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# Addendum to the Statewide Greenhouse Gas Emissions Level: 1990 Baseline Update

Regulatory Authority: MGL Chapter 21N, Section 3

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# Introduction

The Massachusetts Global Warming Solutions Act (GWSA)[1] was signed into law in August of 2008 to address the challenge of climate change caused by the emissions of greenhouse gasses (GHG). GHGs accumulate in the atmosphere and trap heat that would otherwise be radiated back into space. This "greenhouse effect" is the primary cause of global climate change. There are a number of gases that are considered GHGs. The most prevalent GHG is carbon dioxide ($CO_2$), which is emitted when fuels are burned. Methane ($CH_4$), nitrous oxide ($N_2O$), and several other compounds primarily used as refrigerants are also GHGs of concern due to their potential to contribute to climate change.[2]

Given the emergence of improved information, MassDEP proposed in May 2021[3] to update the data sources and methodologies used to estimate Massachusetts' 1990 GHG emissions and asked for public comment on the updates it was considering for inclusion. MassDEP has been considering the comments received. Please refer to the May 2021 update for additional background.

Two additional issues involving data sources and methodologies have developed and MassDEP is now proposing an addendum to the May 2021 update. The data sources and methodologies for this *Addendum to the Statewide Greenhouse Gas Emissions Level: 1990 Baseline Update* (Addendum) are described below. As detailed below, the proposed approach to calculating 1990 emissions would result in a 21.5% emission reduction from 1990 to 2018.

A public comment period is now open on this Addendum. MassDEP will accept written comments until 5:00 PM on Thursday, March 24, 2022. Written comments must be submitted by email to climate.strategies@mass.gov or by mail to Sue Ann Richardson, MassDEP, One Winter Street, 6th Floor, Boston, MA 02108.

## Updated Data Sources, Methodology Changes, and Corrections

Since the initial Massachusetts GHG inventory, MassDEP has relied on the United States Environmental Protection Agency (EPA)'s State GHG Inventory Tool (SGIT) and the U.S. Department of Energy's Energy Information Administration (EIA)'s State Energy Data System (SEDS)[4] to calculate $CO_2$, $CH_4$ and $N_2O$ emissions from fuel combustion. Two updates to these sources for the transportation sector have occurred since the publication of the May 2021 update.

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[1] See https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter298

[2] Not all GHGs have the same heat-trapping capacity. For example, one ton of methane is equivalent to greater than 20 tons of $CO_2$ with respect to their heat trapping potentials. To account for these differences, a standard, known as the global warming potential (GWP), relating the heat trapping potential of each GHG to an equivalent quantity of $CO_2$ over a given time horizon, has been developed. Emissions shown in this document utilize this standard and are expressed in units of million metric tons of carbon dioxide equivalents (MMTCO2e).

[3] *Statewide Greenhouse Gas Emissions Level: 1990 Baseline Update*, May 2021 at https://www.mass.gov/lists/massdep-emissions-inventories#proposed-2021-update-of-statewide-greenhouse-gas-(ghg)-emissions-baseline-

[4] See the EIA State Energy Data System (SEDS) at https://www.eia.gov/state/seds/

1. In August 2021, EPA informed MassDEP of corrections to SGIT Mobile Combustion $CH_4$ and $N_2O$ emissions. These corrections decrease 1990 emissions by 0.6 million metric tons of carbon dioxide equivalents ($MMTCO_2e$) and 2018 emissions by 0.1 $MMTCO_2e$.
2. In October 2021, EIA updated its methodology used to determine state-level jet fuel use for the years 2010 forward, but does not have sufficient data sources to enable it to update years before 2010.[5]

The impact of EPA's error correction and EIA's methodology change will affect progress toward the reduction target under GWSA (i.e., 25% below 1990 emissions by 2020). The inventory the Commonwealth posted with the May 2021 update indicated a 2018 statewide reduction of 22.0% from 1990.[6]

As a result of EIA's jet fuel methodology change, MassDEP reviewed Massachusetts 1990 jet fuel use, to ensure use of the most accurate 1990 baseline possible. MassDEP has found two 1990 jet fuel values:

1. EIA's statewide value of 411,852,000 gallons and
2. Massport's Boston Logan airport only value of 438,100,000 gallons.[7]

Because EIA's 1990 statewide Massachusetts jet fuel consumption value is incorrectly lower than that of 1990 Logan jet fuel consumption alone, MassDEP is proposing to not use EIA's 1990 value, and to increase the 1990 Logan jet fuel value to 463,700,000 gallons to cover statewide jet fuel use, by using the average 2010 to 2019 difference between Logan and statewide jet fuel use.

To date, SGIT and the Massachusetts GHG inventory for all years have included all jet fuel, whether the flight's destination is in-state, domestic US, or international. As noted by California in its GHG Emissions inventory, "The [Intergovernmental Panel on Climate Change] IPCC guidelines recommends separating international from domestic aviation emissions.…Emissions resulting from international flights were ... excluded in accordance with international convention, and appear as an "excluded line item" in the inventory."[8] As indicated by IPCC, "All emissions from fuels used for international aviation (bunkers) and multilateral operations pursuant to the

[5] EIA's October 29, 2021 data release detailed the data sources as "2010 forward: Estimated by EIA based on unpublished airport jet fuel consumption data from Airlines for America (A4A), published "Air Carrier Statistics (Form 41 Traffic) — All Carriers", T-100 Segment (All Carriers), data from the U.S. Bureau of Transportation Statistics (BTS), unpublished General Aviation and Part 135 Activity Survey data from the U.S. Federal Aviation Administration (FAA), and unpublished military and federal government sales data from the U.S. Defense Logistics Agency (DLA)." See U.S. Energy Information Administration, State Energy Data 2020: Consumption, Section 4. Petroleum, page 58 and further details on pages 56-59 of https://www.eia.gov/state/seds/sep_fuel/notes/use_petrol.pdf

[6] MassDEP is still in the process of compiling data for 2019 and 2020 and is awaiting data from federal sources to calculate progress in those years.

[7] Boston Logan International Airport 2010 Environmental Data Report, Table J-15. *Logan Airport Oil and Hazardous Material Spills and Jet Fuel Handling – 1990 to 2010*, page 561 of 628 of https://www.massport.com/media/2284/2010edr_part_1_main.pdf.

[8] See *California's 2000-2014 Greenhouse Gas Emission Inventory Technical Support Document* page 38 of https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2014/ghg_inventory_00-14_technical_support_document.pdf.

Charter of UN are to be excluded from national totals, and reported separately as memo items."[9] SGIT, and therefore MassDEP, have long followed this convention for international marine bunker fuel, reporting marine bunker $CO_2$ emissions on the 'CO2_FFC' tab of the inventory spreadsheet. MassDEP is proposing to use Bureau of Transportation Statistics (BTS) data[10] to exclude international flight jet fuel use when comparing statewide emissions to the statewide limits, and to separately report international jet fuel emissions. New York has recently published a GHG inventory using a similar approach.[11] Using all jet fuel results in a 2018 reduction from 1990 of 21.0%, while using only domestic jet fuel results in a 2018 reduction from 1990 of 21.5%.

Table 1 presents a comparison of GHG emissions by year. GHG emissions are shown for: 1990, 2013 (the last year for which a complete inventory was developed in the 2016 update), and the 2020 limit (25% below 1990).[12] The columns in the table show GHG emissions published by MassDEP at the time of the 1990 Baseline update in 2016, the May 2021 proposed update, and this Addendum.

**Table 1: Comparison of Massachusetts 1990 and 2013 GHG Emissions, and the 2020 Limit (MMTCO2e)**

| Year | 2016 Published Values | May 2021 Published Values | Addendum Published Values |
|---|---|---|---|
| 1990 (Baseline) | 94.4 | 94.3 | 94.0 |
| 2013 (Actual) | 75.5 | 75.6 | 76.3 |
| 2020 Limit (25% below 1990) | 70.8 | 70.7 | 70.5 |

Using the revised data sources and methodologies described above, MassDEP estimates that statewide GHG emissions in 1990 were 94.0 $MMTCO_2e$. Table 2 below compares 1990 Baseline GHG emissions by sector from the May 2021 update and this Addendum. Figures 1 and 2 present annual GHG emissions consistent with this Addendum. An accompanying revised Appendix C spreadsheet contains the calculations that the tables and figures in this Addendum are based on.

[9] See page 3.57 of https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf
[10] https://www.transtats.bts.gov/DL_SelectFields.asp?gnoyr_VQ=FMG&QO_fu146_anzr=Nv4%20Pn44vr45
[11] https://www.dec.ny.gov/energy/99223.html
[12] 2025 and 2030 interim statewide GHG limits and sector-based GHG emissions sublimits must be adopted and published no later than July 1, 2022.

**Table 2: 1990 Baseline Update and Addendum GHG Emissions ($MMTCO_2e$)**

| Sector | 1990 Emissions (May 2021 Update) | 1990 Emissions (Addendum) |
|---|---|---|
| $CO_2e$ from Energy | 88.0 | 87.8 |
| Residential $CO_2e$ from Fuel Combustion | 15.3 | unchanged |
| Residential - $CO_2$ | 15.1 | unchanged |
| Residential - $CH_4$ & $N_2O$ | 0.2 | unchanged |
| Commercial $CO_2e$ from Fuel Combustion | 8.4 | unchanged |
| Commercial - $CO_2$ | 8.4 | unchanged |
| Commercial - $CH_4$ & $N_2O$ | 0.1 | unchanged |
| Industrial $CO_2e$ from Fuel Combustion | 5.8 | unchanged |
| Industrial - $CO_2$ | 5.6 | unchanged |
| Industrial - $CH_4$ & $N_2O$ | 0.0 | unchanged |
| Industrial - MSW ($CO_2$, $CH_4$ & $N_2O$) | 0.1 | unchanged |
| Industrial - Nat Gas System ($CO_2$, $CH_4$ & $N_2O$) | 0.1 | unchanged |
| Transportation $CO_2e$ from Fuel Combustion | 30.5 | 30.2 |
| Transportation - $CO_2$ | 28.9 | 29.2 |
| Transportation - $CH_4$ & $N_2O$ | 1.6 | 1.0 |
| Electricity Total $CO_2e$ from Fuel Combustion | 28.0 | unchanged |
| Electric Generation - $CO_2$ | 25.1 | unchanged |
| Electric Generation - $CH_4$ & $N_2O$ | 0.1 | unchanged |
| Electric Generation - MSW ($CO_2$, $CH_4$ & $N_2O$) | 0.9 | unchanged |
| Electricity Imports ($CO_2$, $CH_4$ & $N_2O$) | 1.9 | unchanged |
| Natural Gas Systems ($CO_2$ and $CH_4$) | 2.3 | unchanged |
| Natural Gas Distribution System | 2.1 | unchanged |
| Natural Gas Transmission and Storage System | 0.2 | unchanged |
| Industrial Processes | 0.7 | unchanged |
| Lime, Dolomite, Soda Ash, Urea ($CO_2$) | 0.2 | unchanged |
| ODS Substitutes, Semiconductor Manufacturing, Electricity Transmission (HFCs, PFCs, $NF_3$, $SF_6$) | 0.5 | unchanged |
| Agriculture & Land Use ($CO_2$, $CH_4$ & $N_2O$) | 0.4 | unchanged |
| Waste | 2.9 | unchanged |
| Wastewater ($CH_4$ & $N_2O$) | 0.7 | unchanged |
| Municipal Solid Waste - Landfills Only ($CO_2$, $CH_4$ & $N_2O$) | 2.3 | unchanged |
| *Gross Emissions* | *94.3* | *94.0* |

Note: Due to rounding to 1 decimal place, some totals appear higher or lower than the simple sum of the sectors. GHGs include: carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulfur hexafluoride ($SF_6$), and nitrogen trifluoride ($NF_3$).

**Figure 1: Massachusetts 1990-2018 GHG Emissions with Updated 1990 Baseline**

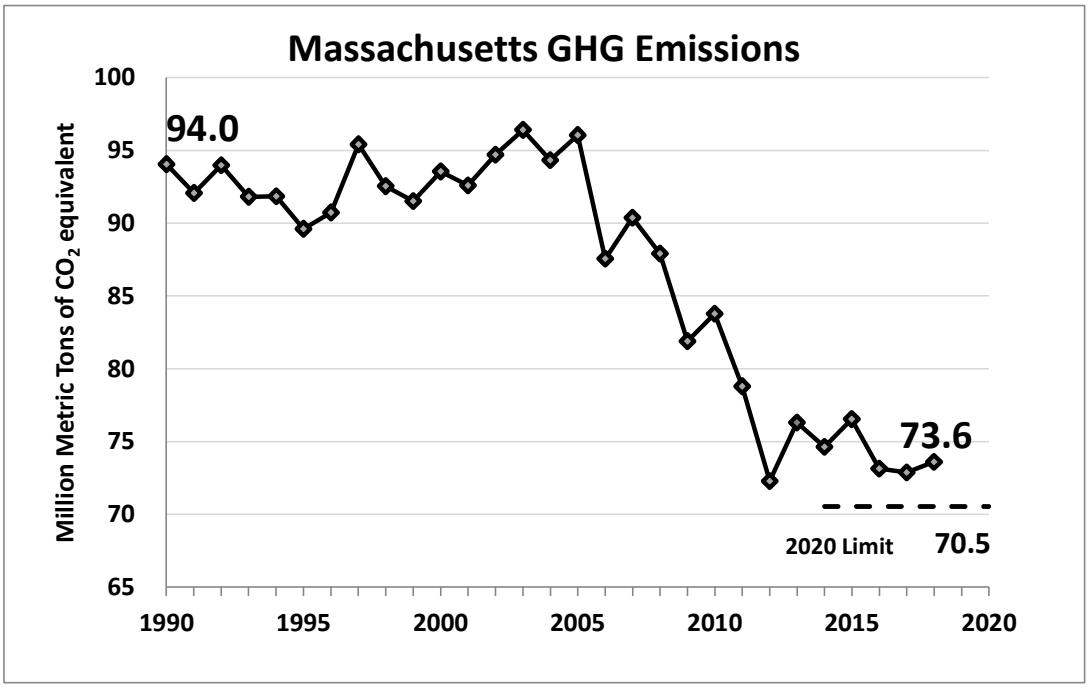


**Figure 2: Massachusetts 1990-2018 Fuel Combustion GHG Emissions by Sector**