QUARTERLY REPORT ON THE ELECTRICITY GENERATOR EMISSIONS LIMITS PROGRAM (310 CMR 7.74): FOURTH QUARTER 2018

Prepared for:

Massachusetts Department of Environmental Protection on behalf of the Commonwealth of Massachusetts

Prepared by:

POTOMAC ECONOMICS

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A. INTRODUCTION AND SUMMARY

The Massachusetts Department of Environmental Protection ("MassDEP") implemented its program to limit CO_2 emissions from electricity generators in 2018. This report provides background on relevant aspects of the program, a summary of market activity through the fourth quarter of 2018, an overview of 2018 emissions and allowance holdings patterns, and discussion of the results of our market power screens.

- *CO_2 Allowance Holdings and Emissions*: 2018 emissions totaled 7.35 million metric tons, which was nearly 20 percent lower than the 2018 emissions cap.
  - ✓ While most regulated entities were allocated sufficient allowances to satisfy their 2018 compliance obligations, some regulated entities had to purchase allowances in the secondary market and/or reduce their electricity production to satisfy their 2018 compliance obligations.
- *CO_2 Allowance Prices and Volumes*: Prices averaged $9.49 per metric ton for a modest volume (391k) of allowance transfers in the last quarter of 2018 (including transfers in January 2019 of allowances usable for 2018 compliance).
  - ✓ These prices were down significantly from January to April 2018, when the weighted-average price was $16.83 per metric ton, and relatively consistent with prices from May to September.
  - ✓ Given the large surplus of allowances relative to 2018 emissions, prices in the fourth quarter were likely driven by expectations of tighter conditions in subsequent years.
  - ✓ However, illiquid conditions in the secondary market for allowances have likely also contributed to higher prices. This is discussed further in Section C.
- *Auction Outcomes* – In the first auction, which was held in December, allowances for the 2019 compliance year were sold at a price of $6.71 per metric ton.
  - ✓ While the clearing price was lower than the prices of transfers reported in the fourth quarter, the distribution of allowances in the auction was generally consistent with the pattern of transfers in the secondary market.
  - ✓ Twelve regulated entities submitted bids for 1.56 million allowances, more than 3.5 times the supply of allowances in the auction.

We evaluate information on the holdings and 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 anti-competitive conduct in the secondary market for allowances, and we find that firms have generally sought to acquire or sell allowances consistent with their expected needs.

B. BACKGROUND

Regulation, 310 CMR 7.74, creates a cap-and-trade program to reduce carbon dioxide emissions from electricity generating facilities located in Massachusetts.[1] 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 hold 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.

Covered compliance entities and emissions are consistent with the Regional Greenhouse Gas Initiative (RGGI) regulation, implemented as 310 CMR 7.70 in Massachusetts. The first compliance period under 310 CMR 7.74 went from January 1st to December 31st, 2018. The Massachusetts Carbon Allowance Registry ("Registry") went online in July of 2018. Once an allowance is allocated or purchased in the auction, it can be resold in the secondary market. Participation in the market for allowances is limited to regulated electricity generating facilities.

The secondary market is important for several reasons. First, it gives firms an ability to obtain allowances at any time, while the auctions are relatively infrequent. Second, it provides firms a way to protect themselves against unexpected swings in future prices. Third, it provides price signals that assist firms in deciding how much electricity to produce and in making investment decisions that are affected by the costs of compliance.

The market for Massachusetts allowances has several key elements, which are discussed in this section: the emissions cap, allocations, auctions, banking, program participation, and compliance.

Emissions Cap and Allowance Acquisition

The program's annual emissions cap was set at 9,149,979 metric tons for 2018, which was the first year of program implementation. The annual cap will fall to 8,731,175 metric tons in 2019

[1] https://www.mass.gov/guides/electricity-generator-emissions-limits-310-cmr-774

and by 223,876 metric tons in each subsequent year, eventually reaching 1,791,019 metric tons in 2050.[2]

One hundred percent of the 2018 vintage allowances were allocated to individual generators, including 1.5 million allowances that were allocated to new facilities. Because new facilities emitted only 318,993 metric tons of CO_2 in 2018, the remaining 1,181,007 allowances were apportioned among existing facilities in proportion to their initial allocations.[3]

Starting with the 2019 compliance year, the MassDEP is transitioning from allocating allowances directly to using auctions as the primary mechanism for distributing allowances.[4] For the 2019 compliance year, the MassDEP will distribute 75 percent of allowances through direct allocation. On December 18th, 2018, the MassDEP conducted the first auction in which it sold 5 percent of the vintage 2019 allowances.

Banking of Allowances

In August 2018, the MassDEP adopted changes to the provisions for banked allowances (i.e., allowances held by covered entities after the compliance deadline for a given year). Under the new provisions, if the number of banked allowances after a particular year exceeds 223,875, the number of allowances distributed in the subsequent year will be adjusted downward by the difference between the number of banked allowances and 223,875. For instance, compliance obligations totaled 7,348,480 in 2018, so 1,801,499 allowances were banked and, thus, became usable for compliance in 2019. Since the number of banked allowances exceeded 223,875 by 1,577,624, the number of allowances that will be distributed by MassDEP for 2019 by auction will be reduced by 1,577,624. Since 436,559 allowances have already been auctioned for 2019, it leaves just 168,611 allowances that remain to be auctioned.

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2 310 CMR 7.74(5)(a)

3 310 CMR 7.74(5)(c)(2)

4 In this report, the term "allowance" refers to allowances that can be used to comply with 310 CMR 7.74 only. These allowances cannot be used to comply with requirements of the Regional Greenhouse Gas Initiative, which is implemented in Massachusetts pursuant to a different regulation, 310 CMR 7.70.

Participants in the Program

Participation in the program, including auctions, is restricted to the owners and operators of covered facilities. The term "Regulated Entity" is used in the Registry to refer to the highest level of facility ownership, and in the case of shared ownership groups together several facilities.[5] A list of facilities and associated regulated entities is available to the public at https://macar.apx.com/ (select "Reports"). The following tables list regulated facilities at the beginning of 2018 and their initial allowance allocation.[6]

Facility	Limit
ANP Bellingham	860,250
ANP Blackstone	787,429
Bellingham	233,789
Berkshire Power	437,049
Braintree Electric	24,425
Canal Station	101,922
Cleary Flood	50,453
Dartmouth Power	48,348
Dighton	330,396
Fore River Energy	1,433,568

Kendall Square	502,191
MASSPOWER	304,108
Medway Station	1,603
Milford Power, LLC	148,912
Millennium Power	667,082
Mystic	1,516,066
Pittsfield Generating	79,959
Stony Brook	68,844
Tanner Street	36,655
Waters River	1,587
West Springfield	15,343

In 2019, the number of allowances allocated to each Regulated Facility will be reduced proportionally to account for: (a) the reduction in the emissions cap from 2018 to 2019 and (b) the reduction in the share of allowances to be distributed through allocation from 100 percent in 2018 to 75 percent in 2019. In 2020, the number of allowances allocated to each Regulated Facility will be further reduced to account for: (a) the reduction in the emissions cap from 2019 to 2020 and (b) the reduction in the share of allowances to be distributed through allocation to 50 percent. Starting in 2021, allowances will no longer be distributed through allocation.

5 For example, Medway Station and Mystic receive allocations separately, but are both owned by Exelon, so for tracking and market monitoring purposes their demand is aggregated.

6 310 CMR 7.74(5)(b): Table B

The new Salem Harbor and West Medway facilities are also covered under the program. However, they receive allocations based on the rules for new facilities that were discussed earlier.

Compliance

On March 1st, every generating facility's Registry account is required to hold sufficient allowances to satisfy obligations from the prior calendar year. Facilities that do not hold sufficient allowances may qualify for "emergency deferred compliance." Under emergency deferred compliance, the compliance obligations from emissions that occurred during a MLCCP#2 designated period can be deferred to the following year.[7] However, those emissions are required to be offset on a two for one basis in that following year.[8] For example, if a facility deferred 1,000 allowances for 2018 compliance, they are required to hold a number of allowances for 2019 compliance equal to their 2019 emissions plus 2,000 additional allowances for their deferred compliance from the previous year. This provision is intended to provide generators with additional flexibility when they may be needed for system reliability, while still discouraging generators from exceeding the cap in a given year. Thus, it is unlikely that facilities will use this option under normal circumstances.

By April 1st the Department will deduct allowances from each generating facility's registry account; first to address any deferred obligations, then to meet the facility's obligations from the previous calendar year. For 2018, allowance deductions were carried out successfully and all facilities met their obligations without the use of emergency deferred compliance. The Registry tracks current holdings, allowance transfers, and allocations, as well as ownership and representation of each facility or regulated entity.

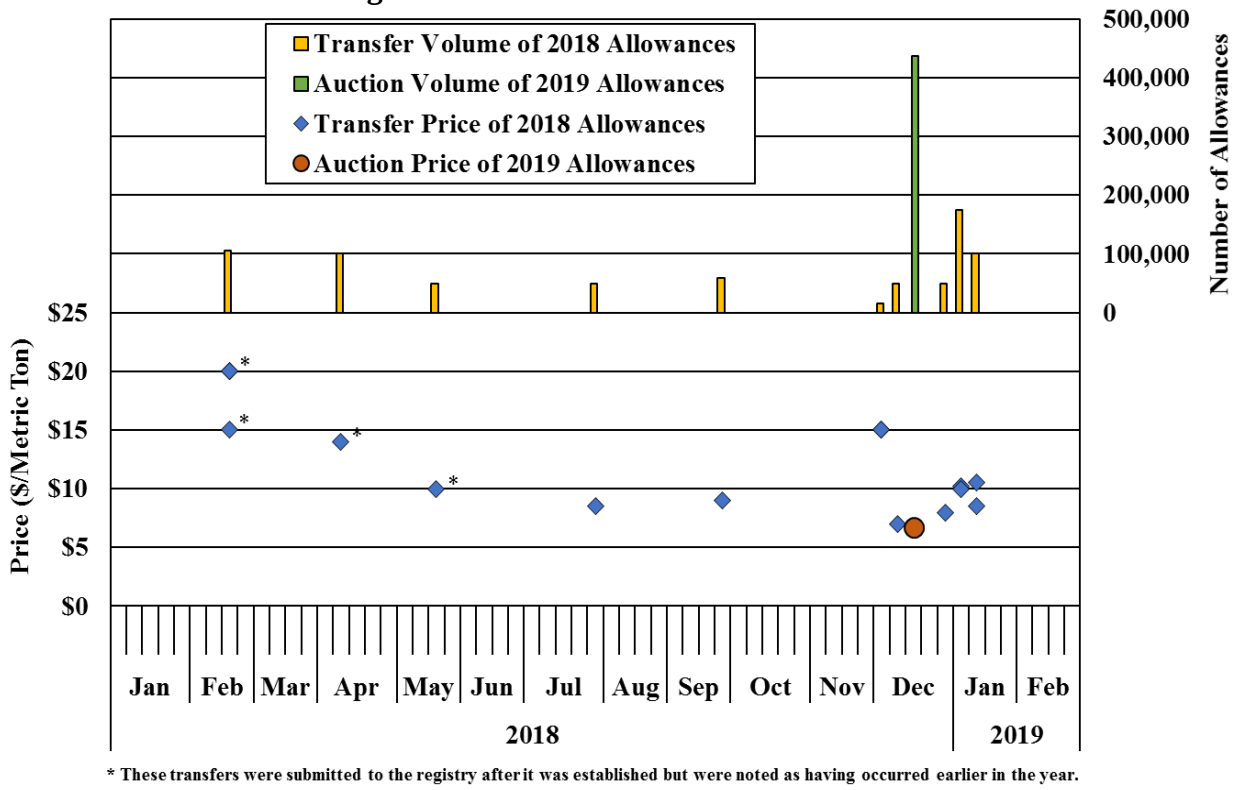
7 These are periods when ISO New England has triggered "Master Local Control Center Procedure No.2"

8 310 CMR 7.74(6)(d)

C. Summary of Prices and Traded Volumes

This section evaluates the available information regarding the purchase of allowances in the auctions and transfers in the secondary market for allowances. The Massachusetts GHG program allowance registry did not begin operating until July 2018, but several transfers were reported to the registry as having occurred in the first and second quarters. Figure 1 displays the weekly volumes of allowance transfers and weighted average prices as well as auction results.

Figure 1: Allowance Prices and Volumes[9]



* These transfers were submitted to the registry after it was established but were noted as having occurred earlier in the year.

The transfers shown above for 2018 allowances can be divided into three time periods:

- January to April 2018, four transfers had a weighted-average price of $16.83;
- May to October 2018, three transfers had a weighted-average price of $9.16; and
- November 2018 and January 2019, eight transfers had a weighted-average price of $9.49.

9 Figure 1 shows transfers reported to the registry by the end of February 2019, but since there is no prompt reporting requirement, other transactions may have occurred that have not yet been reported.

Although transaction prices have fallen since the first half of 2018, they remain high relative to levels that would be anticipated based on:

- The analyses that were performed to support the implementation of the regulation – These suggested that prices would be much closer to $0 per metric ton and that the demand for allowances would be relatively price-elastic.[10]
- The supply and demand for allowances in 2018 – Section D of this report shows that 2018 emissions were approximately 20 percent below the emissions cap for the year.
- The supply and demand for allowances in 2019 – The newly adopted banking provisions encourage firms to hold allowances if they anticipate higher prices in the future. [11] However, the prices of most 2018 allowance transactions were significantly higher than the $6.71 per metric ton price of 2019 allowances sold in the auction.

We find that the anomalously high transaction prices observed through the first year of program implementation are at least partly attributable to a short-term lack of liquidity rather than an indication of the supply-demand balance for several reasons. First, high prices involved a relatively small number of transactions—just 15 reported transactions involving just six buyers for a total net acquisition of just 550k allowances through January 2019.

Second, the anomalous prices have likely been affected by elements of the market power mitigation rules used by ISO New England. The rules allow a generator whose offer is mitigated (i.e., reduced to an administratively determined competitive benchmark) to seek cost recovery if it is later determined that the competitive benchmark was set below the generator's verifiable costs.[12] Generators that seek cost recovery after being mitigated by the ISO New England may

10 The most credible modeling results forecasted that BAU ("Business As Usual") emissions would not exceed the cap, suggesting that prices would be near $0/ton. To the extent that scenarios were run to evaluate price-elasticity (i.e., how prices might respond to unexpectedly high emissions), they suggested that prices might be expected to rise from $0 to $2 if emissions were reduced by 1 million below BAU emissions.

11 It is unclear how much the value of allowances in future years explains high transaction prices of 2018 allowances, since the final banking provision was not proposed until April 2018 and not adopted until August.

12 Normally, the generator must seek cost recovery within 60 days, although on January 8, 2018, NRG submitted a filing asking the Federal Energy Regulatory Commission ("FERC") to extend this deadline because generators do not have an accurate way to estimate the cost of MassGHG allowances. FERC granted this request on February 8, 2018.

not have strong incentives to obtain allowances at a competitive price level, since the cost recovery provision allows them to pass the cost on to the ISO.

Third, some suppliers may have been reluctant to sell allowances until more information was available regarding the demand for 2018 vintage allowances from newly-constructed generators. Some suppliers may have anticipated that the new Salem Harbor and West Medway units would emit near the new facility allocation of 1.5 million metric tons, however, these facilities emitted just 319k metric tons in 2018.

Fourth, there was no established venue (e.g., a public commodity exchange) where suppliers post standing offers, so some firms may have been willing to sell allowances for lower prices but were not aware of opportunities to sell. Thus, it is unclear whether the anomalous prices reflected the market expectations of most regulated entities.

Finally, many generators received 2018 allocations at or near their emissions in prior years and may therefore have chosen to simply forgo participation in the allowance market rather than analyzing options for buying or selling allowances.

D. EMISSIONS AND ALLOWANCE HOLDINGS

Allowance prices are generally driven by the fundamentals of supply and demand, which we evaluate by reviewing patterns of emissions, allocations, and forecasted holdings of firms. Table 1 and Figure 2 evaluate emissions and electricity supply over the last three years, while Figure 3 compares allowance holdings to emissions by regulated entity for the 2018 compliance year.

Table 1 summarizes electricity supply and emissions in 2018 compared to 2016 and 2017. Data is provided for regulated facilities by type: combined cycle units running on liquified natural gas ("LNG"), all other combined cycle units ("CC"), gas/oil-fired steam turbines ("ST"), and thermal peaking units ("CT"). Data is also provided for coal-fired steam turbines ("Coal"), although these are not regulated facilities because they retired in 2017. The table shows the supply of electricity from other non-regulated sources, including: nuclear generation, other non-program units such as renewables and waste burners, and net generation from the commercial and industrial sectors ("C&I").[13] Figure 2 summarizes this information on a monthly basis. The figure also reports emissions on a rolling 12-month basis for each month of 2018.

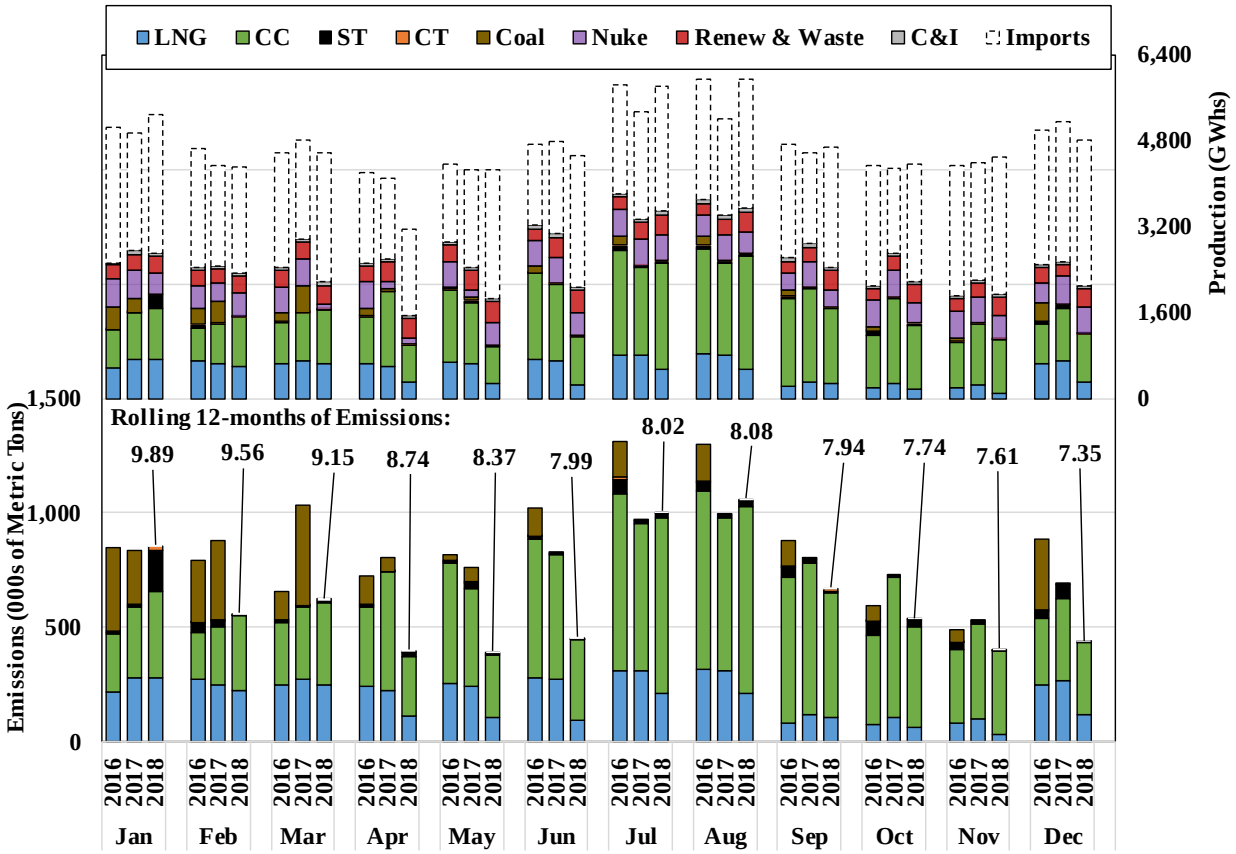
Table 1: Annual Electricity Supply and Emissions[14]

Year	Generation By Type (TWh)									
	LNG	CC	ST	CT	Coal	Nuclear	Renew & Waste	C&I	Imports	Total
2016	6.9	14.0	0.5	0.1	2.1	5.4	3.1	0.7	25.1	57.9
2017	7.2	15.2	0.3	0.1	1.3	5.0	3.6	0.7	22.8	56.3
2018	4.7	13.8	0.4	0.1	0.0	4.4	4.3	0.8	27.8	56.2
	Carbon Dioxide Emissions (Million Metric Tons)									
2016	2.6	5.4	0.3	0.1	1.9	-	-	-	-	10.32
2017	2.8	5.7	0.2	0.1	1.1	-	-	-	-	9.87
2018	1.8	5.2	0.3	0.0	-	-	-	-	-	7.35

[13] Based on EIA Form 923 data and Real-Time Load Obligations posting on the ISO-NE website. Form 923 data for 2018 is not final, so some values for 2018 may change in future reports.

[14] Table 1 and Figure 2 include emissions covered by the regulation and coal units that retired before the regulation was implemented. This excludes emissions from eligible combined heat and power output that do not count toward its compliance obligation. Emissions from non-regulated sources are also excluded, while their electricity production is reflected in the "Other" category.

Figure 2: Monthly Electricity Supply and Emissions



Emissions fell significantly from 2017 to 2018. The rolling 12-month emissions fell from 9.89 million metric tons after the cold month of January 2018 to just 7.35 million metric tons at the end of 2018. This steep decline in emissions resulted from:

- The retirement of coal-fired generation, which accounted for 1.1 million metric tons in 2017;
- Thirty-five percent less output from LNG-supplied generation, which accounted for a 1.0 million metric ton reduction from 2017 to 2018; and
- Nine percent less output from other combined cycle generation, which accounted for a 0.5 million metric ton reduction from 2017 to 2018.

High allowance prices likely contributed to the decrease in emissions from the LNG-supplied and other combined cycle generation in 2018, while the steep reduction in emissions likely helped reduce allowance prices after the first four months of 2018.[15]

In the month of January 2018, emissions were elevated primarily because of increased utilization of fuel oil and less fuel-efficient units during a period of extreme cold weather, which largely offset the emissions reduction that resulted from the retirement of coal-fired generation in May 2017. Emissions in February, March, July, and August 2018 were consistent with emissions from non-coal-fired generation in previous years, while emissions throughout the second quarter and the last four months of 2018 were significantly lower than in recent years.[16]

In 2018, aggregate emissions equaled 7.35 million metric tons, nearly 20 percent lower than the cap of 9.15 million metric tons. Although the cap will fall in each year going forward, the 2018 emissions were lower than the cap in each year until 2025. Since the Pilgrim nuclear unit is scheduled to retire by June 2019, it is anticipated that this will result in some increase in emissions from regulated facilities.

Figure 3 shows allowance deductions for 2018 compliance as well as the pre-deduction holdings of each Regulated Entity at the compliance deadline. The figure also distinguishes between allowances received through direct allocation versus allowances that were acquired (or sold) in the secondary market.

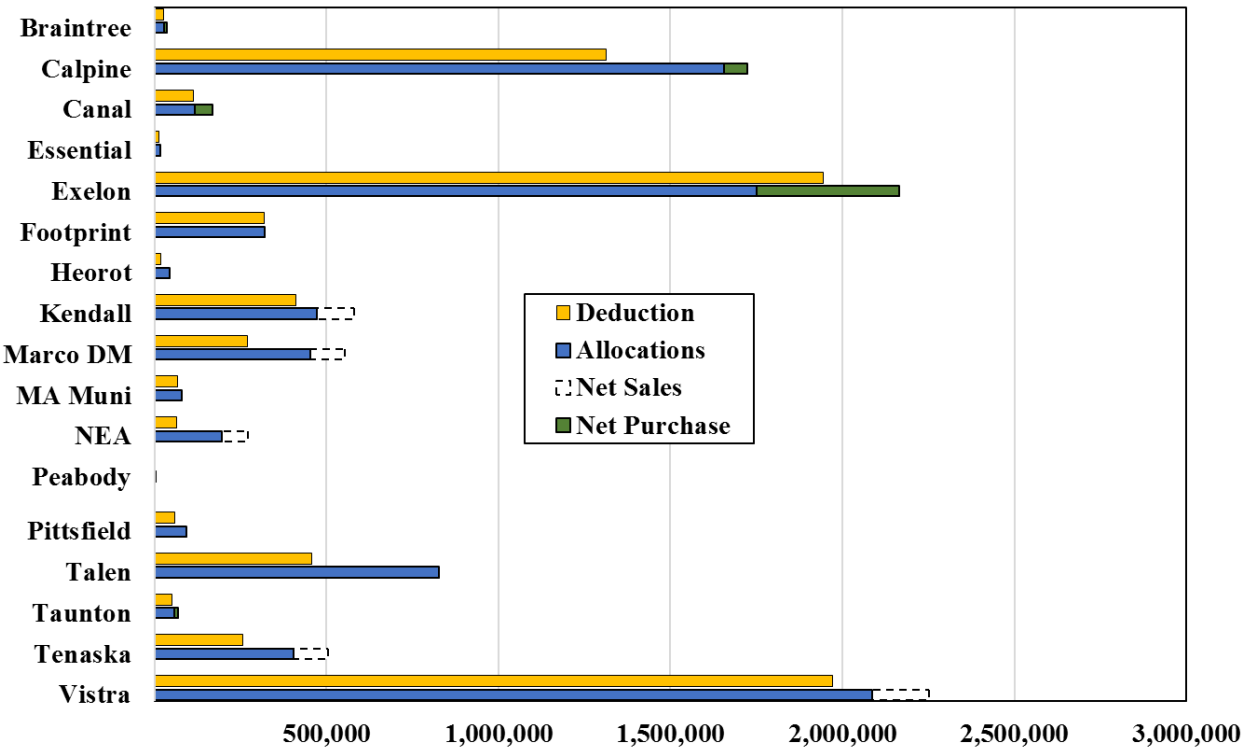
In general, the comparison of allowance holdings to compliance obligations provides insight about which firms likely to buy additional allowances versus ones that are more likely to sell

15 The start-up of new combined cycle generator in CT in the spring of 2018 could also have contributed to reduced demand for generation by facilities in MA later in the year.

16 Some have raised the concern that the Massachusetts cap-and-trade program could exacerbate New England's fuel security issues, but the reduction in emissions during the second quarter suggests that regulated entities are able to offset higher winter emissions with emission reductions during low-demand periods such as the spring.

allowances. After the compliance deadline, this comparison indicates which firms have banked allowances for the next compliance year.

Figure 3: Allowance Allocations, Deductions, and Transfers by Regulated Entity



Each Regulated Entity held sufficient allowances to satisfy its compliance obligations at the deadline. As discussed in Section B, approximately 1.18 million allowances originally allocated to new facilities (i.e., Salem Harbor) that went unused were reallocated to other Regulated Entities. Some Regulated Entities had to purchase allowances in the secondary market in order to satisfy their obligations. Others likely reduced their obligations by reducing electricity production as discussed earlier in this section.

In general, entities that are trending above their initial allocation can satisfy their obligations through some combination of: (a) allowances reallocated from new facilities later this year, (b) reduced emissions relative to business as usual, and (c) allowance purchases in the secondary market. Starting with the 2019 compliance year, regulated entities can also purchase allowances in the auctions.

E. Discussion of Market Monitoring

As the Massachusetts Carbon Allowance Program Market Monitor, we monitor trading and holdings amongst regulated entities in order to identify anticompetitive conduct. This section discusses two types of anti-competitive conduct for which we monitor in the secondary market. In the current period 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 production inputs. Hence, we screen information on the holdings of CO_2 allowances and the demand for allowances to identify firms that might acquire a position that raises competitive concerns.

Another potential concern is that a firm expecting to purchase CO_2 allowances in the auction might sell a large number of allowances below the competitive level. Such a firm might profit from buying a larger number of CO_2 allowances in the auction at a discount if the bidding in the auction were influenced by the depressed transfer price. For this to be a profitable strategy, the firm would need to be able to substantially depress the current price with a relatively small amount of sales—an amount smaller than the amount of CO_2 allowances it planned to buy in the auction. Firms that are looking for an opportunity to sell excess allowances or to purchase CO_2 allowances for their future compliance needs help limit the effectiveness of a strategy to depress prices below the competitive level.