National Port Strategy Assessment

Presented by:

United States Environmental Projection Agency

Office of Transportation and Air Quality

Tuesday, November 29, 2016 at 2:00 pm – 3:00 pm EST

Thursday, December 15, 2016 at 1:00 pm – 2:00 pm EST

Housekeeping

- Please use the Q&A pod within Adobe Connect to ask questions. We will try to respond to as many as possible throughout the webinar

- Please direct any technical issues to: vangessel.benjamin@epa.gov

- **IMPORTANT NOTE:** If prompted for audio options, please select “Listen Only”. Audio should be coming through your computer’s speakers. Please ensure that your computer’s volume is properly adjusted.

Agenda

- Why Focus on Ports?
- Understanding Emissions Trends
- Strategies and Scenarios to Reduce Future Emissions
- Key Findings
- Questions

Why Focus on Ports?

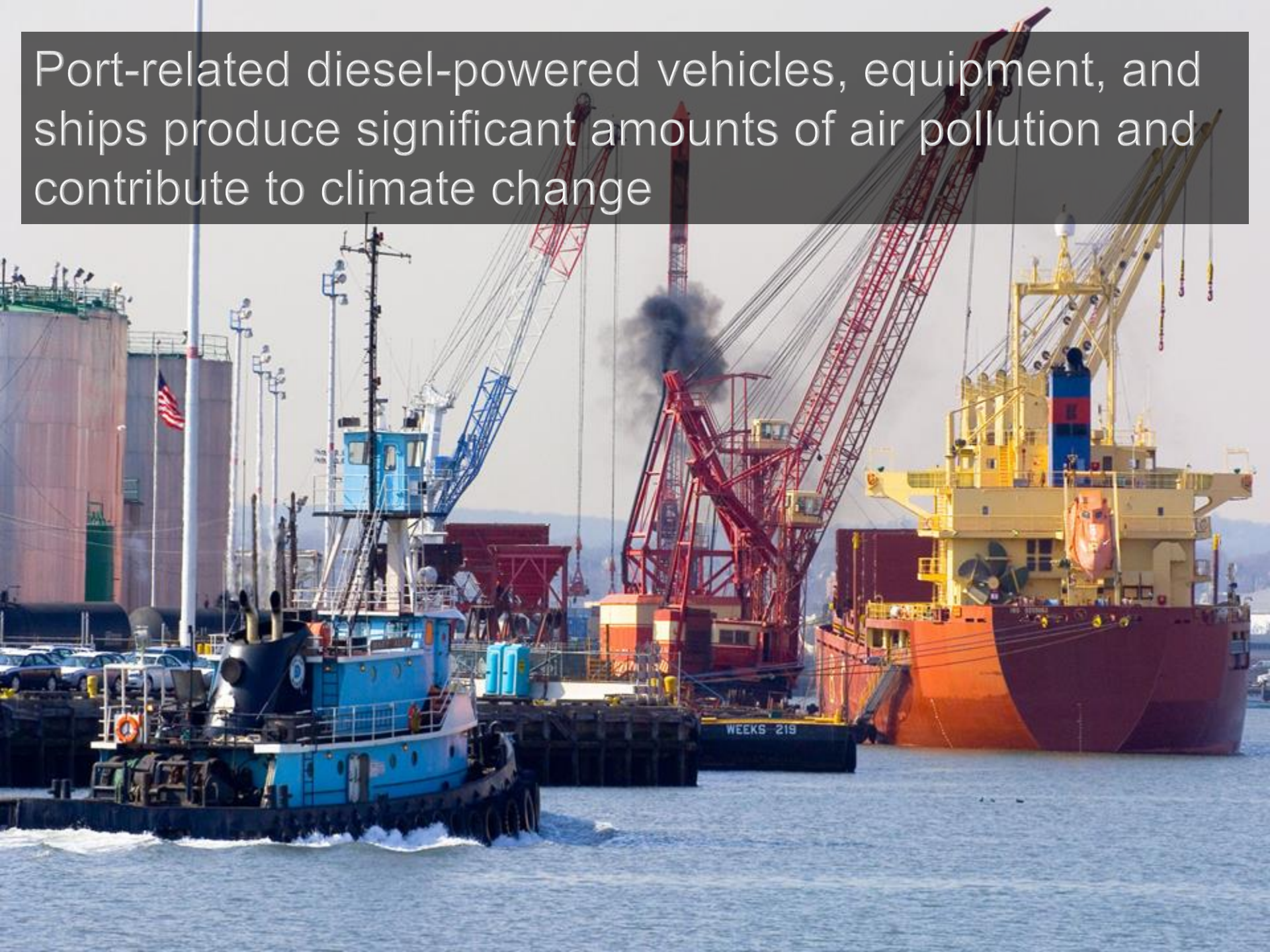
Why Focus on Ports?

- Ports are an important part of the U.S. economy with expected growth in the future
- Port-related diesel emissions impact public health and the climate
- There is a need for better data, emission inventories, and other support for environmental planning and decision-making

The American Association of Port Authorities estimates that seaports alone account for more than 23 million jobs in the United States


The U.S. Army Corps of Engineers estimates that bigger Post-Panamax size ships will represent 62% of total global container ship capacity by 2030

Port-related diesel-powered vehicles, equipment, and ships produce significant amounts of air pollution and contribute to climate change

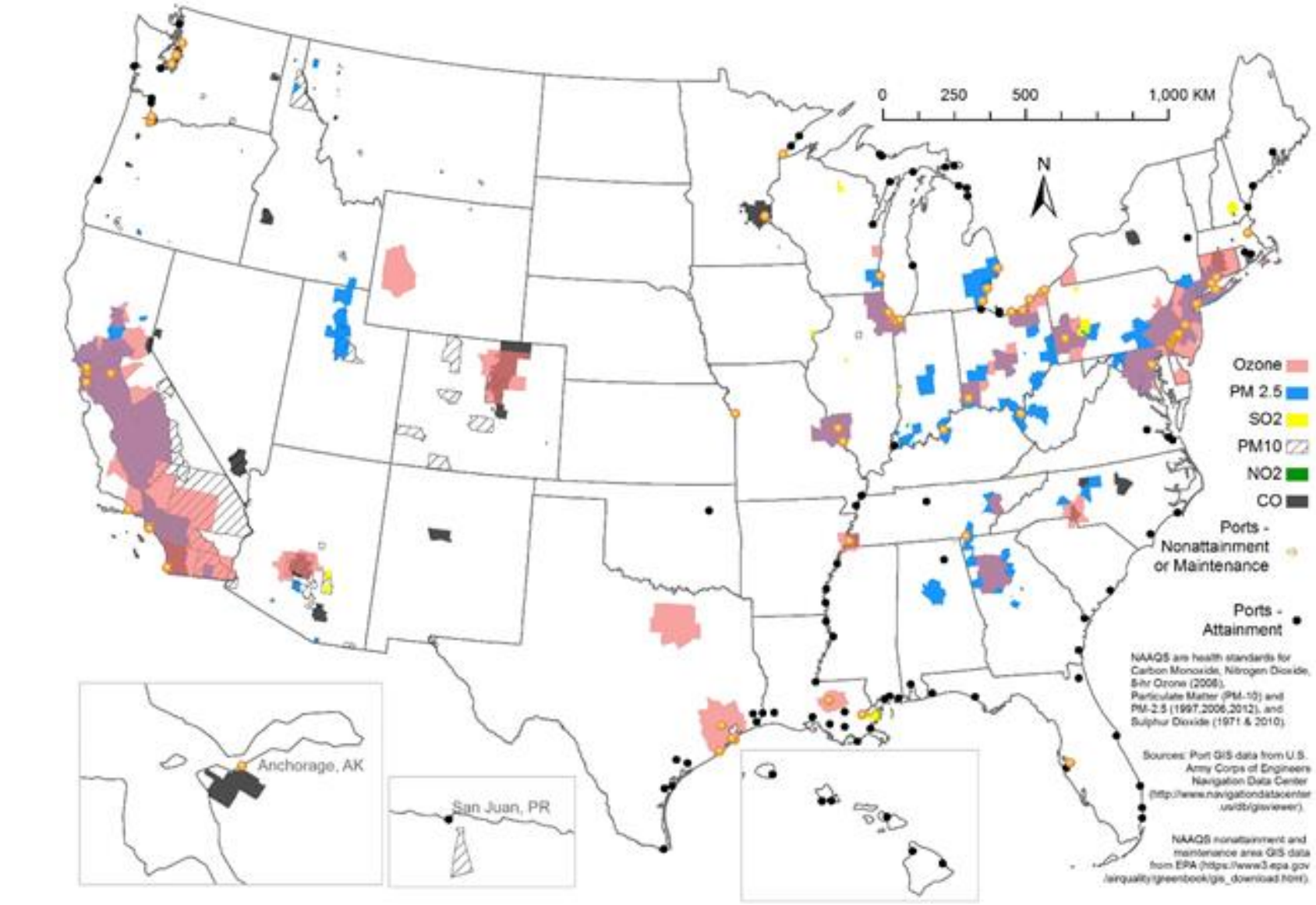


Public Health and Climate Impacts

- Diesel emissions, such as $PM_{2.5}$, NOx, and air toxics, can contribute to significant health problems, and diesel emissions are considered a likely human carcinogen
- Many ports and port-related corridors are located in areas with high percentages of low income and minority populations who are often disproportionally impacted by higher levels of diesel emissions
- Port-related diesel emissions, such as CO_2 and black carbon, also contribute to climate change, with significant health and environmental impacts

EPA estimates that approximately 39 million people in the United States currently live in close proximity to ports

Ports in Nonattainment and Maintenance Areas



EPA Ports Initiative: Areas of Focus

Remove Barriers to Technology Development and Application

Emission Inventories, Tools & Metrics

Create a Bridge to EPA/Federal Partners

Develop Strategies for Community–Port Engagement

EPA Ports Initiative: Background

- *National Conversation With Port Stakeholders*

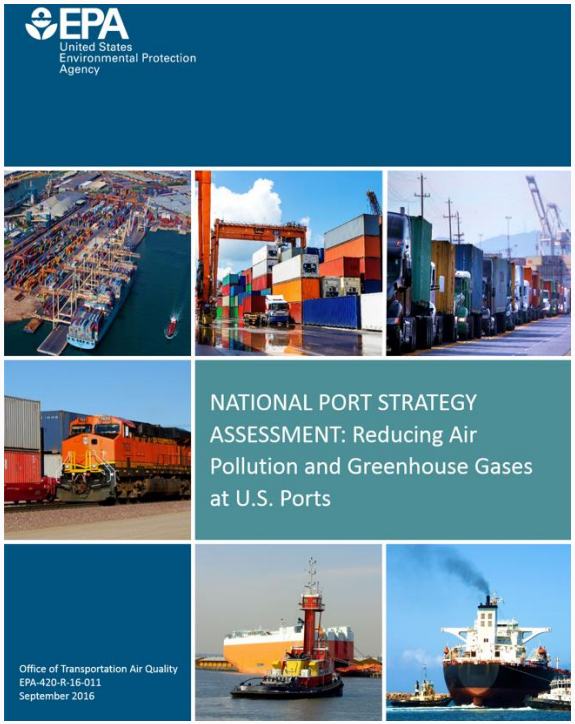
  Webinar Listening Sessions

  - 9/27/2013: *Promoting Port Stakeholder Success*
  - 1/14/2014: *Goods Movement and Ports: Collaborative Solutions & Community Impacts*
  - 3/04/2014: *Advancing Sustainable Solutions*

- 4/08/2014: Port Stakeholders Summit
- May/2014: Formed Ports Initiative Workgroup under Mobile Sources Technical Review Subcommittee (MSTRS) FACA
- 9/07/2016: Clean Air Act Advisory Committee (CAAAC) approved MSTRS Ports Workgroup recommendations

Recent Release

- EPA released the ***National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports*** on September 22, 2016
- Developed in consultation with Clean Air Act Advisory Committee's Mobile Sources Technical Review Subcommittee (MSTRS)
- Available for download at: https://www.epa.gov/ports-initiative/national-port-strategy-assessment



Purpose of the Assessment

- Examine current and future emissions from a variety of diesel sources operating at ports
- Explore the potential effectiveness of a range of emission reduction strategies
- Inform EPA's Ports Initiative and voluntary port-related efforts across the country

Overview of the Assessment

- Estimated 2011 baseline emissions of selected pollutants
  - NOx, $PM_{2.5}$, VOC, SO_2, CO_2, BC, and air toxics (acetaldehyde, benzene, and formaldehyde)
- Estimated business-as-usual (BAU) inventories for 2020, 2030, and 2050 (CO_2 only)
- Estimated potential for emission reductions of 2 scenarios:
  - Scenario A: Faster introduction of newer technologies in port vehicles and equipment beyond what would occur through normal fleet turnover
  - Scenario B: Further acceleration of clean diesel and zero emissions vehicles and equipment beyond Scenario A
- Some operational strategies were also included in both scenarios for some mobile source sectors

Types of Emissions in Assessment

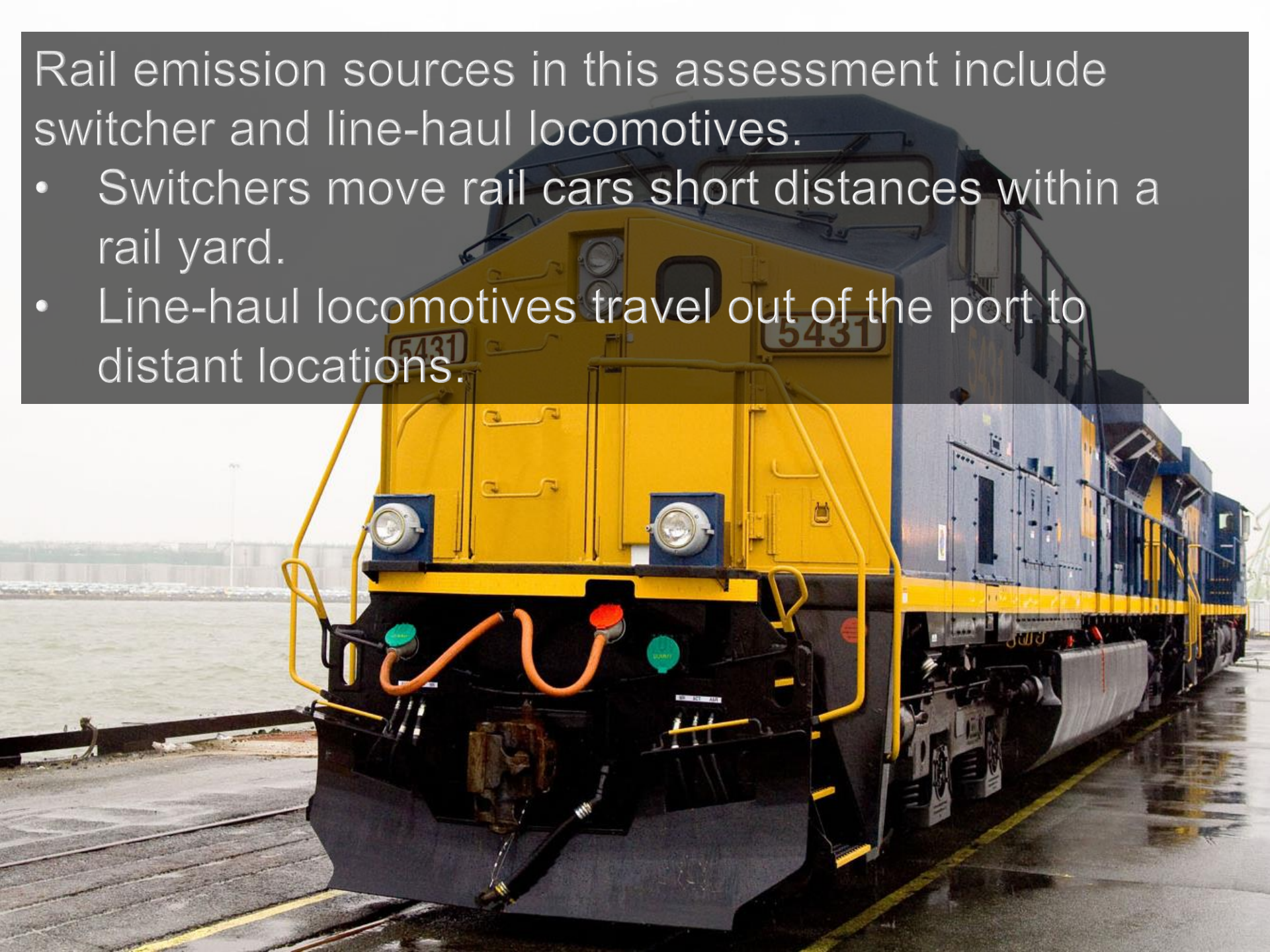
- Examines emissions from 5 mobile source sectors:
  - Drayage Trucks*
  - Rail*
  - Cargo Handling Equipment (CHE)
  - Harbor Craft**
  - Ocean-Going Vessels (OGVs)**

* Modeling domain covered 0.5 km from port for rail and drayage trucks.
** Modeling domain covered 5-10 km from port for ships


Drayage trucks are combination short-haul trucks that move cargo into and out of ports. Drayage trucks typically travel short distances to and from the port to a nearby rail yard or distribution center.

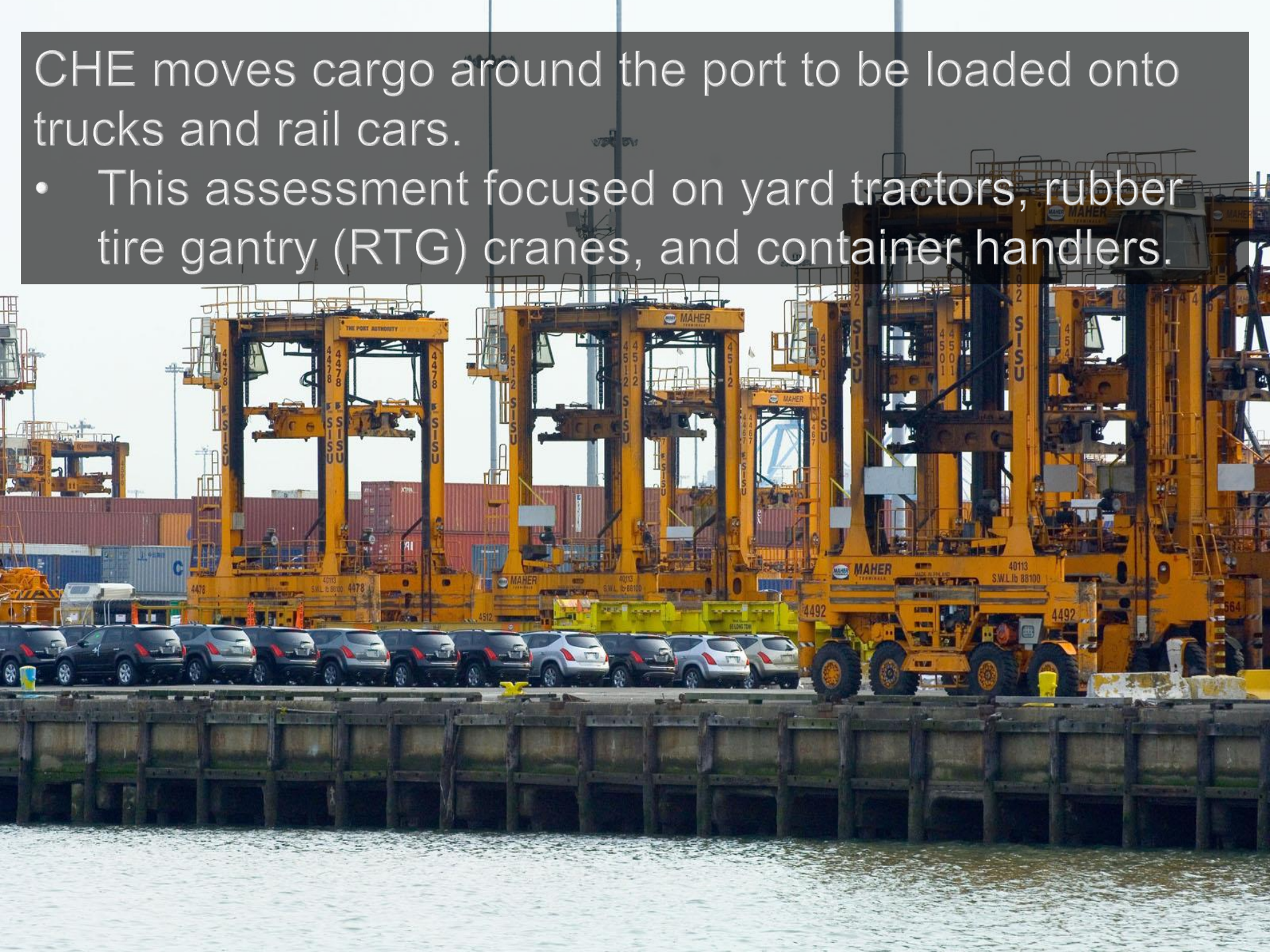
Rail emission sources in this assessment include switcher and line-haul locomotives.

- Switchers move rail cars short distances within a rail yard.
- Line-haul locomotives travel out of the port to distant locations.



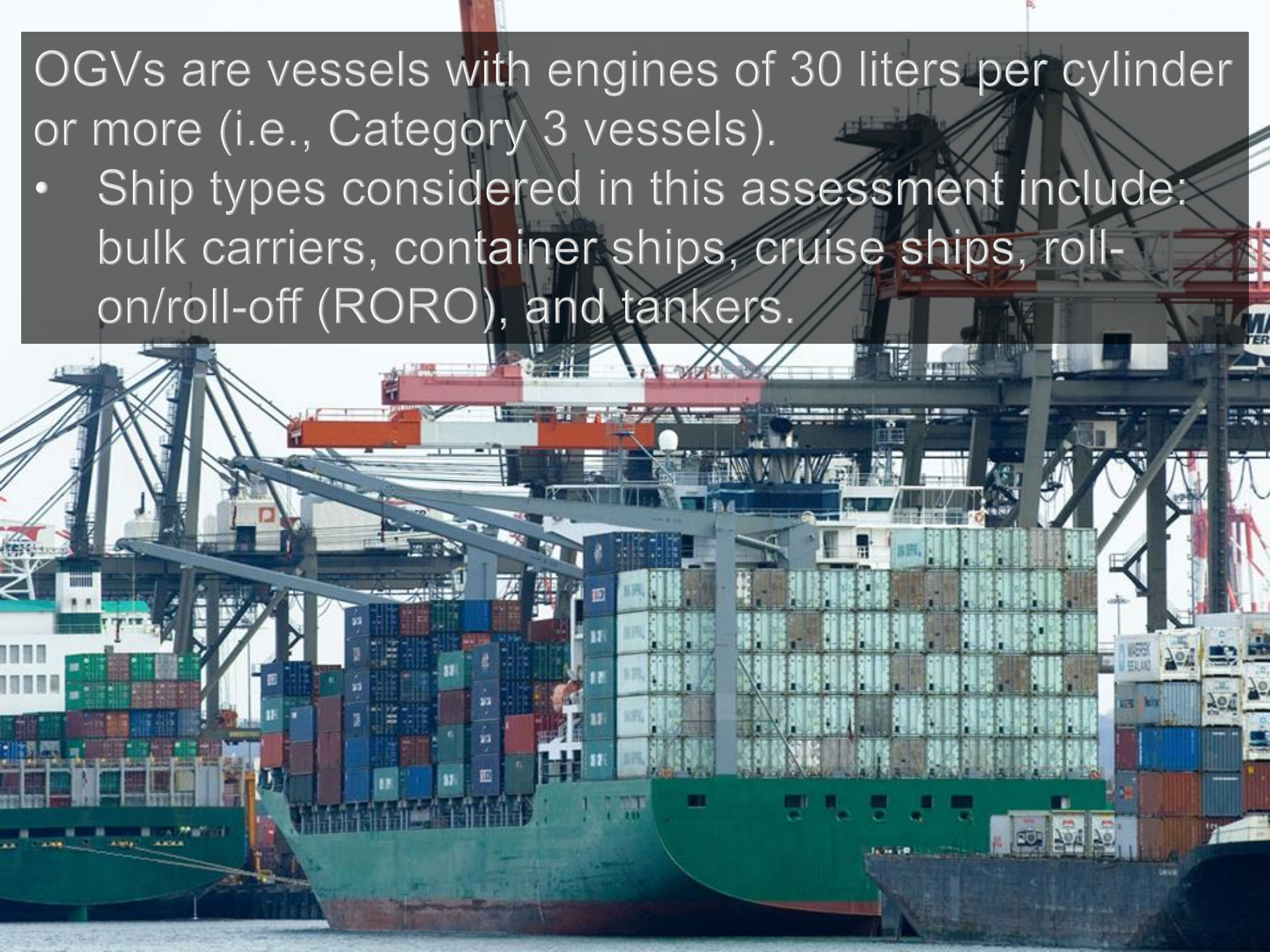
CHE moves cargo around the port to be loaded onto trucks and rail cars.

- This assessment focused on yard tractors, rubber tire gantry (RTG) cranes, and container handlers.



Harbor craft are vessels with engines less than 30 liters per cylinder and are classified as Category 1 and 2 vessels.

- This assessment focused on tugs and ferries.



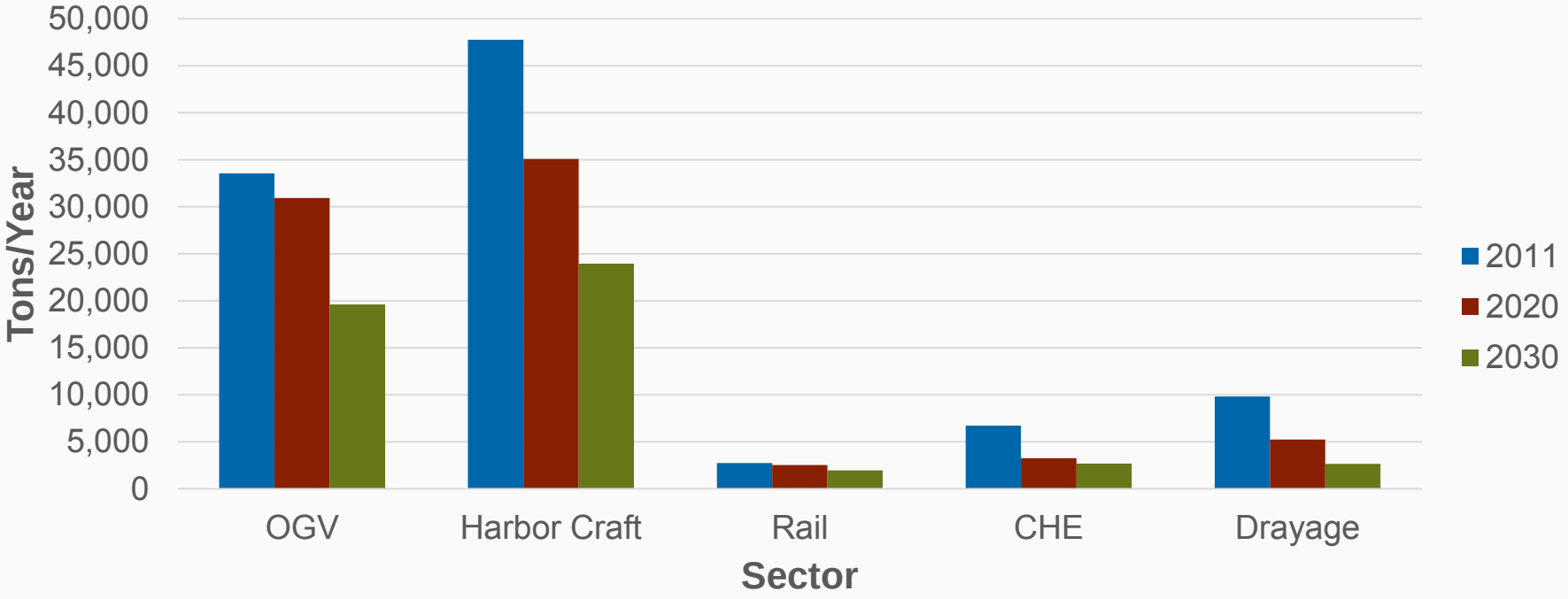
OGVs are vessels with engines of 30 liters per cylinder or more (i.e., Category 3 vessels).

- Ship types considered in this assessment include: bulk carriers, container ships, cruise ships, roll-on/roll-off (RORO), and tankers.

Understanding Current and Future Trends of Port-related Emissions

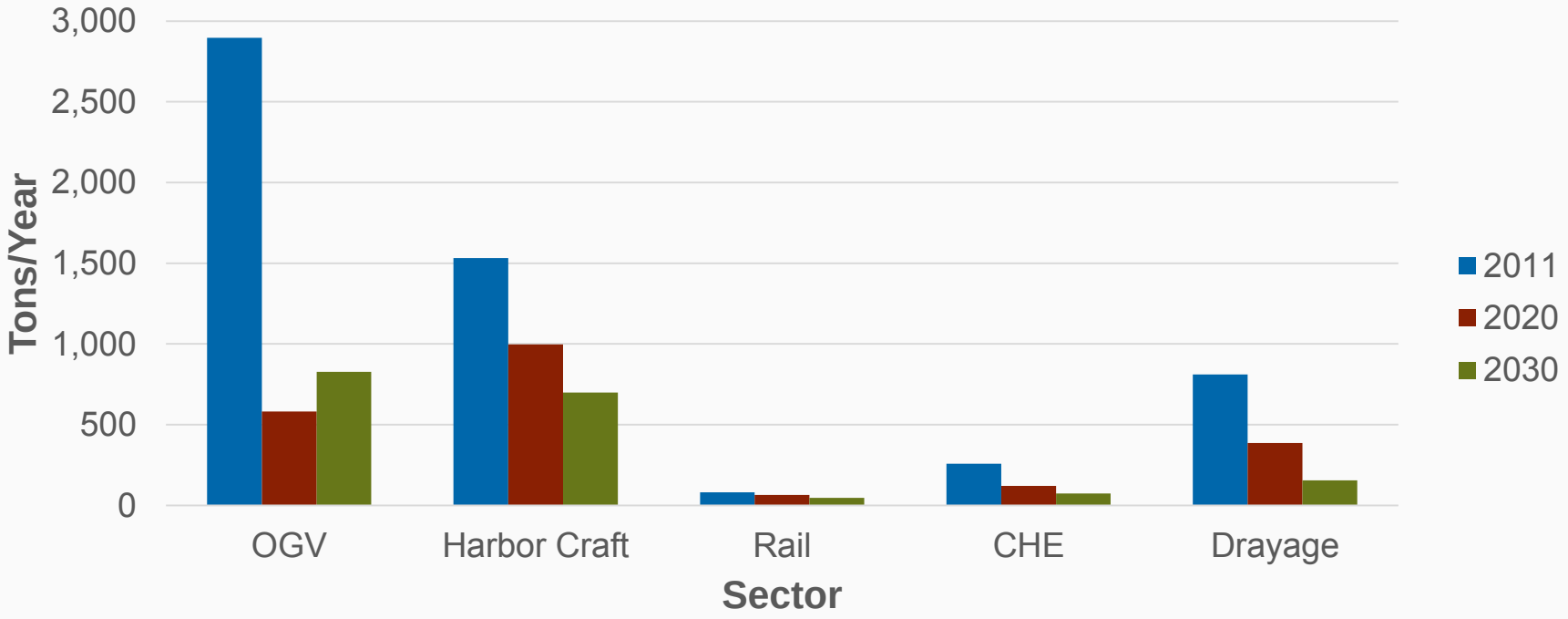
Where are we starting from?

Business As Usual Total NOx Emissions Aggregated by Sector, Tons/Year



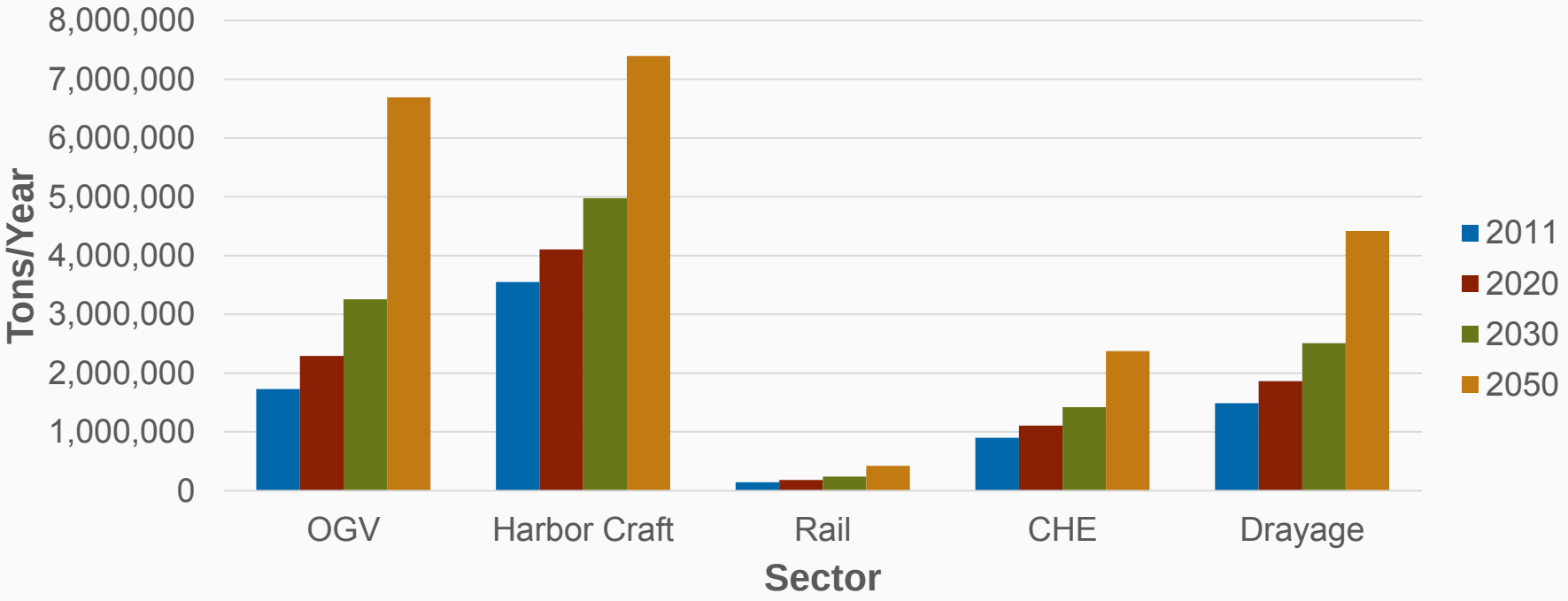
Note: Modeling domain covered 5-10 km from port for ships and 0.5 km from port for rail and drayage trucks.

Business As Usual Total $PM_{2.5}$ Emissions Aggregated by Sector, Tons/Year



Note: Modeling domain covered 5-10 km from port for ships and 0.5 km from port for rail and drayage.

Business As Usual Total CO_2 Emissions Aggregated by Sector, Tons/Year



Note: EPA's Phase I and II HD GHG truck regulations and the IMO's energy efficiency design index (EEDI) requirements are not reflected in these results. If included, we would expect smaller increases in these sectors in 2030 and 2050.

Strategies and Scenarios to Reduce Future Emissions

What is the potential?

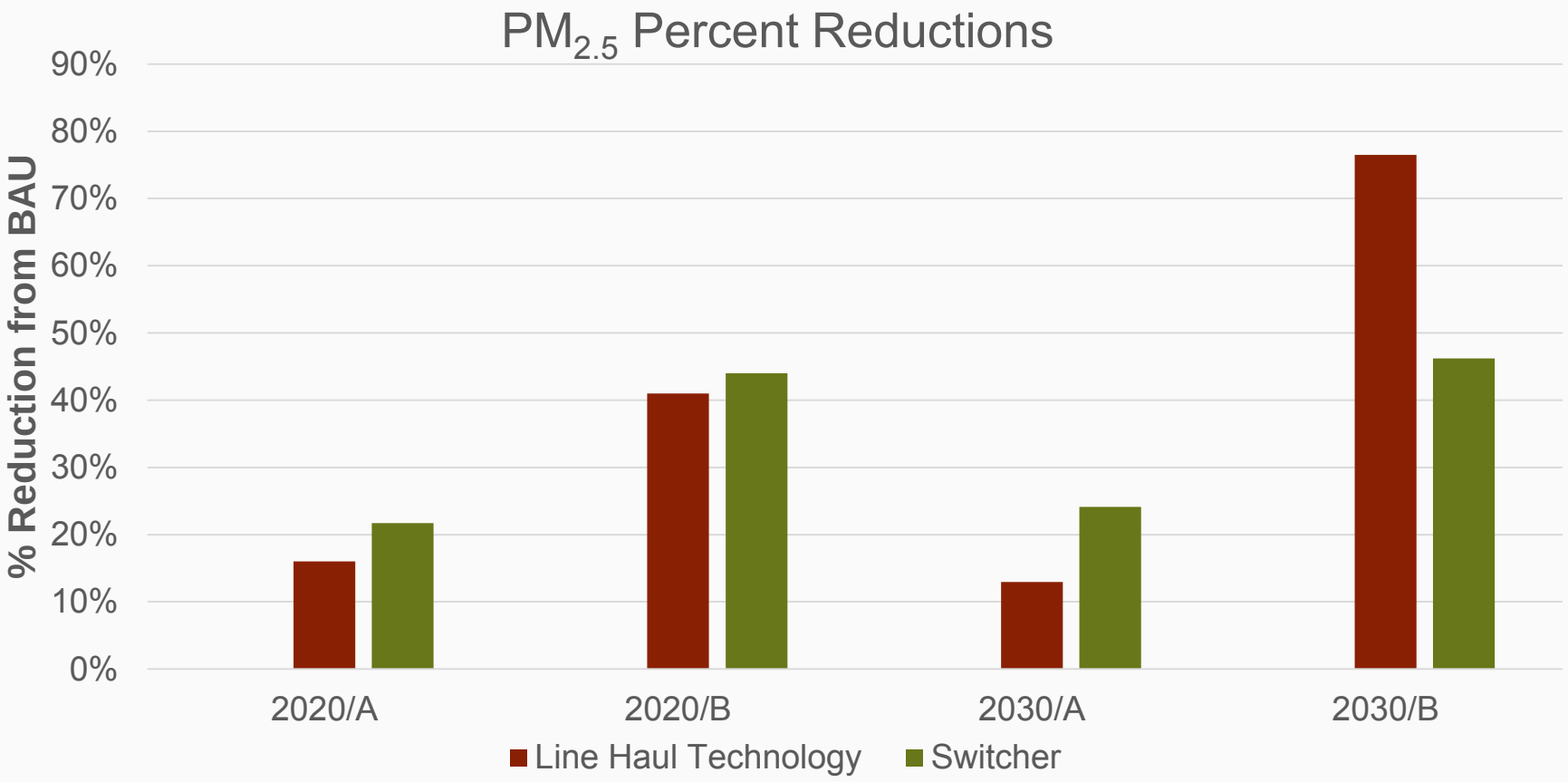
Non-OGV Strategies Modeled

Mobile Source Sector	Strategy	Applied to
Drayage Trucks	Cleaner Technology	On-road Trucks
	Operational Improvements	
Rail	Cleaner Technology	Line Haulers, Switchers
	Operational Improvements	Line Haulers
Cargo Handling Equipment	Cleaner Technology	Yard Trucks, RTG Cranes, Container Handlers
Harbor Craft	Cleaner Technology	Tugs, Ferries

Example: Rail Strategy Scenarios

Scenario	Line-haul Technology Strategy	Switcher Technology Strategy
2020/A	Replace 50% of Tier 0+ engines with Tier 2+ engines	Replace 50% of Pre-Tier 0 engines with 95% Tier 2+ engines and 5% Tier 4 Genset
2020/B	Replace 100% of Tier 0+ engines with 50% 2+ engines and 50% Tier 4 engines	Replace all Pre-Tier 0 engines with 90% Tier 2+ and 10% Tier 4 Genset
2030/A	Replace 100% of Tier 1+ and earlier engines with 50% 2+ engines and 50% Tier 4 engines	Replace all Pre-Tier 0 engines and 20% of Tier 0+ with 90% Tier 2+ engines and 10% Tier 4 Genset
2030/B	Replace all pre-Tier 4 engines with Tier 4 engines	Replace all Pre-Tier 0 engines and 40% of Tier 0+ with 70% Tier 4 engines and 30% Tier 4 Genset

Potential Reductions: Rail Strategy



OGV Strategies

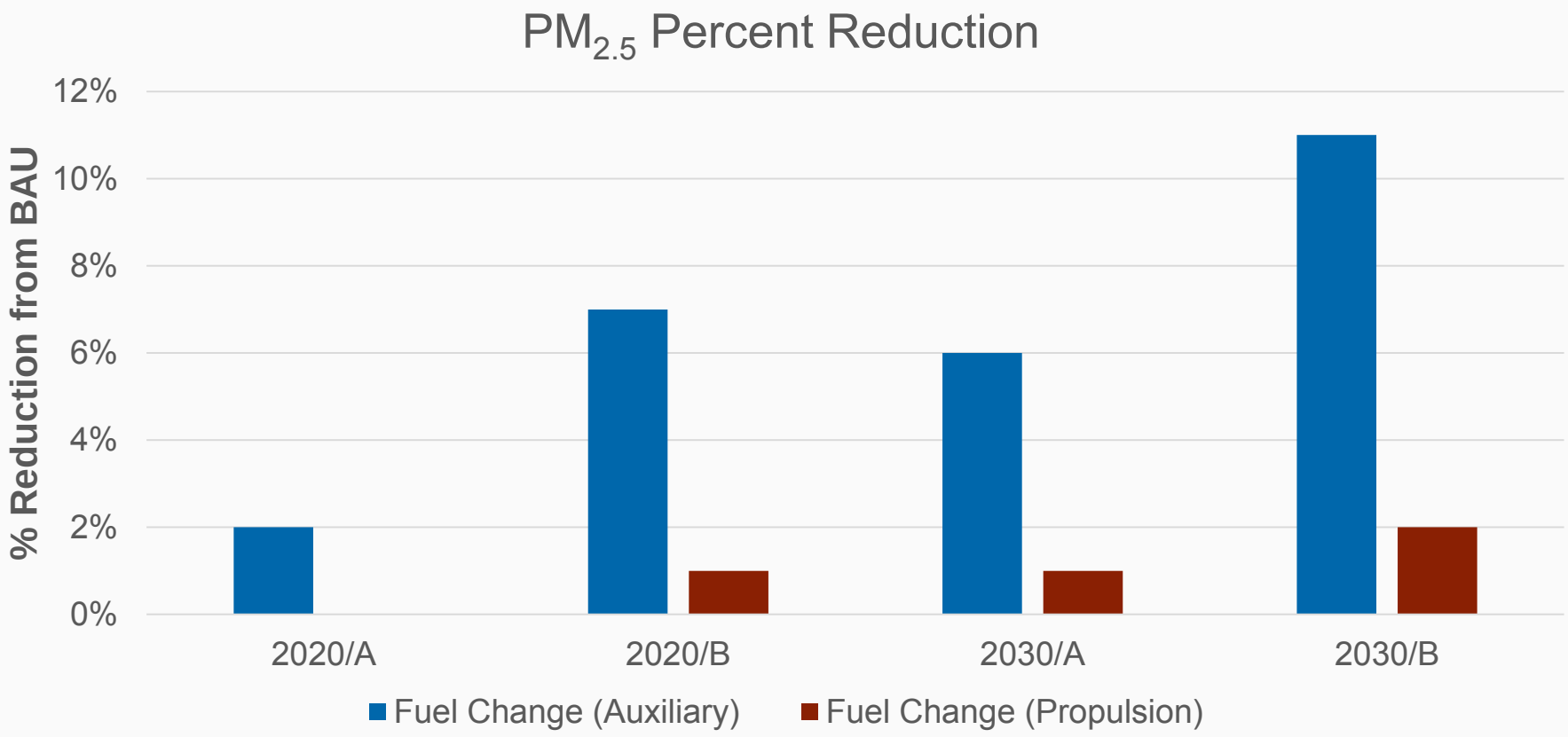
Strategy:	Applied to:
Fuel Changes (lower sulfur levels, LNG)	Propulsion & Auxiliary Engines
Shore Power	Frequent Callers Only
Advanced Marine Emissions Control Systems (AMECS)	Non-frequent Callers Only (container & tanker)
Reduced Hoteling	Container Ships Only

OGV Example: Fuel Change Strategies

- Switch to lower sulfur diesel
  - For bulk carriers, container ships, passenger ships, and tankers
  - Use either 500 or 200 ppm S diesel fuel for propulsion
  - Use ultra-low sulfur diesel (ULSD) for auxiliary
- Switch to liquified natural gas (LNG)
  - For bulk carriers, container ships, and tankers
  - In both propulsion and auxiliary engines
- Example:

Ship Type	2020/A	2020/B	2030/A	2030/B
Bulk	10% use 500 ppm sulfur fuel; 2% use LNG	25% use 500 ppm sulfur fuel; 10% use LNG	25% use 200 ppm sulfur fuel; 4% use LNG	50% use 200 ppm sulfur fuel; 15% use LNG

Potential Reductions: OGV Fuel Changes Strategy

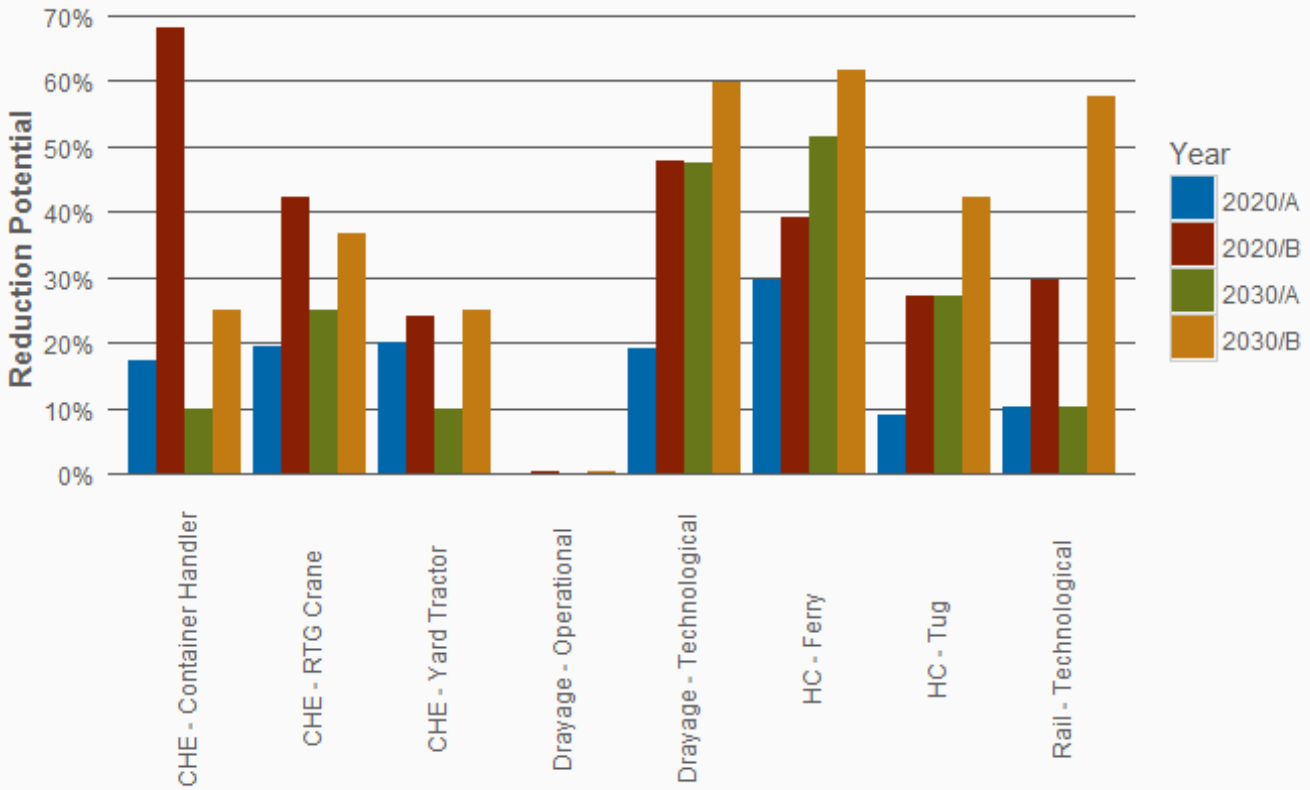


Key Findings of the National Port Strategy Assessment

What did we learn?

Progress is happening, but more emission reductions are possible

NOx Relative Reduction Potential of Non-OGV Sectors



We can reduce emissions with effective strategies that are currently available

Sector	Scenario Description
Drayage Trucks	Replace older diesel trucks with trucks that meet cleaner EPA standards and plug-in hybrid electric vehicles.
Rail	Replace older line-haul locomotive engines with cleaner technologies, including electric locomotives.
	Improve fuel economy.
	Replace older switcher locomotive engines with cleaner technologies and Generator Set (GenSet) technology.
Cargo Handling Equipment	Replace older yard truck, crane, and container handling equipment with cleaner technologies, including electric technologies.
Harbor Craft	Replace or repower older tugs and ferries with cleaner technologies, including hybrid electric vessels.
Ocean-going Vessels	Switch to lower sulfur fuel levels that are below EPA's regulatory standards, and liquified natural gas for certain vessel types.
	Utilize shore power to reduce hoteling of container, passenger, and reefer vessels.
	Apply Advanced Marine Emission Control Systems for container and tanker vessels.

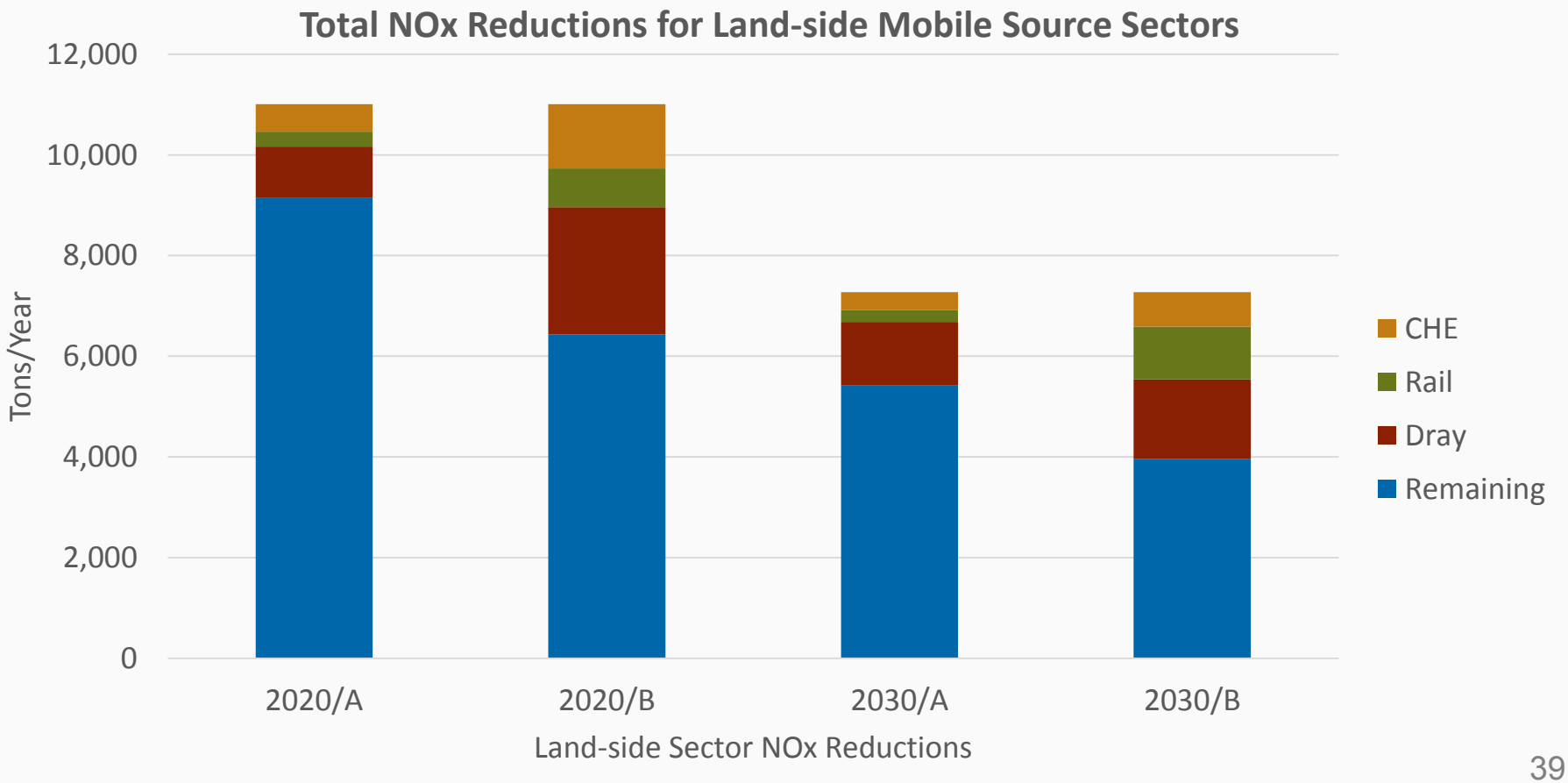
Replace older, dirtier diesel vehicles and equipment first

Strategy Scenario	Percent reduction from BAU			
	NOx		$PM_{2.5}$	
	2020	2030	2020	2030
Replace older drayage trucks	19–48%	48–60%	43–62%	34–52%
Replace older switcher locomotives	16–34%	17–43%	22–44%	24–47%
Replace older CHE	17–39%	13–25%	18–37%	12–25%
Replace or repower harbor craft	10–24%	25–38%	13–41%	28–37%
Reduce OGV hoteling emissions with shore power	4–9%	7–16%	3–8%	7–16%

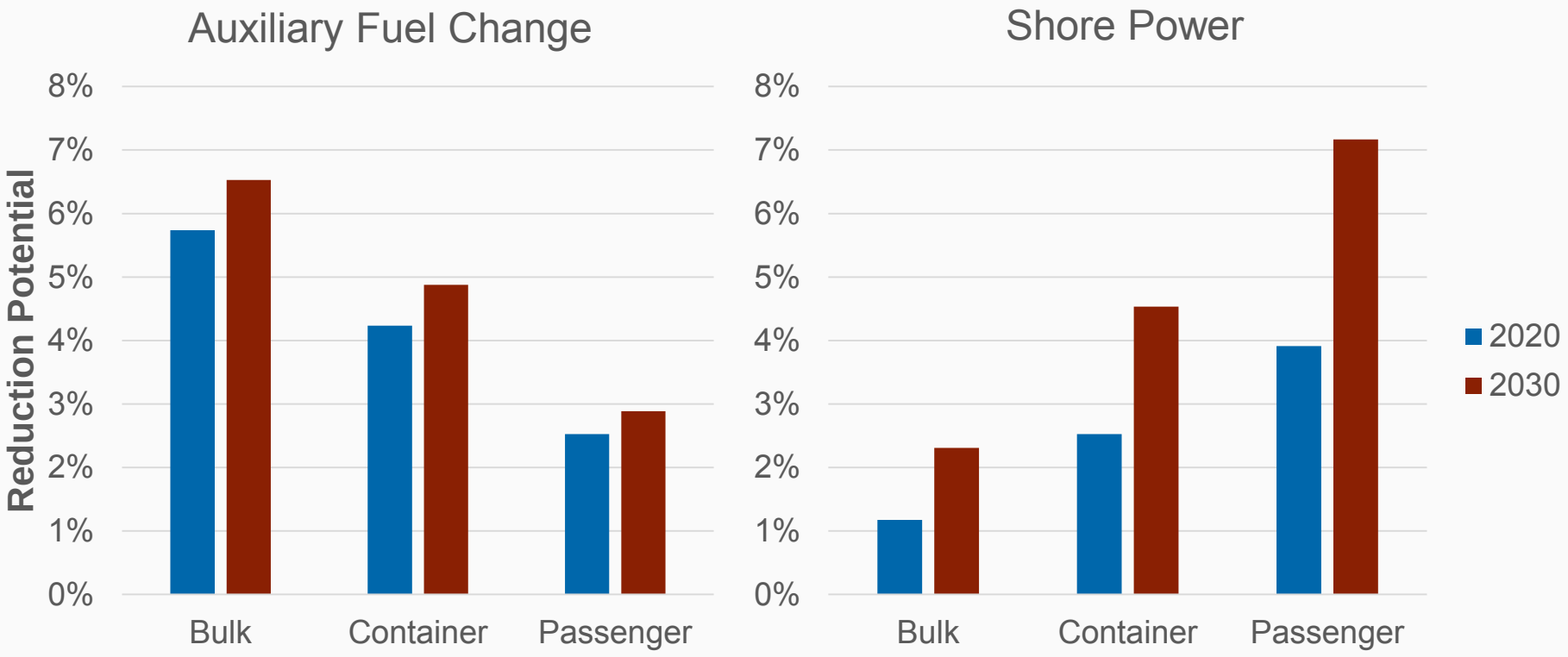
CO_2 continues to increase, but effective strategies are available

Strategy Scenario	% reduction from CO_2 BAU	
	2030	2050
Replace older drayage trucks with plug-in hybrid electric trucks	0–4%	6–12%
Replace older locomotives with electric locomotives, GenSets, and fuel efficiency	3–6%	11–23%
Replace older CHE with electric technologies	7–18%	27–45%
Reduce OGV hoteling emissions with shore power	2–5%	4–10%

Reduction potential varies across mobile source sectors



Effective strategies are available for every type and size of port



More focus is needed to reduce port-related emissions

- This assessment is a tool to inform priorities and decisions about individual port areas
- When assessing strategies for a specific port area, here are some questions to consider:
  - Is there a port-specific emission inventory or clean air plan available to inform decisions?
  - What is the type and size of the port?
  - What source sectors are the most significant diesel emitters at the port?
  - How old are the diesel fleets of each port sector?
  - Is there an existing forum for stakeholder participation?

Additional Resources

- Press release, assessment documents, and EPA blog can be found at:
  - Assessment page
  - Press release
  - Main Report download
  - Executive Summary download
  - Report Appendices download
  - Blog post from Chris Grundler, Office Director of EPA's Office of Transportation Air Quality

- Direct inquiries about the NPSA and Ports Initiative to talkaboutports@epa.gov

Questions?

Appendix

Overview of Strategy Scenarios

Sector	Strategy	Scenario Summary Description
Drayage Trucks	Technological	Truck replacement strategies to accelerate turnover to cleaner EPA standards and plug-in hybrid electric vehicles (PHEVs)
	Operational	Reduced gate queues
Rail	Line-haul Technology	Locomotive engine replacement strategies
	Line-haul Operational	Fuel economy improvements
	Switcher Technology	Switcher locomotive engine replacement strategies, including use of Gensets

Overview of Strategy Scenarios

Sector	Strategy	Scenario Summary Description
CHE	Yard Truck	Yard truck replacement strategies, including battery electric vehicles
	RTG Crane	Crane replacement strategies, including electric cranes
	Container Handler	Container handling equipment replacements, including electric equipment
Harbor Craft	Tug	Tug repower and replacement strategies, including hybrid electric vessels
	Ferry	Ferry repower and replacement strategies, including hybrid electric vessels

Overview of Strategy Scenarios

Sector	Strategy	Scenario Summary Description
OGV	Fuel Change in Propulsion Engines	Fuel use switch strategies to 500 ppm sulfur fuels, 200 ppm sulfur fuels, and liquified natural gas (LNG) for bulk, container, passenger, and tanker vessels
	Fuel Change in Auxiliary Engines	Fuel use switch strategies to ultra low sulfur diesel (ULSD) fuel and LNG for bulk, container, passenger, and tanker vessels
	Shore Power	Shore power for container, passenger, and reefer vessels
	AMECS	Advanced Marine Emission Control Systems (AMECS) for container and tanker vessels
	Reduced Hoteling	Hoteling time reduction for container vessels