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

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 January 2018. This report provides background on relevant aspects of the program, a summary of market activity through the third quarter of 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 dramatically since the program began, resulting in a large number of banked allowances after each annual compliance deadline.
  - ✓ In 2019, the cap was 8.73 million allowances compared to 5.83 million metric tons of emissions. The cap is not scheduled to fall below this level of emissions until 2032.
  - ✓ In 2020, the cap was 8.51 million allowances compared to 5.48 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 (which was up 8 percent year-over-year). The cap is not scheduled to fall below this level until 2032.
  - ✓ In 2022, the cap was 8.06 million allowances, while January to September emissions were up 0.42 million metric tons in 2022 compared to the same months of the previous year. Emissions totaled 6.34 million metric tons over the 12-month period ending September 2022. 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 is on track to have higher emissions than 2020 and 2021.
  - ✓ Generation from covered units rose by 6.8 percent through August 2022 from the first eight months of previous year. Most 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 very limited in the first nine months of 2022.
  - ✓ Prices averaged $8.08 per metric ton for 292k allowance transfers during 2022 with the highest priced transaction occurring in February.
  - ✓ 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 per metric ton in Auction 2022-1 in December 2021,

- 1,611,909 allowances for $0.5 per metric ton in Auction 2022-2 in March 2022,
- 1,203,642 allowances for $9.75 per metric ton in Auction 2022-3 in June 2022, and
- 1,203,642 allowances for $14.73 per metric ton in Auction 2022-4 in September 2022.

✓ Beginning with Auction 2022-3 held in June 2022, a portion of the 2023 vintage allowances were auctioned further in advance of the compliance year. The two offerings of 2023 vintage cleared:

- 391,784 allowances for $4 per metric ton in Auction 2022-3 in June 2022, and
- 391,784 allowances for $7.51 per metric ton in Auction 2022-4 in September 2022.

✓ 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.

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 first nine months of 2022.

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 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.

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 2021 cap was 8,238,423, the 2022 cap is 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).

Auctions

Ten percent of the 2023 vintage allowances were auctioned in Auction 2022-3 and 2022-4. The MassDEP plans to distribute allowances for the 2023 compliance year through four quarterly auctions:

- On December 14, 2022: 15 percent of the 2023 unadjusted emissions limit will be offered (1,175,351 allowances).
- In March 2023: 15 percent of the total 2023 unadjusted emissions limit will be offered (1,175,351 allowances).
- In June 2023: 50 percent of the allowances remaining after the first two auctions and the adjustment for allowances banked after 2022 will be offered. Publication of the final amount will occur following the adjustment for banking, which will occur during the 2022 compliance process in March 2023.
- In September 2023: All remaining 2023 allowances will be offered for sale.

In addition to 2023 vintage allowances, 5 percent of the 2024 annual cap (which equals 380,590 allowances for the 2024 vintage) will be offered in each of the four auctions listed above.

Participants in the Program

Participation in the program, including the 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").

[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.

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 2021 compliance, they are required to hold a number of allowances for 2022 compliance equal to their 2022 emissions plus 2,000 additional allowances for their emergency 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. From January through September 2022, ISO New England has declared MLCCP#2 periods for a total of 195 hours.

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 each year from 2018 to 2021, 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.

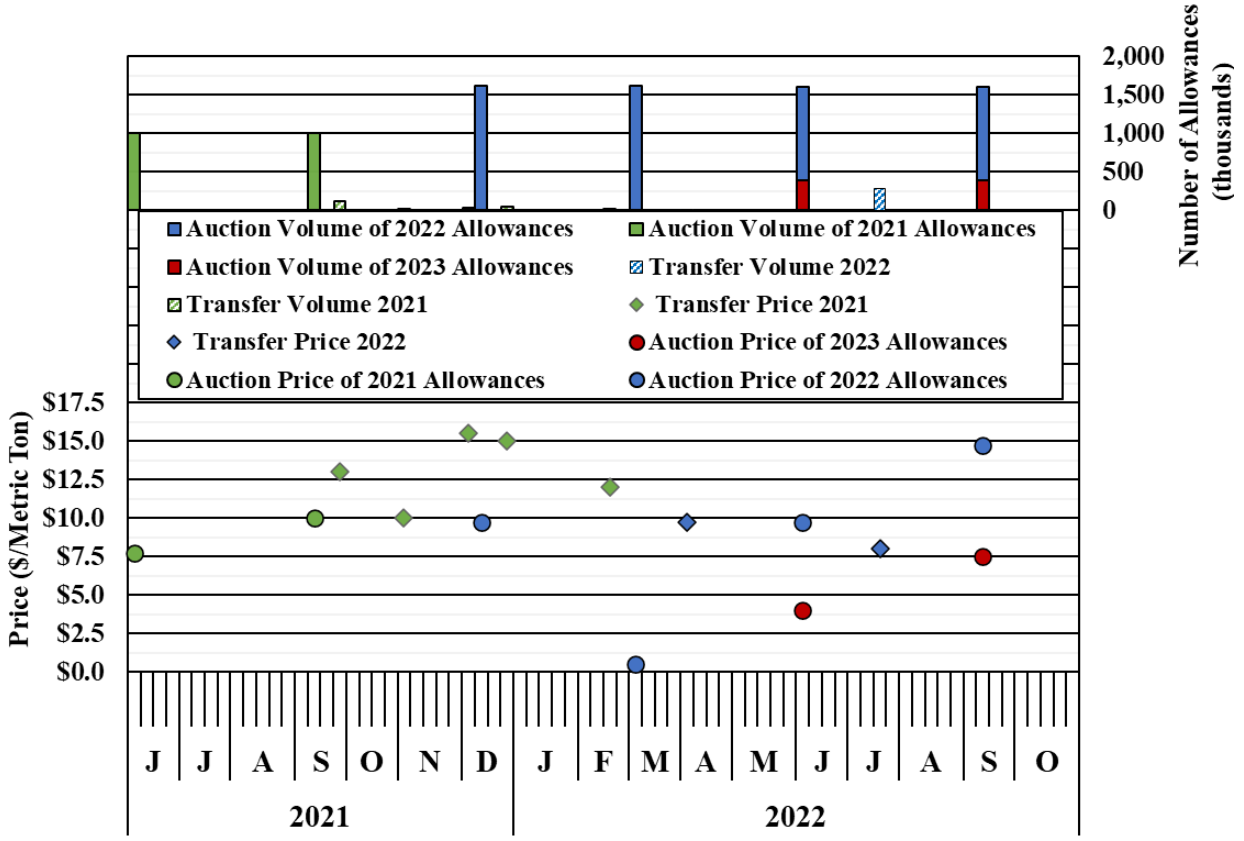
5 These are periods when ISO New England has triggered "Master Local Control Center Procedure No.2"

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]



There were three transfers between unaffiliated entities in 2022:

- In February, 5k allowances for the 2021 vintage were transferred at $12 per metric ton.
- In April, 2.2k allowances for the 2022 vintage were transferred at $9.75 per metric ton.
- In July, 285k allowances for the 2022 vintage were transferred at $8 per metric ton.

[7] Figure 1 shows transfers reported to the registry by the end of October 2022, but since there is no prompt reporting requirement, other transactions may have occurred that have not yet been reported.

In the four allowance auctions held for 2022 vintage allowances:

- Auction 2022-1 (on December 15, 2021) cleared at $9.75 per metric ton.
- Auction 2022-2 (on March 18) cleared at $0.5 per metric ton.
- Auction 2022-3 (on June 10) cleared at $9.75 per metric ton.
- Auction 2022-4 (on September 15) cleared at $14.73 per metric ton.

In the two allowance auctions held for 2023 vintage allowances:

- Auction 2022-3 (on June 10) cleared at $4 per metric ton.
- Auction 2022-4 (on September 15) cleared at $7.51 per metric ton.

Figure 1 shows that prices have fluctuated considerably over the period shown and that there has been a relatively small number of allowance trades in the secondary market. 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.

The Mass DEP discontinued allocating allowances in 2021 and has since distributed allowances entirely through the quarterly auctions, providing additional opportunities for price discovery and for regulated entities seeking allowances. The quarterly auctions account for the vast majority of allowance purchases in 2022.

In the two auctions in which allowances have been sold for multiple vintages, there has been a substantial premium on the clearing price of the current vintage over the future vintage. Specifically, in Auction 2022-3 the clearing price of 2022 vintage allowances was 144 percent higher than the clearing price of 2023 vintage allowances, and in Auction 2022-4 the clearing price of 2022 vintage allowances was 96 percent higher. However, each year a substantial quantity of allowances is banked and such allowances are completely fungible with allowances for the next year's vintage, so it is notable that some firms are paying more than a modest

premium for the current year vintage (even though they already hold sufficient allowances to satisfy their 2022 compliance obligations).

This pattern may result from the fact 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.

The Mass DEP recently began (in June 2022) 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.[8]

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

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.

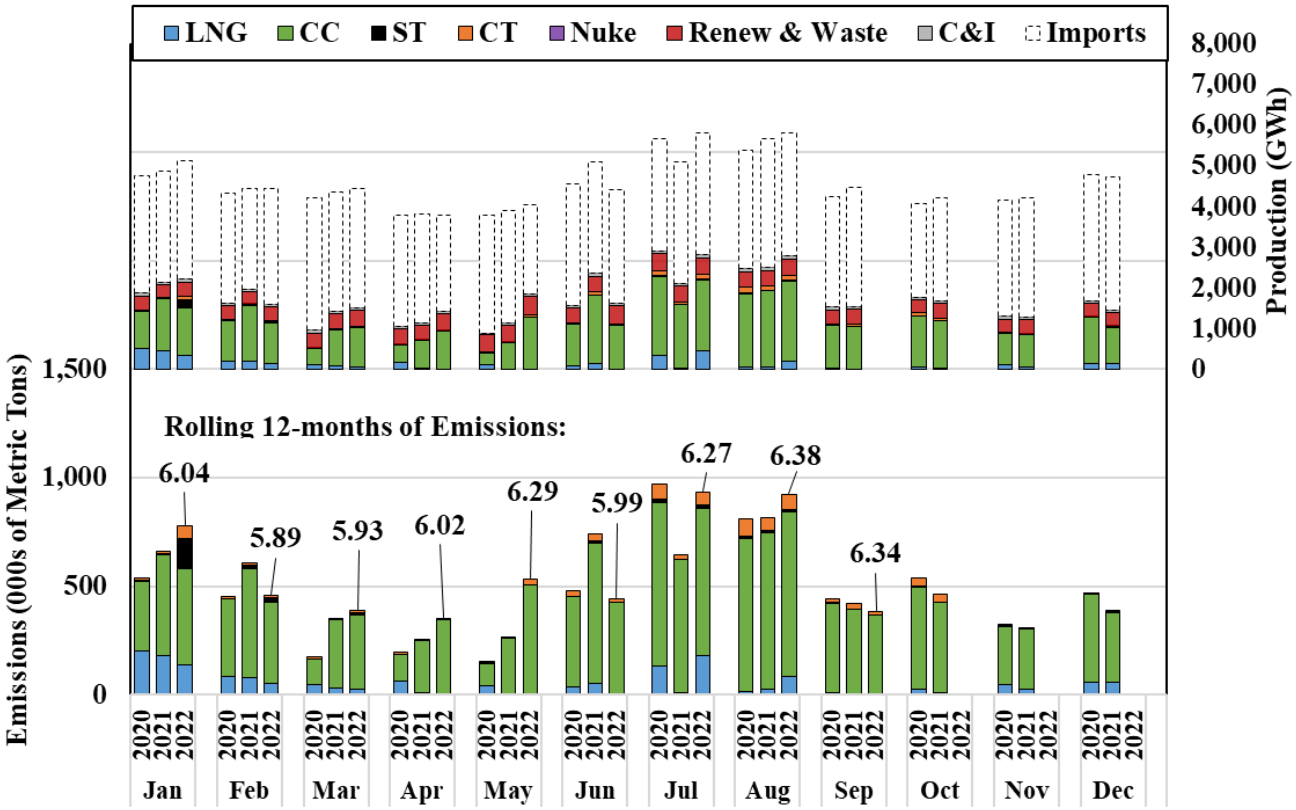
Table 1 summarizes electricity supply and emissions through part of 2022 compared to the same time periods in 2020 and 2021. Data is provided for regulated facilities by type: combined cycle units running on liquified natural gas ("LNG"), all other combined cycle units ("CC"), gas/oil-fired steam turbines ("ST"), and combustion turbine peaking units ("CT"). The table shows the supply of electricity from other non-regulated sources, including: other non-program units such as renewables and waste burners, and net generation from the commercial and industrial sectors ("C&I"). Two different time horizons are specified for generation and emissions due to data availability issues. Generation data is provided through August of each year while emission estimates extend through September. 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.

Table 1: Electricity Supply[9] and Emissions

Year	Generation By Type, January-August (TWh)							
	LNG	CC	ST	CT	Renew & Waste	C&I	Imports	Total
2020	1.6	7.8	0.05	0.43	3.0	0.54	23.1	36.5
2021	1.0	10.0	0.07	0.29	2.9	0.52	22.5	37.2
2022	1.2	10.1	0.30	0.45	3.2	0.50	22.1	37.9
	Carbon Dioxide Emissions, January-September (Million Metric Tons)							
2020	0.6	3.3	0.04	0.24	-	-	-	4.21
2021	0.4	4.1	0.05	0.18	-	-	-	4.76
2022	0.5	4.2	0.21	0.26	-	-	-	5.18

[9] Generation is based on EIA Form 923 data, and Real-Time Load is from the ISO-NE website. Form 923 data for 2022 is not final, so values for 2022 may change in future reports. Form 923 data was not available for September 2022 when this report was produced, so generation is shown for January to August only.

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



2022 emissions have increased from both 2020 and 2021. Twelve month-rolling-average emissions rose to 6.34 million metric tons in September 2022, which is up from annual emissions of 5.92 million metric tons in 2021. This increase in emissions reflected:

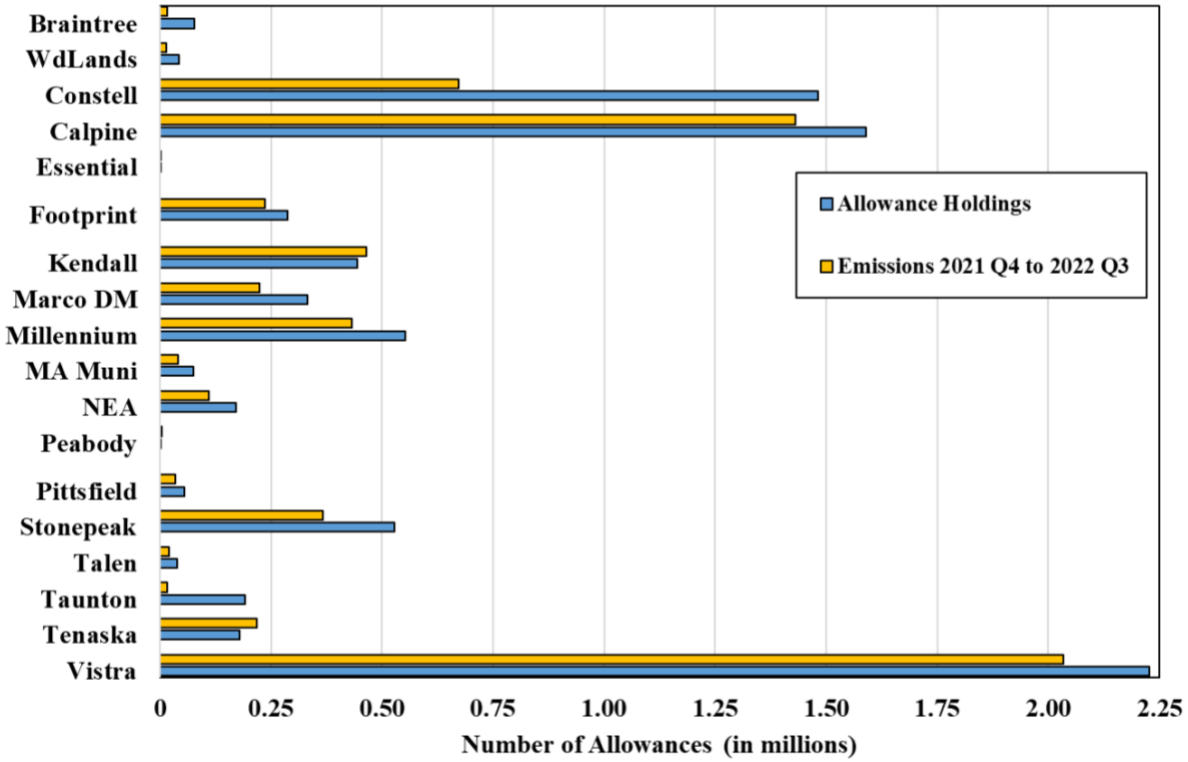
- Load levels increased 2 percent as the economy further recovered from the pandemic,
- Fewer imports in 2022 compared to the same period in 2021, and
- Emissions from combustion turbines and steam turbines increased by 240 thousand metric tons from 2021 to 2022 in the months of January to September.

Emissions from pipeline gas-fired combined cycle generators increased by 100 thousand metric tons from the first three quarters of 2021. This was partly offset by reduced emissions from LNG-supplied generation, which has been very low since 2019 largely due to pipeline gas prices being low relative to prices of imported LNG.

Figure 3 shows, for each regulated entity, its 12-month total emissions from October 2021 to September 2022 compared to its estimated holdings of allowances that are usable for 2022

compliance.[10] This is composed of the sum of allowances banked from previous years and vintage 2022 allowances acquired.

Figure 3: Allowance Holdings for 2022 and Emissions by Regulated Entity [11]



The figure shows that nearly all regulated entities already hold sufficient allowances to meet their compliance obligations if 2022 emissions are similar to emissions over the 12-month period ending in September 2022. In general, regulated entities whose 2022 emissions are trending above the number of allowances they hold for 2022 will be able to satisfy their compliance obligations through some combination of:

- Allowance purchases in the secondary market – Based on Figure 3, most regulated entities already have sufficient allowances to satisfy their likely compliance obligations in 2022, suggesting that they may be willing to sell some. However, some regulated entities may prefer to bank a number of allowances for future years. The sale of future

10 Holdings and allocations are shown as of November 2, 2022.

11 Holdings and allocations are shown as of November 2, 2021. Emissions reporting available at the time of report creation covered the first three quarters of 2021.

vintage allowances beginning in the June 2022 auction has provided additional options to regulated entities that would otherwise have to bank current year allowances.

- Reducing emissions – Emissions fell more than 40 percent from 2017 to 2021. 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.

- Emergency deferred compliance – Several MLCCP#2 events occurred in 2022, and emissions that occurred during these events can be offset on a two for one basis at the 2023 compliance deadline, instead of the 2022 deadline. The use of emergency deferred compliance would likely not be economic because of the two for one compliance requirement. However, facilities with emissions that exceed their allowance holdings may benefit from the option to consider accepting the two for one obligation for a small portion of their emissions, rather than risking non-compliance with the requirements of 310 CMR 7.74.

Thus, it appears that regulated entities will have options for satisfying their 2022 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 help limit the effectiveness of a strategy to depress prices below the competitive level.