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# New Bedford Marine Commerce Terminal (NBMCT) Baseline Emissions Inventory

September 2026

# Agenda

**01** Background and Executive Summary

**02** Inventory Approach

**03** NBMCT 2024 Baseline Emissions

- *Scope 1 + 2 GHG Emissions*
- *Scope 3 GHG Emissions*
- *Criteria Pollutant and GHG Emissions by Source*

**04** Next Steps

# Overview of the Baseline Emissions Inventory

- **WHAT:** Quantification of criteria pollutants and greenhouse gas (GHG) emissions from off-shore wind deployment operations at New Bedford Marine Commerce Terminal ("NBMCT")
- **WHY:** The baseline inventory was created to understand the terminal's current air quality and climate impact and support the development of an aligned strategy for the reduction of that impact on the nearby community
- **WHERE:** Located at the New Bedford Marine Commerce Terminal within the Port of New Bedford, MA
- **WHEN:** 2024 (latest year with accessible data that reflects typical operating conditions)
- **HOW:** Emissions calculations follow the U.S. EPA's Port Emissions Inventory Guidance methodology, along with the WRI/WBCSD GHG Protocol Corporate Accounting and Reporting Standard (GHGP). Emission factors for off-road and on-road equipment are based on EPA's Motor Vehicle Emission Simulator (MOVES)

**Emissions included:**

- Criteria pollutants: NOx, $PM_{2.5}$, $PM_{10}$, $SO_2$, VOC
- Greenhouse gases (GHG): $CO_2$, $CH_4$, $N_2O$, black carbon (BC)
- Mobile source toxics: Diesel $PM_{2.5}$, Diesel $PM_{10}$

**Inventory coverage/Boundaries:**

- On-site terminal activity
- Land-side boundary at the first intermodal point
- Ocean-side boundary at first 25 nautical miles from where the pilot boards the ship for entry into the port
- Excluded: any off-port activities such as vessel anchorages or freight terminals not part of current operations at the MCT

Sources:

*World Resources Institute & World Business Council for Sustainable Development. 2004. The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard.*
U.S. Environmental Protection Agency. 2022. *Port Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions*
U.S. EPA Motor Vehicle Emission Simulator (MOVES)

# Executive Summary

## What are the main emission drivers at the terminal?



Top contributors to Total **$CO_2e$** are Harbor Craft towing, OGV berthing, and Cargo Handling Equipment



Top contributors to Total **NOx** are Harbor Craft towing and Cargo Handling Equipment

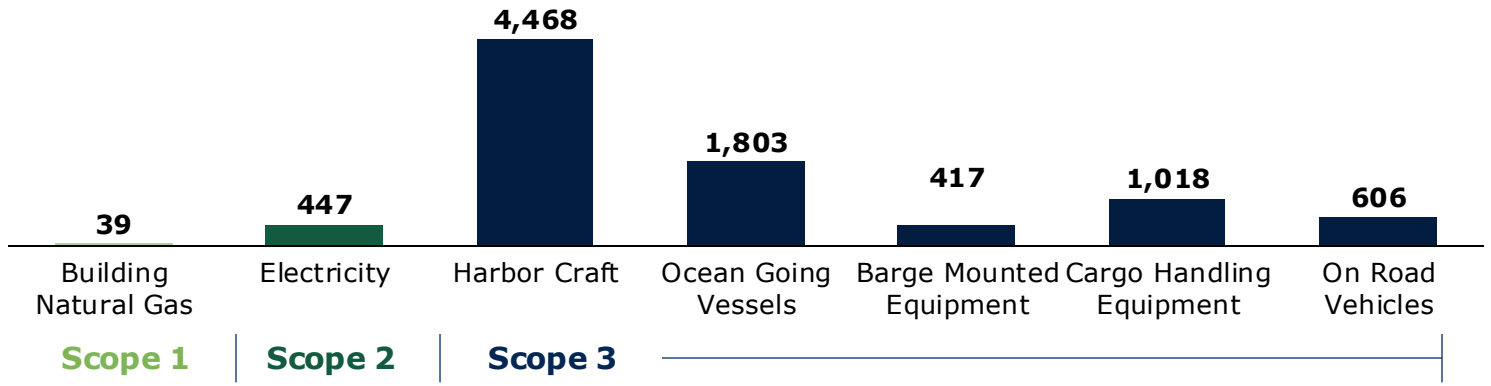


Top contributors to Total **$PM_{10}$** are Harbor Craft towing activity and OGV berthing activity

## Details on emissions sources:

- **Cargo Handling Equipment (CHE)** – CHE GHG and $NO_x$ emissions are driven by generators (49% of CHE GHG emissions, 43% of CHE NOx) and cranes (30% of CHE GHG emissions, 44% of CHE NOx)
- **Harbor Craft** – Harbor Craft GHG emissions come primarily from feeder barges (43% of Harbor Craft GHG emissions) and project tugboats (38% of Harbor Craft GHG emissions). Harbor Craft $NO_x$ emissions are driven by towing (58%) and berthing (40%). Towing also contributes to 57% of Habor Craft $PM_{10}$
- **Ocean Going Vessels (OGV)** - Emissions are primarily emitted from berthing (88% of OGV GHG emissions). Berthing activity contributes to 86% of OGV $PM_{10}$
- **On Road Vehicles** - Emissions are driven by trucks, including both light trucks and commercial trucks (99% of On Road GHG emissions)
- **Facility grounds** – Electricity consumption on the grounds is responsible for 92% of scope 1 and 2 emissions

### Total 2024 GHG Emissions by Source (MT $CO_2e$)



# Benchmarking comparison

We compared to NMBCT emissions[1] to similar sources from other marine terminal operations (i.e. the Port of Los Angeles Emissions Inventory[2]):

| Major Emission Sources | GHGs (MT $CO_2e$ / Million kWh) | | | NOx (tons / Million kWh) | | | $DPM_{10}$ (tons / Million kWh) | | |
|---|---|---|---|---|---|---|---|---|---|
| | **NBMCT** | **POLA EI** | **Difference** | **NBMCT** | **POLA EI** | **Difference** | **NBMCT** | **POLA EI** | **Difference** |
| Harbor Craft | 688 | 676 | **2%** | 6.8 | 5.5 | **24%** | 0.15 | 0.10 | **54%** |
| Ocean Going Vessels | 818 | 809 | **1%** | 4.8 | 10.7 | **-55%** | 0.3 | 0.1 | **~170%** |
| CHE | 763 | 747 | **2%** | 5.0 | 1.3 | **~300%** | 0.2 | 0.0 | **~400%** |
| Barge Generators | 724 | 776 | **-7%** | 0.7 | 4.4 | **~ -90%** | 0.03 | 0.3 | **~ -90%** |

- **GHGs provide the more reliable basis for comparison** — $CO_2e$ per kWh is determined primarily by fuel consumed (compared fleets are predominantly diesel) and is not sensitive to engine standards or emission controls. On this like-for-like basis, NBMCT falls within approximately 1–7% of the emissions in POLA's emissions inventory, suggesting that NBMCT emissions are in the right order of magnitude.
- **NOx and $DPM_{10}$ show greater variation** because they depend on engine tier, aftertreatment, and duty cycle, which vary with fleet composition. These differences run in both directions across sources, indicating fleet-specific variation rather than a difference in emissions performance or estimation methodology differences.
- **On an absolute basis, NOx and $DPM_{10}$ emissions remain small** and within the same order of magnitude across both terminals, so the larger percentage differences do not reflect materially different emissions.

1 – Emissions were adjusted based on energy consumption (kWh)
2 – There are limited publicly available emissions inventories from ports that have similar operations to NMBCT. The Port of Los Angeles inventory was selected as the most representative marine terminal for comparison

# Inventory Approach

# Overview of the emissions accounting methodology

Emissions in the baseline inventory were determined through the following steps:

| Identify Inventory Boundaries | Gather Usage Data | Calculate Emissions |
|---|---|---|
| Determine what facilities and equipment should be included | Collect annual energy consumption, activity, and characteristics for all sources | Use emission factors to convert usage or activity values to emissions |

**Sample GHG Calculation**

| Usage/activity | | Emission Factor | | Emissions |
|---|---|---|---|---|
| 6,000 gallons of gas / year | ✖ | 0.001 MT $CO_2$/gal | = | 6 MT $CO_2$ /year |

# We divided emissions into two categories based on geographical boundaries

**On-site emissions, including:**

- Cargo handling equipment operating on-site
- Vessel and tug-barge berthing / hoteling
- Barge mounted generators operation during tower lifts
- Building and grounds natural gas usage and electricity
- Visiting on-road vehicles movement on terminal grounds (within 0.3 miles of entrance)

**Off-site emissions, including:**

- Ocean going vessels (OGV) and harbor craft travel
  - Within the harbor (federal and terminal channels)
  - Out to 25 nautical miles from Hurricane Barrier[1]
- Barge mounted generators while barges during departure transits
- On-road vehicle travel off-site out to 20 miles from terminal




*NBMCT Berths*

*Navigation channels for harbor craft and OGVs*

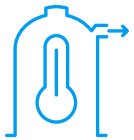
1 - Analysis assumed about 4 hrs for vessels to travel from 25 mile sea boundary to terminal berths

# GHG emissions were divided into Scopes 1, 2, and 3 to better reflect the amount of control the terminal has over emissions

*Emissions with operational control by MassCEC*

**Scope 1**

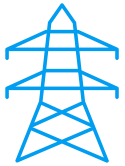
Direct greenhouse gas (GHG) emissions that occur from sources **that are controlled or owned** by an organization.



Stationary combustion - natural gas usage for building heating

**Scope 2**

Indirect GHG emissions associated with the organization's **energy use** (the purchase of electricity, steam, heat, or cooling).



Building and grounds' purchased electricity from Eversource

*Emissions from terminal value chain*

**Scope 3**

Indirect emissions resulting from activities from assets **not owned or controlled** by the organization but contained in **their value chain** (upstream or downstream activities).*



Tenant off-shore wind operations on-site:

- On-road vehicles (light duty trucks, delivery trucks, etc.)
- Off-road equipment (cranes, generators, forklifts, etc.)
- Harbor craft (escort tugs and barge-pulling tugs)
- Ocean-going vessels (heavy lift vessels)

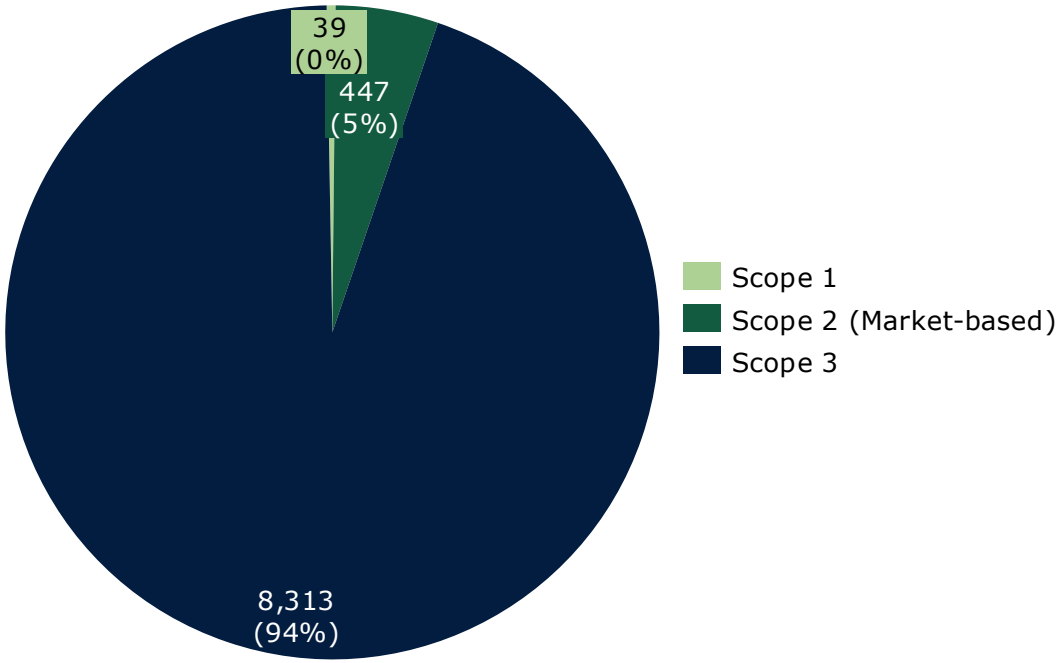


*Note: These can be allocated to Category 13: Downstream Leased Assets. Note that remaining Scope 3 categories are not covered

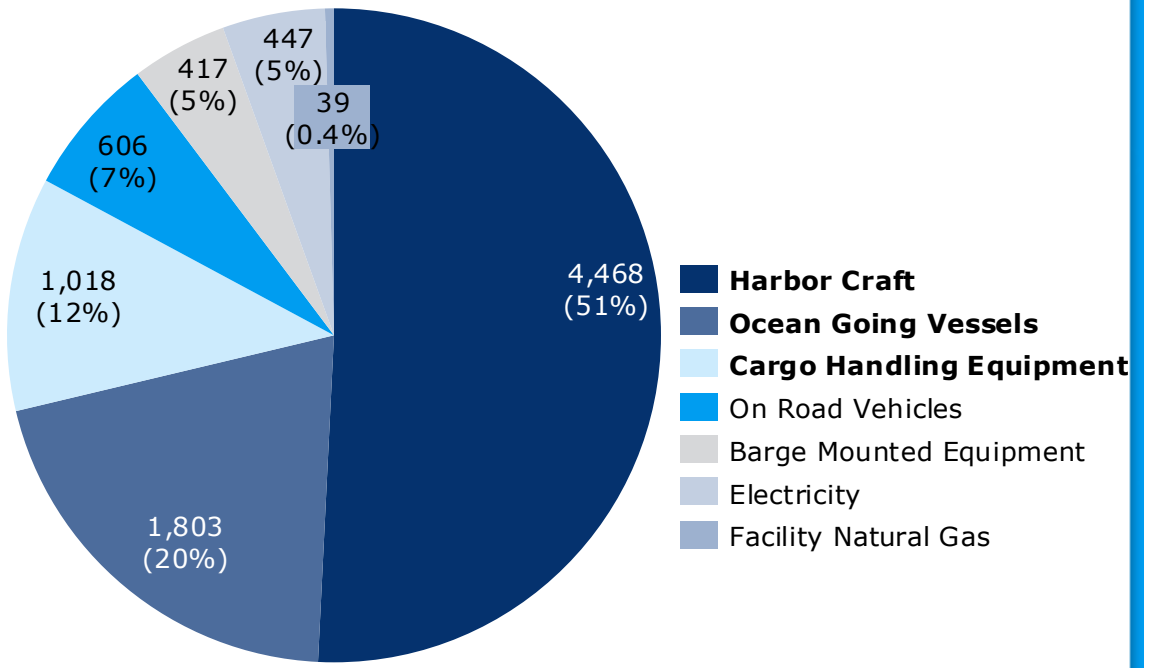
# NBMCT 2024 Baseline Emissions Overview

# Summary of NBMCT 2024 Total GHG Inventory

## Total 2024 GHG Emissions by Scope (MT $CO_2e$)



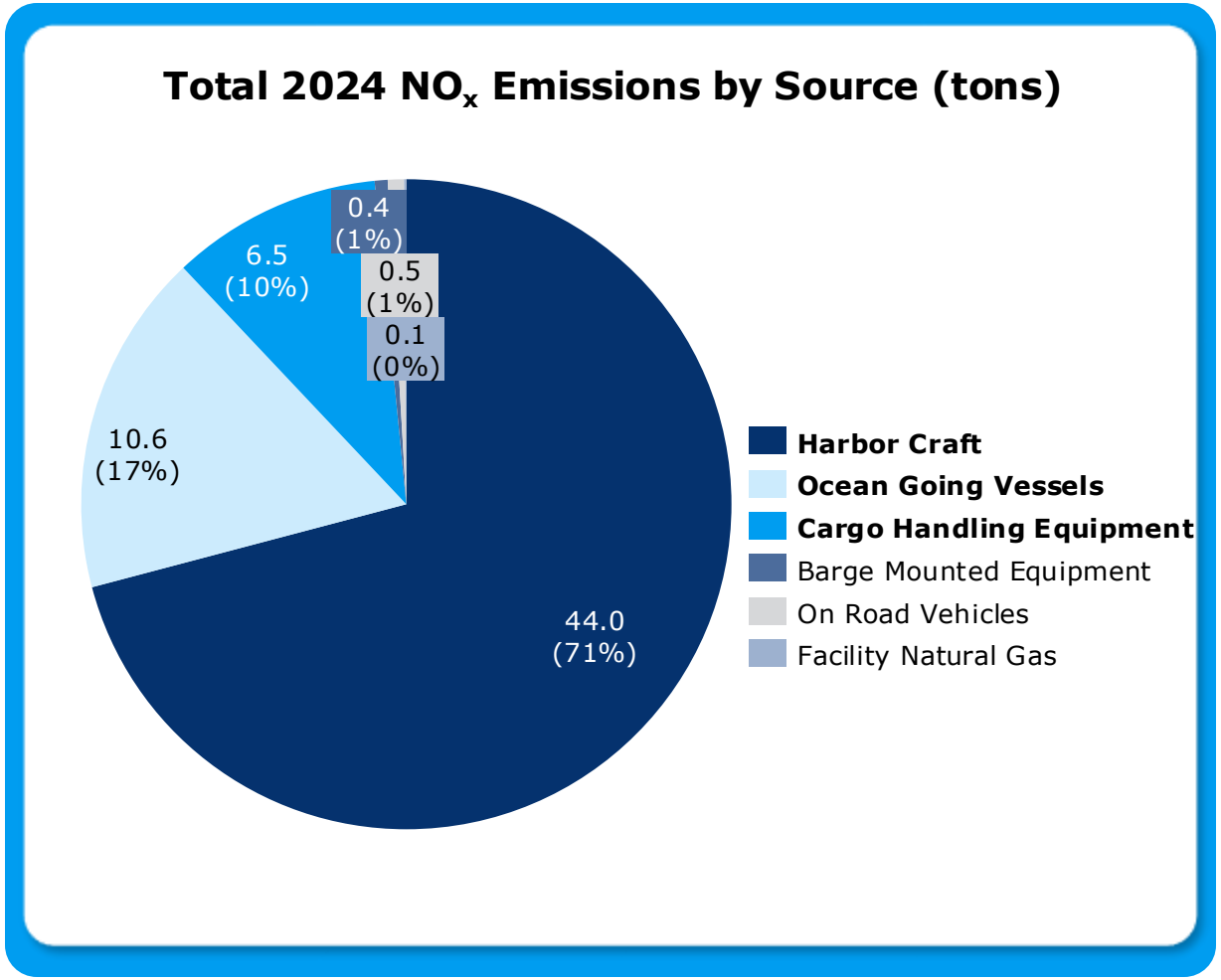

## Total 2024 GHG Emissions by Source (MT $CO_2e$)

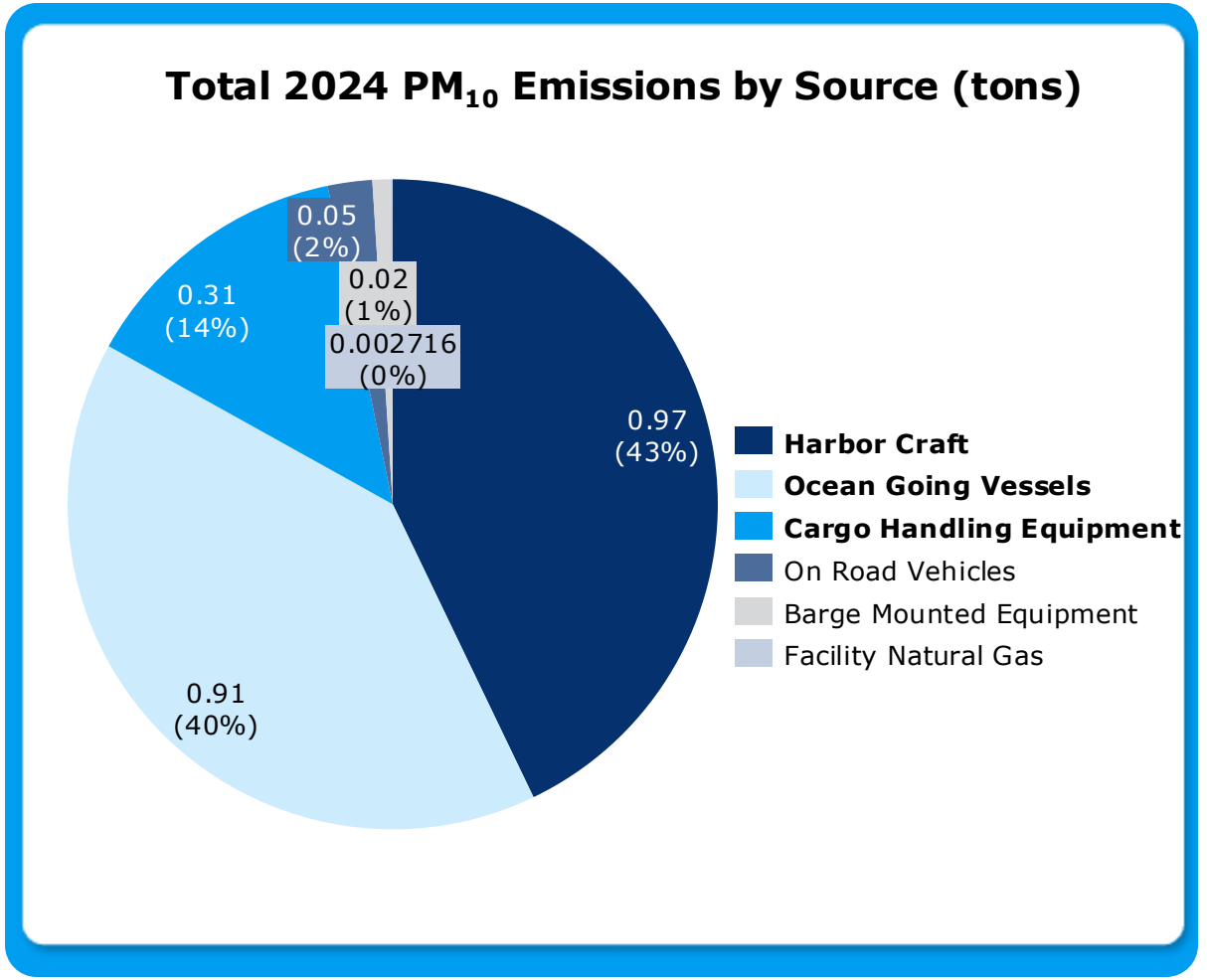



Top 3 sources are in **bold**

Note: Market-Based method reflects emissions from electricity that companies have purposefully chosen, deriving emission factors from contractual instruments including contracts for purchased renewable energy. Market-based was reported throughout this presentation as it reflects a more accurate representation of MassCEC's emissions due to using a utility-specific emission factor rather than an average grid factor.

# Summary of NBMCT Criteria Pollutants - $NO_x$ and PM Emissions




Top 3 sources are in **bold**

# Summary of NBMCT Criteria Pollutants – Other Pollutants and Mobile Source Air Toxics (MSATs)

| Emissions Source | % Emissions Contribution by Source | | | | | |
|---|---|---|---|---|---|---|
| | Other CAPs | | | MSATs | | |
| | PM2.5 | SO2 | VOC | DPM10 | DPM2.5 | BC |
| **Ocean Going Vessels** | 39% | 99.8% | 30% | 35% | 34% | 31% |
| **Harbor Craft** | 44% | 0% | 42% | 47% | 48% | 51% |
| **Cargo Handling Equipment** | 14% | 0.1% | 17% | 15% | 16% | 17% |
| **Barge Mounted Equipment** | 1% | 0.0% | 1% | 1% | 1% | 1% |
| **On Road Vehicles** | 1% | 0.1% | 10% | 2% | 1% | 0% |
| **Facility Natural Gas Usage** | 0% | 0% | 0.1% | 0% | 0% | 0% |

## Insights

- Other pollutants and MSATs were included because of their high negative impacts on climate change and human health (particularly on respiratory and cardiovascular health), including:
  - Particulate matter 2.5 ($PM_{2.5}$)
  - Sulfur dioxide ($SO_2$)
  - Volatile Organic Compounds (VOC)
  - MSATs: Diesel Particulate matter 10 and 2.5 ($DPM_{10}$ and $DPM_{2.5}$) and Black carbon (BC)
- Most of these pollutants are created by Ocean Going Vessel (OGVs) and Harbor Craft activities
  - Example: Most $SO_2$ is generated by OGV auxiliary and propulsion engine activity, which burns marine diesel oil (higher sulfur content)
- MSATs are specifically tracked as a separate category within the inventory. Similar to other pollutants covered to the left, most MSATs are being generated by OGVs and harbor craft

# Scope 1 and 2 GHG Emissions

# Summary of NBMCT Scope 1 & 2 GHG Emissions

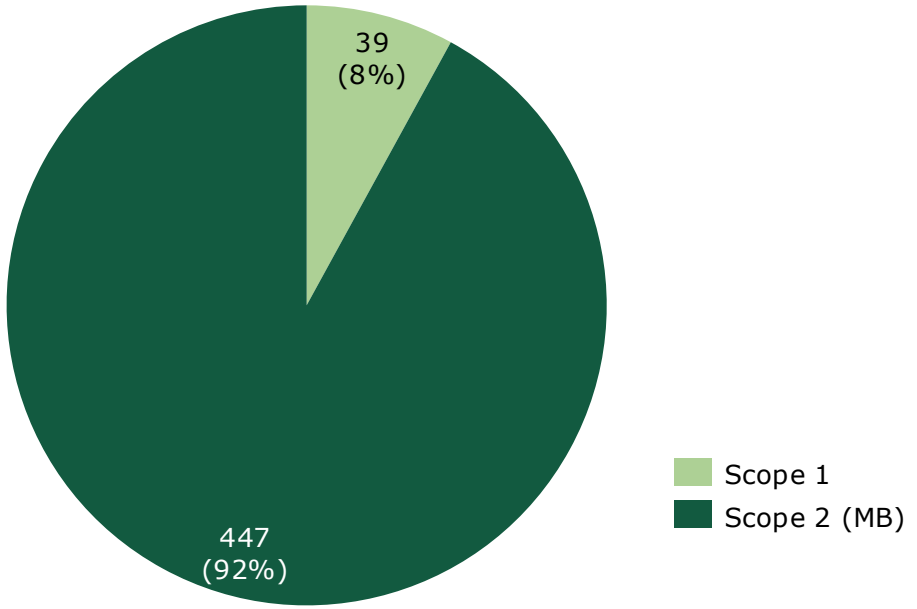
Total 2024 scope 1+2 emissions:

**485 MT $CO_2e$**

## Insights

- Scope 1 emissions are primarily driven by natural gas consumption from the 4 Wright St location (Office/Warehouse)
- Scope 2 emissions represent purchased electricity and are primarily driven by activity from terminal grounds (Heavy Lift Staging Area – 80%) and the 4 Wright St building (20%)

**Total 2024 Scope 1+2 GHG Emissions by Scope (MT $CO_2e$)**



# Summary of NBMCT Scope 1 and 2 GHG Emissions by Location

Scope 1 and 2 GHGs mainly associated with 4 Wright St [Office/Warehouse] and 16 Blackmer St [general terminal grounds]

**Scope 1+2 emissions by location:**

| | |
|---|---|
| **Building Electricity* (MT CO2e)** | **446.56** |
| 16 Blackmer St, New Bedford, MA | 331.69 |
| 4 Wright St, New Bedford, MA | 104.64 |
| 360/362 S. Front St, New Bedford, MA | 5.58 |
| 18 Wright St, New Bedford, MA | 3.77 |
| 350 S. Front St, New Bedford, MA | 0.86 |
| 54 Wright St, New Bedford, MA | 0.01 |
| **Natural Gas Usage (MT CO2e)** | **38.72** |
| 4 Wright St, New Bedford, MA | 35.39 |
| 350 S. Front St, New Bedford, MA | 2.83 |
| 54 Wright St, New Bedford, MA | 0.46 |
| 18 Wright St, New Bedford, MA | 0.02 |
| 360/362 S. Front St, New Bedford, MA | 0.01 |
| 16 Blackmer St, New Bedford, MA | 0.00 |
| **Total Scope 1+2 Emissions (MT CO2e)** | **485.27** |




* Electricity emissions shown are based on a market-based calculation.

# Scope 3 GHG Emissions

# Summary of NBMCT Scope 3 GHG Emissions

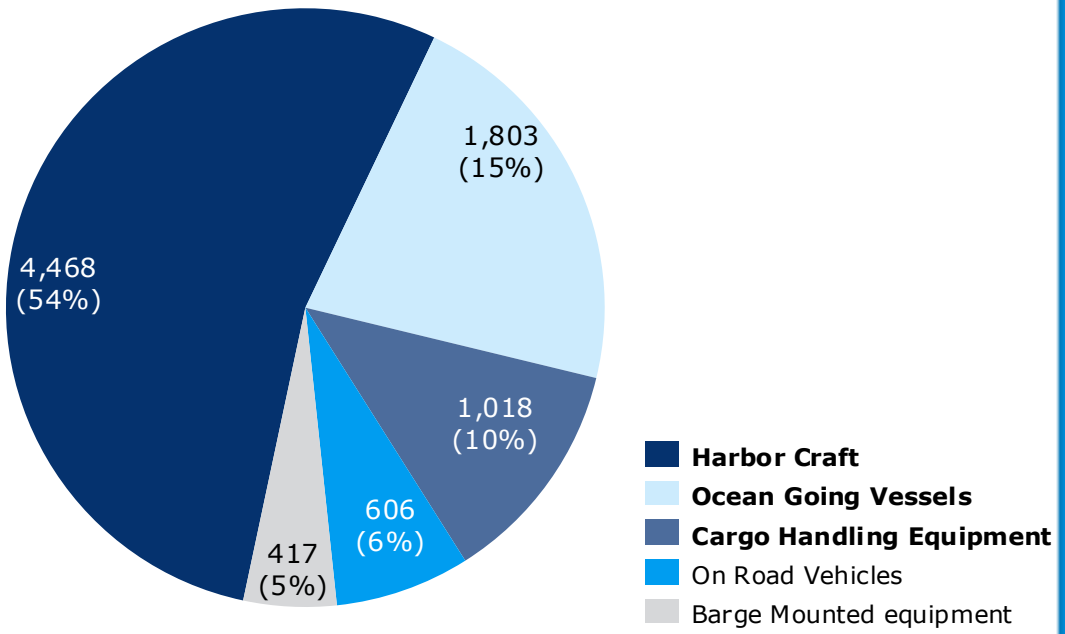
Total 2024 scope 3 emissions:

**8,313 MT $CO_2e$**

## Insights

- Scope 3 emissions are mostly generated from tenant activities related to off-shore wind deployment operations
  - More than half of scope 3 emissions (54%) come from harbor craft, which were the type of vessel with the largest number of calls in 2024 (274)
  - OGVs account for almost 15% of emissions despite having fewer calls in 2024 (29)
  - This indicates that OGV calls are more emissions-intensive per call than harbor craft calls – if OGV calls increase in future years, they may represent a larger portion of emissions

**Total 2024 Scope 3 GHG Emissions by Scope (MT $CO_2e$)**




Top 3 sources are in **bold**

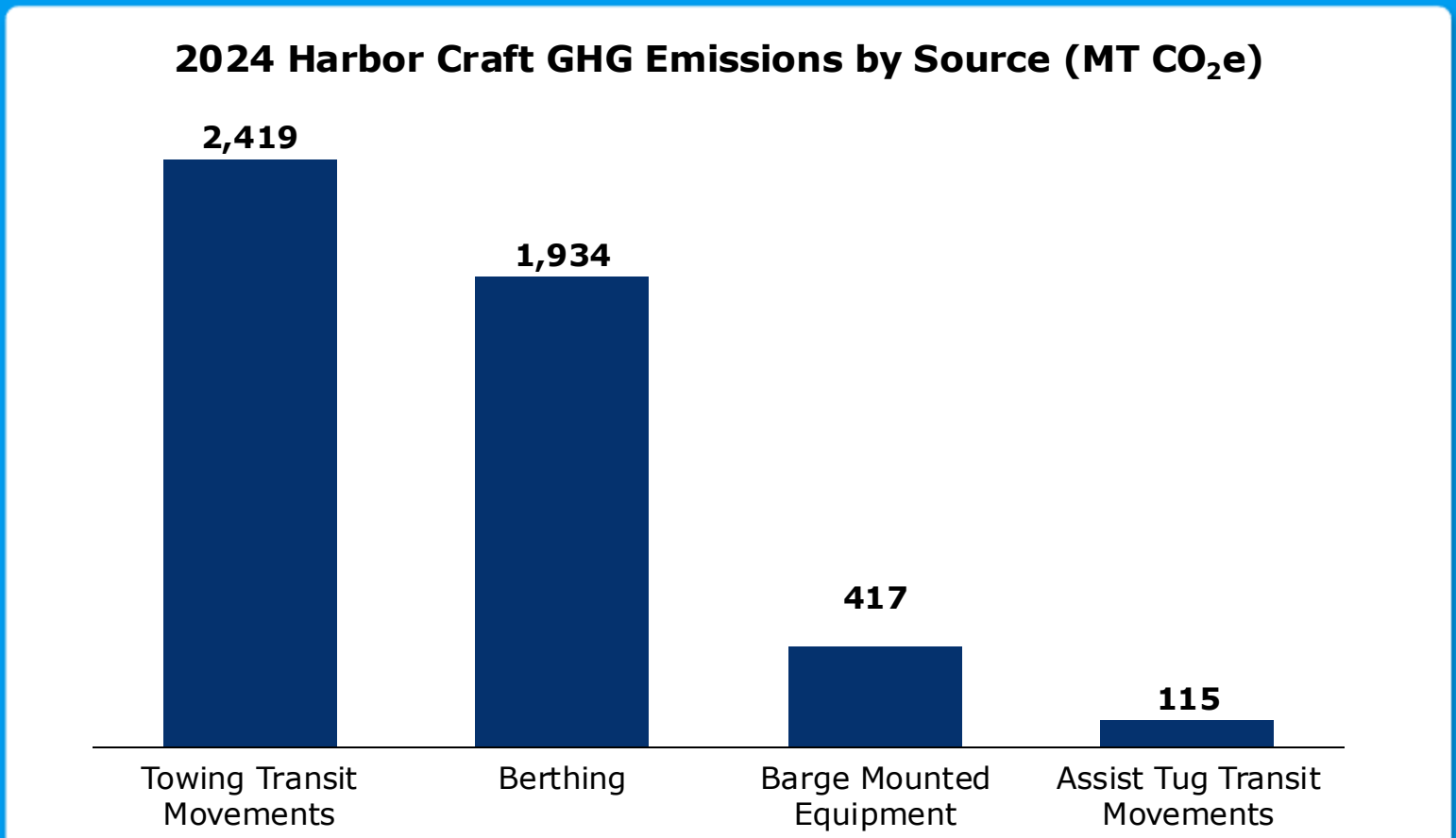
# NBMCT Detailed Emissions by Source Category

# Harbor Craft

Three activities and vessel groups:

- Towing and Assist Tugboats for Feeder Barges
- Escort/Assist Tugboats for Heavy Lift Vessels (HLVs)
- Various “C1/C2 engine” vessels  (OSVs, CTV, Fishing Vessels, Fuel Boat)

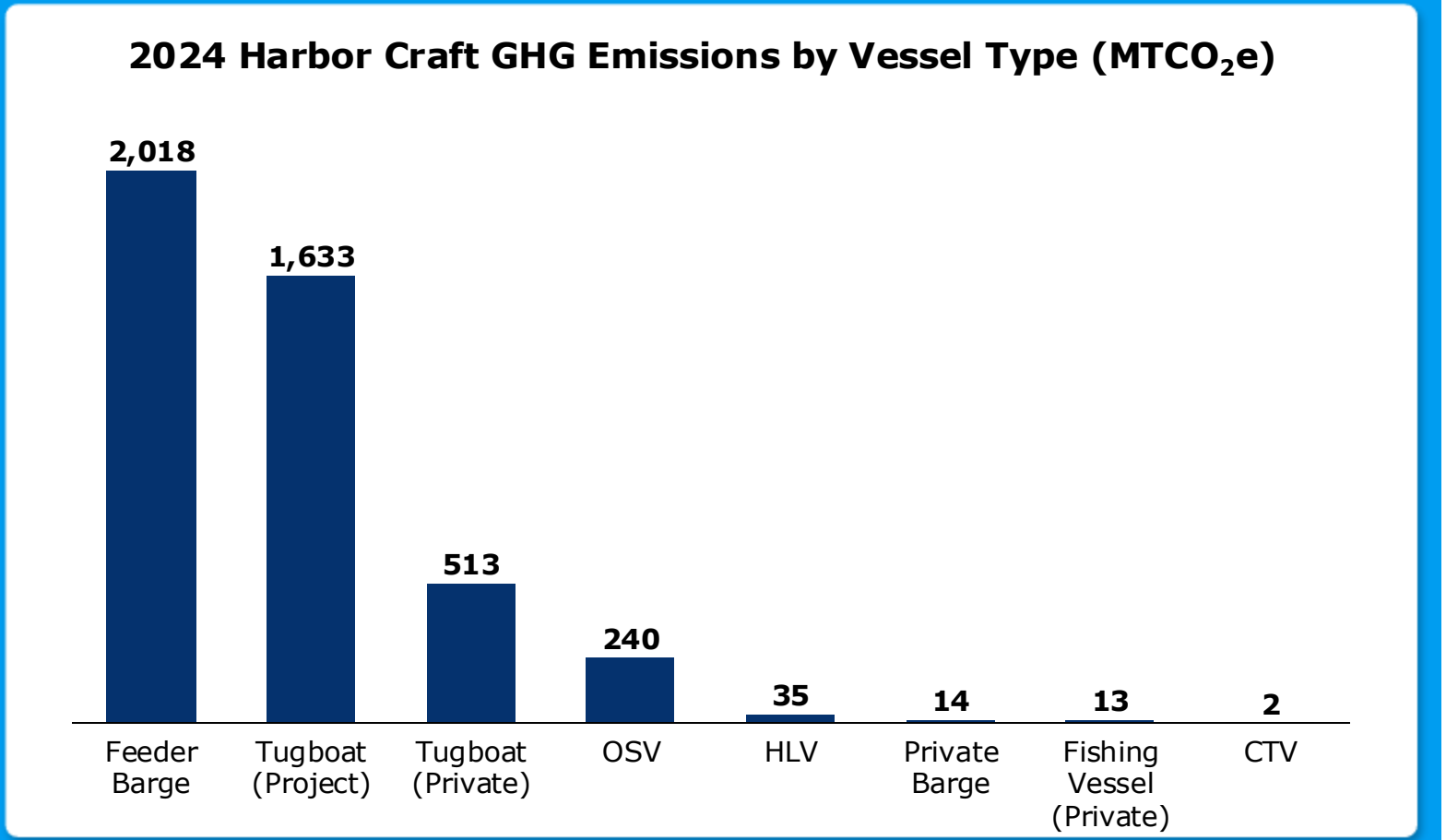
# Harbor Craft - GHG Emissions




## Insights

- Harbor craft and barge-mounted generators account for a large share of Scope 3 emissions, contributing 54% and 5% of total scope 3 GHG emissions, respectively
- Harbor craft emissions primarily result from **towing transit movements,** driven by large propulsion engines and auxiliary engine use
- During **berthing**, propulsion engines are off, with only auxiliary engines running. However, off-shore wind assembly hotelling durations are longer than typical marine operations:
  - Average duration: ~43 hours per call
  - Maximum duration: ~37 days per call
- **Assist tug transits** involve escorting heavy lift vessels (HLVs) and feeder barges
- **Barge-mounted generators**, operate fully during tower lifts (approximately 3 hours per call) and while departing the terminal

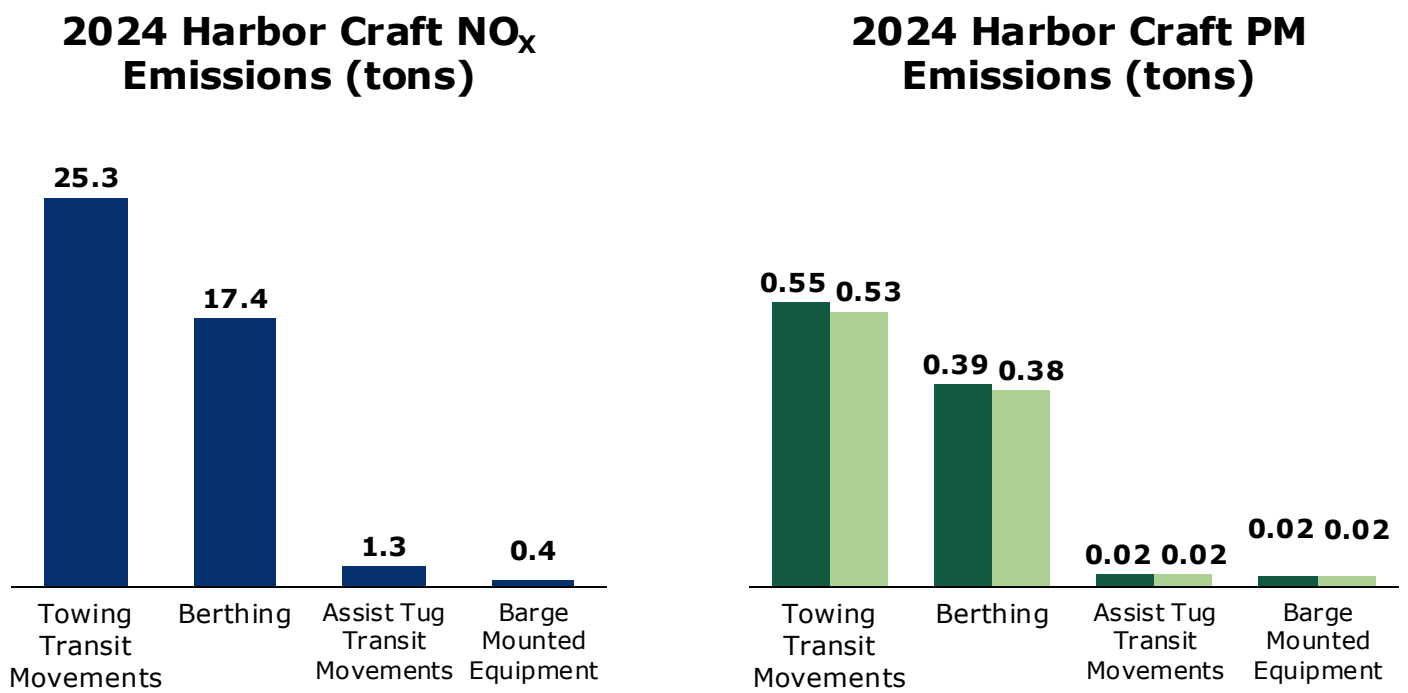
# Harbor Craft - GHG Emissions by Vessel Type




## Insights

- **Tug-pulled feeder barges (45%) and project tugboats (37%)** dominate the GHG emissions from harbor craft
  - Feeder barges are non-self propelled and must be pulled by tugboats to transit to/from the terminal. The tugboat propulsion and auxiliary engines are the source of emissions.
- As noted before, GHG emissions are **primarily driven by how much time the harbor craft in activity mode** (transit, berthing, escorting, etc.)
  - Transit emissions can be controlled by full tug repowering, electrification or hybridization
  - Berthing emissions may be controlled via shore power usage (cold ironing)
  - MassCEC may consider during the strategy if any of these are feasible for controlling harbor craft emissions

# Harbor Craft – $NO_x$ and PM




## Insights

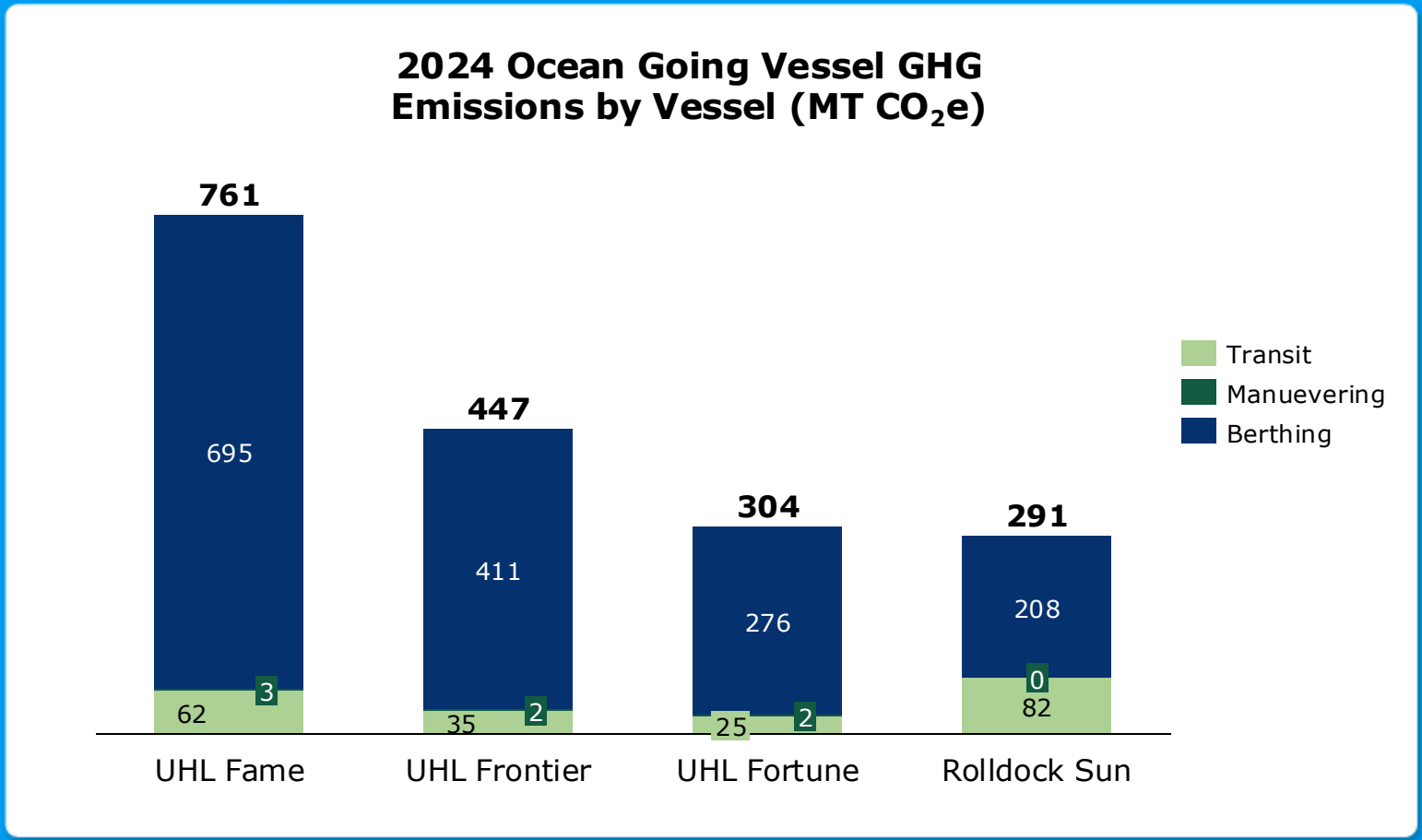
- NOx and PM emissions are **primarily driven by towing transit and berthing activities.**
  - Any strategy to reduce emissions will need to prioritize these modes to reduce NOx and PM levels
- Barge-mounted equipment (specifically generators) show lower than expected pollutant levels, compared to the time spent in that mode
  - The barge-mounted generators used in the Project meet 'Tier 4 final' emission standards, the strictest for NOx and PM emissions
  - As a result, barge mounted equipment has lower emissions in comparison to other harbor craft sources when it comes to NOx and PM emissions.

# Ocean Going Vessels

Consists of Heavy Lift Vessels:

- Rolldock Sun
- UHL Fame
- UHL Fortune
- UHL Frontier

# Ocean Going Vessels (OGVs) – GHG Emissions



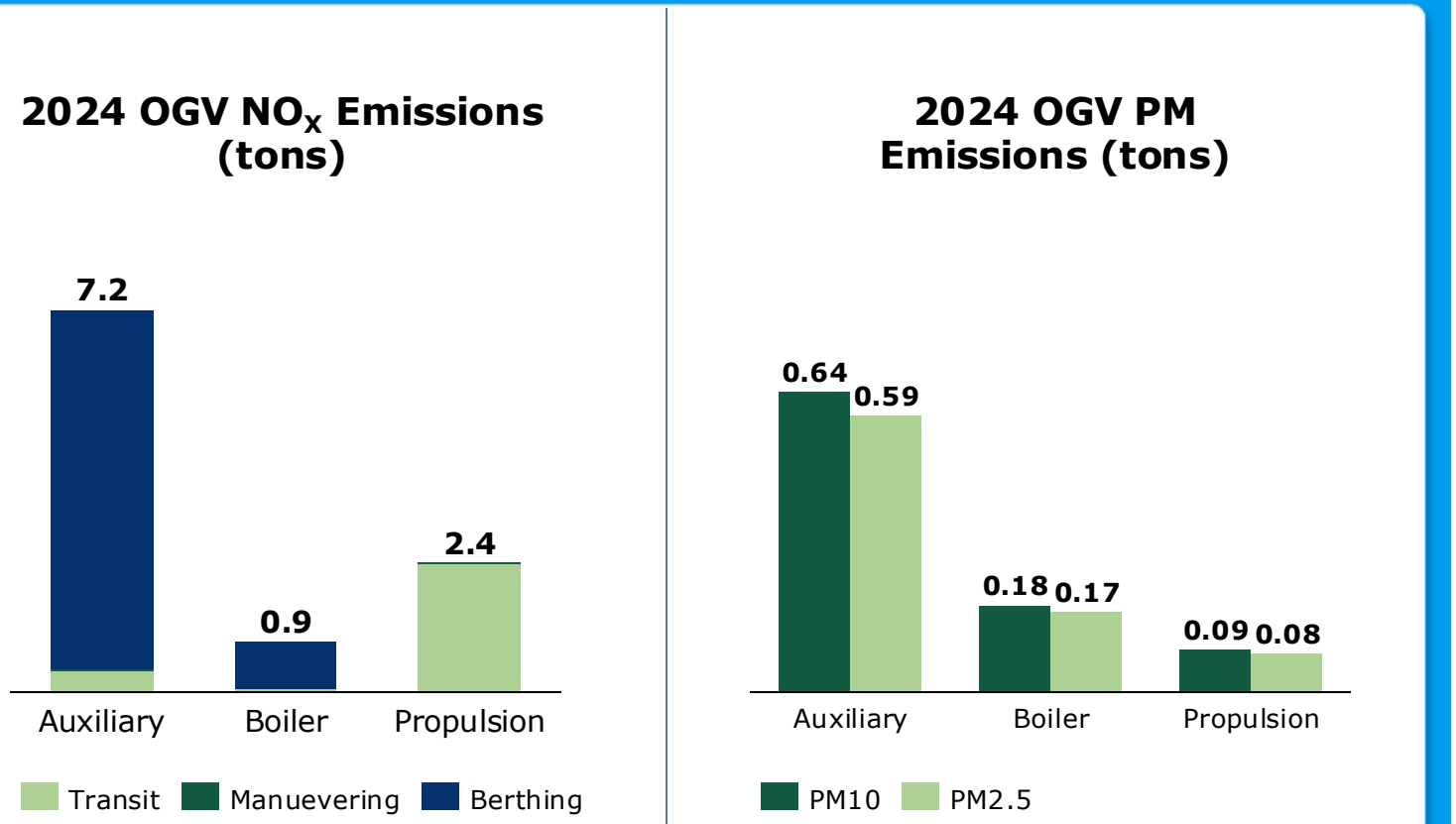

## Insights

- The majority of OGV emissions (67%) were generated by **UHL Fame and Frontier**
  - Though there were more visits in 2024 from the Rolldock Sun, it has smaller auxiliary engines than the UHLs and it spent less time at berth per call (53 vs 150 hrs) than the UHL vessels
- Similar to barges at NBMCT, OGV berthing **times for off-shore wind operations are longer** than other typical marine operations[1]:
  - Average duration: ~125 hours per call
  - Maximum duration: ~157 hours per call



1 - Transit emissions are included up to the 25 nautical miles from the hurricane barrier. Each transit takes which take about 4 hours per call from berth to 25nm.

# Ocean Going Vessels (OGVs) – $NO_x$ and PM Emissions



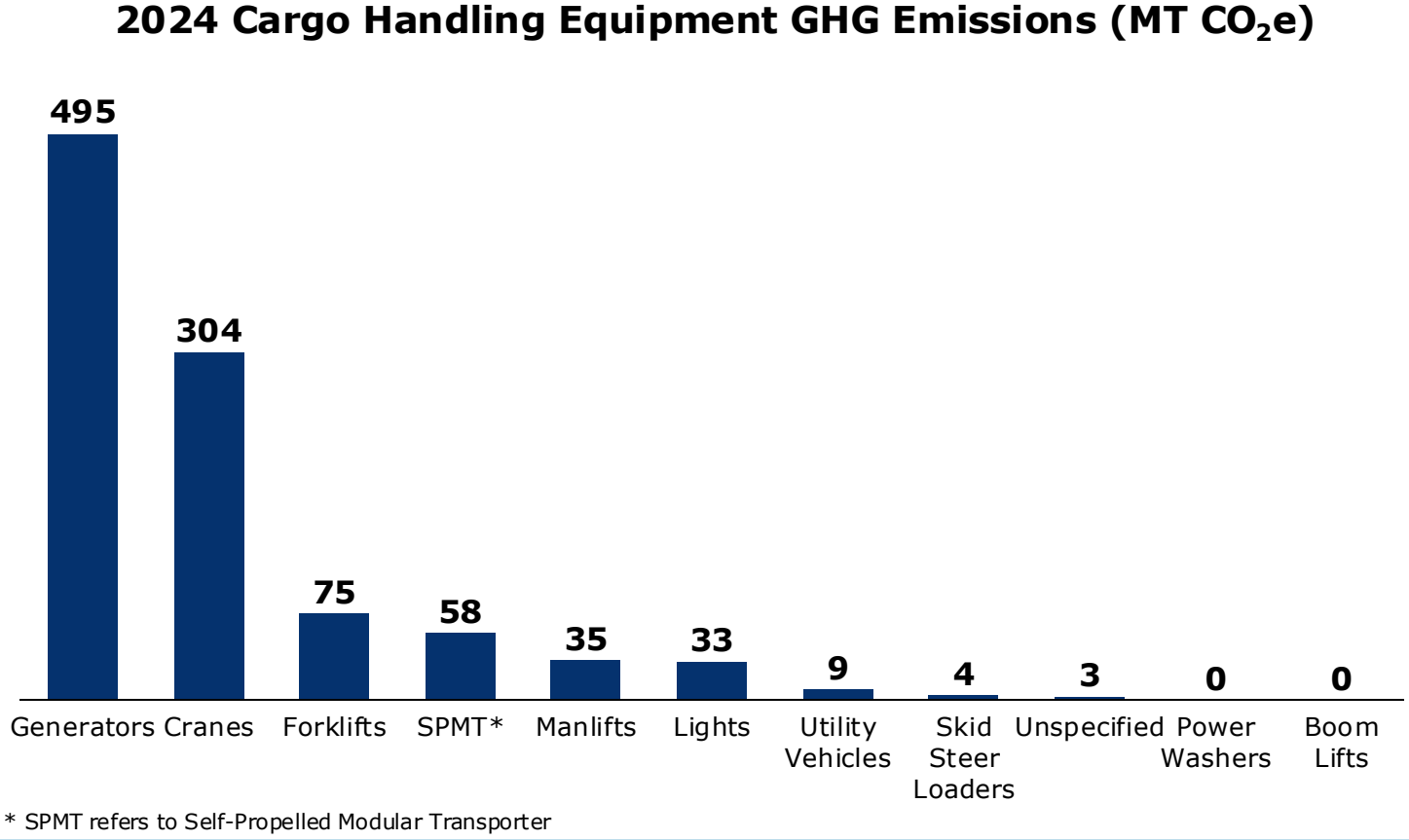

## Insights

- The majority of OGV emissions, such as PM and NOx, originate from berthing operations when **auxiliary engines and boilers run** while propulsion engines are inactive
- Using **shore power (cold ironing)** during berthing can help reduce emissions and will be considered as a possible approach for the future emission reduction strategies

# Cargo Handling Equipment

- Generators
- Cranes
- Manlift
- Lights
- Self-Propelled Modular Transporter (SPMT)
- Utility Vehicles
- Skid Steer Loader
- Forklift
- Power Washer
- Boom Lift
- etc.

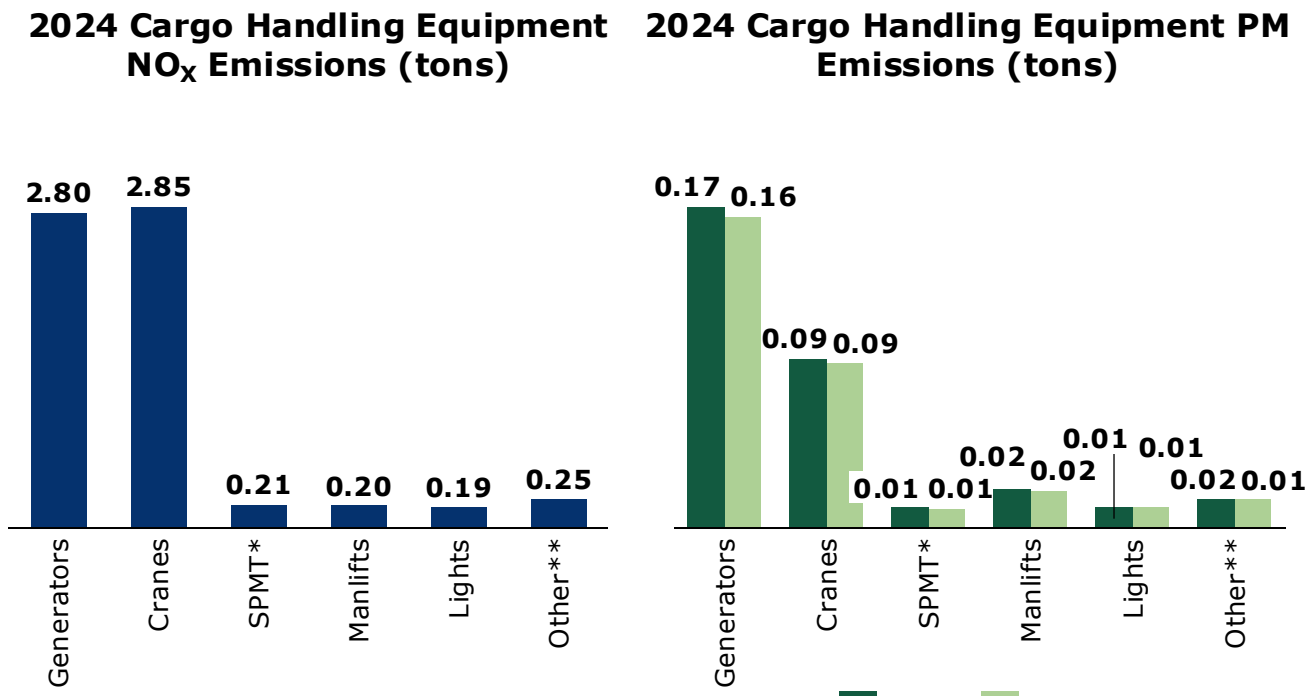
# Cargo Handling Equipment (CHE) – GHG Emissions




## Insights

- CHE GHG emissions fall within Scope 3
- **Generators and cranes** are the largest contributors to GHG emissions of all CHE sources, aligned with their proportion of fuel consumed in 2024
- All CHE uses diesel fuel, but emissions factors from EPA MOVES model **differ by type of equipment**
- Annual fuel usage was **partially estimated,** as measured consumption data was available for April-December only
  - Collecting **full-year consumption data** would lead to more accurate results in the future
- Employing **more fuel-efficient models** or substituting for **hybrid or electric** equipment where feasible would reduce CHE emissions

# Cargo Handling Equipment (CHE) – $NO_x$ and PM




* SPMT refers to Self-Propelled Modular Transporter
** For both $No_x$ and PM, Other CHE sources include forklifts, utility vehicles, skid steer loader, power washers, boom lifts, and unspecified equipment

## Insights

- NOx and PM emissions are driven by **generators and crane usage**, similar to the trend observed for GHGs
- High NOx emissions from cranes[1] reflect larger fuel consumption from **older crane models,** which have lower NOx emission standards (controls)

| Equipment ID | Model Year | Rated Power (HP) | Annual Fuel Usage (gal) |
|---|---|---|---|
| PT50-2 | 2003 | 2000 | 11,979 |
| 1500T Crane | 2009 | 1,500 | 6,268 |
| 650T Crane | 2015 | 523 | 2,873 |
| 400T Crane | 2014 | 400 | 1,978 |
| 450T Crane | 2009 | 500 | 4,167 |
| RT 90 | 2022 | 280 | 1,867 |
| **Total** | | | **29,131** |

- As part of the decarbonization strategy, MassCEC may consider targeting older equipment in high use for **upgrade / replacement** where feasible

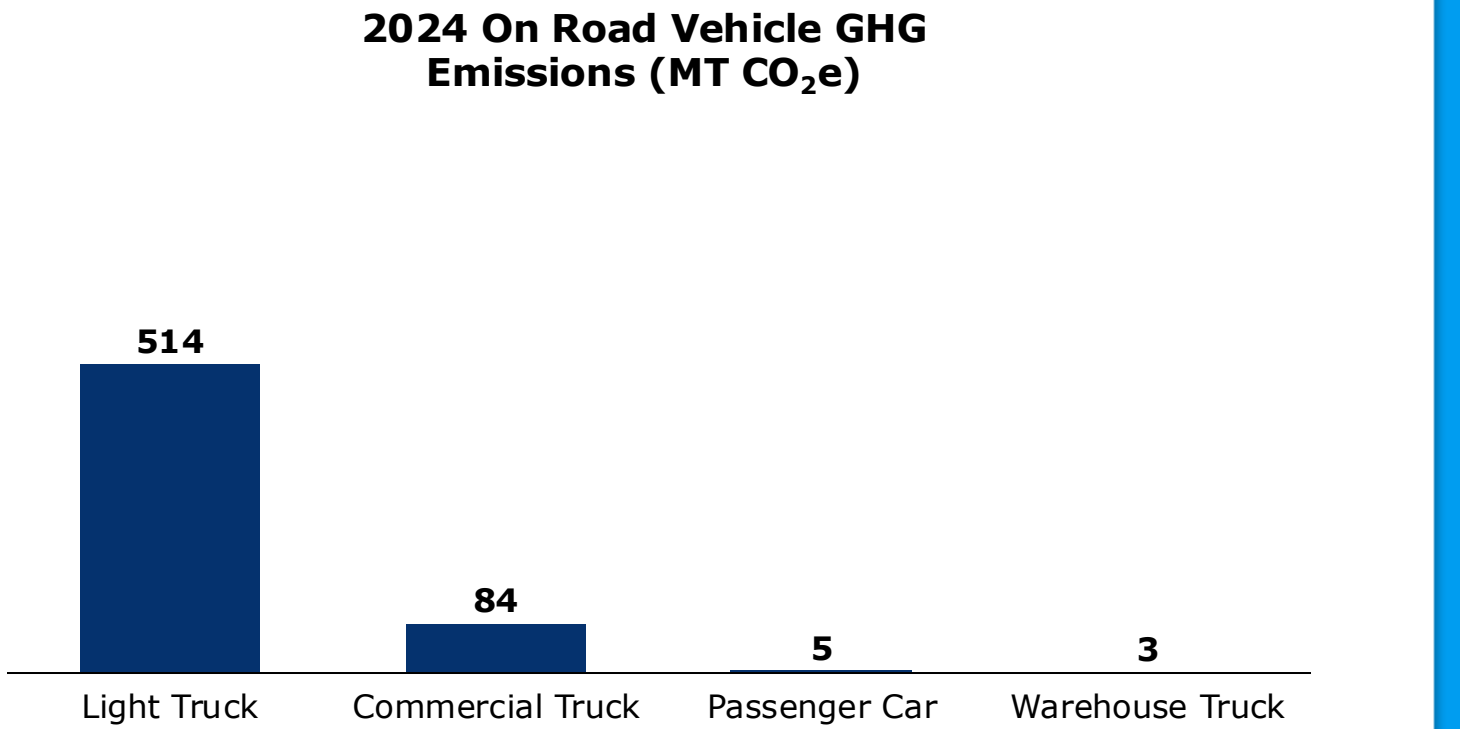
1 - For cranes, NOx and PM emission factors were selected based on Model Year (MY) data provided by tenants, reflecting specific equipment Tier levels, unlike other equipment types representing an average fleet. A fleet-wide average EF based on MOVES US National Defaults was implemented for pieces for which no MY data was available.

# On-road Vehicles

Vehicle traffic includes:

- Passenger vehicles
- Light trucks
- Commercial trucks
- Warehouse trucks

# On-Road Vehicles - GHGs

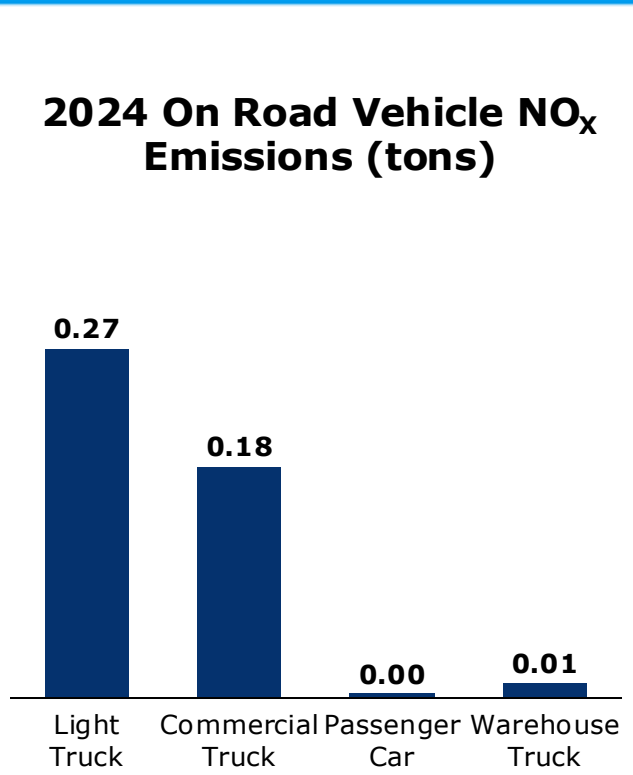


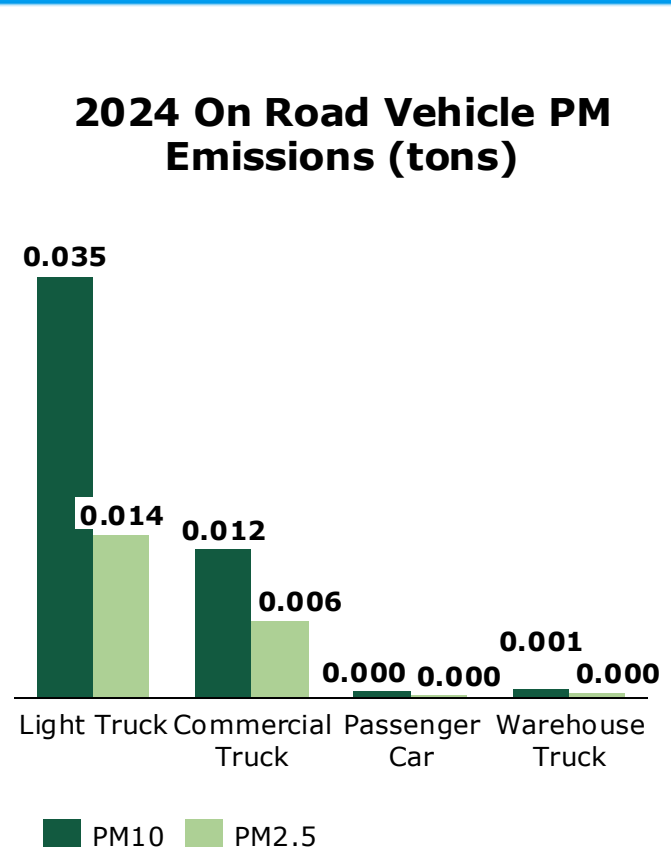

## Insights

- On-road vehicles represent the **smallest share of Scope 3 emissions (6%)**
- **Light trucks account for more than 90%** of the annual on-road vehicle visits to the NBMCT
- Vehicle emissions are estimated based on a one-week representative study of vehicle visits conducted by MassCEC[1]
  - Monitoring vehicle visits over an extended timeframe could enhance the precision of these estimates
- Due to the involvement of third parties and its **minor impact on the overall inventory**, it is recommended to **deprioritize** this category in the strategy

1 – This study included all vehicles except warehouse trucks, whose activity is approximated at about one visit per week by MassCEC

# On-Road Vehicles – $NO_x$ and PM




## Insights

- On-road vehicle emissions contribute **just 1-2% of the total inventory** for NOx and PM pollutants
- Given the participation of third parties and the **minimal effect on the overall inventory**, it is advisable to lower the priority of this category in the strategy

# Next steps



# Emissions Inventory Improvements

## Expand the scope of inventory:

- Expand the analysis to include additional supply-chain (Scope 3) emissions in future inventory updates will **provide better insight** into key emissions sources for the terminal, such as
  - Purchased goods and services (cat. 1): MassCEC contracted services or goods
  - Capital goods (cat. 2): maintenance dredging or any construction activities
  - Upstream fuel and energy (cat. 3): relevant if renewable energy contracts are going to be considered for strategy.

## Improve the data quality of the inventory:

- Improving data quality of key emission sources will **improve the accuracy** of the overall inventory and help MassCEC better understand its key emission sources
- On-road vehicles:
  - Data was derived from limited samples, and information on fleet composition was not available
  - Extending the **monitoring period of vehicle visits** could improve the accuracy of these estimates
- Generators:
  - Obtaining **model year details** from GE and APM or future CHE operators may enhance the precision of emissions calculations, as current estimates use a default fleetwide average
- Cargo Handling Equipment (CHE)
  - Most CHE emissions were based on fleet-average factors from EPA MOVES, reflecting U.S. default values
  - Future inventory rounds could benefit from **requesting fleet equipment lists from tenants and vendors** to better specify engine sizes and tier classifications

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# Details on approach and emission factor overview

| Source | Applicability | Data Source | Approach | Emission Factors Source |
|---|---|---|---|---|
| Stationary Combustion | NBMCT | Utility meter readings | Fuel-based method using primary data for natural gas consumption for building heating. | U.S. EPA Emission Factor Hub and U.S. EPA AP 42, Fifth Edition, Volume I Chapter 1: External Combustion Sources |
| Purchased Electricity | NBMCT | Utility meter readings | Location-based and market-based calculations using primary data and grid average and utility-specific emission factors. | eGRID and utility-specific factors |
| Fugitive Emissions | NBMCT | N/A | Only R-22 was reported by NBMCT as refrigerants used onsite – this is not considered an in-scope GHG and therefore has been excluded from the inventory. | N/A |
| On-road Mobile | Third-party suppliers & NBMCT | Vehicle Entry Count | Annual trips estimated based on MCT's 1-week traffic study from both terminal entrances. Assumes this is reflective of typical traffic and is inclusive of miles driven between the terminal and the first intermodal point.<br><br>Average trip length assumed to be 20 miles based on the maximum established off-site boundary. | GHG Protocol Cross-Sector Tools Emission Factors and U.S. EPA Motor Vehicle Emission Simulator (MOVES) |
| Off-road Mobile | Tenants and their contractors | Fuel consumption by piece of equipment | Fuel-based method using primary data from fuel provider. Assumes fuel list provided by GE is inclusive of all offroad/CHE equipment. | U.S. EPA Emission Factor Hub, U.S. EPA Motor Vehicle Emission Simulator (MOVES), and U.S. EPA Port Emissions Inventory Guidance |

# Details on approach and emission factor overview (cont.)

| Source | Applicability | Data Source | Approach | Emission Factors Source |
|---|---|---|---|---|
| Ocean Going Vessels | Third-party suppliers | Vessel Call Logs | • Hotelling calculations based on primary data from time logged at berth<br>• Arrivals, departures, and internal movements based on speeds provided by pilots and assumed travel distance | U.S. EPA Port Emissions Inventory Guidance |
| Harbor Craft | Third-party suppliers | Vessel Call Logs | • Hotelling calculations based on primary data from time logged at berth<br>• Arrivals, departures, and internal movements based on speeds provided by pilots and assumed travel distance | U.S. EPA Port Emissions Inventory Guidance |
| Barge-Mounted generators | Third-party suppliers | Vessel Call Logs<br><br>Supplier generator specifications | • Generator run time assumes that the generator is running during transit, and 3 hours for loading for each call<br>• Generators characteristics obtained from public article on NBMCT's specialty barges | U.S. EPA Motor Vehicle Emission Simulator (MOVES), and U.S. EPA Port Emissions Inventory Guidance |