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Massachusetts Leverages Quantitative and Qualitative Methodologies to Reduce State Transportation Sector's Greenhouse Gas Emissions

OVERVIEW

The Massachusetts Department of Transportation (MassDOT) tracks greenhouse gas (GHG) emissions and estimates GHG impacts of transportation projects as part of its transportation planning process. MassDOT and the metropolitan planning organizations (MPOs) include GHG impacts as a criterion in their project prioritization processes and estimate the impact of their transportation plans on the Commonwealth's GHG reduction goals.

BACKGROUND

In 2008, the Commonwealth of Massachusetts enacted the Global Warming Solutions Act (GWSA). This Act establishes goals for reducing GHG emissions (Figure 1). The [Massachusetts Clean Energy and Climate Plan \(CECP\) for 2050](#) implements the GWSA, providing a roadmap for achieving the Commonwealth's GHG reduction goals by sector. The roadmap includes a statewide 85% emissions reduction limit from 1990 levels. The roadmap identifies respective sublimits for Transportation, Residential Heating and Cooling, Commercial & Industrial Heating and Cooling, Electric Power, Natural Gas Distribution & Service, and Industrial Processes.

MassDOT and MPO practices have been reinforced through [310 CMR 60.05: Global Warming Solutions Act Requirements for Transportation](#), which formalized the existing processes for MassDOT and the

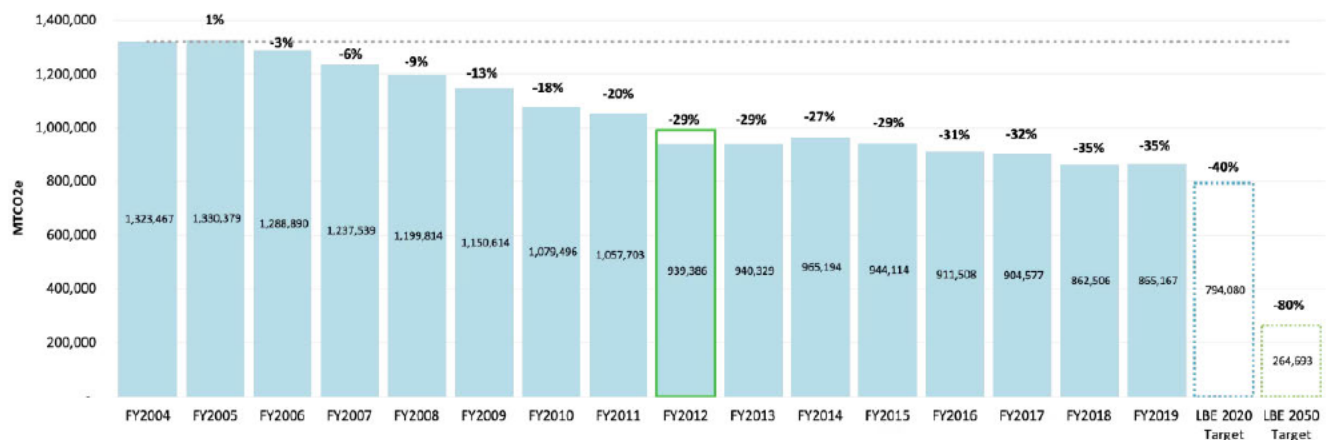


Figure 1: Overall Annual GHG Emissions with E.O. 484 Targets



MPOs to incorporate GHG impacts in their project prioritization processes and to evaluate annually the GHG impacts of MassDOT's Statewide Transportation Improvement Program (STIP) and the MPOs' Transportation Improvement Plans (TIPs).

GOALS AND TARGETS

The GWSA established overarching goals of reducing GHG emissions by 25 percent below 1990 levels by 2020 and 80 percent below 1990 levels by 2050. For the transportation sector, the most recent version of the CECP specifies an emissions sublimit of 4.1 Million Metric Tons of Carbon Dioxide Equivalent (MMT_{CO₂e}), or an 86 percent reduction from 1990 levels. The Commonwealth declared overachievement in meeting the 2020 target and reached 31.4 percent below the 1990 level, with the caveat that the COVID-19 pandemic created unusual conditions and contributed to decreased driving and subsequently lower GHG emissions. The target GHG emissions limit for 2020 was 25 percent below the 1990 level.

The CECP aims to achieve these transportation sector sublimits via a wide range of policies that include zero emission vehicle standards and subsidies and infrastructure investments that support low carbon modes of travel (Table 1). Years 2010, 2015, and 2020 demonstrate historical performance in line with the Commonwealth's goals and years 2025, 2030, and 2050 demonstrate future emissions reduction limits and anticipated performance. The Commonwealth fell short on meeting intended transportation emissions reduction targets in 2010 and 2015 but saw substantial emissions reductions in 2020.

Transportation	1990	2010	2015	2020	2025	2030	2050
Gross Emissions (MMT _{CO₂e})	29.6	30.8	30.4	23.7	24.9	19.8	4.1
Emissions Limit as a % Reduction from 1990		(2%)	(1%)	22%	18%	34%	86%

Table 1: Historical and Modeled GHG Emissions and Statutorily Required Emissions Reduction; Sector-Specific Sublimits for 2050

Source: [Massachusetts Clean Energy and Climate Plan for 2025 and 2030; MA CECP for 2050](#)

Note: GHG emissions in 2020 are based on preliminary estimates from Massachusetts Department of Environmental Protection (MassDEP) as of June 2022, while historical GHG emissions for years before 2020 are based on MassDEP's preliminary estimates in February 2022.

INTEGRATION WITH TRANSPORTATION PLANNING

MassDOT and the State's 13 MPOs include estimates of GHG emissions impacts for projects in the Long-Range Transportation Plan (LRTP), TIP, and STIP. MassDOT's Office of Transportation Planning provides [guidelines](#) for MPOs to assess and report GHG impacts using a GHG impact template to derive estimated emissions impacts and the eSTIP application to report these results. The guidelines assist MassDOT and the MPOs in determining the appropriate level of analysis for projects and to guide resource allocation. Each MPO can determine their preferred approach to applying and weighting different project selection



criteria. For GHG accounting purposes, TIP projects are separated into two categories: 1) projects with readily quantifiable carbon dioxide (CO₂) impacts and 2) projects with assumed CO₂ impacts.

MassDOT provides spreadsheets to quantitatively calculate emissions impacts for the following project types:

- Adoption of alternative fuel vehicles
- Anti-idling strategies
- Bike sharing
- Bike and pedestrian facilities
- Bus replacements
- Complete Streets projects
- Induced travel
- Intersection and traffic flow improvements
- New bus or shuttle services
- Park and ride lots
- Speed reduction
- Transit signal priority
- Truck stop electrification

For projects that cannot be quantitatively assessed, the MassDOT guidelines include qualitative direction to help MPOs determine the category of impact as either increase, decrease, or no impact. An example of the methodology can be seen in Figure 2). The [2022-2026 STIP](#) outlines categories of projects intended to result in decreased GHG emissions for the transportation sector, including quantified decrease in emissions from new/additional transit, bus replacement, pedestrian and bicycle projects.

Increase	Decrease	No/Negligible Impact
Procuring less efficient buses than those they replace	Pavement improvement	Bridge maintenance that does not change the roadway
	Transit marketing or customer experience improvement	Utility relocation
	ITS improvement	Median barrier replacement
	Bicycle rack installation	Visitor center improvement
	Safe Routes to School project	Retaining wall replacement
		Culvert repair
		Bridge replacement
		Highway lighting improvement

Figure 2: Example of Qualitative Methodology for Determining GHG Impact Direction
Source: [Transportation Improvement Program Greenhouse Gas Assessment and Reporting Guidance](#)

IMPLEMENTATION AT THE MPO LEVEL

The MPOs in Massachusetts work with MassDOT and other stakeholders to assess the GHG impacts of projects included in the TIP by examining additions or reductions in CO₂. [Amendment 1](#) to the Boston Region MPO's LRTP, [Charting Progress to 2040](#), outlined the MPOs' efforts to complete modeling and develop long-range statewide projections for GHG emissions produced by the transportation sector. The Boston Region MPO's travel demand model and the statewide travel demand model were used to



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project GHG emissions levels for 2018, 2019, and 2020 No-Build (base conditions). Reducing GHG emissions and improving multimodal options are key drivers for determining the MPO's goals and investments.

To monitor and evaluate the GHG impacts of TIP projects, MassDOT and the MPOs developed approaches for identifying anticipated GHG emissions impacts of different types of projects. Given that CO₂ is the largest component of GHG emissions overall and is the focus of regulation 310 CMR 60.05, CO₂ has been used to measure the GHG emissions impacts of transportation projects in the TIP and LRTP. Projects with quantified impacts consist of capacity-adding projects from the LRTP and other projects from the TIP for which MassDOT's guidance requires a quantitative GHG assessment. Projects with qualitative impacts are those that would be expected to produce a minor decrease or increase in emissions, and those that would be assumed to have no CO₂ impact.

NEXT STEPS

MassDOT will continue to work with the State's MPOs to reduce GHG emissions from transportation, by providing technical resources such as GHG quantification tools and MOVES emissions factors to help MPOs annually evaluate the GHG impacts of their TIPs and the aggregate GHG impact of the STIP. According to the GWSA, interim emission limits are revisited every five years. Regional and state transportation agencies will continue to advance their GHG accounting efforts to inform transportation system investments.