



Measuring GHG Emissions Saved through Transit Systems

The New York Metropolitan Transit Authority (MTA) acknowledges public transit's role in reducing greenhouse gas (GHG) emissions as both an emitting system and also as a robust strategy to efficiently reduce GHG emissions while providing access and mobility to millions of people. The agency has taken steps to reduce emissions from its own operations and has also measured emissions displaced by the transit agency to show progress towards regional goals.

MTA measures "displaced emissions" to account for the difference in carbon emissions per passenger mile from driving a single-occupancy vehicle (SOV) to riding in a transit vehicle. Each trip shifted from a SOV to a transit vehicle will result in a smaller amount of GHG emissions compared to the emissions that would have been spent on the SOV trip. MTA notes that "For every pound of carbon emitted as a result of MTA operations, almost 10 pounds are avoided through the mode shift, land use, congestion, and upstream benefits."

Greenhouse Gas Reporting to the Climate Registry

MTA is a founding member of the Climate Registry, a nonprofit organization that provides programs and services to help agencies and organizations measure and reduce GHG emissions. MTA has been voluntarily reporting GHG emissions to the Climate Registry since 2008, reporting transit agency-specific performance metrics, which include emissions per passenger mile, emissions per vehicle mile, and emissions per revenue vehicle hour.

Fleet/Agency Emissions Reduction

MTA set a goal in its 20-Year Needs Assessment to reduce agencywide operational GHG emissions by at least 85 percent by 2040 from a 2015 baseline. The assessment notes that this may be met by fleet transition to zero-emission vehicles, facility upgrades, and energy efficiency efforts.

Fleet Transition

In 2017, MTA purchased 25 battery-electric buses to replace buses at the end of their useful life. The agency studied the impacts of the battery-electric bus operations to help determine future low- or zero-emission types of vehicles to purchase. Finding limitations to operational ability in cold weather and a learning curve among maintenance staff, MTA also purchased hydrogen fuel cell electric buses. Hydrogen fuel cell electric buses have a longer range and less intensive supportive charging infrastructure; however MTA's transition plan focuses on use of battery-electric buses due to the availability of technology and internal expertise with battery-electric bus operations and maintenance.

MTA plans to transition its entire bus fleet to zero-emission vehicles by 2040, as noted in its Zero-Emission Transition Plan. This plan lays out four stages to replace its fleet with zero-emission buses, with a mix of battery-electric and hydrogen fuel cell technologies. As part of the plan, MTA will update its depot facilities with charging infrastructure and will train staff to operate and maintain electric vehicles and charging equipment. The MTA's 2025-2029 Capital Plan

Highlights

- Measuring displaced emissions
- Strategic fleet transition plan
- Equitable deployment of zero-emission vehicles
- Communication of avoided GHG emissions in trip planner
- Clean construction program

Context

The New York Metropolitan Transportation Authority (MTA) provides transit services to 15.3 million people across a 5,000-square-mile travel area around New York City. MTA operates over 6,380 subway cars, 5,900 buses, and commuter rail service.



includes the purchase of 500 zero-emission buses and the installation of charging infrastructure at bus depots in alignment with the Zero-Emission Transition Plan.

Energy Efficiency

MTA also reduces GHG emissions by upgrading facilities with energy-efficient technology to reduce electricity needs. The agency is exploring onsite renewable energy generation and battery storage.

Measuring Emissions Displaced Through Transit

In the early 2000s, MTA wanted to clearly communicate the environmental benefits of its public transit system. While there was a broad understanding among transit agencies that transit systems displaced GHG emissions, there was not a commonly used methodology for calculating these impacts. In 2008, MTA joined a climate action working group, sponsored by the American Public Transportation Association (APTA), to create a recommended practice for quantifying emissions from transit agencies. The recommended practice considers not only the emissions produced from the transit agency's own operations but also the emissions displaced by avoided trips by private automobiles along with mitigation efforts. The calculation includes directly avoided trips as well as a calculation of the land use efficiency factor, which indicates that compact land use drives a reduction in private vehicle use. The APTA report notes that the GHG impacts of transit include emissions from transit, emission reductions from the ridership effect, and carbon offsets and sinks, as shown in **Table 1**.



Figure 1. MTA electric bus at charging station. Source: MTA.

Table 1. Collective Greenhouse Gas Impacts of Transit. Source: Adapted from the American Public Transportation Association

Produced Emissions	Displaced Emissions	Carbon Offsets and Sinks
- Tailpipe emissions from transit vehicles. - Electricity use for vehicle propulsion, maintenance yards, stations, offices, and other stationary sources. - Purchased goods, recycling, employee commuting.	- Transportation efficiency (avoided car trips from private vehicles – mode shift). - Land use efficiency (compact land use leads to shorter trips, greater walk/bike trips, trip chaining, lower rates of car ownership).	- Purchase of offsets. - Sale of offsets. - Sinks.

This practice allows for the normalization of greenhouse gas emissions, rather than a simple calculation of MTA's emissions, with the idea that if MTA stopped operating, its GHG emissions would drop to zero, however, overall GHG emissions from transportation would rise in the region. MTA notes that increases in GHG emissions from transit operations will continue to displace emissions from automobile use, assuming that the increase is the result of increased transit ridership and reduced SOV use. MTA calculations also include emissions reductions from avoided fuel production and congestion and have shown that for about every pound of carbon emitted by MTA operations, approximately 10 pounds of carbon are avoided.

Avoided Carbon Calculator

In 2024, MTA launched its Avoided Carbon Calculator as part of its TrainTime mobile trip planner app, which shows the carbon emissions avoided by using the commuter rail compared to the same trip traveled by car. This mobile calculator helps MTA communicate the benefits of using public transit to its ridership on a personal level. On its website, MTA provides the example of a Metro-North rider traveling from Peekskill to Grand Central Terminal avoids 64 pounds of carbon dioxide equivalent (CO₂e) and 45 car miles. The calculator assumes the avoided trip to be a single-occupancy vehicle driving between the origin and the destination station. The per-mile vehicle emission used to calculate the avoided trip is based on the fuel mix of registered light-duty vehicles in the MTA's service area, including gasoline, diesel, and electric vehicles. The calculator provides information only on emissions saved through mode shift and does not include the additional system savings related to land use impacts and other efficiencies.

Equity

Zero-emission buses offer additional benefits, including noise and air pollution reduction, creating a better experience for both transit riders and people living in the neighborhoods on bus routes. MTA is prioritizing environmental justice communities for the service area of the new zero-emission buses, as a means to meet the New York State goal for an equitable green energy transition.

Clean Construction Program

MTA launched its Clean Construction Program in 2023, which focuses on the reduction of GHG emissions from materials, equipment, waste, and sustainable design principles. Under this program, all MTA contractors are required to report on the embodied carbon content of materials and prioritize re-using or recycling waste from construction projects. MTA is also working on piloting zero-emission construction vehicles and working on incorporating sustainable design components into construction projects. The agency is collecting data from construction projects, which will inform "future sustainable design principles."

Key Takeaways

- **Normalizing emissions.** Transit agencies can communicate their role in reducing GHG emissions by normalizing emissions to account for emissions saved through private automobile use avoidance. MTA's calculations indicate that for every pound of carbon emitted by MTA operations and facilities, approximately 10 pounds of carbon are avoided.
- **Reducing agency-produced emissions.** Beyond a transit agency's GHG reduction impacts through displaced personal vehicle travel, agencies can reduce emissions through fleet transition, energy efficiency upgrades of facilities, low-carbon construction materials and construction waste recycling.
- **Communicating GHG reduction benefits.** MTA actively communicates the benefits of transit, including a feature on its trip planning app which calculates the emissions saved by choosing transit for a particular trip.
- **Opportunity to address equity.** In addition to reducing GHG emissions, zero-emission vehicles reduce noise and health-impacting air pollutants, creating a better experience for transit riders and people living in neighborhoods along bus routes. Agencies can address equity in transportation by prioritizing the transition of vehicles in environmental justice areas or in historically disadvantaged areas.

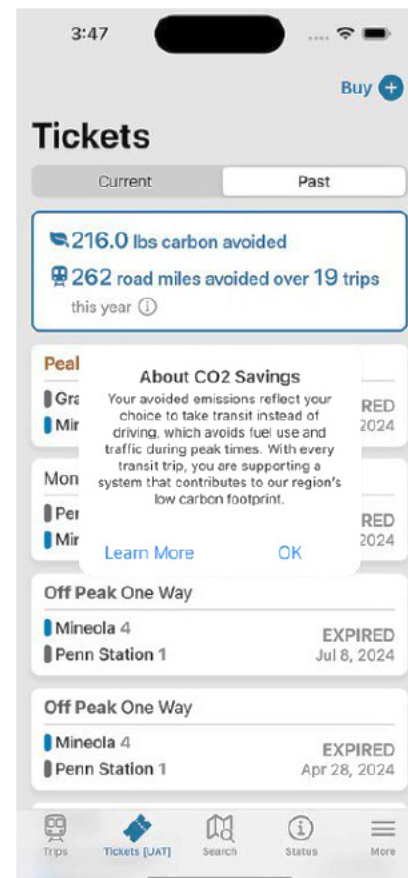


Figure 2. Screenshot of MTA's Avoided Carbon Calculator on its TrainTime mobile app.
Source: MTA.



Resources

- MTA Needs Assessment. <https://future.mta.info/>
- MTA 2024 Zero-Emission Transition Plan. [https://new.mta.info/project/zero-emission-bus-fleet#:~:text=In%20Stage%201%20\(2015%2D19.orders%20will%20be%20zero%2Demission](https://new.mta.info/project/zero-emission-bus-fleet#:~:text=In%20Stage%201%20(2015%2D19.orders%20will%20be%20zero%2Demission)
- 2025-2029 MTA Capital Improvement Plan. <https://new.mta.info/document/151266>
- MTA Clean Construction Program. <https://new.mta.info/climate/sustainability/clean-construction>
- APTA. Quantifying Greenhouse Gas Emissions from Transit. https://www.apta.com/wp-content/uploads/Standards_Documents/APTA-SUDS-CC-RP-001-09_Rev-1.pdf