



**REPORT ON THE SECONDARY MARKET
FOR RGGI CO₂ ALLOWANCES: SECOND QUARTER 2015**

Prepared for:

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

Prepared By:



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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 (CO₂) 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 AND SUMMARY

The primary market for RGGI CO₂ allowances consists mainly of the auctions where allowances are initially sold. Once a CO₂ allowance is purchased in the primary market, it can then be resold in the secondary market. The secondary market for RGGI CO₂ 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 CO₂ 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 second quarter of 2015 and discusses the results of our market power screens. Several patterns have emerged in this period in the secondary market:

- CO₂ Allowance Prices – The average CO₂ allowance futures price was \$5.53 during the second quarter of 2015, two percent higher than in the first quarter and 19 percent higher than the second quarter of 2014. Prices ranged between \$5.30 and \$5.60 from April until Auction 28 in early June, and then prices increased steadily during June and reached \$5.80 at the end of the quarter.
- Secondary Market Activity – Secondary market activity decreased significantly from the first quarter of 2015 (when trading was elevated by firms seeking CO₂ allowances before the March 1 compliance deadline for the second control period).
 - ✓ The total volume of CO₂ allowance transfers between unaffiliated firms was 15.1 million, down 56 percent from the first quarter and down 28 percent from the second quarter of 2014.
 - ✓ The total volume of trading of RGGI futures listed on ICE was 29.3 million CO₂ allowances in the second quarter of 2015, equal to the trading volume in the first quarter and up 59 percent from the second quarter of 2014.
- CO₂ Allowance Holdings – Of the 169 million CO₂ allowances in circulation at the end of the second quarter of 2015, compliance entities and their affiliates held approximately 116 million of which an estimated 80 percent were held for compliance purposes.

We evaluate information on the holdings of CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 2015 expiration date. If the price of the corresponding forward contract rose to \$5.75, the firm could exercise the option to buy CO₂ 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 CO₂ 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 CO₂ 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 CO₂ allowances.

The category *compliance entities and their affiliates* includes firms that are believed to: (i) have a parent-subsidary relationship with a compliance entity, (ii) be subsidiaries of a parent company that has a large interest in a compliance entity, (iii) have substantial control over the operation of a budget source and/or responsibility for acquiring RGGI allowances to satisfy its compliance obligations.

Allowances held by compliance entities and their affiliates are categorized as *held for compliance purposes* unless a firm holds a number of allowances that exceeds its compliance obligations by a margin that suggests it is also buying for re-sale or some other investment purpose. For such a firm, the portion of its allowances that appear to be held for re-sale or some other investment purpose are excluded from the category *held for compliance purposes*.

C. SUMMARY OF PRICES

This section summarizes prices in the secondary market for RGGI CO₂ allowances in the second quarter of 2015. Figure 1 summarizes transaction prices in the secondary market for CO₂ allowances, including the prices of allowance transfers registered in COATS² and the prices of futures contract trades on the Intercontinental Exchange (“ICE”). Figure 2 summarizes the option-implied (i.e., expected) volatility of RGGI CO₂ allowance prices based on an analysis of the trading of options contracts.³ Key observations regarding RGGI CO₂ allowance prices:

- The average futures price for CO₂ allowances was \$5.53 during the second quarter of 2015, two percent higher than in the first quarter and 19 percent higher than the second quarter of 2014. Prices ranged between \$5.30 and \$5.60 from April until Auction 28 in early June, and then prices increased steadily during June and reached \$5.80 at the end of the quarter.
- The clearing price in Auction 28 (which was held on June 3) was \$5.50, consistent with secondary market prices leading up to the auction. The auction clearing price increased 2 percent from Auction 27 (which was held on March 11).
- Option-implied volatility decreased from an average of 18 percent in the first quarter to 16 percent in the second quarter of 2015, continuing the downward trend in option-implied volatility that has been observed over the last year.

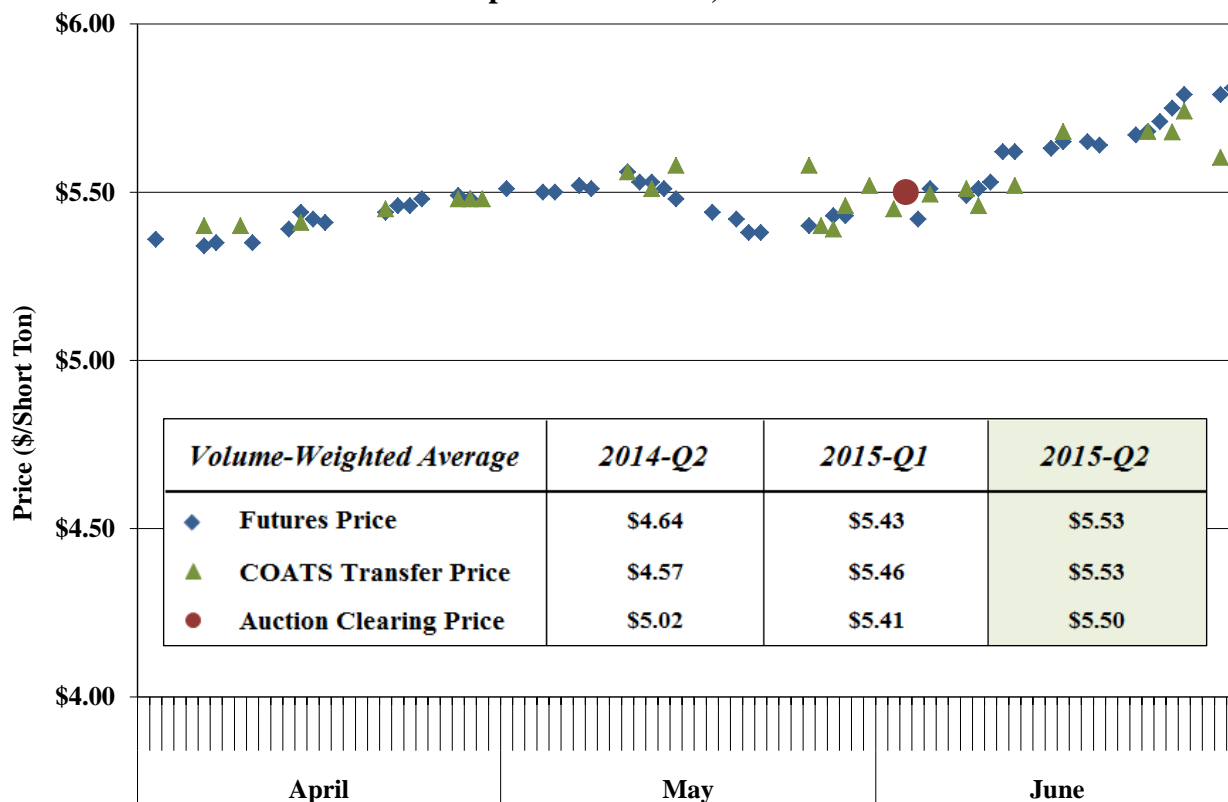
Prices of CO₂ Allowances and Allowance Derivatives

Figure 1 summarizes prices in the secondary market during the period. The blue diamonds show the price of ICE futures on days with trading 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 CO₂ allowances that were sold in RGGI Auction 28, which was held on June 3. Figure 1 also shows volume-weighted average prices for each category in the second quarter of 2015 compared to the previous quarter and the second quarter of the previous year. Volume-weighted average prices for the first, second, and third control period CO₂ allowances are shown together.

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 CO₂ allowance refers to the expected standard deviation of the distribution of allowance prices one year in the future.

**Figure 1: Prices in the Secondary Market for RGGI CO₂ Allowances⁴
April 1 to June 30, 2015**



Key observations regarding CO₂ allowance prices:

- The average transfer price of CO₂ allowances in COATS during the second quarter of 2015 was \$5.53, approximately one percent higher than in the prior quarter and 21 percent higher than the second quarter of 2014. Prices gradually increased in April, varied between \$5.35 and \$5.60 during May, and then increased steadily after Auction 28 (which was held on June 3).
- The prices of ICE futures trades were consistent with COATS transfer prices throughout the second quarter. The average futures price of \$5.53 was just two percent higher than the average price in the prior quarter and 19 percent higher than in the second quarter of 2014. At the end of the quarter price levels were approximately \$5.80.

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. Futures prices are shown for the prompt month contract settlement price even if the volume traded was for another contract.

- The clearing price in Auction 28, held on June 3, was \$5.50, which was slightly greater than most secondary market prices leading up to the auction. The auction clearing price increased 2 percent from Auction 27 (which was held in March).

Prices of Options for CO₂ 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 CO₂ allowances in the second quarter of 2015:

- Forty-three option trades were recorded on ICE during the second quarter of 2015, up from 27 trades in the previous quarter.
- Nine percent of the volume was for contracts with June 2016 expiration, while 46 percent was for contracts with December 2015 expiration and 41 percent was for contracts with December 2016 expiration.
- Eighty-one percent of the trading volume was for call options, up from 68 percent in the prior quarter.
- The strike prices of the 37 call options ranged from \$5.75 to \$8.00, while six put options were sold at strike prices of \$5.25 to \$5.50. These strike prices provide some indication of the market's expectations for the potential range of variation in allowance prices.

Volatility of CO₂ Allowance Prices

Market-based emissions reduction programs such as RGGI 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 CO₂

allowance prices decrease the risks associated with making long-term investments in reducing CO₂ emissions. Since CO₂ allowance prices can be volatile, the availability of futures and options contracts allows firms to protect themselves from the risks of such investments.

Expected price volatility is affected by elements of the RGGI program that promote allowance price stability. Potential upward price movements are limited by the Cost Containment Reserve (“CCR”), which allows for the sale of a fixed number of allowances in addition to the cap if the auction clearing price reaches the CCR Trigger Price.⁵ Potential downward price movements are limited by the Reserve Price, which currently prevents allowances from being sold in the auction at a price below \$2.05 (and is indexed to inflation).

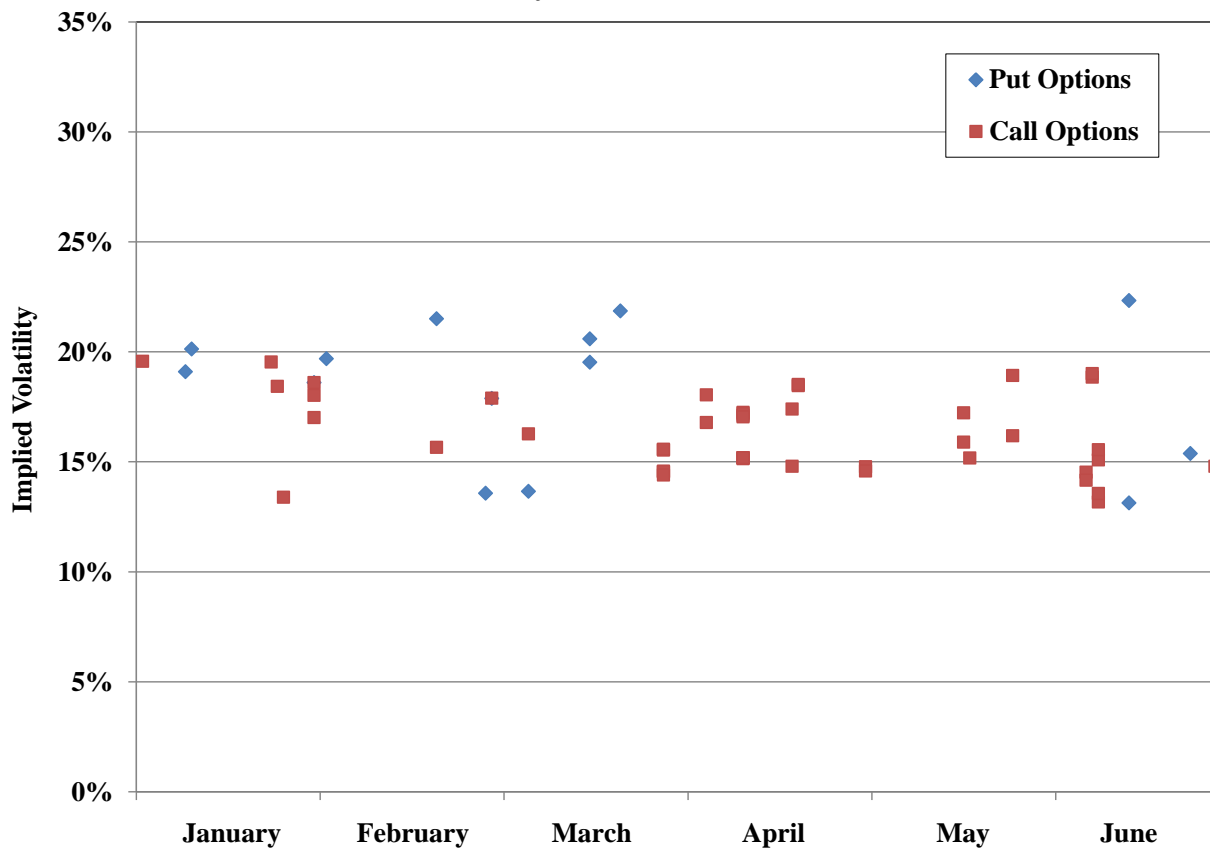
One measure of the volatility of CO₂ allowance prices is known as option-implied volatility, which measures the volatility that is implied by the trading of option contracts for CO₂ allowances. If a firm perceives that CO₂ allowance prices are volatile, the firm may be willing to pay a high price for an option contract that protects it from unforeseen allowance price fluctuations. Likewise, if a firm perceives that CO₂ 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 CO₂ allowance futures contracts, which can be inferred from the trading of options contracts over the last six months.⁶ The vertical axis shows the option-implied (expected) volatility of CO₂ 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 From 2015 to 2020, the annual withdrawal limit is ten million allowances, and the CCR Trigger Prices will rise from \$6.00 in 2015 to \$8.00 in 2016 and \$10.00 in 2017, and it will rise 2.5 percent in each year thereafter.

⁶ 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 CO₂ Allowance Futures Prices
January 1 to June 30, 2015**



Observations regarding the option-implied volatility of CO₂ allowance prices:

- In the first quarter of 2015, there were 23 trades where implied volatility ranged between 13 and 22 percent.
- In the second quarter of 2015, there were 37 trades where implied volatility ranged between 13 and 22 percent.
- Option-implied volatility levels decreased from an average of 18 percent in the first quarter to 16 percent in the second quarter of 2015, continuing the downward trend that has been observed over the past year.
- Although only three put options trades were included in the study, the range of option-implied volatility of put options was slightly greater than that of call options.

D. VOLUMES AND OPEN INTEREST

This section evaluates the volume of COATS transactions (i.e., transfers of CO₂ 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 second quarter of 2015:

- The total volume of CO₂ allowance transfers between unaffiliated firms was 15.1 million, down 56 percent from 34.4 million allowances in the first quarter (when trading was elevated by firms seeking CO₂ allowances before the March 1 compliance deadline for the second control period).
- The total volume of trading of RGGI futures listed on ICE was 29.3 million CO₂ allowances in the second quarter of 2015, equal to the trading volume in the first quarter and up 59 percent from 18.4 million in the second quarter of 2014.
- The open interest in RGGI options increased 30 percent from 43.7 million at the beginning of the quarter 56.7 at the end of the quarter. This was driven primarily by a 44 percent increase in the open interest of put options.
- Of the 169 million CO₂ allowances in circulation at the end of the second quarter of 2015, compliance entities and their affiliates held approximately 116 million of which an estimated 80 percent were held for compliance purposes, while the other 20 percent appeared to be held for re-sale or some other investment purpose.⁷

Volume of CO₂ Allowance Transfers, Futures, and Options

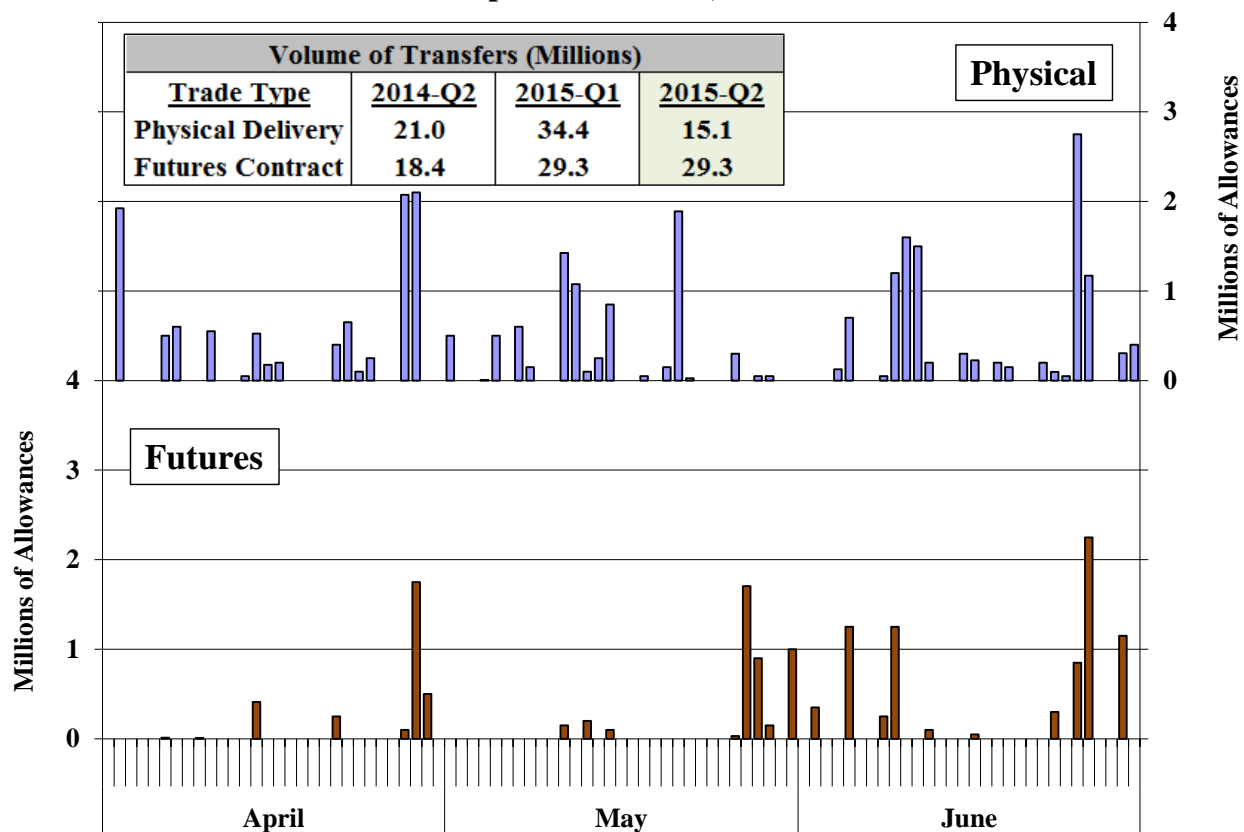
Figure 3 summarizes the volume of transfers of CO₂ allowances between the COATS accounts of unaffiliated firms and the volume of trading of RGGI futures listed on ICE. The figure also shows the volume of transfers in the second quarter of 2015 compared to the previous quarter and to the second quarter of 2014.⁸ The volume of futures trading and transfers of CO₂

⁷ Note, this implies that 55 percent of the 169 million CO₂ allowances in circulation were held for compliance purposes. Section B discusses the criteria used to estimate the share of allowances held for compliance purposes.

⁸ 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.

allowances for each control period are shown together because all CO₂ allowances are essentially interchangeable for compliance purposes.

**Figure 3: Volume of CO₂ Allowance Transfers Between Unaffiliated Parties⁹
April 1 to June 30, 2015**



Key observations regarding the volume of transfers of CO₂ allowances in COATS between unaffiliated firms:

- CO₂ allowance trading decreased significantly in the second quarter, as was expected in the quarter following the second control period compliance deadline (on March 1).
- The total volume of CO₂ allowance transfers between unaffiliated firms was 15.1 million, down 56 percent from 34.4 million allowances in the prior quarter, and down 28 percent from 21 million allowances in the second quarter of 2014.

⁹ Source: CO₂ allowance transfers are based on information in COATS.

- Fifty-seven percent of the volume of CO₂ allowance transfers between unaffiliated firms occurred in the last three trading days of each month. This is typical as transfers often result from the final settlement of RGGI futures contracts.
- The share of CO₂ allowances that were held by compliance entities and their affiliates at the end of the second quarter of 2015 was 69 percent (out of approximately 169 million allowances in circulation).

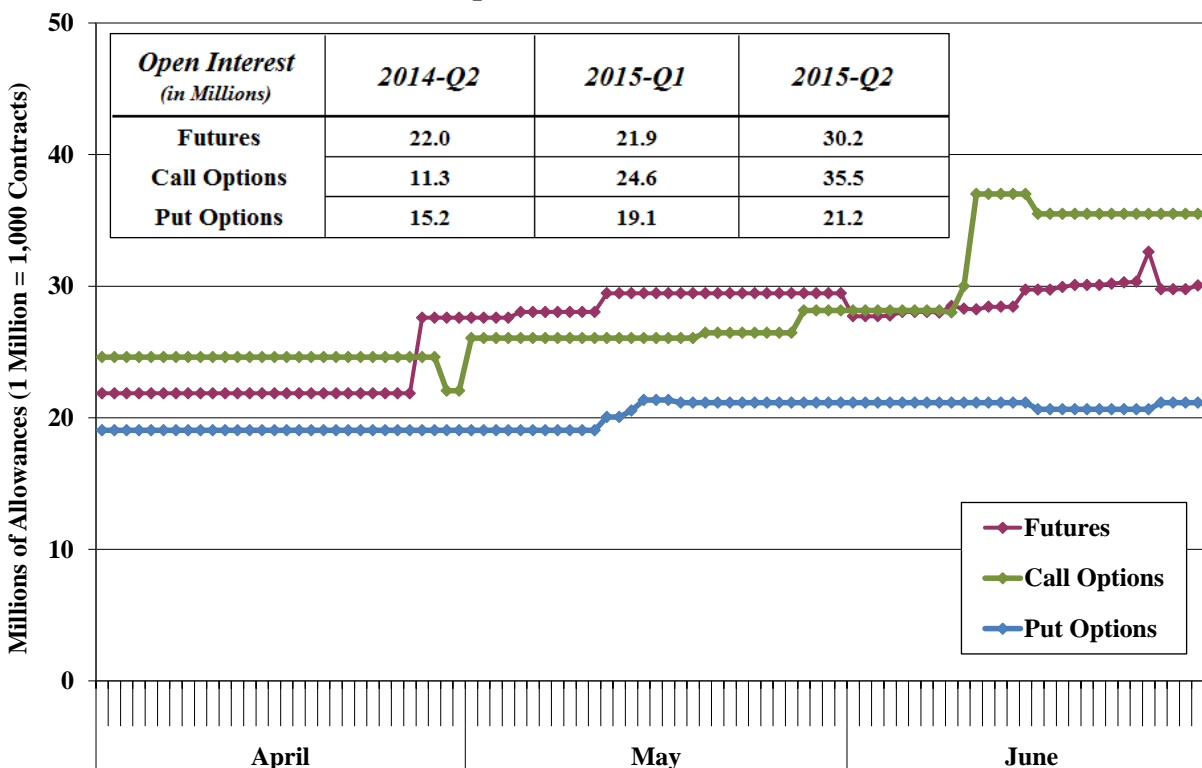
Key observations regarding the volume of trading of RGGI futures and options contracts:

- The total volume of trading of RGGI futures listed on ICE was 29.3 million CO₂ allowances in the second quarter of 2015, equal to the trading volume in the prior quarter but up 59 percent from 18.4 million in the second quarter of 2014.
- Approximately 33 percent of the volume of trading of futures listed on ICE during the second quarter of 2015 was for contracts that expired during the quarter. An additional 53 percent of the volume of trading was for contracts that will expire in December 2015.
- There were 43 option trades reported on ICE in the second quarter of 2015, up from 27 trades the prior quarter.
- The total volume of options traded in the second quarter of 2015 was for 26.8 million CO₂ allowances, which was an increase from 15.5 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 second quarter of 2015. The red line shows the level of open interest in futures contracts. 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
April 1 to June 30, 2015**



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

- The total open interest in RGGI futures increased throughout the period, reached a high of 32.6 million on June 25, and then dropped to 30.2 million just before the end of the quarter.
- The open interest in RGGI put options increased 11 percent from 19.1 million at the end of the first quarter to 21.2 million at the end of the second quarter of 2015.
- The open interest in RGGI call options increased 44 percent from 24.6 million at the end of the first quarter to 35.5 million at the end of the second quarter of 2015. This was a 214 percent increase from just 11.3 million the end of the second 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

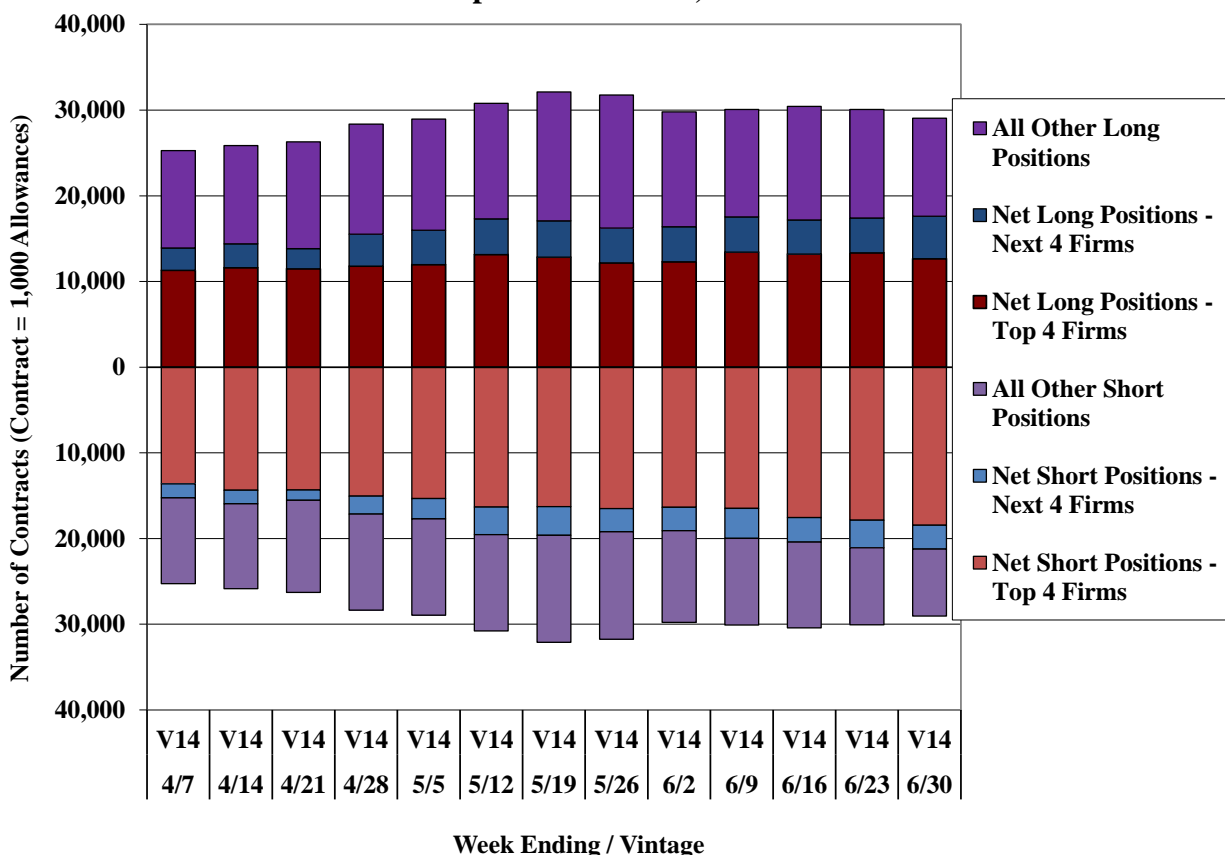
Futures Trading Commission (“CFTC”)^{10,11} for each week when greater than 20 firms have reportable positions in a particular product.

Figure 5 summarizes the concentration of open interest in 2015 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.

¹⁰ 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.

¹¹ 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 any vintage contract other than 2014 (each vintage is reported separately).

Figure 5: Concentration of Open Interest in CCFE Futures and Options¹²
April 1 to June 30, 2015



Observations regarding the concentration of open interest:

- Many firms have open interest in RGGI CO₂ 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 43 percent of the total long positions for the weeks shown during the quarter, while 56 percent of the total long positions were held by eight firms.
 - ✓ The “Top Four” Firms accounted for an average of 55 percent of the total short positions for the weeks shown during the quarter, while 64 percent of the total short positions were held by eight firms.

¹² Source: The CFTC’s Commitment of Traders reports which are available at [“www.cftc.gov/MarketReports/CommitmentsofTraders/HistoricalCompressed/index.htm”](http://www.cftc.gov/MarketReports/CommitmentsofTraders/HistoricalCompressed/index.htm).

- ✓ These results suggest that many firms have significant spreading positions (i.e., combinations of long and short positions of equal magnitude with different expiration dates).
- 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 of individual firms. Combined with firm-specific information about CO₂ 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 CO₂ allowances, which is discussed further in Section E.

E. DISCUSSION OF MARKET MONITORING

As the RGGI Market Monitor, we monitor trading in the secondary CO₂ allowance market in order to identify anticompetitive conduct. Additionally, the Commodity Futures Trading Commission (“CFTC”) evaluates trading in the secondary CO₂ 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 CO₂ allowances. Hence, we screen information on the holdings of CO₂ allowances and allowance-derivatives and the demand for allowances to identify firms that might acquire a position that raises competitive concerns. The ability of an individual firm to hoard is limited by the substantial private bank of CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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.