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**RGGI Inc.**



**ANNUAL REPORT ON THE MARKET  
FOR RGGI CO<sub>2</sub> ALLOWANCES: 2020**

**Prepared for:**

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

**Prepared By:**

**POTOMAC  
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The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort of Eastern states of the US to reduce emissions of carbon dioxide (CO<sub>2</sub>) 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<sub>2</sub> emissions in the United States in 2009. Electric power generators with generating capacity at or above 25 MW located in the states participating in RGGI have been required to obtain a number of CO<sub>2</sub> allowances equal to the number of tons of CO<sub>2</sub> they emit.<sup>1</sup>

RGGI distributes CO<sub>2</sub> emissions allowances to the market primarily through auctions, making it distinctive among existing cap-and-trade programs. Ninety-four percent of the CO<sub>2</sub> allowances that have entered into circulation initially entered the market through one of the auctions.

Through the end of 2020, RGGI has conducted 50 successful auctions, selling a total of 1.11 billion CO<sub>2</sub> allowances for \$3.78 billion.

The RGGI CO<sub>2</sub> emissions cap was 96.2 million tons for the ten states participating in 2020. The emissions budget for each state drops each year, but since Virginia is participating for the first time in 2021, the 11-state cap rose to 119.8 million tons in 2021. The cap will be reduced gradually each year until it reaches 86.9 million tons in 2030.

RGGI has been using an adjusted cap that was 21.9 million tons lower than the emissions cap in each year from 2015 to 2020 (to account for the surplus of CO<sub>2</sub> allowances that accumulated from 2009 to 2013). From 2021 to 2025, the Third Adjustment for Banked Allowances will reduce the state budgets by 19 million in each year to account for the 95 million allowance surplus that remained at the end of 2020.<sup>2</sup>

This report evaluates activity in the market for RGGI CO<sub>2</sub> allowances in 2020, focusing on the following areas: allowance prices, trading and acquisition of allowances in the auctions and the

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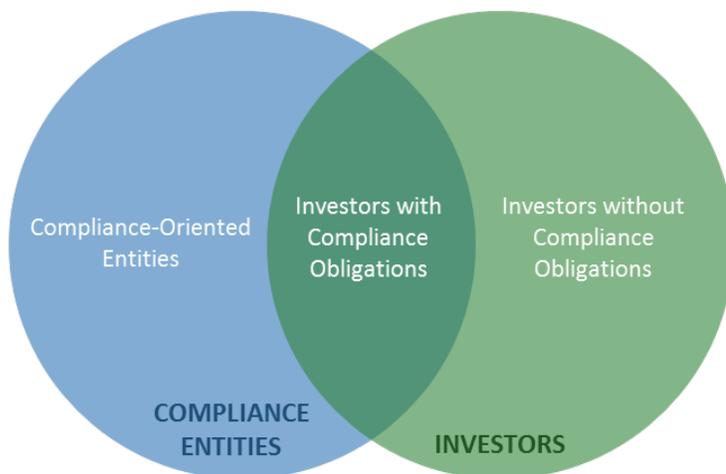
<sup>1</sup> As of December 2020, the New York DEC adopted revisions to Part 242 which has lowered this limit to 15 MW for units which are physically co-located with an existing budget source, and to any 15 MW unit that resides at a facility with two or more units with 15 MW or greater nameplate capacities.

<sup>2</sup> These program details are described further in Section II.A.

secondary market, participation in the market by individual firms, and market monitoring. For reporting purposes, firms are often broken up into the following categories:

- *Compliance-Oriented Entities* – Compliance entities that appear to acquire and hold allowances primarily to satisfy their own compliance obligations.
- *Investors with Compliance Obligations* – Firms that have compliance obligations, but which hold a number of allowances that exceeds their estimated compliance obligations by a margin suggesting they also buy for re-sale or some other investment purpose. These firms often transfer significant quantities of allowances to unaffiliated firms.<sup>3</sup>
- *Investors without Compliance Obligations* – Firms without any compliance obligations.

In this report, the “Investors with Compliance Obligations” category is sometimes combined with one of the other two categories when discussing market trends and participation. In all such cases, the text of this report clearly defines the grouping as either: “compliance entities” combining the first and second categories or “investors” combining the second and third categories. These categories are illustrated by the diagram above.



### ***CO<sub>2</sub> Allowance Prices***

The average auction clearing price increased 18 percent from \$5.43 in 2019 to \$6.41 in 2020, and secondary market prices were generally consistent with auction clearing prices throughout

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<sup>3</sup> 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 2026, (b) the total number of allowances in circulation, and (c) consideration of the pattern of the entity’s allowance transfers to unaffiliated firms versus affiliated firms. Since the designation of a compliance entity as an investor is based on a review of its transactions and holdings, the designation of a particular firm may change over time as more information becomes available. Therefore, some of the quantities in this report may not match previous reports because of changes in the classification of particular firms.

both years. Secondary market prices remained between \$5 and \$6 throughout 2019, closing the year near \$5.70.<sup>4</sup> Prices rose to nearly \$6 early in 2020 and then declined in March amid commodity market fluctuations in response to the impacts of COVID-19. Following the first quarter, prices trended upwards, with the most significant escalation

Secondary Market and Auction Prices



occurring early in the third quarter, and to end the year, as prices closed near \$8. From the dip in mid-March to the peak in late December, secondary market prices rose by more than \$3.

In 2019, price levels suggested that market participants expected auctions to clear near the \$6.00 Emission Containment Reserve Trigger Price when it is first implemented in the March 2021 auction.<sup>5</sup> However, price levels observed at the end of 2020 suggest that market participants don't expect the Emission Containment Reserve to be triggered until near the end of this decade.

### *Acquisition and Holdings of CO<sub>2</sub> Allowances*

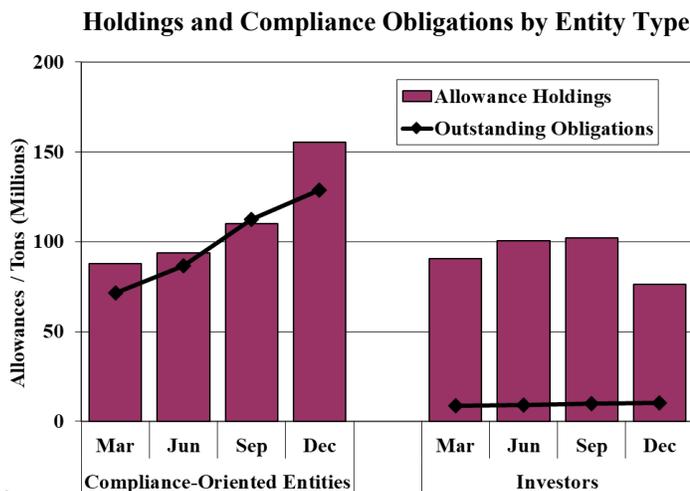
Firms initially acquire CO<sub>2</sub> allowances in the primary market, mainly by purchasing them in the quarterly auctions. Firms can also buy and sell CO<sub>2</sub> allowances in the secondary market. Secondary market activity consists mainly of trading of futures and options contracts on the public exchange and transfers of ownership recorded in COATS ("CO<sub>2</sub> Allowance Tracking System").

The large private bank of surplus CO<sub>2</sub> allowances (which accumulated primarily before 2013) rose slightly during 2020 from 94 million at the beginning of the year to 95 million at the end of

<sup>4</sup> Allowance prices are summarized in more detail in Section III.A.

<sup>5</sup> The Emission Containment Reserve and other program details are described further in Section II.A.

the year.<sup>6</sup> Surplus allowances would have fallen, but generation in 2020 was lower than anticipated. The increase in the surplus occurred despite significant reductions in the number of allowances sold at the auctions in 2020 because of the interim adjustments in the cap (i.e., FCPIA and SCPIA).<sup>7</sup> Because of the third interim adjustment to the cap, the current surplus of allowances is expected to fall considerably by the end of 2025.



The figure above summarizes the holdings of CO<sub>2</sub> allowances at the end of each quarter in 2020 for two categories of firms.<sup>8</sup> It shows that, as a group, compliance-oriented entities held more CO<sub>2</sub> allowances than needed to satisfy their current compliance obligations for the fourth control period at the end of 2020. These entities held 155 of the 231 million allowances in circulation at the end of 2020, and they accounted for 129 million of the outstanding compliance obligations.

Although some compliance-oriented entities used the auction as the primary means of acquiring CO<sub>2</sub> allowances, overall, compliance-oriented entities as a group relied more on the secondary market in 2020. Of the CO<sub>2</sub> allowances held by compliance-oriented entities at the end of 2020, 39 million were held by firms that acquired them through auctions or state allocations during 2020, almost 42 million were held by firms that purchased them in the secondary market during 2020, and 74 million were retained from the prior year. A robust secondary market is beneficial

<sup>6</sup> 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.

<sup>7</sup> The First Control Period Interim Adjustment (“FCPIA”), the Second Control Period Interim Adjustment (“SCPIA”), and the Third Adjustment for Banked Allowances are described in Section II.A.

<sup>8</sup> Monthly totals are provided with additional detail in Section IV.D.

because it provides compliance entities with more flexibility about when they can purchase CO<sub>2</sub> allowances.

Investors without compliance obligations purchased significant quantities of allowances in the auctions, and then generally used the secondary market to reduce their allowance holdings. These investors purchased more than 18 million (28 percent) of the allowances auctioned in 2020, but most used the secondary market to sell more allowances than they purchased, transferring away a net of more than 38 million allowances in the secondary market by the end of 2020. Investors with compliance obligations purchased nearly 12 million allowances in the auctions and generally increased their holdings throughout the year. The largest allowance transfers between unaffiliated firms occurred in December.

### *Participation in the Market by Individual Firms*

Participation by many firms promotes competition and helps ensure that CO<sub>2</sub> allowance prices are determined efficiently. Over time, firms that need CO<sub>2</sub> 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.<sup>9</sup>

In 2020, we found broad participation in the RGGI market. The demand for CO<sub>2</sub> allowances is dispersed relatively widely across firms as the three largest compliance-oriented entities accounted for just 27 percent of the total projected demand, which was similar to 2019. The average number of auction participants increased to 48, reflecting increased participation by both compliance-oriented entities and investors. Allowance holdings were generally distributed across compliance-oriented entities consistent with their compliance obligations, although the surplus of allowances in circulation led many individual firms to hold substantial surpluses. The top ten compliance-oriented entities, by estimated demand for allowances, accounted for 47 percent of total holdings and smaller compliance-oriented entities accounted for 20 percent. The top ten investors (ranked by surplus holdings) accounted for 32 percent, a reduction from 2019 as

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<sup>9</sup> Participation in the auctions and the secondary market by individual firms is evaluated in Section V.

compliance entities acquired allowances from investors at the end of 2020 in order to meet fourth control period compliance obligations. These levels are consistent with competitive expectations given that the current private bank of allowances far exceeds the outstanding compliance obligations of firms in the fourth 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 Enel X.

In our reviews of the four auctions in 2020, 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<sub>2</sub> 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<sub>2</sub> allowances, and we find that firms have generally purchased quantities of allowances that are consistent with their expected needs.

## II. BACKGROUND ON THE CO<sub>2</sub> ALLOWANCE MARKET

In 2009, RGGI became the first mandatory market-based program to limit CO<sub>2</sub> 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.

In the eleven states that as of January 1, 2021 participate in RGGI, electricity generating plants with 25 MW<sup>10</sup> of capacity or greater (“CO<sub>2</sub> budget sources”) must acquire a number of CO<sub>2</sub> allowances sufficient to cover their CO<sub>2</sub> emissions by the end of each control period. Firms that own budget sources (“compliance entities”) can acquire CO<sub>2</sub> 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<sub>2</sub> allowances has several key elements, which are discussed in this section: the regional cap, compliance obligations, the CO<sub>2</sub> Allowance Tracking System (“COATS”), the primary market for allowances, and the secondary market for allowances.

### A. Regional CO<sub>2</sub> Emissions Cap

The RGGI CO<sub>2</sub> cap for the period from 2014 to 2020 was set based on the 2012 Program Review. The nine-state cap was set at 91.0 million tons for 2014 and reduced by 2.5 percent per year until it reached approximately 78.2 million tons for 2020. However, with the addition of New Jersey effective January 2020, the cap for 2020 was raised to 96.2 million tons.

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<sup>10</sup> As of December 2020, the New York DEC adopted revisions to Part 242 which has lowered this limit to 15 MW for units which are physically co-located with an existing budget source, and to any 15 MW unit that resides at a facility with two or more units with 15 MW or greater nameplate capacities.

The RGGI CO<sub>2</sub> cap for the period from 2021 to 2030 was determined at the end of the 2016 Program Review.<sup>11</sup> The CO<sub>2</sub> cap for the nine participating states at the time was scheduled to fall by 30 percent from approximately 78.2 million tons for 2020 to 54.7 million tons for 2030. With the addition of New Jersey, the cap was scheduled to fall from 96.2 million tons in 2020 to 67.3 million tons in 2030. With Virginia joining the program in 2021, the cap is now scheduled to fall from 119.8 million tons in 2021 to 86.9 million tons in 2030. Other key changes to the Model Rule that arose from the 2016 Program Review include cap adjustments to account for banked allowances and the implementation of an Emissions Containment Reserve, which are both described below in more detail.

### *Interim Adjustments to Account for Banked Allowances*

Adjustments were made to the cap to account for the surplus of allowances that was banked from allocation years 2009 to 2013.<sup>12</sup> For allocation years 2009 to 2013, 690 million allowances were put in circulation compared to total compliance obligations of 550 million tons for the period.<sup>13</sup> Unused CO<sub>2</sub> 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 made to adjust the RGGI CO<sub>2</sub> cap to account for the large private bank of allowances that had accumulated by the first quarter of 2014.

Additional adjustments will be used to account for surplus allowances from allocation years 2014 to 2020. In the 2016 Program Review, it was determined that surplus allowances from allocation years 2014 to 2020 would likely be put into circulation, so the 2017 Model Rule provided for the Third Adjustment for Banked Allowances.

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<sup>11</sup> For a list of changes made to the Model Rule following the 2016 Program Review, see [www.rggi.org/sites/default/files/Uploads/Program-Review/12-19-2017/Summary\\_Model\\_Rule\\_Updates.pdf](http://www.rggi.org/sites/default/files/Uploads/Program-Review/12-19-2017/Summary_Model_Rule_Updates.pdf).

<sup>12</sup> Also, 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, which ran from 2009 to 2011.

<sup>13</sup> This includes 53 million tons of compliance obligations for New Jersey from 2009 to 2011.

*First Control Period Interim Adjustment for Banked Allowances (“FCPIABA”)* – This was a reduction in the number of CO<sub>2</sub> allowances to be sold over the seven-year period from 2014 to 2020. The amount of the reduction was equal to the private bank of first control period CO<sub>2</sub> allowances (i.e., allocation years 2009, 2010, and 2011) that were in circulation after compliance was completed for the first control period. The FCPIABA was approximately 8.2 million CO<sub>2</sub> allowances per year from 2014 to 2020.<sup>14</sup>

*Second Control Period Interim Adjustment for Banked Allowances (“SCPIABA”)* – This was a reduction in the number of CO<sub>2</sub> allowances to be sold over the six-year period from 2015 to 2020. The amount of the reduction was equal to the private bank of 2012 and 2013 allocation year allowances that were in excess of 2012 and 2013 emissions. The SCPIABA was approximately 13.7 million CO<sub>2</sub> allowances per year from 2015 to 2020.<sup>15</sup>

Due to the two interim control period adjustments for banked allowances that resulted from the 2012 Program Review, the adjusted CO<sub>2</sub> cap fell from approximately 82.8 million in 2014 to 62.5 million in 2017 and was planned to eventually fall to 56.3 million in 2020. However, with the addition of New Jersey as a participating state in 2020, the adjusted cap for 2020 was raised to 74.3 million tons. Including New Jersey, the number of CO<sub>2</sub> allowances that were distributed for the period from 2014 to 2020 was approximately 467 million. Including the 140 million surplus allowances that were already in circulation at the end of 2013, the total supply was 607 million allowances from 2014 to 2020 (not including allowances sold from the Cost Containment Reserve, which is discussed in the next part of this section.).

*Third Adjustment for Banked Allowances* – This is a reduction in the number of CO<sub>2</sub> allowances that is to be sold over the five-year period from 2021 to 2025. In each year, the reduction will be approximately 19.1 million allowances. The amount of the reduction is based on the private

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<sup>14</sup> See [www.rggi.org/program-overview-and-design/elements](http://www.rggi.org/program-overview-and-design/elements).

<sup>15</sup> See [www.rggi.org/program-overview-and-design/elements](http://www.rggi.org/program-overview-and-design/elements).

bank of allowances that existed after the compliance deadline for the fourth control period, which was approximately 95.5 million allowances.<sup>16</sup>

### *Cost Containment Reserve*

RGGI implemented a provision known as the Cost Containment Reserve (“CCR”) in 2014.<sup>17</sup> 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 exceeds 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, 2016, 2017, 2018, and 2019, the CCR had a withdrawal limit of ten million allowances, and the CCR Trigger Prices were \$6.00, \$8.00, \$10.00, \$10.25, and \$10.51, respectively. In 2020, the annual withdrawal limit was 11.8 million allowances and the CCR Trigger Price was \$10.77.

All 15 million allowances were sold from the CCR for the period from 2014 to 2015, but the CCR was not triggered in 2016, 2017, 2018, 2019, or 2020. These sold CCR allowances, combined with the 607 million allowances already available for the 2014-2020 period, raised the total supply to 622 million allowances.

From 2021 to 2030, the size of the CCR is planned to be 10 percent of the cap in each year, so the CCR will fall from nearly 12 million allowances in 2021 to 8.7 million in 2030. The CCR Trigger Price is planned to rise from \$13.00 in 2021 by 7 percent each year, so it will reach \$23.89 in 2030.

### *Emissions Containment Reserve*

RGGI implemented a provision known as the Emissions Containment Reserve (“ECR”) in the first auction of 2021. The ECR is intended to reduce the supply of allowances in the market if emissions reduction costs are lower than expected by allowing for states to withhold allowances

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<sup>16</sup> See [https://www.rggi.org/sites/default/files/Uploads/Press-Releases/TABA\\_Announcement\\_2021-03-15.pdf](https://www.rggi.org/sites/default/files/Uploads/Press-Releases/TABA_Announcement_2021-03-15.pdf).

<sup>17</sup> See [https://www.rggi.org/sites/default/files/Uploads/Design-Archive/Model-Rule/2012-Program-Review-Update/Summary\\_of\\_Model\\_Rule\\_Changes\\_02\\_07\\_13.pdf](https://www.rggi.org/sites/default/files/Uploads/Design-Archive/Model-Rule/2012-Program-Review-Update/Summary_of_Model_Rule_Changes_02_07_13.pdf).

from circulation if the auction clearing price falls below the ECR Trigger Price. Allowances withheld under this program will not enter circulation. Up to 10 percent of a participating state's allowance budget can be withheld using the ECR. The ECR Trigger Price is set at \$6.00 in 2021, and it is planned to rise by 7 percent each year. At the time of this writing, Maine and New Hampshire do not plan to utilize the ECR mechanism.

### *Entry of New Participating States*

In 2019, the state of New Jersey formally agreed to resume participation in RGGI for the final year of the fourth control period, which was 2020. New Jersey sources were not subject to emissions compliance for the first two years of the fourth control period. In 2020, Virginia affirmed its intent to participate in RGGI beginning in 2021. Virginia sources have been subject to emissions compliance since the beginning of the fifth control period, which began on January 1<sup>st</sup>, 2021.

### **B. Compliance Obligations**

CO<sub>2</sub> budget sources are fossil fuel-fired electricity generating plants with at least 25 MW of capacity.<sup>18</sup> Shortly after the end of each control period, compliance entities must submit a sufficient number of CO<sub>2</sub> allowances to cover their CO<sub>2</sub> emissions during the control period. 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 ran from January 1, 2015 to December 31, 2017. The fourth control period ran from January 1, 2018 to December 31, 2020.

In 2021, RGGI and the Participating States are conducting the compliance process for the fourth control period ending December 2020. By January 30, 2021, compliance entities were required to submit all CO<sub>2</sub> emissions data for CO<sub>2</sub> budget sources for the fourth control period to the Environmental Protection Agency's ("EPA's") Clean Air Markets Division ("CAMD") Business System. By March 1, 2021, the Compliance Account for each CO<sub>2</sub> budget source was required

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<sup>18</sup> Apart from New York; see footnote 10.

to hold first, second, third, or fourth control period CO<sub>2</sub> allowances sufficient to satisfy its compliance obligation. Each CO<sub>2</sub> budget source was also required to submit a Compliance Certification Report certifying that it was in compliance with its state's CO<sub>2</sub> Budget Trading Program.<sup>19</sup>

RGGI also has interim compliance requirements whereby compliance entities are required to surrender CO<sub>2</sub> allowances for 50 percent of their compliance obligations after the first two years of each three-year control period. In 2019 and 2020, 64.9 million allowances were surrendered for fourth control period interim compliance.

### C. CO<sub>2</sub> Allowance Tracking System (“COATS”)

COATS is the registry for RGGI CO<sub>2</sub> allowances. Each CO<sub>2</sub> allowance has a unique serial number and can be used to satisfy one short ton of compliance obligation. When firms trade CO<sub>2</sub> allowances in the secondary market, the seller must record the transfer of ownership in COATS before the buyer is recognized as the owner.<sup>20</sup>

### D. Primary Market for RGGI CO<sub>2</sub> Allowances

The participating states have taken the approach of using auctions rather than free allocations as the primary means for distributing RGGI CO<sub>2</sub> allowances to the market. Accordingly, the primary market for CO<sub>2</sub> allowances consists mainly of the quarterly auctions.

*Auctions* – Through the compliance deadline for the fourth control period, 94 percent of the CO<sub>2</sub> allowances that have been put into circulation initially entered the market through one of the 50 auctions that had taken place on a quarterly basis since September 2008.

*Offset Projects* – Additional CO<sub>2</sub> allowances can also be awarded for approved CO<sub>2</sub> emissions offset projects (project-based greenhouse gas emissions reductions or carbon sequestration that

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<sup>19</sup> The Compliance Summary for the first, second, third, and fourth control periods may be found at <https://rggi-coats.org/eats/rggi/>.

<sup>20</sup> Public information related to the COATS registry may be found at <https://rggi-coats.org/eats/rggi/>.

occurs outside the capped electricity generation sector), although fewer than 0.1 million 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<sub>2</sub> emissions reductions achieved at CO<sub>2</sub> budget sources during 2006 through 2008, prior to the start of the first control period.

*Allocations & Sales by States* – Approximately 29.7 million CO<sub>2</sub> allowances for the first control period were allocated by individual states through either fixed-price sales or free allocations. Approximately 16.0 million CO<sub>2</sub> allowances for the second control period were allocated by individual states. Approximately 11.7 million CO<sub>2</sub> allowances were allocated for the third control period, and approximately 13.5 million were allocated for the fourth control period.

Regardless of how CO<sub>2</sub> allowances initially enter the market, they can be traded to other firms in the secondary market.

#### **E. Secondary Market for RGGI CO<sub>2</sub> Allowances**

The secondary market is important for several reasons. First, it gives a firm the ability to obtain CO<sub>2</sub> 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<sub>2</sub> allowances comprises the trading of physical allowances and financial derivatives, such as futures, forwards, and option contracts. A physical CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> allowance that is to be transferred. One standard futures contract equals 1,000 RGGI CO<sub>2</sub> allowances. These contracts are listed by an exchange with simple standardized terms to promote liquidity.
- *Forwards* – These are like futures contracts, but a forward contract typically requires that all financial settlement occur at expiration. These contracts can be made off an exchange between two parties, allowing the parties to agree to less standardized terms.
- *Call Options* – Call options give the purchaser the option to buy a fixed number of CO<sub>2</sub> allowances of a certain vintage year at a particular strike price at the expiration date. For example, suppose a firm holds a call option with a \$4 strike price and a December 2020 expiration date. If the price of the corresponding forward contract rose to \$5 at expiration, the firm would exercise the option to buy CO<sub>2</sub> allowances at \$4 and immediately sell them at \$5. Alternatively, if the price of the forward contract was below \$4, 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<sub>2</sub> allowances of a particular vintage year at a specified strike price at 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 generally require less financial security since they do not obligate the holder to exercise the contract if its value declines, 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<sub>2</sub> ALLOWANCE PRICES

The market for RGGI CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> allowances in 2020.

Key observations regarding RGGI CO<sub>2</sub> allowance prices:

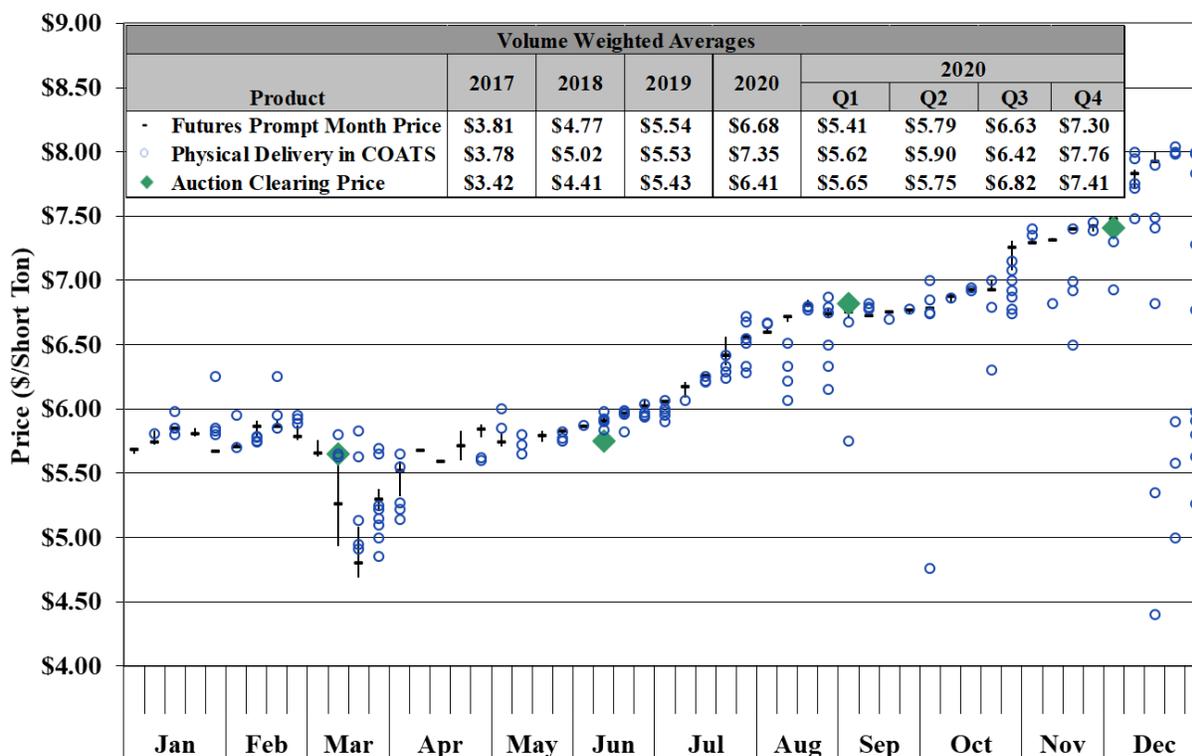
- *Price Trends* – Prices in the secondary market opened the year around \$5.65 and increased to nearly \$6 through February before declining sharply in March as the COVID-19 pandemic became widespread and impacted commodities markets. By mid-June prices had recovered to their previous levels and began to increase, plateauing near \$6.80 in late August. In October prices began to increase again, and jumped following Auction 50 in early December, closing the year at \$8. Overall, futures prices rose from a volume-weighted average of \$5.54 in 2019 to \$6.68 in 2020.
- *Physical Deliveries in COATS* – Although the majority of physical transactions were priced similar to futures contracts, a substantial number of these transactions differed significantly from prevailing market trends. These were priced lower, particularly in the latter half of the year. It is typical to see some outlier-priced transactions in the final year of a control period, which reflect contractual terms determined in an earlier timeframe.
- *Auction Clearing Prices* – The volume-weighted average auction clearing price increased 18 percent from \$5.43 in 2019 to \$6.41 in 2020. The auction clearing prices were generally consistent with prices in the secondary market at the time of the auction.
- *Price Volatility* – Overall volatility of CO<sub>2</sub> allowance prices in 2020 was higher than in 2019 but still low relative to futures price history over the life of the program. During the first quarter, volatility spiked as a result of futures price fluctuations related to the impact of COVID-19, but volatility was lower in the second through fourth quarters.

#### A. Prices in the Auctions and the Secondary Market

Figure 1 summarizes prices in the auctions and the secondary market on a weekly basis in 2020. Futures contract prompt-month 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<sub>2</sub> 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.<sup>21</sup> The figure also shows the auction clearing prices of CO<sub>2</sub> allowances in the four quarterly auctions held during 2020, which are represented by the green diamonds.

**Figure 1: CO<sub>2</sub> Allowance Prices in the Auctions and Secondary Market 2020**



Observations regarding prices in auctions and the secondary market:

- *General Price Levels* – The price of CO<sub>2</sub> allowances increased substantially over the course of the year from around \$5.65 in January to \$8 in late-December. Prices were relatively flat from January to May—except for a brief but pronounced decline in March as the worldwide spread of COVID-19 accelerated. Prices steadily increased from less than \$6 in early-June to \$8 in late-December.
- *Physical Deliveries in COATS* – The volume-weighted average transaction price of CO<sub>2</sub> allowances increased 33 percent from \$5.53 in 2019 to \$7.35 in 2020. The pricing of transactions was generally consistent with futures trades and auction clearing prices occurring at the same time. However, a minority of transactions were reported at much

<sup>21</sup> Parties must report the transaction price if there is an underlying financial transaction related to the transfer.

lower price levels. These likely reflect transactions whose price terms were determined at an earlier date.

- Auction Clearing Prices – The volume-weighted average auction clearing price increased 18 percent from \$5.43 in 2019 to \$6.41 in 2020. Auction clearing prices increased in each auction of the year, with the largest increase occurring between Auctions 48, which cleared at \$5.75 and Auction 49, which cleared at \$6.82.
- Comparison of Auction Prices and Secondary Market Prices – The auction prices were generally consistent with secondary market prices for transactions around the time of the auctions.

## **B. Volatility of CO<sub>2</sub> 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 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 old inefficient generation, to retain existing zero-emissions generation, and to perform maintenance that increases fuel efficiency and lowers carbon-intensity. Predictable CO<sub>2</sub> allowance prices decrease the risks associated with making long-term investments in reducing CO<sub>2</sub> emissions. Since CO<sub>2</sub> 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<sub>2</sub> allowances.

One measure of volatility is known as *historic volatility*,<sup>22</sup> 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 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<sub>2</sub> allowance prices:

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<sup>22</sup> 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. In this report, volatility is calculated based on quarters and annualized for each quarter. Annual volatility discussed here is the average of the annualized quarterly-based volatility.

- *Historic Volatility in 2019 & 2020* – The historic volatility of futures prices increased slightly in 2019 from late-2018, averaging 15.3 percent in the first three quarters of the year. In the fourth quarter of 2019, volatility fell to 9 percent reducing the annual average to 13.7 percent. In 2020, historic volatility increased sharply in the first quarter, to 33 percent. This was driven by large fluctuations in futures prices as commodity markets reacted to the global spread of COVID-19 and the ensuing disruption of normal activities. However, volatility did not remain elevated throughout the year, closing 2020 at 10.5 percent. The annual 2020 average was 16.2 percent, higher than 2019, but in line with the lower volatility of recent years.

Another measure of the volatility of CO<sub>2</sub> allowance prices is known as *option-implied volatility*,<sup>23</sup> which measures the volatility that is implied by the trading of option contracts for CO<sub>2</sub> allowances. If a firm perceives that CO<sub>2</sub> 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<sub>2</sub> allowance prices are relatively stable, the firm will be willing to pay relatively little for the same option contract.<sup>24</sup>

The following scatter plot reports the option-implied (i.e., expected) volatility of RGGI CO<sub>2</sub> allowance futures contracts, which can be inferred from the trading of options contracts in 2020.<sup>25</sup> The vertical axis shows the option-implied (expected) volatility of CO<sub>2</sub> 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 to focus on contracts that provide insight about the expected volatility of allowance prices over the long term rather than price variations around the quarterly auctions.

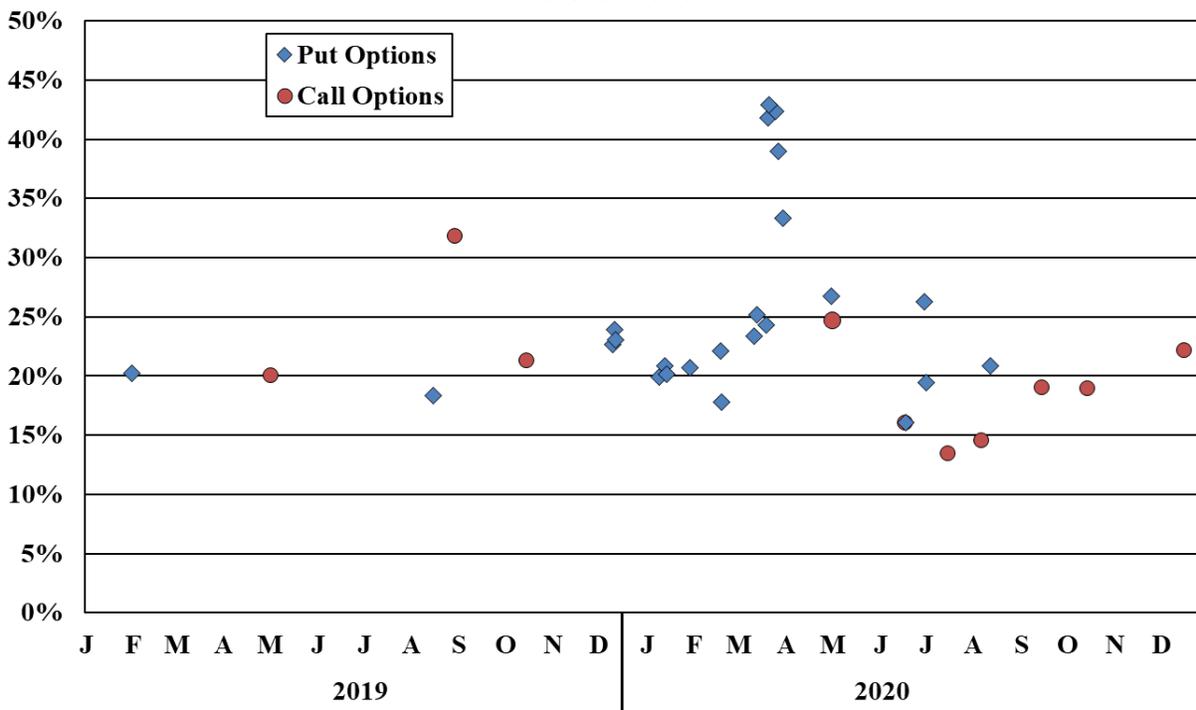
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<sup>23</sup> The option-implied volatility of a CO<sub>2</sub> allowance refers to the expected standard deviation of the distribution of allowance prices one year in the future. For example, if the expected value of the price one year in the future 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.

<sup>24</sup> The price of an option contract depends primarily on two factors: (i) the expected value of a CO<sub>2</sub> 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.

<sup>25</sup> 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<sub>2</sub> Allowance Futures Prices  
2019 & 2020**



Observations regarding the option-implied volatility of CO<sub>2</sub> allowance prices:

- *General Patterns of Volatility* – Option-implied volatility was relatively low throughout 2019 with sparse trading but increased in the first quarter of 2020, particularly in March during the initial response to the COVID-19 pandemic. Volatility declined in the second and third quarters but picked up slightly in the fourth quarter though trading was sparse.
- *Cost Containment Reserve and Emissions Containment Reserve* – The CCR and the ECR provisions were introduced into the RGGI program in February 2013 and December 2017, respectively. Since 2013, the CCR has been a significant factor in reducing the volatility of allowance prices. The CCR reduces volatility directly by making additional supply available if allowance prices rise to the prescribed levels, while the ECR, once implemented in 2021, will reduce volatility directly by reducing supply if allowance prices fall to the prescribed levels. Both the CCR and the ECR also have significant indirect effects on expectations. For example, the placement of the ECR trigger price at \$6.00 and the CCR trigger price at \$13.00 in 2021 reduces the likelihood that prices will fall outside of this range in 2021. This, in turn, reduces the likelihood of price variations far outside this range (adjusted for expectations of inflation and the time-value of money) in the short-term.

#### IV. TRADING AND ACQUISITION OF CO<sub>2</sub> ALLOWANCES

This section evaluates the trading and acquisition of CO<sub>2</sub> allowances in the primary and secondary allowance markets. Firms initially acquire CO<sub>2</sub> allowances in the primary market, mainly by purchasing them in the quarterly auctions. Firms then buy and sell CO<sub>2</sub> 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<sub>2</sub> allowances from their initial introduction to the market and in the secondary market.

Key observations regarding trading and acquisition of CO<sub>2</sub> allowances:

- *CO<sub>2</sub> Allowances in Circulation* – The number of allowances in circulation increased from 191 million at the end of 2019 to 231 million at the end of 2020 as total purchases in the auctions exceeded the amount surrendered for fourth control period interim compliance. In 2020, nearly 75 million tons were emitted and nearly 30 million allowances were surrendered. The amount of surplus holdings (in excess of outstanding compliance obligations) increased from 94 million at the end of 2019 to more than 95 million at the end of 2020, primarily due to a reduction in emissions associated with COVID-19 and a relatively mild winter. Going forward, the private bank of surplus allowances is expected to fall each year until 2025 because of annual reductions in the emissions cap in combination with interim adjustments for banked CO<sub>2</sub> allowances.
- *Participation by Compliance-Oriented Entities* – Of the allowances circulating at the end of 2020, 155 million (67 percent) were held by compliance-oriented entities. This exceeded their outstanding compliance obligations (129 million) at the end of 2020.
- *Participation by Investors* – Seventy-six million CO<sub>2</sub> allowances (33 percent) were held by investors at the end of 2020. Investors with compliance obligations surrendered around one million allowances for fourth control period interim compliance (for emissions that occurred in 2019). A high level of participation by investors is expected given the large current surplus of CO<sub>2</sub> allowances. As the CO<sub>2</sub> emissions cap tightens, the proportion of allowances held by investors will likely fall as the amount of surplus allowances falls.
- *Trading Activity in the Secondary Market* – The volume of futures trading decreased 14 percent from 259 million CO<sub>2</sub> allowances in 2019 to 223 million in 2020.<sup>26</sup> The volume of allowance transfers between unaffiliated firms in COATS increased 27 percent from

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<sup>26</sup> The 2019 futures volume has been revised up from the 2019 Annual Report to reflect updated historical data.

approximately 68 million CO<sub>2</sub> allowances in 2019 to 86 million in 2020. Overall, the secondary market was relatively liquid and competitive in 2020.

- *Patterns of CO<sub>2</sub> Allowance Acquisition* – Of the CO<sub>2</sub> allowances in circulation at the end of 2020, 54 percent were held by firms since the beginning of the year, 28 percent were held by firms that acquired them through auctions or state allocations in 2020, and 18 percent were held by firms that purchased them in the secondary market in 2020.
- *Reliance on the Auctions versus the Secondary Market* – Of the CO<sub>2</sub> allowances held by compliance-oriented entities at the end of 2020, more than 39 million were held by firms that acquired them through auctions or state allocations during 2020, while nearly 42 million (27 percent of holdings in 2020 compared to 15 percent in 2019) were held by firms that purchased them in the secondary market during 2020. Some compliance-oriented entities relied primarily on the auctions to acquire CO<sub>2</sub> allowances in 2020, while others relied primarily on the secondary market to obtain allowances.

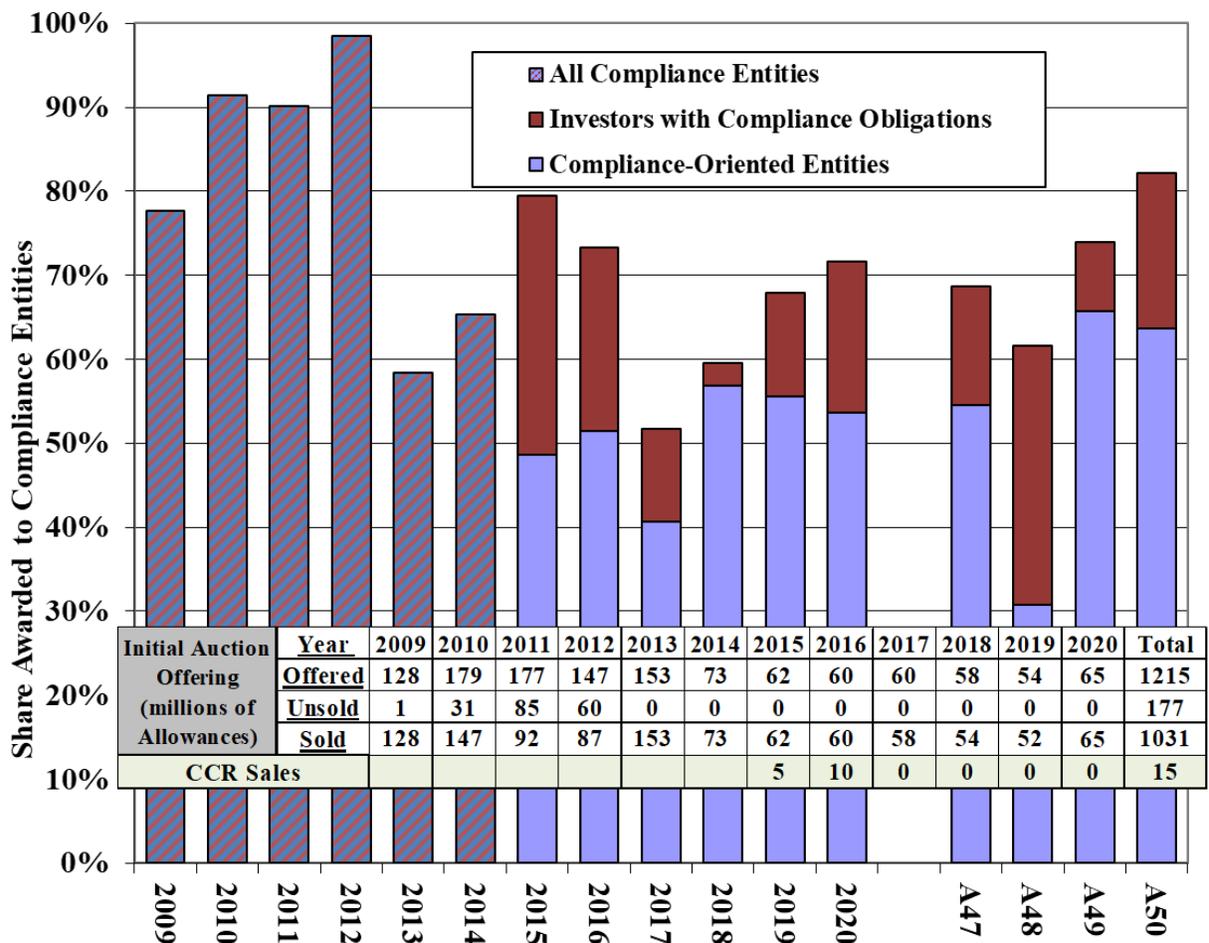
#### A. Distribution of Auction Awards

Figure 3 reports the quantity of CO<sub>2</sub> allowances that were offered and sold in each auction held in 2020 (i.e., Auctions 47 through 50) and in each year from 2009 to 2020. The height of each bar represents the percentage of CO<sub>2</sub> allowances (as a share of allowances sold) that was purchased by compliance entities, while the remaining share was purchased by investors 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 investors with compliance obligations. The table in the figure shows the numbers of offered, unsold, and sold allowances in each calendar year since 2009.

Observations regarding the distribution of auction awards in Figure 3:

- *Compliance Entities* – The share of CO<sub>2</sub> allowances purchased in the auctions by all compliance entities increased from 68 percent in 2019 to 72 percent in 2020, while the share purchased by compliance-oriented entities alone decreased slightly from 56 percent in 2019 to 54 percent in 2020.
- *Investors* – The share of CO<sub>2</sub> allowances purchased in the auctions by investors with compliance obligations averaged 18 percent in 2020 and peaked at 31 percent of the allowances sold in Auction 48. The share of allowances purchased by investors without compliance obligations averaged 28 percent in 2020.
- *Unsold CO<sub>2</sub> Allowances* – For the eighth year in a row, 100 percent of the allowances in the initial offerings of the auctions were sold.

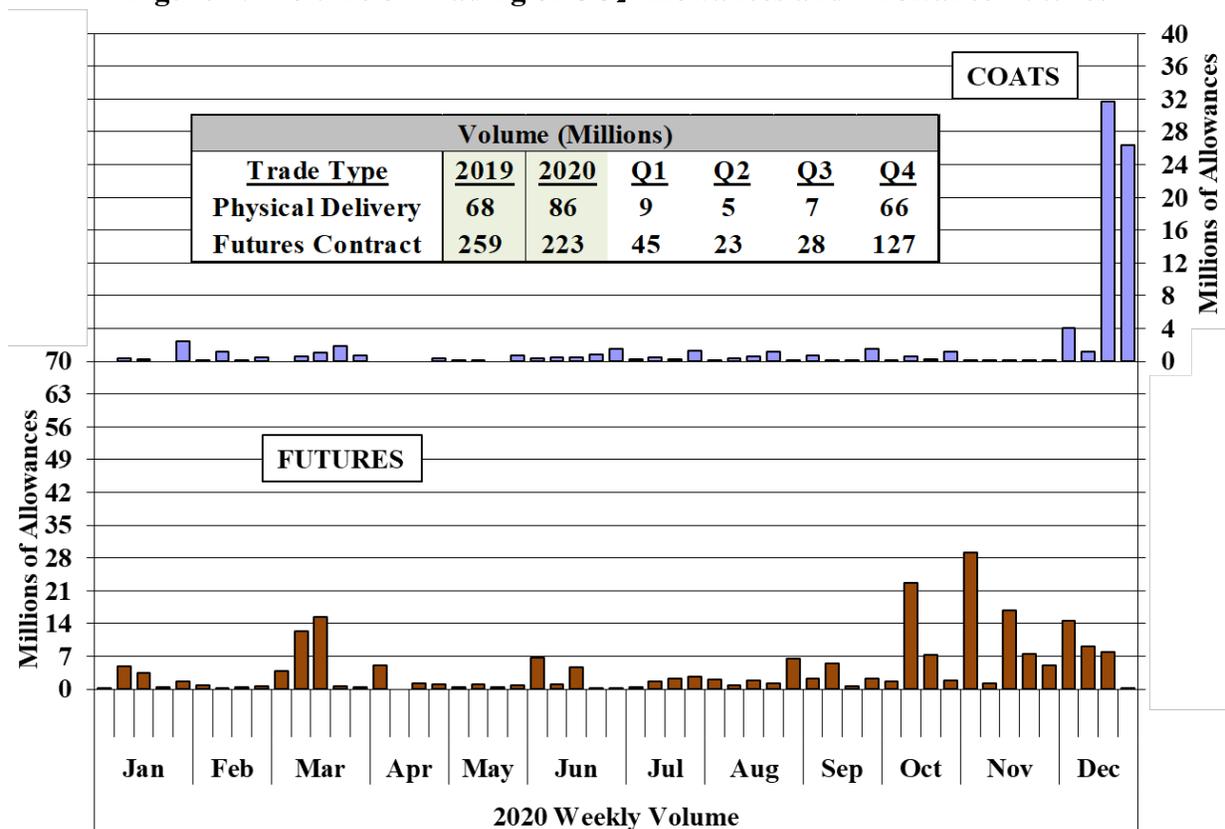
Figure 3: Distribution of Auction Awards



B. CO<sub>2</sub> 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<sub>2</sub> allowances between unaffiliated parties that were recorded in COATS on a weekly basis in 2020. The bottom portion of the figure is plotted against the left vertical axis and shows the weekly volume of futures trading of CO<sub>2</sub> allowance contracts. The top portion of the figure is plotted against the right vertical axis and shows the weekly volume of CO<sub>2</sub> allowance transfers between unaffiliated firms that are reported in COATS. The table shows quarterly volumes in 2020 as well as a year-over-year comparison of the total volume of futures trading and CO<sub>2</sub> allowance transfers in COATS.

Figure 4: Volume of Trading of CO<sub>2</sub> Allowances and Allowance Futures



Observations regarding CO<sub>2</sub> allowance trading volumes:

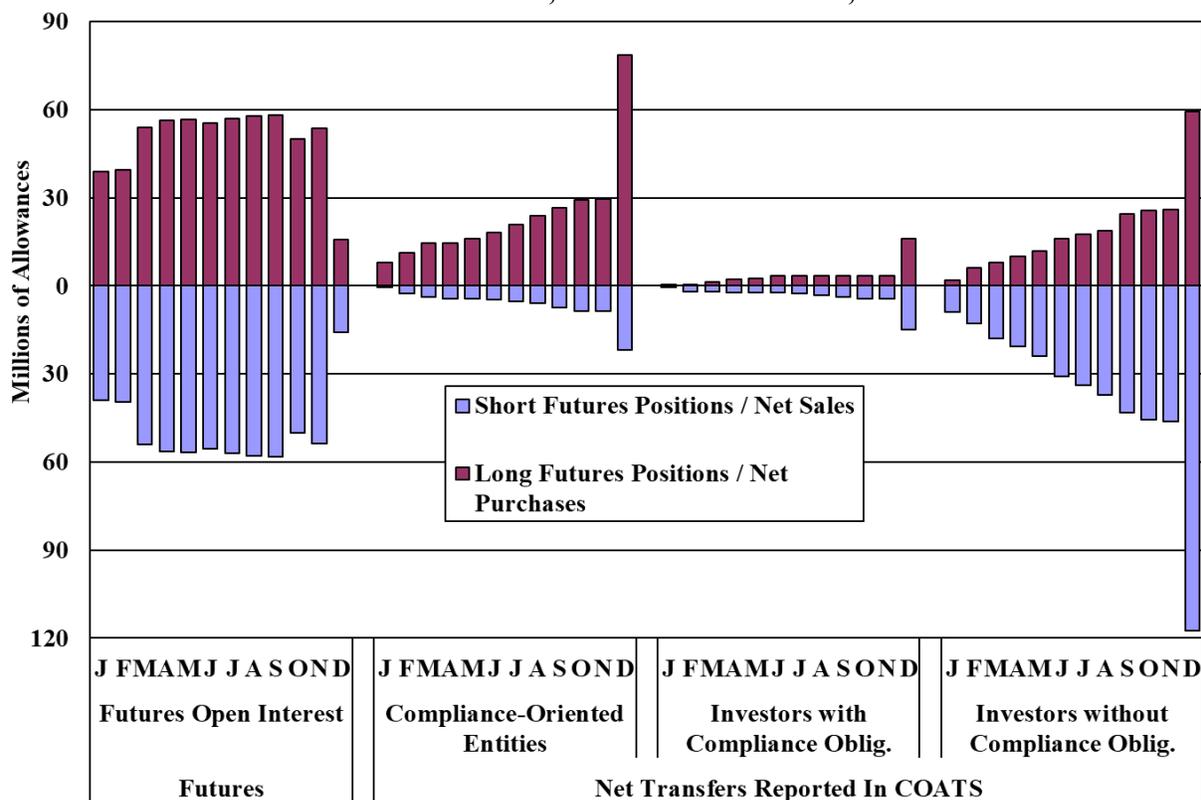
- *Volume of Futures Trading* – The volume of futures trading totaled approximately 223 million CO<sub>2</sub> allowances in 2020, down 14 percent from 2019. Fifty-seven percent of the 2020 volume occurred in the fourth quarter, when 127 million was traded ahead of compliance for the fourth control period.
- *CO<sub>2</sub> Allowance Transfers* – The volume of allowance transfers between unaffiliated firms was 86 million in 2020. This was up from 68 million in 2019, in anticipation of the March 2021 compliance deadline for the fourth control period. Allowance transfers rose dramatically in December as a result of the settlement of the benchmark futures contract. Seventy-seven percent of 2020 allowance transfer volume occurred in the fourth quarter.

### C. Acquisition of CO<sub>2</sub> Allowances in the Secondary Market

This section evaluates how the ownership of CO<sub>2</sub> allowances is affected by trading in the secondary market. Net changes in the ownership of CO<sub>2</sub> allowances are quantified in Figure 5 for 2020 using two measures: the open interest in RGGI futures contracts and the net purchases and sales of CO<sub>2</sub> allowances by individual firms. 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. The figure reports net changes that have occurred since January 1, 2020.<sup>27</sup>

**Figure 5: Net Changes in Futures Open Interest and Net Transfers of CO<sub>2</sub> Allowances From December 31, 2019 to December 31, 2020**



Observations regarding the acquisition of CO<sub>2</sub> allowances in the secondary market:

- *Open Interest in Futures* – The net change in open interest of futures contracts from the beginning of 2020 peaked at 58.1 million allowances on September 30 before falling to 15.7 million after the settlement of the benchmark contract.
- *Net Transfers Reported by Compliance-Oriented Entities* – Overall, compliance-oriented firms who used the secondary market to increase their holdings in 2020 purchased a net of 57 million allowances in 2020.

<sup>27</sup> Open interest is defined in Section II.E. Net purchases/sales of CO<sub>2</sub> allowances by a particular firm include the net change in the amount of CO<sub>2</sub> 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<sub>2</sub> allowances from another firm, and then sells 30,000 allowances, the firm’s net purchase of allowances would be 70,000.

- *Net Transfers Reported by Investors with Compliance Obligations* – Investors with compliance obligations are reported separately from compliance-oriented entities because they often exhibit different transaction patterns. However, some investors with compliance obligations used the secondary market to increase their holdings, while others used it to reduce their holdings. In total, these investors purchased a net of 1 million allowances in 2020.
- *Net Transfers Reported by Investors without Compliance Obligations* – Purely investment-focused entities without compliance obligations continued to be active in the secondary market in 2020. A few of these firms used the secondary market to increase their CO<sub>2</sub> allowance holdings during 2020, while most used the secondary market to reduce their holdings. Collectively, these entities sold a net of 58 million CO<sub>2</sub> allowances over the year, primarily to compliance-oriented entities.
- *Total Net Acquisition Reported in COATS* – The total net purchase of CO<sub>2</sub> allowances by firms that used the secondary market to increase their holdings in 2020 (58 million) is much lower than the gross volume of transactions between unaffiliated firms (86 million as shown in Figure 4). This is because some firms have both purchased and sold CO<sub>2</sub> allowances in the secondary market such that the net change in their position is smaller than the total volume of their transactions. The total net purchase of CO<sub>2</sub> allowances by firms that increased their holdings was smaller than the 65 million CO<sub>2</sub> allowances that were acquired in the auctions in 2020. Some compliance entities relied primarily on the auctions to acquire CO<sub>2</sub> allowances in 2020, while others relied primarily or exclusively on the secondary market.

#### **D. Patterns of CO<sub>2</sub> Allowance Holdings**

Figure 6 below combines information on the acquisition of CO<sub>2</sub> 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, 2020. Together, this information provides a summary of the holdings of CO<sub>2</sub> allowances in COATS accounts according to whether the allowances were acquired: (i) prior to 2020, (ii) through the primary market in 2020, or (iii) through the secondary market in 2020. Figure 6 reports several categories of CO<sub>2</sub> allowances that are described below.

*Net Purchases in the Secondary Market* includes CO<sub>2</sub> allowances that were held in the COATS account of a firm that purchased them in the secondary market after January 1, 2020.

*Awards and Allocations – Retained in COATS Account* includes CO<sub>2</sub> 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 2020. If a firm was a net seller of CO<sub>2</sub> allowances at any point in 2020, then the CO<sub>2</sub> allowances were first deducted from this category.

*Initial Holdings – Retained in COATS Account* includes CO<sub>2</sub> allowances that were held in the COATS account of the firm from the beginning of 2020. If a firm sold CO<sub>2</sub> allowances in 2020, those allowances were deducted from this category after any awards and allocations were exhausted.

For each firm, its holdings of CO<sub>2</sub> 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*.<sup>28</sup> Figure 6 shows the three categories of CO<sub>2</sub> allowances at the end of each month in 2020. The figure also shows the cumulative compliance obligations for compliance entities in the fourth control period. The information is aggregated separately for compliance-oriented entities, investors with compliance obligations, and investors without compliance obligations.

Observations regarding registered CO<sub>2</sub> allowance holdings in Figure 6:

- *Holdings by Compliance-Oriented Entities* – One hundred and ninety-one million CO<sub>2</sub> allowances were in circulation at the beginning of January 2020. Of these, 103 million (54 percent) were held by compliance-oriented entities. These firms remained active in purchasing allowances throughout the year, but they also surrendered nearly 29 million for fourth control period interim compliance in March 2020. At the end of 2020, the number of allowances held by compliance-oriented entities was 155 million.
- *Holdings by Investors with Compliance Obligations* – Approximately 53 million of the CO<sub>2</sub> allowances in circulation at the beginning of 2020 were held by investors with compliance obligations. These firms surrendered approximately one million allowances to satisfy their fourth control period interim compliance obligations and acquired

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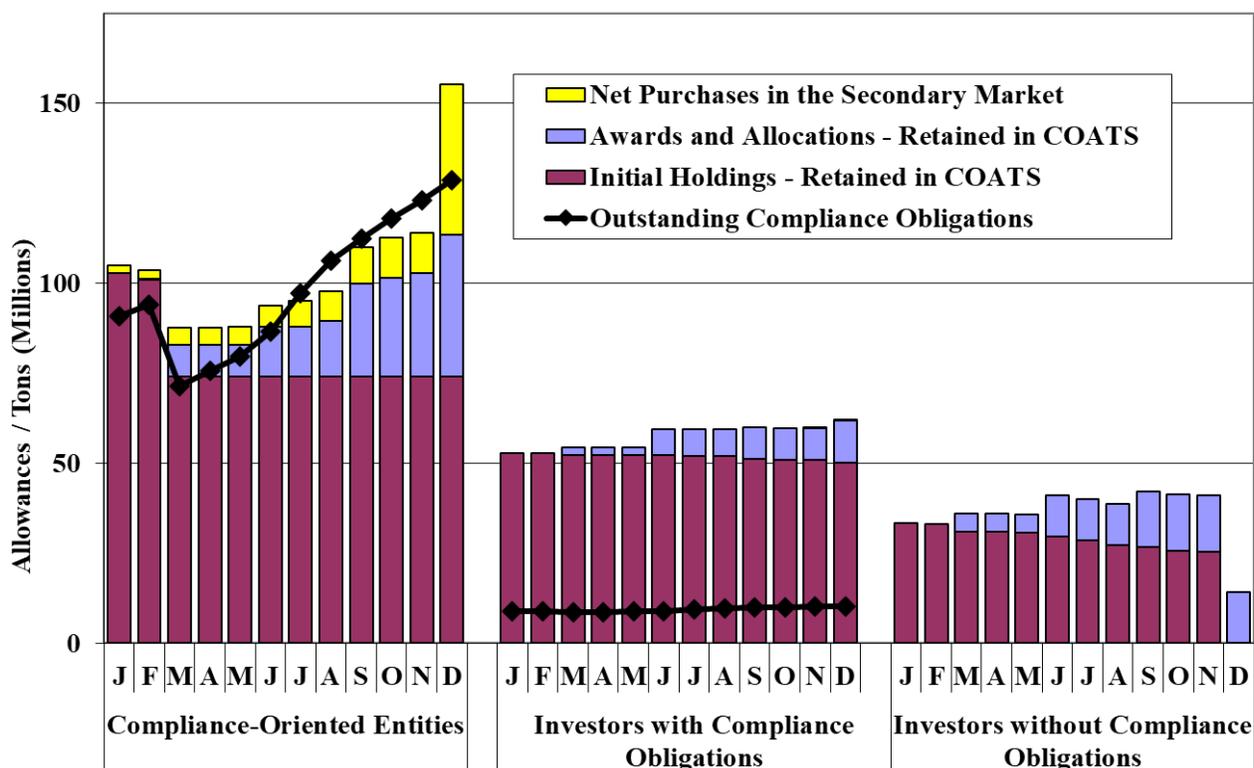
<sup>28</sup> If a firm held 15,000 allowances at the beginning of 2020, purchased 50,000 allowances in an auction, purchased 100,000 allowances in the secondary market, and then sold 130,000 allowances in the secondary market, the firm would contribute:

- 0 allowances to *Net Purchases in Secondary Market*.
- 20,000 allowances to *Awards and Allocation – Retained in COATS Account*.
- 15,000 allowances to *Initial Holdings – Retained in COATS Account*.

allowances in both auctions and the secondary market. These entities held nearly 62 million of the allowances in circulation at the end of 2020 (27 percent).

- *Outstanding Compliance Obligations in the Fourth Control Period* – The fourth control period began in 2018 and ran through 2020. Outstanding compliance obligations for the fourth control period stood at approximately 139 million at the end of 2020.
- *Holdings by Investors without Compliance Obligations* – The share of allowances held by these entities decreased from 18 percent at the beginning of 2020 to 6 percent at the end of the year. At the end of 2020, entities without compliance obligations held 14 million of the allowances in circulation. Investors without compliance obligations only retained allowances that were awarded or allocated in the current year.
- *Surrenders of Allowances for Compliance* – Over the course of 2020, nearly 30 million allowances were transferred to surrender accounts for compliance. Some allowances were transferred to surrender accounts early, including 1.8 million in February, but the vast majority were transferred to surrender accounts in March.<sup>29</sup>

**Figure 6: Sources of CO<sub>2</sub> Allowances Held in COATS Accounts  
2020**



<sup>29</sup> Despite surrenders prior to March, the Outstanding Compliance Obligations in Figure 6 do not decline because emissions were greater than the amount transferred to surrender accounts in February.

## V. PARTICIPATION IN THE CO<sub>2</sub> ALLOWANCE MARKET

This section evaluates participation by individual firms in the CO<sub>2</sub> allowance market.

Participation by many firms promotes competition and helps ensure that CO<sub>2</sub> allowance prices are determined efficiently. Over time, firms that need CO<sub>2</sub> 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.

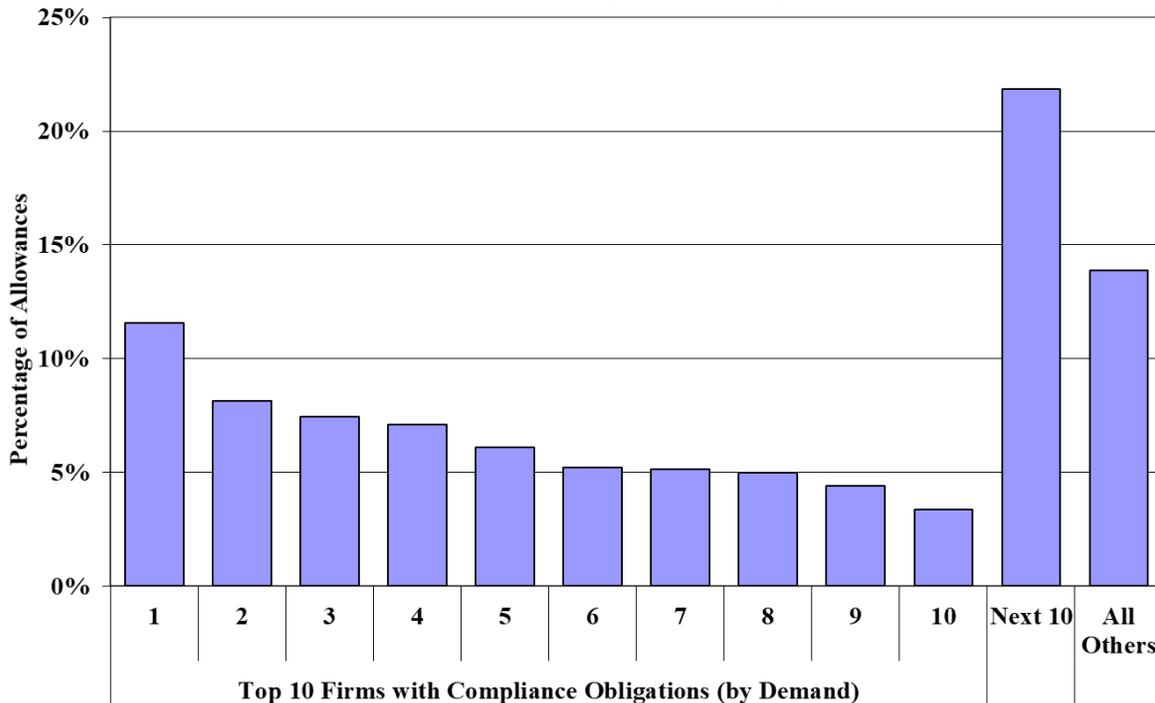
Key observations regarding participation in the CO<sub>2</sub> allowance market:

- *Demand for CO<sub>2</sub> Allowances* – The demand for CO<sub>2</sub> allowances is dispersed widely across firms, resulting in participation in the auctions by large number of firms. The three firms with the largest compliance obligations accounted for 27 percent of the total projected demand and the top ten accounted for 63 percent.
- *Participation in the Auctions* – Large numbers of bidders participated in the quarterly auctions. The average number of compliance-oriented entities submitting bids in the 2020 auctions increased to 37, while the average number of participating investors increased to 11 in 2020.
- *Distribution of CO<sub>2</sub> Allowances Awarded* – Auction awards were widely distributed across different types of firms as the top ten awards to compliance-oriented entities accounted for 57 percent of the total awarded, while the top ten largest awards to investors accounted for 28 percent.
- *Distribution of CO<sub>2</sub> Allowance Holdings* – Holdings are distributed widely across firms. The ten compliance-oriented entities with the largest outstanding obligations accounted for 47 percent of the total holdings and other compliance-oriented entities with smaller outstanding obligations accounted for 20 percent of holdings at the end of 2020. The share of allowances held collectively by the ten investors with the largest holdings decreased from 46 percent at the end of 2019 to 32 percent at the end of 2020.
- *Concentration of Futures Holdings* – Many firms have open interest in RGGI CO<sub>2</sub> allowance futures and options, but a relatively 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 48 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 65 percent of the total short positions.

**A. Demand for CO<sub>2</sub> Allowances**

The following figure summarizes the projected demand for fourth control period CO<sub>2</sub> allowances of individual compliance entities at the end of 2020. We project the demand of each compliance entity for CO<sub>2</sub> allowances based on historical CO<sub>2</sub> 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<sub>2</sub> Allowances  
By All Firms with Compliance Obligations**



Observations regarding demand for CO<sub>2</sub> allowances:

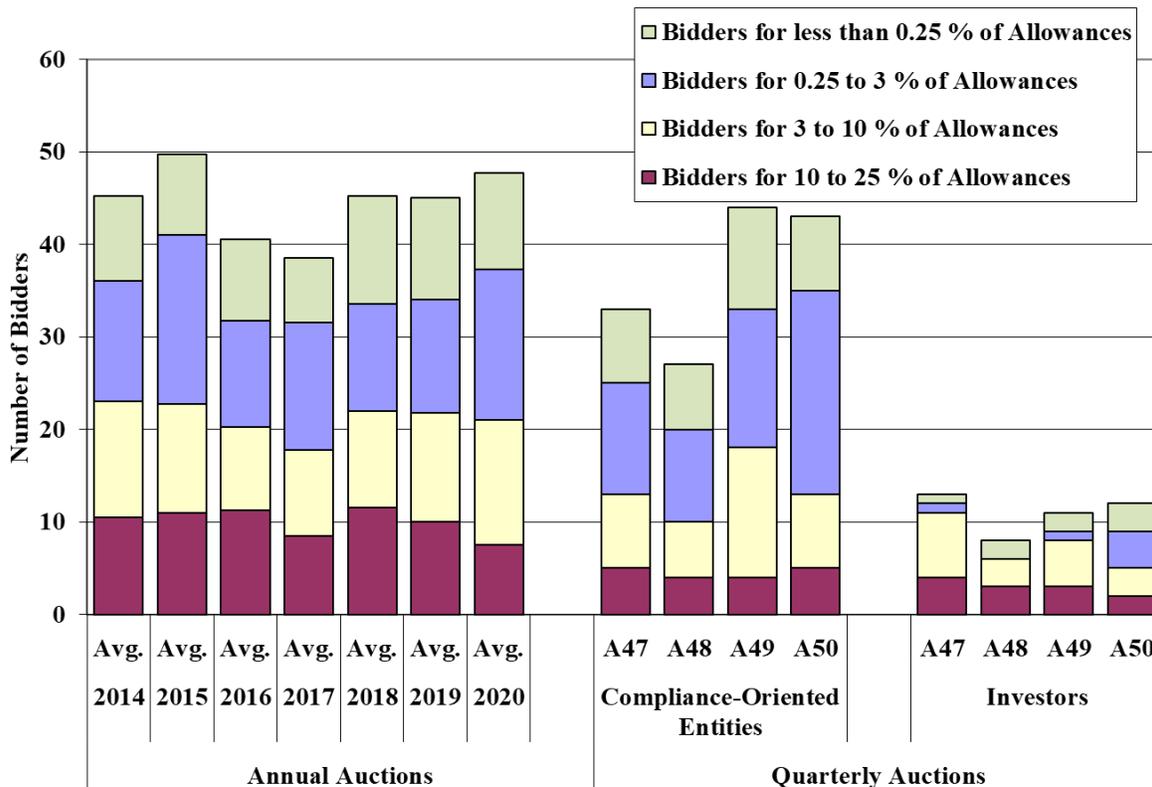
- *Demand for CO<sub>2</sub> Allowances* – The demand for CO<sub>2</sub> allowances is dispersed relatively widely across firms. The three compliance entities with the largest compliance obligations account for 27 percent of the total projected demand. The top ten compliance entities account for 63 percent of the total projected market demand, while the next ten compliance entities account for 22 percent, and compliance entities that are not among the top 20 account for 14 percent.

- *Concentration of Demand* – The concentration of demand by compliance entities in 2020 remained similar to 2019.

**B. Participation in RGGI Auctions**

The following figure summarizes the breadth of participation in the four auctions during 2020. The figure reports the number of firms that submitted bids in each auction. For 2020, the number of bidders is shown separately based on whether the bidder is a compliance-oriented entity or an investor in the RGGI marketplace. The figure shows these quantities averaged across the auctions in each year from 2014 to 2020.<sup>30</sup>

**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:

<sup>30</sup> For example, if 13.5 million CO<sub>2</sub> allowances were offered in an auction, a firm that submitted bids for 200,000 allowances would be counted in the “0.25 to 3 percent” category, since 200,000 ÷ 13.5 million = 1.5 percent.

- *Participation* – In the 2020 auctions, the number of bidders ranged from 35 to 55 and averaged 48, a wider range and higher average than the number of bidders in the 2019 auctions. The number of compliance-oriented entities submitting bids increased from an average of 35 in 2019 to 37 in 2020, while the number of participating investors increased from 10 in 2019 to 11 in 2020.
- *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 21 in 2020, a slight decrease from 2019. The average number of small bidders (i.e., firms submitting bids for up to three percent of allowances offered for sale) was 27, which was greater than the level of participation in 2019.
- *Competition* – Participation by a large number of firms promotes competition and helps ensure that the auction clearing price reflects the market value of CO<sub>2</sub> allowances. The levels of participation in 2020 were similar to those in 2019, 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<sub>2</sub> Allowances by Individual Firms

In a well-functioning market, we expect each firm to purchase a number of CO<sub>2</sub> 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<sub>2</sub> allowances compares to their expectations of allowance prices in the future. Firms that believe CO<sub>2</sub> 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<sub>2</sub> allowances in the auctions and in the secondary market reflects reasonable expectations.

The following two figures examine the distribution of CO<sub>2</sub> allowances across individual firms following the twelfth full year of the RGGI market's operation. Figure 9 illustrates how broadly CO<sub>2</sub> allowances were distributed in the auctions, while Figure 10 illustrates how the holdings of allowances in COATS accounts were distributed after the close of 2020. The figures show that CO<sub>2</sub> 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<sub>2</sub> allowances that were awarded to firms in the auctions in 2019 and 2020. 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 investors (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) firms in each category as a group.

**Figure 9: Distribution of Auction Awards  
2019 – 2020**

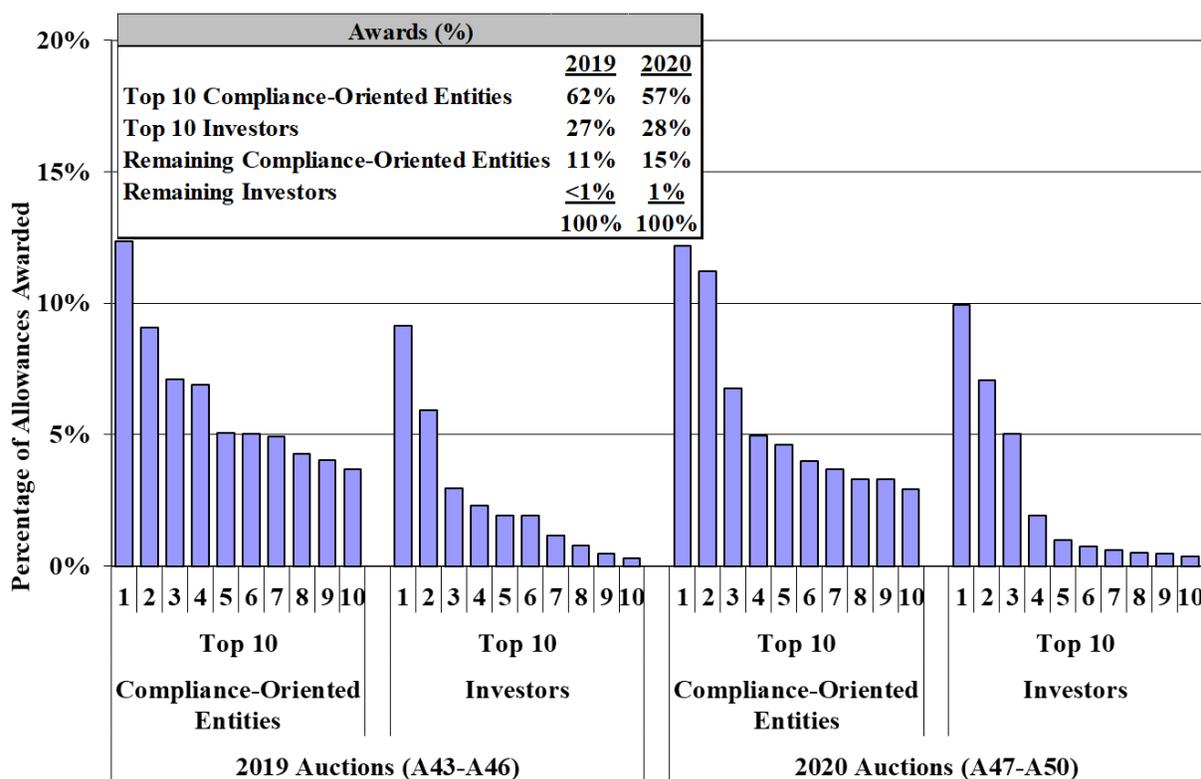
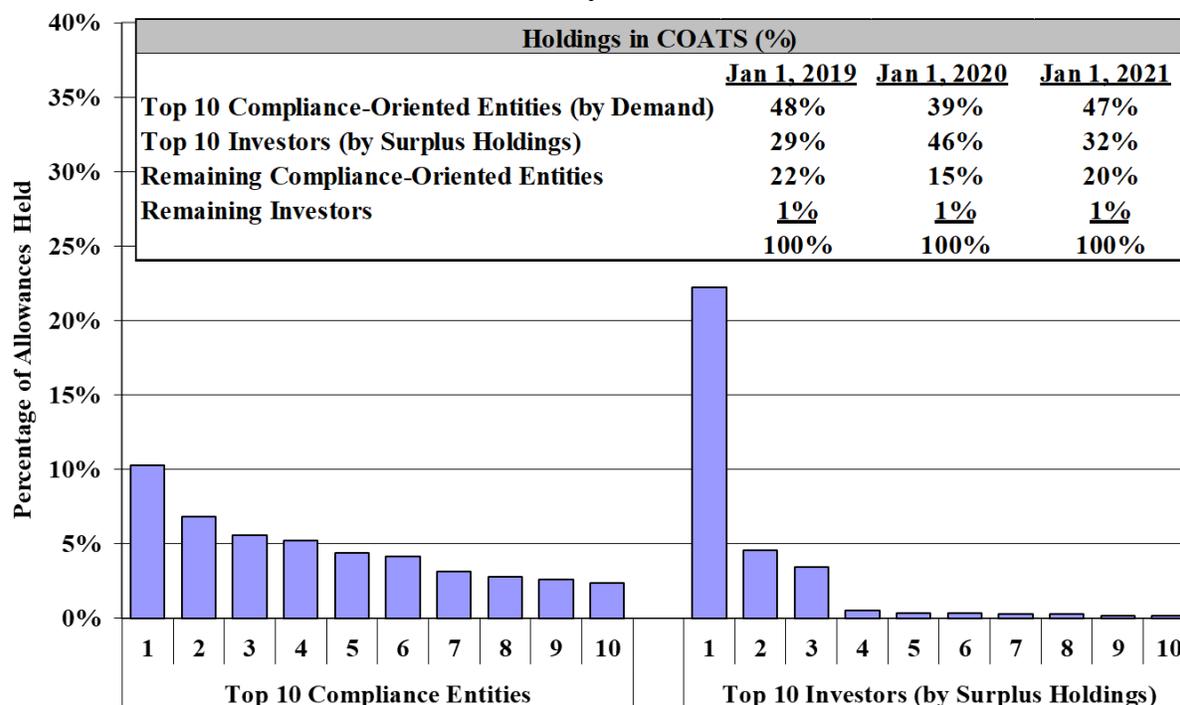


Figure 10 reports the quantities of CO<sub>2</sub> allowances that were held in the COATS accounts of individual firms at the beginning of January 2021, following the delivery of contracts dated for December 2020 delivery. The holdings are shown for each of the top compliance-oriented entities (i.e. the ten firms with the highest projected demand) and for the top ten investors. The top ten investors 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 as a group and investors as a group.

**Figure 10: Distribution of CO<sub>2</sub> Allowance Holdings  
January 1, 2021**



Observations regarding the distribution of CO<sub>2</sub> allowances:

- *Distribution of CO<sub>2</sub> Allowances Awarded* – The share of awards allocated to the top ten compliance-oriented entities decreased from 62 percent in 2019 to 57 percent in 2020, while the share of awards allocated to the top ten investors increased from 27 percent in 2019 to 28 percent in 2020.
- *Distribution of CO<sub>2</sub> Allowance Holdings* – The holdings of CO<sub>2</sub> allowances were distributed across compliance-oriented entities at the close of 2020 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 was 47 percent at the end of 2020, while the share of holdings of smaller compliance-oriented entities was 20 percent. The share of holdings by the top ten investors was 32 percent at the end of 2020. The large decrease in investor ownership was driven by transfers following the close of the benchmark December 2020 futures contract ahead of fourth control period compliance in early 2021. The distribution of allowance holdings is consistent with competitive expectations given that the private bank of allowances far exceeds the compliance obligations of firms thus far in the fourth 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<sub>2</sub> 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”) <sup>31</sup> 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 2019 and Vintage 2020 ICE futures and options contracts during months 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, (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 for three categories.

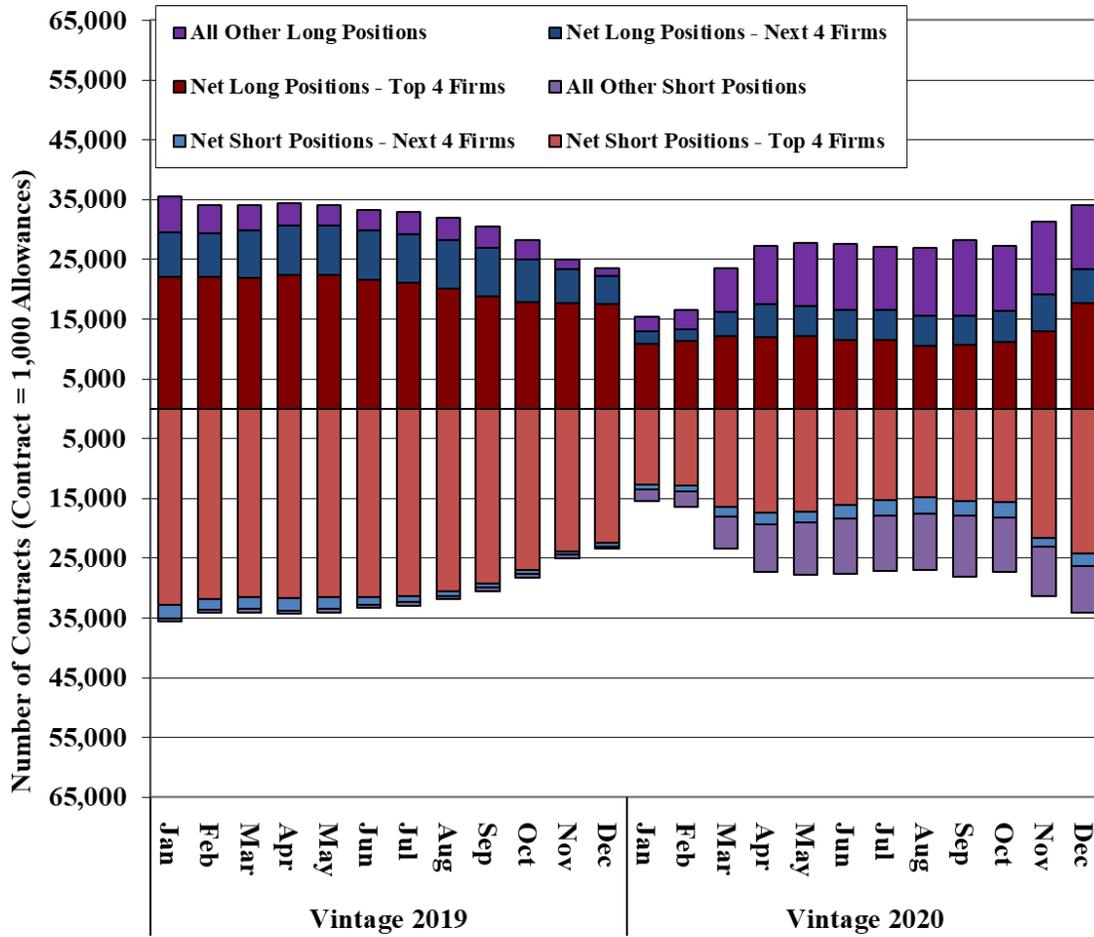
Observations regarding the concentration of open interest in futures and options contracts by individual firms from Figure 11:

- *Number of Participants* – The number of participants in the market for RGGI CO<sub>2</sub> allowance derivatives increased in 2020, and the COT report for Vintage 2019 futures contracts was published 51 weeks of the year as compared to 50 weeks in 2019 and 42 weeks in 2018. For the weeks that were reported in 2020, up to 44 firms had significant positions in RGGI Vintage 2020 futures contracts.
- *Concentration of Ownership* – Many firms have open interest in RGGI CO<sub>2</sub> allowance futures and options, although a small number of firms account for large shares of the net long and short positions in Vintage 2020 contracts. The net long positions of the top four firms accounted for an average of 48 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 65 percent of the total short positions.
- *Contract Vintage* – At the beginning of 2020, the open interest in Vintage 2019 contracts was larger than in Vintage 2020 contracts, since the Vintage 2019 contracts were most liquid in 2019. Vintage 2020 contracts grew relatively slowly over the course of the year, increasing most dramatically in March and November. Open interest in Vintage 2020 contracts did not exceed Vintage 2019 levels until November.

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<sup>31</sup> 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 summarizes the positions of market participants.

Figure 11: Concentration of Open Interest in Futures and Options



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## 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 50 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 quantity of allowances consistent with their obligation thus far for the fourth control period, 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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.