



**NORTH CAROLINA
STATEWIDE
MULTIMODAL
FREIGHT PLAN**
Planning for the Future of Freight Movement

FREIGHT EMISSIONS ASSESSMENT - FINAL



ACRONYMS

| | |
|-----------------|--|
| CMAQ | Congestion Mitigation Air Quality |
| CO ₂ | Carbon Dioxide |
| DERA | Diesel Emissions Reduction Act |
| ECA | Emission Control Area |
| EO | Executive Order |
| IMO | International Maritime Organization |
| GHG | Green House Gases |
| MHD | Medium- and Heavy-Duty |
| NO _x | Nitrogen Oxides |
| NCDOT | North Carolina Department of Transportation |
| PM | Particulate Matter |
| USEPA | United States Environmental Protections Agency |
| VOCs | Volatile Organic Compounds |
| ZEV | Zero Emission Vehicle |
| ZEFV | Zero Emission Freight Vehicle |

FREIGHT EMISSIONS ASSESSMENT

Freight transportation plays an important role in our global economy. Billions of tons of cargo are transported around the world each year by trucks, planes, ships, and trains. According to the [Massachusetts Institute of Technology](#), freight transportation makes up 8% of global greenhouse gas (GHG) emissions, and as much as 11% if warehouses and ports are included.

Emissions from freight transport include GHGs, particulate matter (PM), nitrogen oxides (NO_x) and volatile organic compounds (VOCs). According to the U.S. Environmental Protection Agency (USEPA), the [transportation sector is responsible for](#):

- Over 55% of NO_x total emissions inventory in the U.S.
- Less than 10% of VOCs emissions in the U.S.
- Less than 10% of PM_{2.5} and PM₁₀ emissions in the U.S.

The transportation sector also contributes to emissions of air toxics, which are compounds that are known or suspected to cause cancer or other serious health and environmental effects. Examples of mobile source air toxics include benzene, formaldehyde, and diesel particulate matter. In addition, GHG emissions have been linked to climate change.

According to the [2022 North Carolina Greenhouse Gas Inventory](#), transportation is the largest GHG-emitting sector in North Carolina, representing approximately 36% of gross GHG emissions. Table 1 shows the breakdown of transportation related GHG emissions by vehicle type.

TABLE 1. GHG TRANSPORTATION EMISSIONS BY VEHICLE/EQUIPMENT TYPE

| Highway (~90% of Emissions) | Non-Highway Mobile Sources (~10% of Emissions) | | Alternative Fuel Vehicles (<1% of Emissions) |
|-----------------------------|--|---------------------------|--|
| <u>Light-Duty Vehicles</u> | <u>Off-road Transportation</u> | <u>Off-road Equipment</u> | Compressed Natural Gas |
| Passenger Cars | Airplanes | Construction | |
| Passenger Trucks | Trains | Agriculture | |
| <u>Heavy Duty Trucks</u> | Marine Vessels | Logging | |
| Buses | Recreational Vehicles | Recreation | |
| Commercial Trucks | | | |

Source: North Carolina Department of Environmental Quality

Based on data from the [North Carolina Volkswagen Mitigation Plan](#), freight also constitutes a large percentage of NO_x emissions in North Carolina, as shown in Table 2.

TABLE 2. MOBILE SOURCE NO_x EMISSIONS BY SOURCE (FREIGHT SOURCES IN BOLD)

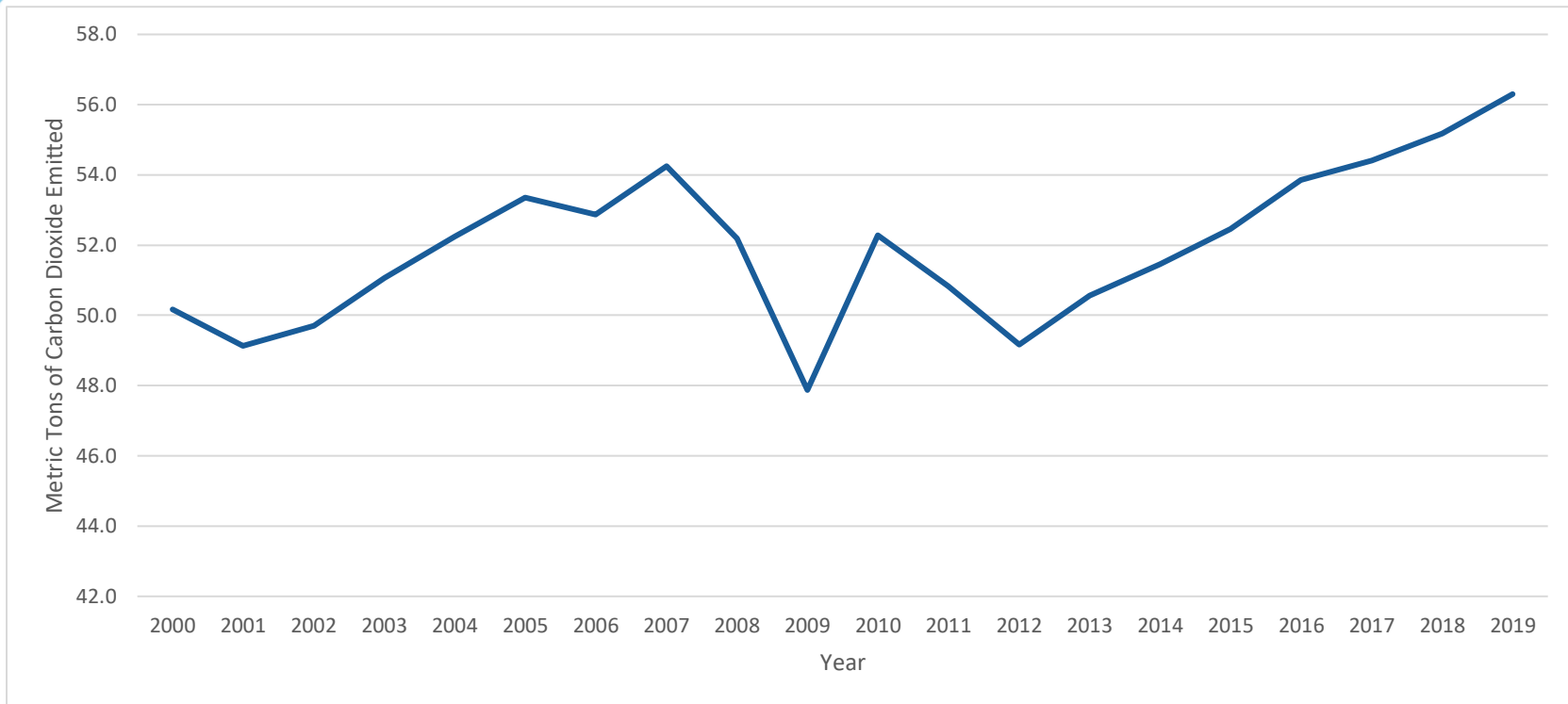
| Mobile Source NO _x Emissions Source | Emissions (tons/year) | Percent of total* |
|--|-----------------------|-------------------|
| Commercial Marine Vessels | 4,395 | 2.8% |
| Non-road Equipment – Diesel | 17,476 | 11.1% |
| On-road Diesel Heavy-duty Vehicles | 29,755 | 18.9% |
| Locomotives | 6,790 | 4.3% |
| On-road Diesel Light-duty Vehicles | 4,489 | 2.9% |
| On-road Non-diesel Heavy-duty Vehicles | 709 | 0.5% |
| Aircraft | 4,290 | 2.7% |
| Non-road Equipment – Gasoline | 6,446 | 4.1% |
| Non-road Equipment - Other | 1,803 | 1.1% |
| On-road Non-diesel Light-duty Vehicles | 81,276 | 51.6% |
| Total | 157,428 | |

Source North Carolina Phase 2 Volkswagen Mitigation Plan, 2021

*Note, percentages do not add up to 100% due to rounding

As detailed in the Statewide Multimodal Freight Plan, North Carolina freight is heavily dependent on trucks. This trend is anticipated to continue through 2050. Emission trends for total transportation use have also been relatively constant, with an average increase from 2000 to 2019 of about 300,000 metric tons of Carbon Dioxide (CO₂) per year. Data on transportation-related CO₂ emissions in North Carolina during this period are shown in Figure 1.

Figure 1. North Carolina Transportation Carbon Dioxide Emissions, 2000 to 2019



Source: [US Energy Information Administration](#)

Reduction and Mitigation Programs

[Heavy-Duty Vehicle Fuel Efficiency Standards](#)

The National Highway Traffic Safety Administration’s fuel efficiency standards for heavy-duty trucks are currently stayed. However, if the stay is removed, the new standards would affect companies that manufacture, sell, or import into the United States new heavy-duty engines and new Class 2b through Class 8 trucks. Improving fuel efficiency may result in a reduction of all emissions generated as products of combustion.

National Clean Diesel Program ([Diesel Emissions Reduction Act Funding](#))

The Clean Diesel Program offers funding in the form of Diesel Emissions Reduction Act (DERA) grants and rebates as well as other support for projects that protect human health and improve air quality by reducing harmful emissions from diesel engines. North Carolina has been a

recipient of 10 National DERA Awarded Grants that have been used in part to address freight related emissions by replacing diesel cargo handling equipment and ground support vehicles at airports and replacing drayage trucks. Additionally, North Carolina has used its state allocation of DERA funds (including those provided through the American Reinvestment and Recovery Act of 2009) to replace long-haul trucks and provide rebates for auxiliary power units as well as funding to repower locomotive engines.

[Congestion Mitigation Air Quality](#)

The Congestion Mitigation Air Quality (CMAQ) program was authorized through the Intermodal Surface Transportation Efficiency Act and reauthorized in subsequent transportation bills. This program was implemented to support surface transportation projects and other related efforts that contribute to air quality improvements and provide congestion relief. The Port of Wilmington has leveraged CMAQ funding to subsidize the intermodal rail service between Wilmington and Charlotte, thereby taking trucks off the roads and significantly reducing emissions, especially in Charlotte which is a nonattainment area.

[SmartWay](#)

Freight transportation is a large contributor to air pollution and climate change. SmartWay helps the freight transportation industry improve supply chain efficiency to reduce air pollution from their operations. The three core elements of the SmartWay program include transport partnerships between shippers and carriers and the USEPA, brand awareness of fuel-saving technologies, and global collaboration. In 2018, the USEPA honored two North Carolina truck carriers, [Eagle Transport Corporation and Old Dominion Freight Line, Inc.](#), with the annual SmartWay Excellence Awards at the 2018 American Trucking Associations Annual Management Conference & Exhibition in Austin, Texas. The North Carolina recipients are among 40 being recognized nationally as industry leaders in supply chain environmental and energy efficiency.

[Ports Initiative](#)

The Ports Initiative is working to develop and implement environmentally sustainable port strategies through partnerships between USEPA and ports. The program identifies opportunities to reduce air pollution and improve air quality in port communities and reduce the carbon pollution that contributes to climate change while supporting jobs and the economy. USEPA is supporting these efforts through a number of programs, including funding through the Diesel Emission Reductions Act.

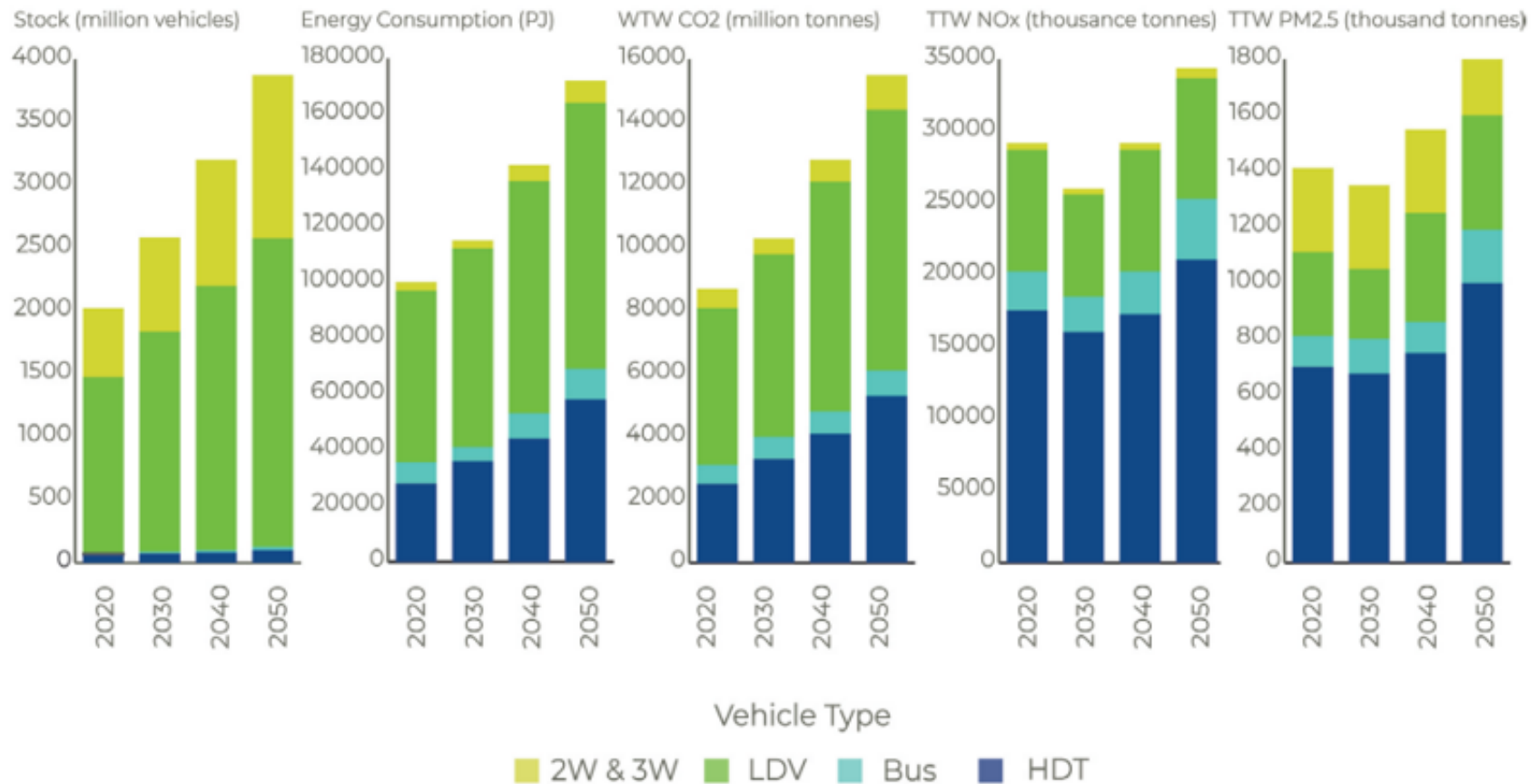
NCPorts continues active work to reduce emissions. The new Ship to Shore container cranes are all electric and help reduce the amount of emissions coming from the port facilities.

Emerging Technologies and Initiatives for Freight Emission Reduction

Zero Emission Freight Vehicles

ZEFVs provide a technological solution that can replace and improve upon the current system that relies predominantly on diesel-powered trucks. This transition is essential. If “business as usual” operations continue, the anticipated emissions from heavy-duty diesel trucks are anticipated to become an increasingly large percentage of energy consumption and emissions of CO₂, NO_x, and PM_{2.5} as shown in Figure 2.

Figure 2. “Business as Usual” Projections of Global Truck Stock, Energy Consumption, and Tailpipe Emissions



Source: [Zero Electric Vehicle Alliance](#)

The ZEFV market has already progressed out of its infancy, with some vehicle segments approaching commercialization stages, though uptake and model availability of larger ZEFVs has been limited to date. The outlook for ZEFV uptake has been bolstered with supportive, large-scale pledges from fleets and manufacturers. Governments are also supporting the transition by placing limitations on diesel use, establishing ZEFV sales requirements, and forming multi-state coalitions to develop and implement market-enabling policies, thereby creating opportunities for ZEFVs to fill the spaced vacated by diesel consumption.

On July 15, 2020, Gov. Cooper joined a bi-partisan group that [now includes 17 states, the District of Columbia, and the Canadian Province of Quebec](#) in signing a [Memorandum of Understanding \(MOU\)](#) committing to the electrification of medium- and heavy-duty vehicles, including large pickup trucks and vans, delivery trucks, box trucks, school and transit buses, and long-haul delivery trucks. The goal is to ensure that 100 % of all new truck and bus sales are zero-emission vehicles (ZEVs) by 2050, with an interim target of 30 % by 2030. To help meet these goals, North Carolina and the other signatories are working through the [Multi-State ZEV Task Force](#) to develop a Multi-State Medium- and Heavy-Duty ZEV Action Plan.

Clean Transportation Plan

Gov. Cooper signed Executive Order (EO) 80, “North Carolina’s Commitment to Address Climate Change and Transition to a Clean Energy Economy” (Oct. 29, 2018) that states North Carolina will support the 2015 Paris Agreement and honor the state’s commitments to the United States Climate Alliance. Another initiative, EO 246 (Jan. 7, 2022), stated North Carolina would release an updated GHG inventory by Jan. 31, 2022, and biennially thereafter. It also established a pathways analysis to evaluate potential emission-reduction pathways for achieving net-zero GHG emissions across North Carolina’s economy by 2050. The EO stated that North Carolina would develop a Clean Transportation Plan that included transitioning medium- and heavy-vehicles to ZEVs. In developing the NC Clean Transportation Plan, one of the five workgroups developed focuses on developing actionable strategies to address emissions from medium- and heavy-duty vehicles.

The Clean Transportation Plan for MHD Vehicles builds off the Multi-State ZEV Task Force work and is committed to the electrification of MHD vehicles. It also includes environmental justice outreach to impacted communities as well as exploring the use of low-carbon fuels. These outreach steps are important, because communities adjacent to freight corridors often bear the greatest burden from air pollution and climate change.

Connected and Autonomous Vehicles

Connected and Autonomous Vehicles (CAVs) technology has the potential to improve the efficiency of transportation systems resulting in both reduced accidents and emissions. This technology helps make truck platooning possible resulting in fuel savings of 5 to 20 %. In January 2017, the Triangle Expressway was designated as a USDOT Autonomous Vehicle Proving Ground and truck platooning was passed in July 2017. In collaboration with Volvo, [truck platooning](#) was demonstrated along this route beginning April 2018. The demonstration took place at the Veridea Parkway outside of a.m. and p.m. peak hour traffic conditions. Trucks were spaced 75 to 100 feet apart and traveled at 62 miles per hour.

North Carolina Alternative Fuel Infrastructure Support

Because transportation emissions constitute the largest percentage of GHG emissions in North Carolina and trucks carry the preponderance of the state's freight, reducing truck emissions will be a key for North Carolina to meet its stated emissions goals. This will involve the conversion of conventionally fueled vehicles to cleaner alternatives such as propane, natural gas, biofuels, electric, and hydrogen.

As part of the Volkswagen Settlement Mitigation Program, the North Carolina Department of Environmental Quality (NCEM) is allocating the full 15 % (\$10,198,826) allowed in the agreement for ZEV charging infrastructure projects as outlined in the [North Carolina Volkswagen Mitigation Plan](#). During Phase 2 of the Volkswagen settlement, North Carolina will facilitate interstate travel with ZEVs by supporting projects to enhance and extend the current ZEV infrastructure network on high-traffic routes between population hubs.

NCDOT has participated in the [FHWA Alternative Fuel Corridor](#) program since its inception in 2016. Through this program, several corridors have been designated (Figure 3). National Electric Vehicle Infrastructure (NEVI) investment must occur along these routes until a build out status is certified. As these routes align with most of the state's interstates and major U.S. routes that also serve a freight purpose, this investment will aid in the electrification of freight vehicles.

Figure 3. North Carolina Alternative Fuel Corridors

