	$4.93
COATS Transfer Price	$3.03	$4.52	$4.87
Auction Clearing Price	$2.67	$5.02	$4.88

Key observations regarding CO_2 allowance prices:

- The average transfer price of CO_2 allowances in COATS during the third quarter of 2014 was $4.87, approximately 8 percent higher than in the prior quarter and 61 percent higher than the third quarter of 2013. Prices remained flat throughout the quarter, with 99 percent of the volume trading between $4.80 and $4.99.
- The prices of ICE futures trades were also relatively flat throughout the quarter, trading between $4.80 and $5.12. The average futures price of $4.93 was 6 percent higher than the average price in the prior quarter and 64 percent higher than in the third quarter of 2013.

[4] Sources: Auction clearing prices are available at www.rggi.org/market/co2_auctions/results, ICE futures prices are available at www.theice.com, and the prices of physical deliveries are based on information in COATS.

- The clearing price in Auction 25, held on September 3, was $4.88, which was consistent with secondary market prices leading up to the auction. The auction clearing price decreased 3 percent from Auction 24 (which was held in June).

Prices of Options for CO_2 Allowances

The clearing prices of option contracts provide insight about how the market expects the price of the underlying commodity to move in the future. The price of an option depends on two factors: (i) the expected value of the underlying commodity relative to the strike price of the option, and (ii) the expected volatility of the underlying commodity over the period before the expiration date. When call option price decreases coincide with put option price increases, it signals a decrease in the expected price of the underlying commodity. Conversely, when call option prices and put option prices move in the same direction, it signals a change in the expected volatility of the underlying commodity price.

Key observations regarding the pricing of options for CO_2 allowances in the third quarter of 2014:

- Eight option trades were recorded on ICE during the third quarter of 2014, down from nineteen trades in the previous quarter. Seventy-five percent of the volume was for contracts with December 2015 expiration, and the remaining 25 percent was for contracts with December 2014 expiration.
- The strike prices of the six call options sold during the third quarter of 2014 ranged from $5.25 to $7.00, while two put options were sold at strike prices of $4.50 and $5.00. These strike prices provide some indication of the market's expectations for the potential range of variation in allowance prices.

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, retire older inefficient generation, and 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

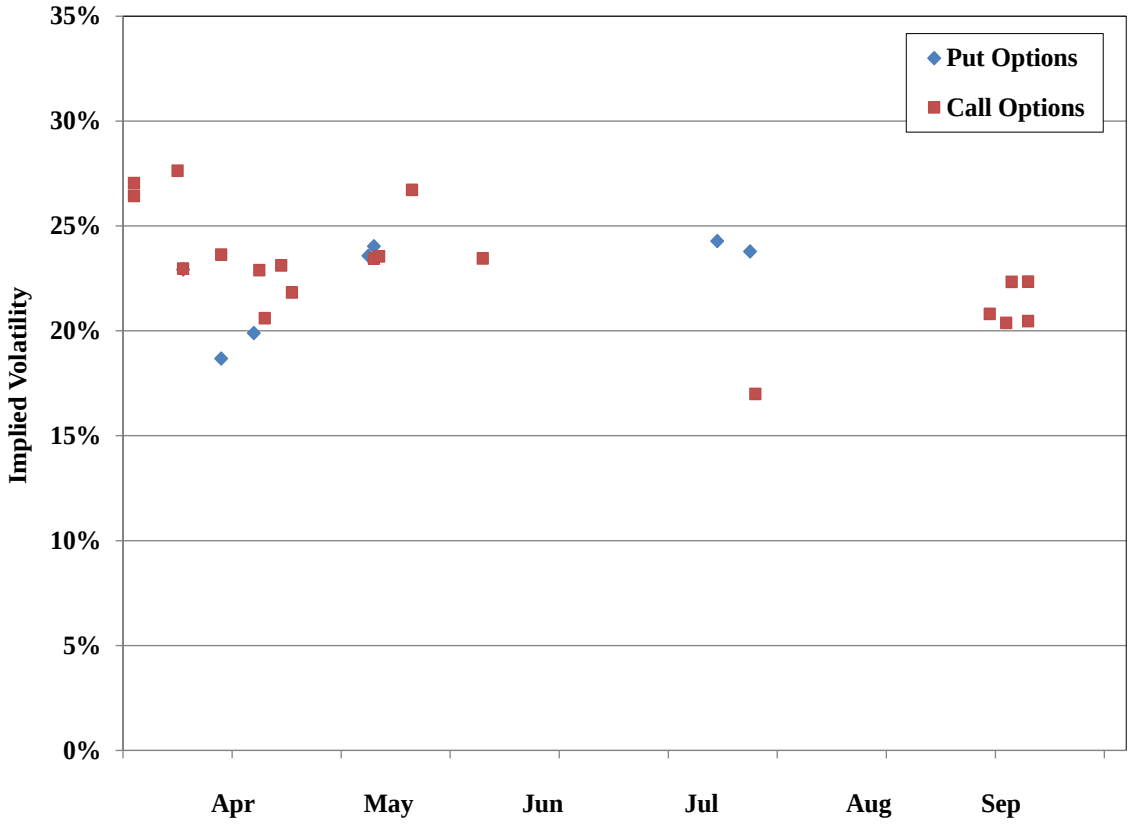
allowance prices can be volatile, the availability of futures and options contracts allows firms to protect themselves from the risks of such investments.

One measure of the volatility of CO_2 allowance prices is known as option-implied volatility, 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.

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 the second and third quarters of 2014.[5] 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 less than 90 days prior to the expiration date. Excluding these contracts reduces variations in implied volatility that are driven by short-term issues such as the timing of the trades within a particular quarter (i.e. around the time of each quarterly auction).

[5] 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
April 1, 2014 to September 30, 2014



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

- Option-implied volatility decreased slightly from the second to the third quarter of 2014.
  - ✓ In the second quarter, there were 19 trades where implied volatility ranged between 19 and 28 percent.
  - ✓ In the third quarter, there were eight trades where implied volatility ranged between 17 and 24 percent.
- Call options in the third quarter exhibited a higher option-implied volatility than put options, which may indicate that the market perceives more risk from future allowance price increases than future decreases.

D. VOLUMES AND OPEN INTEREST

This section evaluates the volume of COATS transactions (i.e., transfers of CO_2 allowances between unaffiliated parties as recorded in COATS) as well as the volume of trading and the level of open interest in exchange-traded futures and options. Figure 3 examines the volumes of transactions recorded in COATS and of futures trading. Figure 4 summarizes the level of open interest in exchange-traded RGGI futures and option contracts. Figure 5 evaluates the concentration of firms with open interest in exchange-traded RGGI futures and option contracts.

Key observations regarding trading volumes and open interest in the third quarter of 2014:

- Secondary market activity over the third quarter of 2014 has decreased from the previous quarter, but it is still up significantly from the third quarter of 2013. The volume of:
  - ✓ Trading of RGGI futures listed on ICE was for 11.2 million CO_2 allowances in the third quarter of 2014; and
  - ✓ CO_2 allowance transfers between unaffiliated firms was 13.1 million.
- Approximately 55 percent of the volume of CO_2 allowance transfers in COATS between unaffiliated firms during the third quarter of 2014 was marked as exchange-traded, illustrating the importance of the futures market in facilitating trading.
- Open interest in RGGI futures increased 15 percent from approximately 22 million at the end of the second quarter to 25.4 million at the end of the third quarter.
- Open interest in RGGI options increased 9 percent from approximately 26.5 million at the end of the second quarter of 2014 to 28.9 million at the end of the third quarter of 2014.
- The share of CO_2 allowances that were held by compliance entities and their affiliates at the end of the third quarter of 2014 was 80 percent (out of approximately 385 million allowances in circulation).

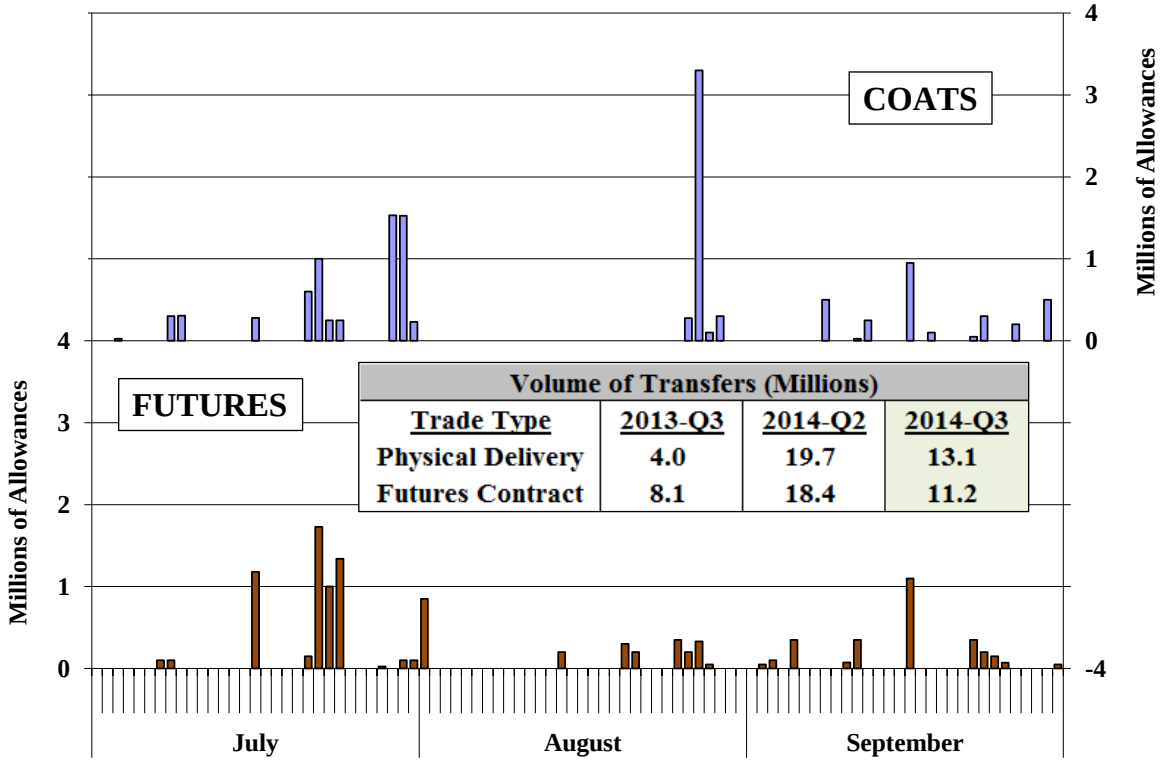
Volume of CO_2 Allowance Transfers, Futures, and Options

Figure 3 summarizes the volume of transfers of CO_2 allowances between the COATS accounts of unaffiliated firms and the volume of trading of RGGI futures listed on ICE. The figure also shows the volume of transfers in the third quarter of 2014 compared to the previous quarter and to the third quarter of 2013.[6] The volume of transfers of allowances for the first and second

[6] Firms are categorized as affiliated based on available information. As a result, calculations provided in previous reports may be inconsistent with ones in this report when new information becomes available.

control periods are shown together because all CO_2 allowances are essentially interchangeable for compliance purposes.

Figure 3: Volume of CO_2 Allowance Transfers Between Unaffiliated Parties[7]
July 1, 2014 to September 30, 2014



Key observations regarding the volume of transfers of CO_2 allowances in COATS between unaffiliated firms:

- The volume of CO_2 allowance transfers between unaffiliated firms was 13.1 million, down from 19.7 million allowances in the previous quarter, but up from 4 million allowances in the third quarter of 2013.
- Fifty-eight percent of the volume of CO_2 allowance transfers between unaffiliated firms occurred in the last three trading days of each month. Most of these transfers resulted from the final settlement of monthly RGGI futures contracts.
- The share of CO_2 allowances that were held by compliance entities and their affiliates at the end of the first quarter of 2014 was 80 percent (out of approximately 385 million allowances in circulation).

[7] Source: CO_2 allowance transfers are based on information in COATS.

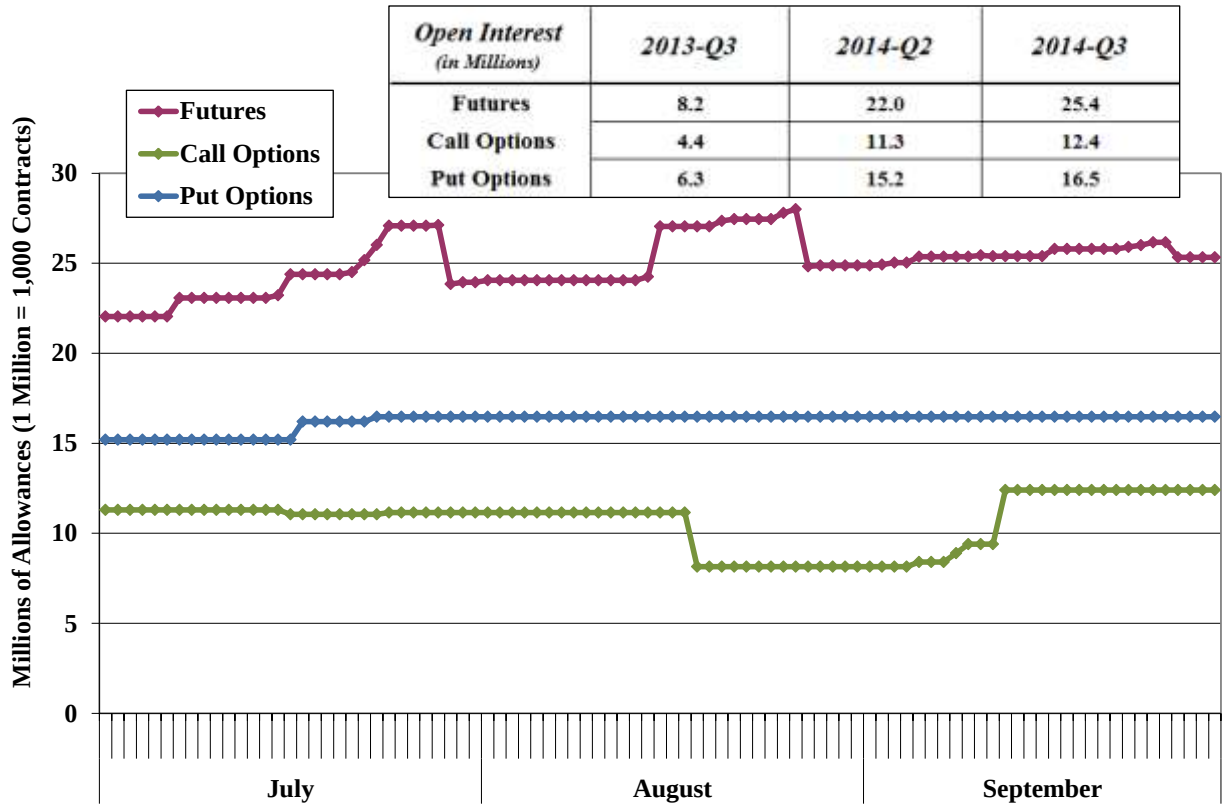
Key observations regarding the volume of trading of RGGI futures and options contracts:

- The volume of trading of RGGI futures listed on ICE was 11.2 million CO_2 allowances in the third quarter of 2014, down from 18.4 million in the prior quarter, but up from 8.1 million in the third quarter of 2013.
- Approximately 43 percent of the volume of trading of RGGI futures listed on ICE during the third quarter of 2014 was for contracts that were delivered in the current quarter, while approximately 51 percent of the volume was for contracts that will be delivered in the fourth quarter of 2014. Thus, a large portion of the futures trading resulted in allowance transfers that were reflected in COATS during the third quarter, while the majority are likely to result in allowance transfers at the end of 2014.
- There were eight option trades reported on ICE in the third quarter of 2014, down from nineteen trades in the prior quarter.
- The total volume of options traded in the third quarter of 2014 was for 5.6 million CO_2 allowances, which was an decrease from 12.4 million in the prior quarter.

Open Interest in Exchange-Traded RGGI Futures and Options

Figure 4 summarizes the level of open interest in exchange-traded futures and options listed on the ICE during the third quarter of 2014. The red line shows the level of open interest in futures contracts. As in Figure 3, the level of open interest in futures contracts for the first and second control period are shown together since all CO_2 allowances are essentially interchangeable for compliance purposes. The green line shows the level of open interest in call options. The blue line shows the level of open interest in put options.

Figure 4: Open Interest in RGGI Futures and Options
July 1, 2014 to September 30, 2014



Key observations regarding the level of open interest in RGGI futures and options:

- The open interest in RGGI futures reached a high of 28 million on August 26, and closed the third quarter up 15 percent from the end of the second quarter at 25.4 million.
- The level of open interest in RGGI futures typically increases throughout each month, then decreases at the end of the month due to the final settlement of the current month contract. The decrease in levels of open interest in RGGI futures on July 29, August 27, and September 26 were due to the settlement of contracts with expiration dates at the end of those months.
- The open interest in RGGI put options increased from 15.2 million at the end of the second quarter of 2014 to 16.5 million at the end of the third quarter of 2014.
- The open interest in RGGI call options increased from approximately 11.3 million at the end of the second quarter of 2014 to over 12.4 million at the end of the third quarter of 2014.

Concentration of Open Interest

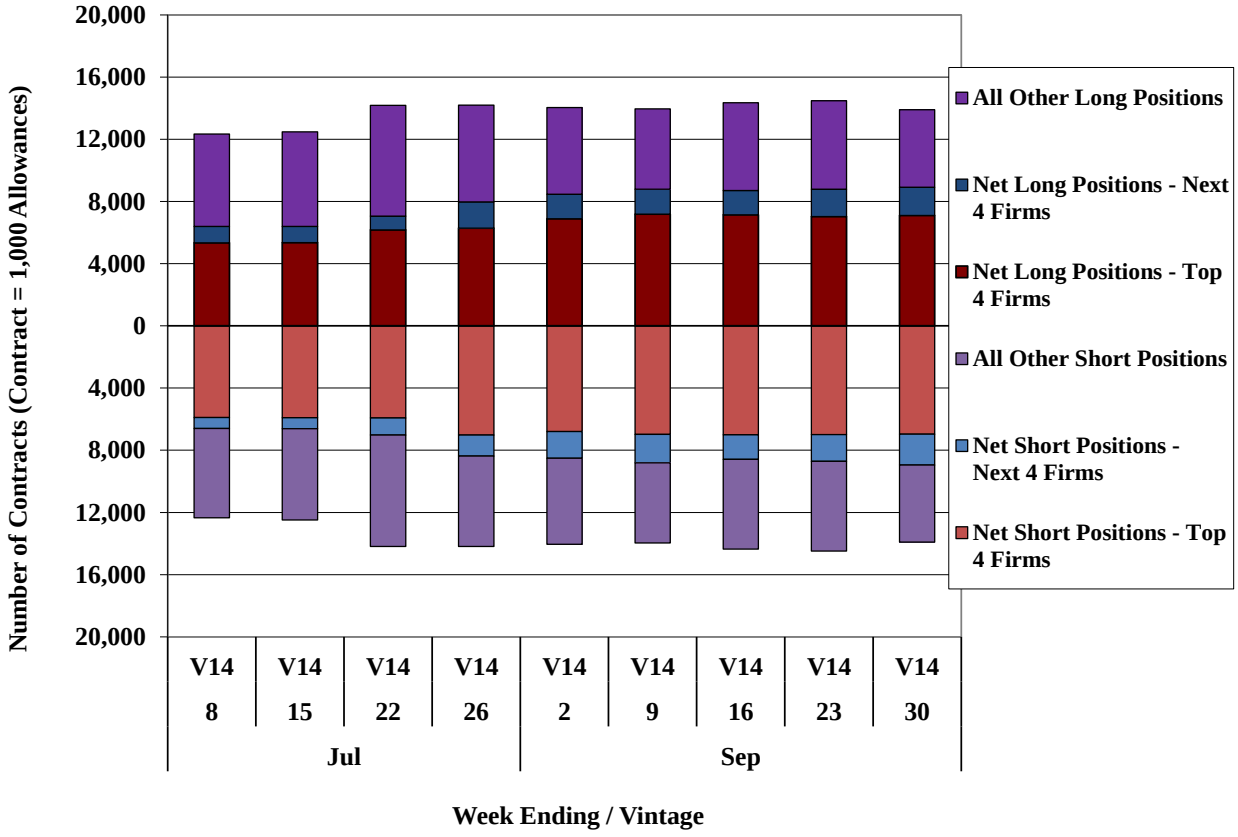
Additional information about the trading of futures, forwards, and options is available in the weekly Commitments of Traders ("COT") reports, which are published by the Commodity Futures Trading Commission ("CFTC")[8,9] for each week when greater than 20 firms have reportable positions in a particular product.

Figure 5 summarizes the concentration of open interest in 2014 vintage ICE futures and options contracts. The figure reports the 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 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.

[8] Each day, firms with an open interest of 25 contracts or more are required to report their positions to the CFTC. The CFTC categorizes each firm as Commercial if it engages in trading primarily to supply its own need for allowances or Non-Commercial if it trades for another purpose. Hence, compliance entities are generally designated as Commercial and other entities are frequently designated as Non-Commercial. Each Tuesday, the CFTC issues the COT report, which is a summary of the long and short positions of participants in the market.

[9] The CFTC does not publish information from the COT reports for weeks when fewer than 20 firms have reportable positions in a given product, which is why no information is shown for the first two weeks of May or for any vintage contract other than 2014 (each vintage is reported separately).

Figure 5: Concentration of Open Interest in CCFE Futures and Options[10]
July 1 to September 30, 2014



Observations regarding the concentration of open interest:

- 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 2014 vintage contracts.
  - ✓ The "Top Four" Firms accounted for an average of 47 percent of the total long positions for the weeks shown during the quarter, while 58 percent of the total long positions were held by eight firms.
  - ✓ The "Top Four" Firms accounted for an average of 48 percent of the total short positions for the weeks shown during the quarter, while 58 percent of the total long positions were held by eight firms.
- The CFTC does not publish firm-level information on open interest, although the information they publish provides an indication of the upper limits of the net long and net short positions

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

of individual firms. Combined with firm-specific information about CO_2 allowance holdings from COATS, the information on open interest that is published by the CFTC is useful for evaluating the potential for a firm to hoard RGGI CO_2 allowances, which is discussed further in Section E.

E. Discussion of Market Monitoring

As the RGGI Market Monitor, we monitor trading in the secondary CO_2 allowance market in order to identify anticompetitive conduct. Additionally, the Commodity Futures Trading Commission ("CFTC") evaluates trading in the secondary CO_2 allowance market consistent with its role as the regulator of derivative markets in the U.S. This section discusses two types of anti-competitive conduct for which we monitor. As in previous reports on the secondary market, we find no evidence of anti-competitive conduct.

In any commodity market, one potential concern is that a firm could hoard a substantial share of the supply of a commodity to influence prices or to prevent a competitor from obtaining CO_2 allowances. Hence, we screen information on the holdings of CO_2 allowances and allowance-derivatives and the demand for allowances to identify firms that might acquire a position that raises competitive concerns. During the first control period, hoarding was not a significant concern for the RGGI CO_2 allowance market because the amount of allowances that were available through the auctions was more than sufficient to satisfy the demand for allowances. During the second control period, which began in January 2012, the ability of an individual firm to hoard is limited by the substantial private bank of CO_2 allowances that has been accumulated and also by the market rules, particularly the auction rules that limit the amount of allowances that can be purchased by a single party or group of affiliated parties in a single offering to 25 percent.

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 the price of the contracts 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. Nevertheless, the CFTC has access to confidential transaction data, which allows it to monitor for evidence of manipulative conduct.