QUARTERLY REPORT ON THE ELECTRICITY GENERATOR EMISSIONS LIMITS PROGRAM (310 CMR 7.74): FOURTH QUARTER 2022

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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 January 2018. This report provides background on key aspects of the program, a summary of market activity through the compliance deadline for 2022, an overview of emissions and allowance holdings patterns, and discussion of the results of our market power screens.

- *CO_2 Emissions versus the Annual Caps*: Emissions have fallen since the program's annual caps were established, resulting in a large number of banked allowances after each annual compliance deadline. However, emissions have risen since 2020.
  - ✓ In 2020, the cap was 8.51 million allowances compared to 5.54 million metric tons of emissions. The cap is not scheduled to fall below this level until 2034.
  - ✓ In 2021, the cap was 8.28 million allowances compared to 5.92 million metric tons of emissions. The cap is not scheduled to fall below this level until 2032.
  - ✓ In 2022, the cap was 8.06 million allowances compared to 6.44 million metric tons of emissions. The cap is not scheduled to fall below this level until 2030.
- *Load, Generation, and Emissions Trends*: Emissions from covered generation have fallen compared to 2018. However, 2022 had higher emissions than 2020 and 2021.
  - ✓ Generation from covered units rose by 5.1 percent in 2022 from the previous year. Almost half of the increase in generation was observed on less fuel-efficient units (e.g., steam turbines and combustion turbines).
- *CO_2 Allowance Prices and Trading Activity*: Trading activity was limited in 2022 and early 2023 as regulated entities relied on banked allowances and auctions to satisfy most or all of their projected compliance obligations for 2022.
  - ✓ Most of the allowance purchases were made through the auctions rather than the secondary market. The four auctions for 2022 vintage allowances cleared:
    - 1,611,909 allowances for $9.75/metric ton in Auction 2022-1 in December 2021,
    - 1,611,909 allowances for $0.50/metric ton in Auction 2022-2 in March 2022,
    - 1,203,642 allowances for $9.75/metric ton in Auction 2022-3 in June 2022,
    - 1,203,642 allowances for $14.73/metric ton in Auction 2022-4 in September 2022.
  - ✓ Beginning with Auction 2022-3 held in June 2022, a portion of the future vintage allowances were auctioned further in advance of the compliance year. The four offerings of 2023 vintage cleared:

- 391,784 allowances for $4.00/metric ton in Auction 2022-3 in June 2022,
- 391,784 allowances for $7.51/metric ton in Auction 2022-4 in September 2022,
- 1,175,351 allowances for $14.20/metric ton in Auction 2023-1 in December 2022,
- 1,175,351 allowances for $12.05/metric ton in Auction 2023-2 in March 2023.

✓ The two offerings of 2024 vintage cleared:

- 380,590 allowances for $6.03/metric ton in Auction 2023-1 in December 2022,
- 380,590 allowances for $5.85/metric ton in Auction 2023-2 in March 2023.

✓ Given the large surplus of allowances relative to 2022 emissions, the prices in 2023 were likely driven by expectations of tighter conditions in subsequent years.

✓ There was a considerable dispersion in prices as future vintage allowances settled at a significant discount relative to the current vintage allowances, and the prices of a particular vintage generally exhibited an upward trend.

- *Distribution of Allowances for 2022 Compliance*: The vast majority of allowances usable for 2022 compliance were distributed by auction (68 percent) while the balance was banked from 2021 (32 percent).

  ✓ In 2022, 100 percent of allowances were distributed through auctions, although the total auction amount was reduced by the bank of allowances from 2021.

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 for 2022 and 2023.

B. BACKGROUND

Regulation 310 CMR 7.74 created a cap-and-trade program to reduce carbon dioxide emissions from electricity generating facilities located in Massachusetts beginning in 2018.[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. Under 310 CMR 7.74, compliance periods are annual. The Massachusetts Carbon Allowance Registry ("Registry") is used to track the ownership of allowances. 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 the 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.

Annual Emissions Cap

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 fell to 8,731,175 metric tons in 2019, 8,507,299 metric tons in 2020, and it declines by 223,876 metric tons in each subsequent year,

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

eventually reaching 1,791,019 metric tons in 2050.[2] The 2022 cap was 8,059,547, and the 2023 cap is 7,835,671.

Allowance Allocations

One hundred percent of the 2018 vintage allowances were allocated to individual generators, including new facilities. Starting with the 2019 compliance year, the MassDEP began to transition from allocating allowances directly to using auctions as the primary mechanism for distributing allowances.[3] For the 2019 and 2020 compliance years, the MassDEP distributed a number of allowances equal to 75 and 50 percent of the cap through direct allocation. As of the 2021 compliance year, all allowances are distributed by auction, subject to the banking adjustment described below.

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. As the cap declines by 223,876 metric tons each year, this approach ensures that each year's emissions are less than the previous year's cap.

For instance, after 2021 compliance obligations were satisfied, 2,652,320 allowances were held in facility accounts on April 1st, 2022. Thus, the number of allowances to be distributed for the 2022 compliance year was adjusted down by 2,428,445 (which equals the 2,652,320 allowances held after 2021 minus the limit of 223,875 allowances). Consequently, the adjusted emissions

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2 310 CMR 7.74(5)(a)

3 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.

cap for the 2022 compliance year was 8,283,422 metric tons (including 2,652,320 banked allowances and 5,631,102 vintage 2022 allowances sold in auctions 2022-1 through 2022-4).

The same calculation was used to determine the adjusted emissions cap for 2023 and the number of 2023 allowances to be sold in Auctions 2023-3 and 2023-4. In 2023, the post-compliance holdings amount was 1,853,109, so the number of allowances to be auctioned for the 2023 compliance year was adjusted down by 1,629,234. Because a total of 2,350,702 vintage 2023 allowances were auctioned in December 2022 and March 2023, the remaining 2023 allowances to be distributed is 3,072,169.

Auctions

Five percent of the 2023 emissions cap was auctioned in Auction 2022-3, and five percent was auctioned in Auction 2022-4. The MassDEP plans to distribute the rest of allowances for the 2023 compliance year through four quarterly auctions:

- In December 2022: 15 percent of the 2023 emissions cap was offered (1,175,351 allowances).
- In March 2023: 15 percent of the 2023 emissions cap was offered (1,175,351 allowances).
- In June 2023: 50 percent of the allowances remaining after the 2022 banking adjustment is performed (1,536,084 allowances).
- In September 2023: All remaining 2023 allowances will be offered for sale (1,536,085 allowances).

Five percent of the 2024 annual cap (which equals 380,590 allowances) will be offered in each of the four auctions 2023-1, 2023-2, 2023-3, and 2023-4.

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.[4] A list of facilities and associated regulated entities is available to the public at https://macar.apx.com/ (select "Reports").

Compliance

On March 1st of each year, 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.[5] However, those emissions are required to be offset on a two for one basis in that following year.[6] For example, if a facility deferred 1,000 allowances for 2019 compliance, they are required to hold a number of allowances for 2020 compliance equal to their 2020 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 2022, 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.

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

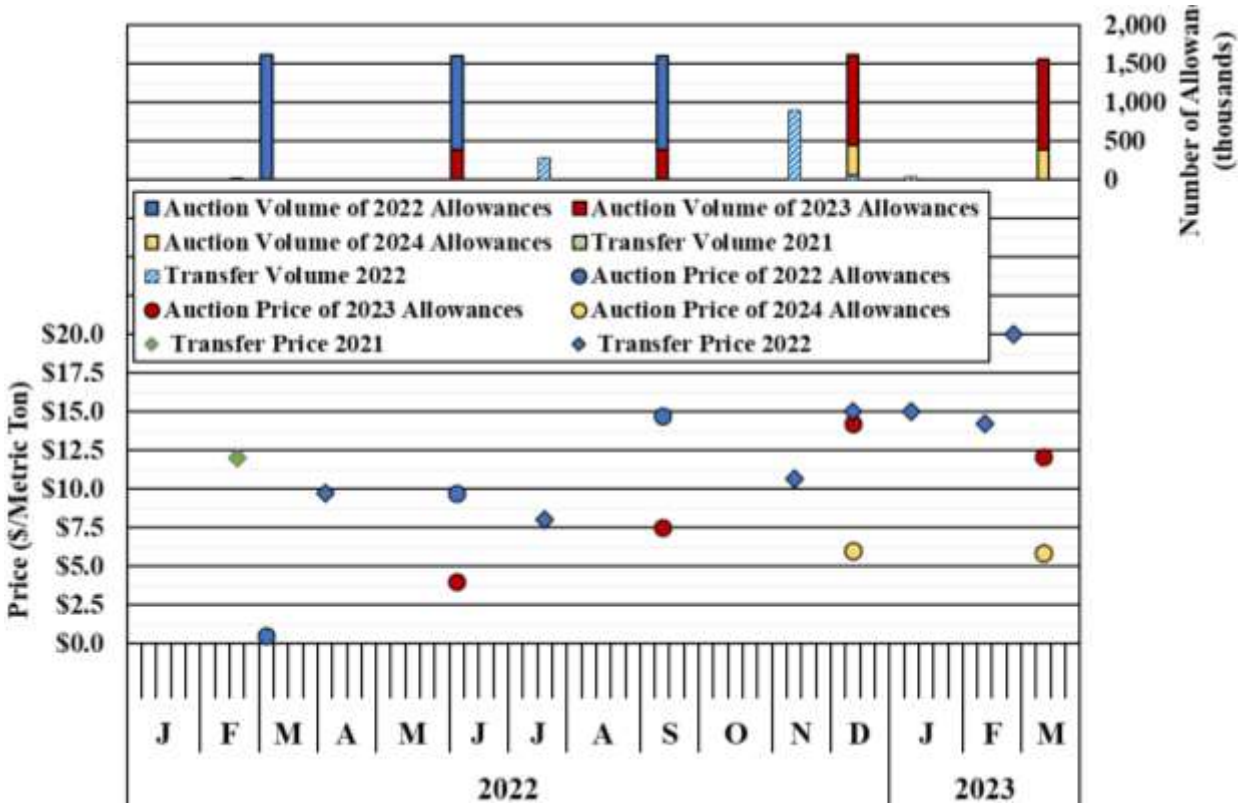
5 These are periods when ISO New England has triggered "Master Local Control Center Procedure No.2"

6 310 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. Figure 1 displays the weekly volumes of allowance transfers and weighted average prices as well as auction results.

Figure 1: Allowance Prices and Volumes[7] [8]



There were six priced transfers between unaffiliated regulated entities in 2022 and three in the first quarter of 2023. All of the transfers were for allowances usable for 2022 compliance. Most of the transfers were for small volumes with just three of the transfers accounting for more than

7 Figure 1 shows transfers reported to the registry through March 31, 2022, but since there is no prompt reporting requirement, other transactions may have occurred that have not yet been reported. Trades are reported by transaction date if one is provided that differs from the date it is reported to the Registry.

8 "2022 Allowances" indicates allowances usable for 2022 compliance, which includes previous vintages.

90 percent of the total volume. In 2022, the average price was $10.27 for nearly 1.25 million allowances.

Figure 1 shows that prices have fluctuated considerably over the period shown. There has been a wide dispersion of bid prices in the auctions, reflecting considerable variation among regulated entities in their expectations regarding the value of allowances. This variation in expectations highlights (a) that relatively little information from trading in the secondary market has been available regarding the value of allowances and (b) that some generators earn high margins on the sale of electricity in some periods due to the wide distribution of hourly prices in the ISO New England market. In the case of the March 2022 auction, the low quantity of bids (1.01 x supply) was a key factor contributing to the low clearing price.

In June 2022, the Mass DEP began to sell future vintage year allowances to help satisfy the demand from regulated entities seeking allowances to hedge future compliance costs (that do not need additional current vintage year allowances). Because the program allows unlimited banking, the current vintage year price should always be greater than or equal to the future vintage year price. Accordingly, the auction clearing mechanism implemented in June 2022 ensures that the future vintage year allowances will never clear at a price higher than the current vintage year allowances.[9]

In the four auctions in which allowances have been sold for multiple vintages, there was a substantial (49 to 59 percent) discount on the clearing price of the future vintage relative to the current vintage. Substantial quantities of allowances have been banked after each compliance year, and current vintage allowances are completely fungible with allowances for the next year's vintage, so it is notable that some firms paid a significant premium for the current year vintage. We found that firms generally submitted higher-priced bids for the current vintage than for the future vintage if they were still seeking allowances to satisfy their eventual 2022 compliance obligations at the time of the auction. Thus, the higher prices for the current vintage allowances were driven by firms still seeking allowances for compliance with the cap for the current year.

[9] See, for example, the Auction 2023-1 Notice which describes the bid clearing mechanism in Section 7.1.

Demand for future vintage allowances and observed banking by some firms reflects that some regulated entities have long-term contractual obligations to deliver electricity in a future year and seek to hedge their exposure to fluctuations in input prices. For example, firms are able to hedge exposure to fluctuations in natural gas prices and RGGI (CMR 7.70) allowance prices through liquid futures markets, but no comparable financial hedges exist for Massachusetts (CMR 7.74) program allowances. Consequently, some regulated entities may be setting aside current vintage allowances as a hedge for obligations in future years.

D. EMISSIONS AND ALLOWANCE HOLDINGS

In this section we review patterns of emissions and allowance holdings to assess the fundamentals of supply and demand. Table 1 and Figure 2 evaluate emissions and electricity supply over the last three years, while Figures 3 compares allowance holdings to emissions by regulated entity.

Table 1 summarizes electricity supply and emissions through 2022 compared to 2020 and 2021. 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 combustion turbine peaking units ("CT"). 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").

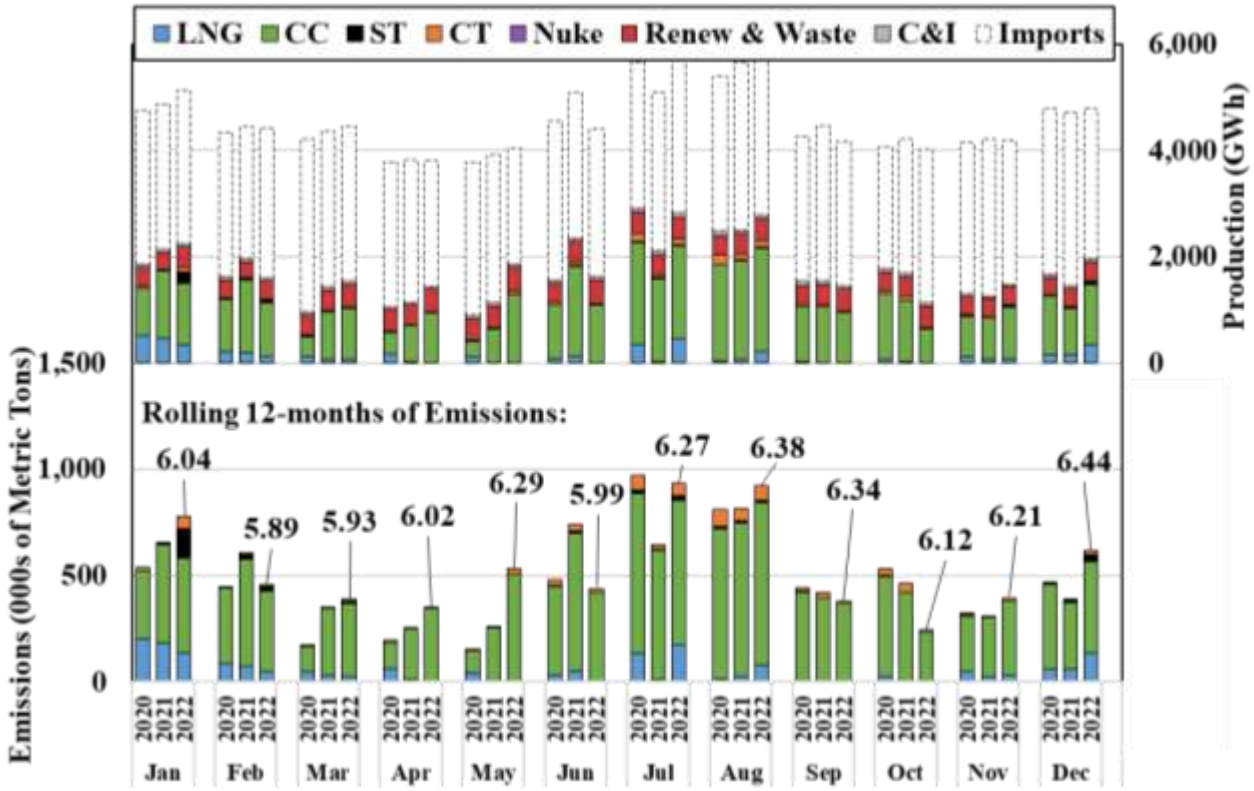
Table 1: Electricity Supply[10] and Emissions

Year	Generation By Type, January-December (TWh)							
	LNG	CC	ST	CT	Renew & Waste	C&I	Imports	Total
2020	1.9	11.9	0.07	0.55	4.4	0.79	34.1	53.7
2021	1.2	13.8	0.08	0.44	4.4	0.78	34.1	54.9
2022	1.7	13.8	0.34	0.56	4.8	0.74	33.1	55.0
	Carbon Dioxide Emissions, January-December (Million Metric Tons)							
2020	0.8	4.4	0.05	0.29	-	-	-	5.54
2021	0.5	5.2	0.06	0.22	-	-	-	5.92
2022	0.6	5.2	0.24	0.31	-	-	-	6.44

Figure 2 summarizes the same categories of information as Table 1 but on a monthly basis. The figure also reports emissions for entities subject to the cap under 310 CMR 7.74.

[10] Generation is based on EIA Form 923 data and Real-Time Load from the ISO-NE website. Form 923 data for 2022 is not final, so values for 2022 may change in future reports.

Figure 2: Monthly Electricity Supply and Emissions, 2020-2022



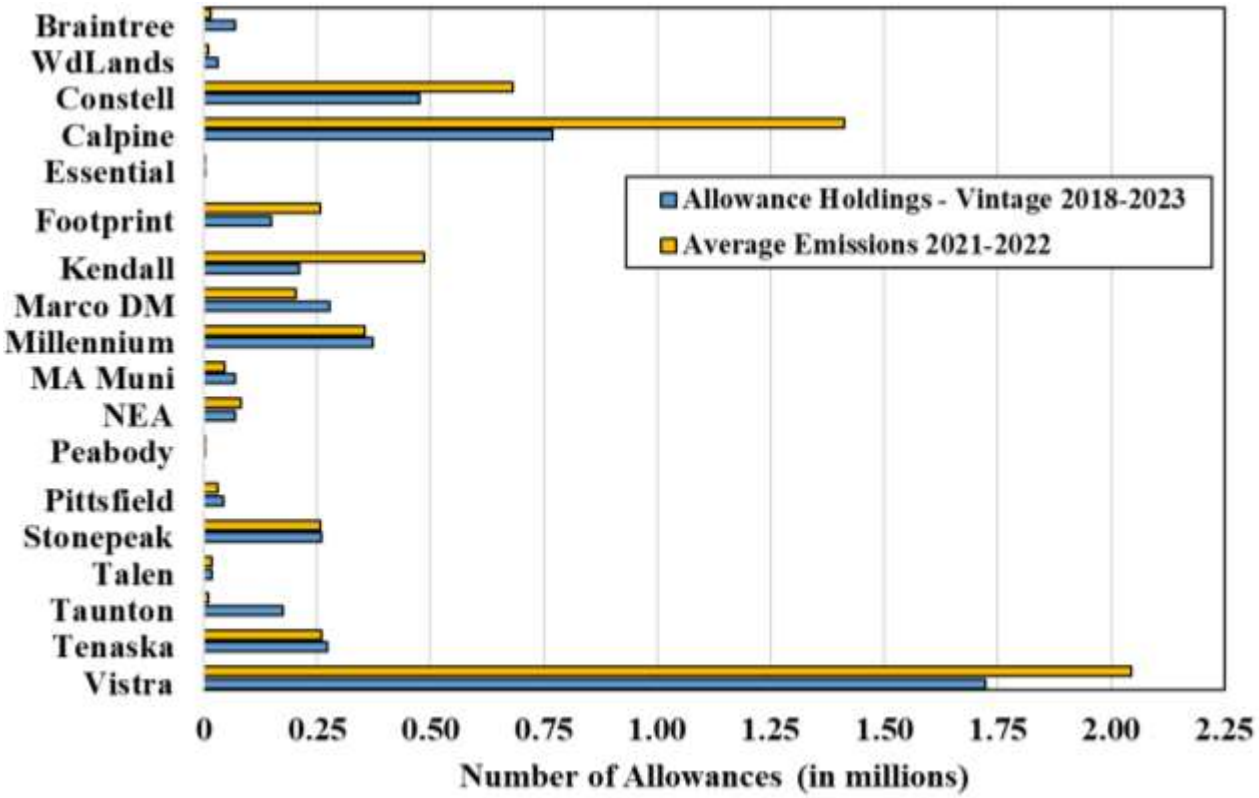
In 2022, emissions totaled 6.44 million metric tons, an increase from 5.54 million metric tons in 2020 and 5.92 million metric tons in 2021. This increase in emissions reflected:

- Imports decreased 3 percent in 2022 compared to 2021, resulting in increased electricity production from combustion turbines, steam turbines, and combined cycle units running on liquified natural gas;
- Emissions from combustion turbines and steam turbines increased by 390 thousand metric tons from 2021 to 2022; and
- Emissions from combined cycle units running on liquified natural gas increased by 170 thousand metric tons from the previous year.

Figure 3 shows, for each regulated entity, its average annual emissions over 2021 and 2022 compared to its estimated holdings of allowances that are usable for 2023 compliance, including

allowances purchased in the December 2022 and March 2023 auctions.[11] This is composed of the sum of allowances banked from previous years and its Vintage 2023 allowance holdings.

Figure 3: Allowance Holdings for 2023 and Average Annual Emissions by Regulated Entity



The figure shows that some regulated entities already hold sufficient allowances to meet their compliance obligations if 2023 emissions are similar to the average annual emissions in 2021 and 2022. In general, regulated entities whose 2023 emissions are trending above the number of allowances they hold for 2023 will be able to satisfy their compliance obligations through some combination of:

- Allowance purchases in the remaining two auctions for 2023 vintage allowances,
- Allowance purchases in the secondary market – However, secondary market activity has been relatively limited, so this accounted for a small share of allowance acquisitions before 2023.

[11] Holdings and allocations are shown as of April 7, 2023.

- Reducing emissions –There is relatively little transmission congestion into Massachusetts from neighboring states, which could allow additional electricity imports if fossil-fuel generators in Massachusetts reduce generation further.

Thus, it appears that regulated entities will have options for satisfying their 2023 compliance obligations.

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 to limit the effectiveness of a strategy to depress prices below the competitive level.