



NORTHWEST PORTS
CLEAN AIR STRATEGY

IMPLEMENTATION REPORT

2018



Executive Summary

In 2013, the Port of Seattle (POS), Port of Tacoma (POT), and Port of Vancouver (VFPA) collaborated to create an updated Northwest Ports Clean Air Strategy (Strategy) with three objectives: reducing port-related air quality impacts of diesel particulate matter (DPM), reducing greenhouse gas (GHG) emissions, and helping meet air quality standards and objectives for the airshed.¹ The Strategy is being implemented in partnership with several agencies, including the U.S. Environmental Protection Agency, the Washington State Department of Ecology (Ecology), the Puget Sound Clean Air Agency, Environment Canada, BC Ministry of Environment and Climate Change Strategy, and Metro Vancouver (strategy partners). This 2018 Implementation Report summarizes the progress made toward the goals and performance targets identified in the 2013 updated Strategy, building on the progress outlined in the 2014, 2015, 2016 and 2017 reports. This report also highlights key demonstration projects and pilot studies undertaken by the Ports in 2018 that support the Strategy goals and provides a summary of initiatives underway in 2019.

The 2018 Implementation Report is the fifth to report performance against the 2013 Strategy goals. In July 2018, the Ports commenced a process to renew the strategy. This is expected to be completed in summer 2020. Implementation reports will continue to use the 2013 Strategy framework until the new strategy is fully adopted.

The strategy renewal process includes a review of the opportunities and challenges of this collaborative program, an updated future direction including a new vision and guiding principles, an updated framework and a defined approach for reporting progress during implementation.

Progress Toward Strategy Goals

The Ports conduct air emission inventories every five years, and these are used to track progress on the two strategy goals. Based on the 2015/2016 inventories, the ports collectively met the 2020 DPM and the 2020 GHG goals by the end of 2016.

Goal 1: Reduce DPM emissions per metric ton of cargo by 80% by 2020, relative to 2005

→ DPM emissions per metric ton of cargo were reduced by **80%** between 2005 and 2015/2016.

Goal 2: Reduce GHG emissions per metric ton of cargo by 15% by 2020, relative to 2005

→ GHG emissions per metric ton of cargo were reduced by **17%** between 2005 and 2015/2016.

¹ In August 2015, POS and POT formed The Northwest Seaport Alliance (NWSA) to jointly manage their marine cargo facilities and business. Since 2015 the NWSA has participated as a port partner in implementing the Strategy. For this report, the NWSA, and the ports of Seattle, Tacoma and Vancouver will be collectively referred to as “the Ports”.

Performance Target Status for 2018

Performance targets are organized into six sectors: ocean-going vessels (OGV), harbor vessels, cargo-handling equipment (CHE), trucks, locomotives and rail transport, and port administration. Table E-1 summarizes the progress toward the 2020 (and 2017 for drayage trucks) performance targets. Further details about this progress are included in the report.

Demonstration Projects and Pilot Studies in 2018

The Ports and their partners undertook pilot studies and demonstration projects in 2018. This report highlights project undertaken at the ports in 2018, as follows:




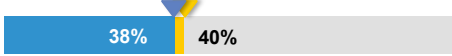



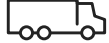
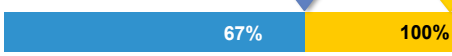


- Port of Vancouver: Low Carbon Drayage Study
- Port of Seattle: Electric Vehicle Charging Station Pilot
- Port of Tacoma: Waste Audit
- NWSA: Shore Power for Ocean-Going Vessels

Key Initiatives for 2019

The Ports have numerous initiatives planned and/or underway for 2019, including creating port-wide greenhouse gas reduction strategies; further international collaboration on emission reduction; planning for new shore power terminals, solar arrays and electric vehicle charging stations; creating new staff positions to focus further efforts on air quality and climate action initiatives; and many others outlined in Section 10.

In 2018, the Ports and strategy partners commenced a renewal of this Strategy with the intention to publish an updated Strategy in 2020 that builds on the strong collaboration established among the participants over the last decade. The ports are committed to continuing to promote emission reductions of both DPM and GHGs and to encouraging sustainable port operations.

Table E-1. Status of 2017 and 2020 Performance Targets for 2018

Sector		2020 Performance Targets*	Results	Status
	Ocean-Going Vessels	OGV 1: Ports track number of vessel calls with Tier 3 marine engines, shore power use, cleaner fuel, or other emission-reducing technologies	4 of 4 Ports track these vessels, and 4% of vessel calls met this standard at the 4 ports	✓ target met
		OGV 2: A: Ports participate in third-party certification programs B: 40% vessel calls participate in Port-designed or third-party certification programs that promote continuous efficiency improvements	A: 3 of 4 Ports participated in Green Marine B: 	A: not yet meeting B: ✓ target met
	Harbor Vessels	Harbor 1: A: Partners conduct outreach B: 90% of harbor vessel companies report best practices and engine upgrades	A: All ports conducted outreach events B: 50% of companies reported; 44% performed engine upgrades and best practices	A: ✓ target met B: not yet meeting
		Harbor 2: A: Ports participate in third-party certification programs B: 40% vessels participate in Port-designed or third-party certification programs	A: 3 of 4 Ports participated in Green Marine B: 	A: not yet meeting B: not yet meeting
	Cargo-Handling Equipment	CHE 1: 80% of CHE meets Tier 4 interim (T4i) emission standards or equivalent		not yet meeting
		CHE 2: A: Ports have fuel-efficiency plans for CHE B: 100% of terminals have fuel-efficiency plans for CHE	A: 2 of 3 Ports with CHE have plans B: 	A: not yet meeting B: not yet meeting
	Trucks	Truck 1: 100% of trucks meet or surpass EPA emission standards for model year 2007, by 2017		not yet meeting (2017 target)
		Truck 2: A: Ports and terminals have fuel-efficiency plans for trucks B: 50% truck companies have fuel-efficiency plans	A: 0 of 2 Ports with trucks and 2 of 10 terminals at 1 of the ports had fuel-efficiency plans for trucks B: 23% of truck companies participated in SmartWay at 1 port	not yet meeting
	Rail	Rail 1: 100% of switcher locomotive owners/operators achieve performance measures of chosen fuel-efficiency program	0 owner/operator was known to achieve performance measures of chosen program	not yet meeting
		Rail 2: 20% of unregulated switcher locomotive engines are upgraded or replaced to Tier 2 or better	9% unregulated engines were known to be upgraded or replaced since December 31, 2013 at 3 of the ports	not yet meeting
	Port Administration	Admin 1: Ports increase use of cleaner vehicles and equipment	A: 2 Ports slightly increased the size of fleets B: 21% on-road vehicles and 48% non-road vehicles use non-conventional fuels C: 13% of fuel used in fleets was non-conventional D: 2 of 3 Ports have fuel efficiency plans in place	in progress
		Admin 2: Ports apply clean construction practices for Port-led construction projects including idle-reduction requirements and enact a plan to address Tier 4 engine emission requirements	3 of 3 Ports have clean construction practices for Port-led projects, but 0 of 3 Ports require Tier 4 non-road engines	not yet meeting
		Admin 3: Each Port completes 3 energy conservation projects	3 of 3 Ports have completed at least 3 projects since 2013	✓ target met

* Partners are striving to meet targets by December 31st of the target year. Note that 2017 is the target year for Trucks.

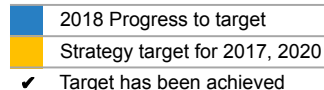


Table of Contents

Executive Summary	i
Table of Contents.....	iv
List of Acronyms.....	v
1. Introduction	1
2. Clean Air Strategy Goals.....	4
3. Ocean-Going Vessels	6
4. Harbor Vessels	12
5. Cargo-Handling Equipment	16
6. Trucks.....	21
7. Locomotives and Rail Transport.....	26
8. Port Administration.....	30
9. Pilot Studies and Demonstration Projects in 2018.....	36
10. Port Initiatives and Pilots for 2019	39
Acknowledgements	42

List of Acronyms

AESS	Automatic engine stop start
CHE	Cargo-handling equipment
CNG	Compressed natural gas
DERA	EPA Diesel Emission Reduction Act
DPM	Diesel particulate matter
ECA	Emission control area
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESI	Environmental Shipping Index
FRATIS	Port of Tacoma Freight Advanced Traveler Information Systems
GHG	Greenhouse gas
HC	Hydrocarbon
IMO	International Marine Organization
LNG	Liquefied natural gas
NO _x	Nitrogen oxides
NRDE	Port of Vancouver Non-Road Diesel Emissions program
NWSA	The Northwest Seaport Alliance
OGV	Ocean-going vessel
PM	Particulate matter
POS	Port of Seattle
POT	Port of Tacoma
PSCAA	Puget Sound Clean Air Agency
RNG	Renewable Natural Gas
RTG	Rubber-tired gantry crane
ScRAPs	NWSA Seaport Scrappage and Replacements for Air in Puget Sound
SO _x	Sulfur oxides
TLS	Port of Vancouver Truck Licensing System
ULSD	Ultra-low-sulfur diesel
VFPA	Vancouver Fraser Port Authority

1. Introduction

The Northwest Ports Clean Air Strategy (Strategy) is a collaboration, established by the ports of Seattle (POS), Tacoma (POT) and Vancouver, with the aim of reducing air emissions from maritime and port-related activities that affect air quality and contribute to climate change. The formation of The Northwest Seaport Alliance (NWSA) in 2015 added a fourth port partner to the Strategy.

Several government agencies work in partnership with the Ports to support implementation of the Strategy, including the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), the Puget Sound Clean Air Agency (Clean Air Agency), Environment Canada, BC Ministry of Environment and Climate Change Strategy, and Metro Vancouver (strategy partners).

The Strategy, originally developed in 2007, was updated in 2013 based on new data and on lessons learned from the first six years of implementation, advances in emission-reduction technology, and changes in the regulatory landscape. The Ports and strategy partners issue annual implementation reports that summarize progress toward the goals and targets identified in the Strategy. *This 2018 Implementation Report is the fifth to report progress against the 2013 Strategy.*

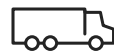
In July 2018, the Ports commenced a process to renew the strategy. This is expected to be completed in 2020. Implementation reports will continue to use the 2013 Strategy framework until the new strategy is fully adopted.

The strategy renewal process includes a review of the opportunities and challenges of this collaborative program, an updated future direction including a new vision and guiding principles, an updated framework and a defined process for reporting progress during implementation. The renewal process includes several opportunities for stakeholders to provide feedback on the new strategy. More details on this process and how to participate can be found on each ports' website.²

The Strategy is organized by these six sectors:



Ocean-going vessels (OGV)



Trucks



Harbor vessels (Harbor)



Locomotives and rail transport (Rail)



Cargo-handling equipment (CHE)



Port administration (Admin)

² Port of Vancouver: <https://porttalk.ca/NWPCAS>; NWSA (including POS and POT): <https://www.nwseaportalliance.com/NWPCAS>

Strategy Objectives, Goals and Targets

The updated 2013 Strategy has three primary objectives:

1. Reduce port-related air quality impacts from diesel particulate matter (DPM) emissions to decrease immediate and long-term effects on human health, the economy, and the environment in the Georgia Basin-Puget Sound airshed.
2. Reduce greenhouse gas (GHG) emissions to limit contributions to climate change and reduce associated environmental, health, and economic impacts.
3. Help meet air quality standards and objectives for the Georgia Basin-Puget Sound airshed.

To track progress on these objectives, the Ports report on two airshed-wide goals – one for DPM emissions and one for GHG emissions (see Section 2 for progress towards these goals) – as well several sector targets, and pilot projects undertaken annually.

Several targets were also defined in the Strategy within each of the sectors identified above. The strategy partners work with stakeholders to meet targets by the end of the stated calendar year—that is, the achievement date for 2020 targets is December 31, 2020. This report focuses on the progress made toward the 2020 (and December 31, 2017 for trucks) performance targets. The Ports continue to work toward achieving both the 2015 and 2020 targets where they have not yet met the 2015 performance targets.

Summary of the Participating Pacific Northwest Ports

In 2018, the ports collectively moved approximately 186.5 million metric tons of cargo. Each port has a unique operating context, including the amount of cargo moved annually, the number of terminals and other operations, and the types of business sectors served (see Table 1 for a summary of these by port). Despite different operating contexts, by working together Ports have demonstrated greater overall impact on reducing port-related air emissions in the Georgia Basin-Puget Sound airshed, and the value of this partnership has led to continued commitment by all ports to the Northwest Ports Clean Air Strategy.

Table 1. Summary of terminals, cargo and passengers moved, and business sectors served at each port

Port	Total tonnage of cargo moved in 2018 (metric tons)	Number of Passengers	Number of Terminals	Types of business sectors served
Northwest Seaport Alliance	30,174,623	n/a	15	Automobile / Roll-on Roll-off Breakbulk Bulk Container
Seattle	4,378,796	1,114,888	3	Bulk Cruise Commercial/Recreational Marinas
Tacoma	4,843,012	n/a	1	Bulk
Vancouver	147,093,498	889,162	27	Automobile / Roll-on Roll-off Breakbulk Bulk Container Cruise Other

How this Report is Organized

This report is organized according to the following key elements from the 2013 Strategy:

- **Goals** for reducing port-related emissions in the Georgia Basin–Puget Sound airshed that focus on DPM and GHGs. *(Report Section 2)*
- **Performance targets** for 2017 and 2020 for reducing emissions in each of the six sectors. *(Report Sections 3 to 8)*
- Port commitments to undertake **pilot studies and demonstration projects** designed to advance emission-reduction technologies that can help meet the emission-reduction goals. *(Report Section 9)*

2. Clean Air Strategy Goals

The actions in the Strategy are intended to complement regulations and, together with the regulations, help to achieve the following emission reductions:

DPM Goal: *Reduce diesel particulate matter emissions per metric ton of cargo by 80% by 2020, to decrease immediate and long-term health effects on adjacent communities, relative to 2005.*

GHG Goal: *Reduce greenhouse gas emissions per metric ton of cargo by 15% by 2020, to limit contributions to climate change and reduce associated environmental, health, and economic impacts, relative to 2005.*

The Strategy goals focus on reducing the intensity of emissions that result from port activities (i.e. reducing the amount of emissions per metric ton of goods that are moved), relative to the baseline intensity of emissions in 2005. Tracking emissions intensity provides a mechanism for reporting progress even when the ports experience different rates of growth in economic activity.

2005 Baseline

In 2005, a total of 137.6 million metric tons of cargo³ were moved through the four ports, and port-related activities resulted in the emission of 2,002 metric tons of DPM and 1.67 million metric tons of GHG emissions in the airshed.⁴ The 2005 baseline intensity emissions were:

- 0.15 metric tons of DPM emissions / 10,000 metric tons of cargo moved.
- 121 metric tons of GHG emissions / 10,000 metric tons of cargo moved.⁵

Progress Toward Goals (2005 to 2015/2016)

Based on the 2015/16 inventories, a total of 174.8 million metric tons of cargo were moved through the four ports, and port-related activities resulted in the emission of 501 metric tons of DPM and 1.75 million metric tons of GHG emissions.⁶ As a result, **the ports met the DPM and GHG goals for 2020 by the end of 2016**. The average change in emission intensity for 2015/2016 across the four ports was (also shown in Figure 1 and by port in Table 2):

- DPM emissions / 10,000 metric ton of cargo moved: **80% lower in 2015/16**, compared to 2005.
- GHG emissions / 10,000 metric ton of cargo moved: **17% lower in 2015/16**, compared to 2005.

³ 2005 cargo volumes were updated for Port of Seattle to reflect the 2016 Puget Sound Air Emissions Inventory report data. Past POT and NWSA cargo data were incorrectly reported due to unit conversion error.

⁴ Emissions are estimated for the "airshed" scale, which includes all emissions related to port activity released in the airshed (note that boundaries are defined differently in the Port of Vancouver inventory compared to the Puget Sound inventory). Emissions were obtained from the 2016 Puget Sound Maritime Air Emission Inventory (Starcrest, October 2018) and the Port of Vancouver 2015 Port Emissions Inventory (VFPA, 2017). For the Port of Vancouver, fine particulate matter is reported for DPM because DPM was not quantified separately in past inventories.

⁵ The 2005 baseline intensity data in this report is different than previous reports, because the 2005 emissions were adjusted with an updated methodology in the 2015 and 2016 emission inventories.

⁶ 2015 Port of Vancouver Emissions Inventory and 2016 Puget Sound Maritime Air Emission Inventory.

The significant reductions in DPM emissions are primarily the result of regulatory changes requiring the use of low sulfur fuels for ships, in addition to cleaner engine standards in new vehicles and equipment. The reductions in the intensity of GHG emissions demonstrate an overall increase in efficiency of vehicles, equipment and operations over time. Although ports achieved these goals early, demonstrating a reduction in the intensity of DPM and GHG emissions, absolute GHG emissions rose over the same period of time by 5% (relative to an increase of 27% of cargo moved).

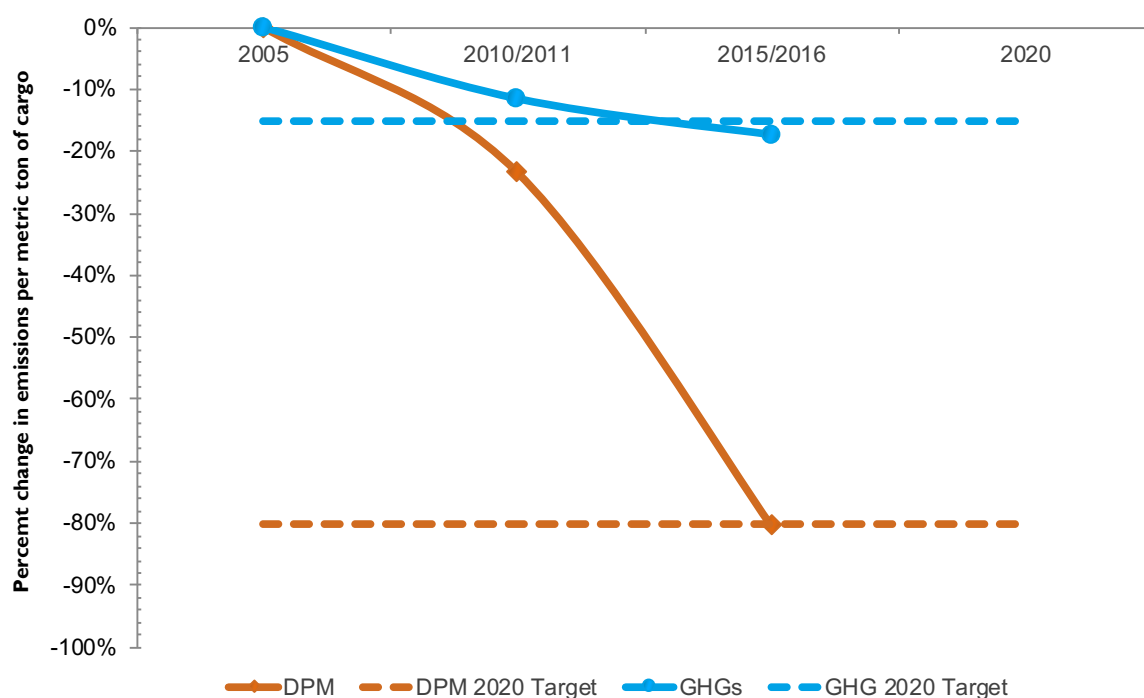


Figure 1: Changes in emission intensity between 2005 and 2015/16, relative to 2020 targets

Table 2. Changes in emissions intensity between 2005 and 2015/16, by port

Port	Change in DPM emissions intensity in 2015/16, relative to 2005	Change in GHG emissions intensity in 2015/16, relative to 2005
Northwest Seaport Alliance ⁷	-80%	-19%
Seattle	-79%	-8%
Tacoma	-77%	-22%
Vancouver	-78%	-10%

Table note: Emissions intensity based on cargo throughput is an imperfect measure. While NWSA and POT deal exclusively with cargo, VFPA and POS have different lines of business. The volume of cruise activity (VFPA and POS) and marina activity (POS) are not reflected in this metric. This accounts for the difference in emission intensity reductions shown above.

⁷ Prior to formation of the Northwest Seaport Alliance in 2015, emissions were assigned to the ports of Seattle and Tacoma. The 2016 Puget Sound Maritime Emissions Inventory re-apportioned 2005 and 2011 emissions to align with each port's current operating scope.



3. Ocean-Going Vessels

Ocean-going vessels (OGV) include container ships, cruise ships, tanker ships, bulk cargo ships and breakbulk cargo ships. Performance reporting focuses on the types of engines and fuel being used, and participation in Port-designed or third-party rating programs.

Context

Based on the 2015/16 emission inventories, OGVs produced approximately 46% of DPM emissions and approximately 50% of GHG emissions from activities related to the ports within the airshed. Table 3 summarizes the number of unique vessels and the total number of calls made by those vessels.

On August 1, 2012, the International Maritime Organization designated waters off North American coasts as an Emissions Control Area (ECA), with increasingly stringent restrictions going into effect between 2012 and 2015. These standards dramatically reduce air pollution from ships and deliver substantial air quality and public health benefits that extend hundreds of miles inland. By 2020, emissions from ships operating in the North American ECA are expected to be reduced by 90,000 metric tons for PM_{2.5} and 920,000 metric tons for SO_x annually (74%, and 86%, respectively, below predicted levels in 2020 absent the ECA).⁸ NO_x emissions are also anticipated to reduce as the number of Tier 3 vessels operating in the region increases over time.

⁸ <https://westcoastcollaborative.org/files/sector-marine/the-north-american-eca-1.pdf>

Table 3. Number of ocean-going vessels and vessel calls at the Ports in 2018

Port	Number of vessels	Number of vessel calls
Northwest Seaport Alliance	422	1,853
Seattle	83	285
Tacoma	68	71
Vancouver	1,778	3,145

Performance Targets

OGV-1: Vessels surpass Emission Control Area requirements

<i>2015 Target</i>	<i>Early compliance with 2015 ECA 0.1% fuel-sulfur level (or equivalent) while hoteling</i> [TARGET COMPLETE]
2020 Target	By 2020, Ports track number of vessel calls with Tier 3 marine engines, shore power use, cleaner fuel, or other emission-reduction technologies⁹
What is being measured?	This measure reports the number of vessel calls to the Ports that have Tier 3 marine engines, and/or use shore power, cleaner fuel (liquefied natural gas), or other emission-reduction technologies, to the best of the Ports' knowledge.
Why is this important?	The Ports created this performance target to recognize the importance of supporting shipping lines in adopting fuels or technologies that reduce emissions beyond those required by the 2015 ECA.
How did we do?	In 2018, 4% of vessel calls had Tier 3 engines, used shore power, and/or used cleaner alternative fuel, compared to 3% in 2017. The number of vessel calls that meet the standard increased from 187 calls in 2017 to 201 calls in 2018.
Definition of terms	<i>Emission Control Area (ECA):</i> The North American ECA is a geographic boundary that extends approximately 200 nautical miles off the coast of the Pacific and Atlantic/Gulf coasts (excluding Mexico). Under the IMO rules, different standards apply to ships while operating outside emission control areas versus those operating in established ECAs.

⁹ The OGV-1 2020 target was first reported in the 2015 Report based on the number of vessels, rather than the number of vessel calls. The 2016 report, and this report both present data based on vessel calls for all years, and includes vessel calls that were known to use shore power, or vessels that have a "keel laid date" on or after January 1, 2016 (which are presumed to have Tier 3 engines).

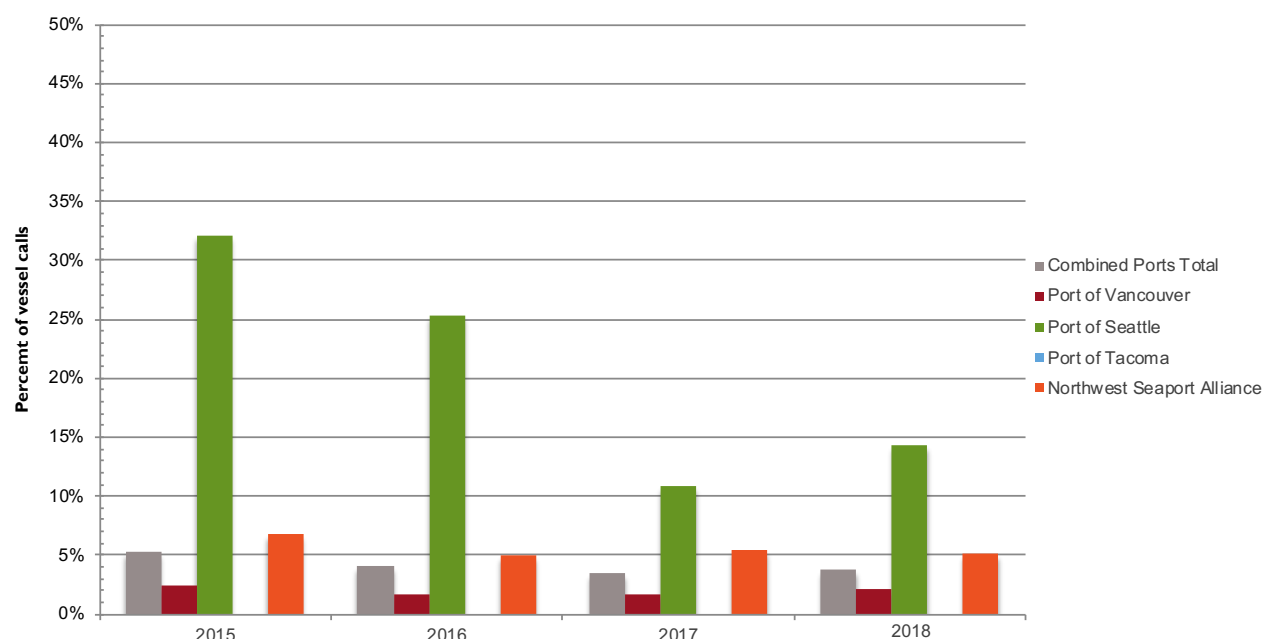


Figure 2. OGV-1: Percent of vessel calls with known Tier 3 marine engines, shore power use, cleaner fuel (better than ECA regulations), or other emission reduction technologies 2018¹⁰

OGV-2: Ports and vessels participate in Port-designed or third-party programs that promote continuous improvement

2015 Target	By 2015, Ports and 10% of vessel calls participate in Port-designed or third-party programs that promote continuous efficiency improvements [TARGET COMPLETE]
2020 Target	By 2020, Ports and 40% of vessel calls participate in Port-designed or third-party programs that promote continuous efficiency improvements [TARGET EXCEEDED]
What is being measured?	This measure reports whether the Ports participated in third-party programs. This measure also reports the percentage of calls to the four ports that are from vessels that participate in a Port-designed or a third-party program that promotes continuous improvement, to the best of the Ports' knowledge.
Why is this indicator important?	The Ports have the greatest influence over vessels when they are in port, at anchor, at dock, or maneuvering. Ports can encourage vessel operators to reduce emissions by incentivizing emission reductions through alternative fuels and technologies, or through participation in continuous improvement programs. This measure captures the level of participation in these programs.
How did we do?	In 2018, 3 out of the 4 Ports participated in the Green Marine program as ports. 62% of vessel calls to the ports were made by vessels participating in at least one continuous improvement program, as shown below, the same as 2017.
Definition of terms	<i>Port-designed programs:</i> This includes the Port of Vancouver EcoAction Program, which helps to promote continuous improvement. <i>Third-party programs:</i> Programs included are the Environmental Ship Index (ESI), Green Award, RightShip, Clean Shipping Index (Port of Vancouver ships only), or

¹⁰ Prior to 2017, POS did not have accurate data on shore power calls and past data has overestimated actual plug-in rates.

Green Marine. Note that only RightShip participants that have verified Existing Vessel Design Index data are included.

Port participation in third-party certification programs: This included Ports that participated in the Green Marine Program. For all other programs, Ports were considered to participate if they incentivized participation in the program (e.g. provided discounts to visiting vessels that participate in the program).

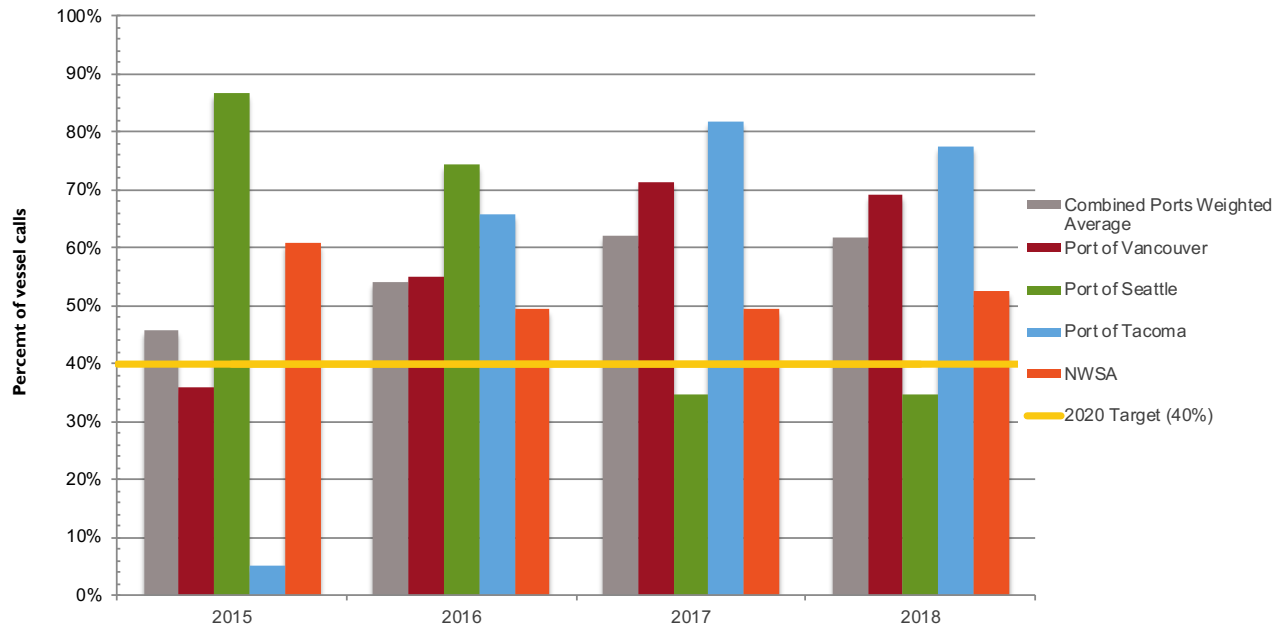


Figure 3. OGV-2: Percent of vessel calls participating in Port-designed or third-party certification programs

Implementation Efforts in 2018 by Port: OGV

Port:	Port of Vancouver
How is the Port of Vancouver doing?	<p>OGV-1: In 2018, 64 calls were made by eleven cruise and container vessels that connected to shore power, and one call was made by a vessel with Tier 3 engines, based on keel laid date only. Combined, this represents 2% of calls, and 0.7% of vessels. In 2018, the use of shore power at the Canada Place Cruise Terminal and Centerm Terminal reduced emissions of GHGs by 2,523 tonnes, and particulate matter by 1 tonne.</p> <p>OGV-2: In 2018, VFPA participated in the Green Marine Program as a port. VFPA also participated in ESI, Green Award, RightShip, Clean Shipping Index and Green Marine by offering discounts to vessels that participate in the programs.</p> <p>69% of calls were made by vessels participating in one or more of VFPA's EcoAction Program, ESI, Green Award, RightShip, Clean Shipping Index or Green Marine. This represents 2,178 out of 3,145 calls for the year.</p>
Program for OGVs:	<p><i>EcoAction Program and Blue Circle Award</i></p> <p>In 2018, these programs continued to recognize and reward vessels that go beyond regulatory requirements to reduce air emissions (considering both air quality pollutants and greenhouse gases). Eligible options for discount through the EcoAction Program include acceptable scores in third-party environmental rating systems, and cleaner fuels and technologies.</p> <p>16 shipping lines received the Blue Circle Award for 2018. The award is given to those lines with the greatest proportion of participation in the EcoAction Program.</p>
Other initiatives:	<p>VFPA is leading the development of an International Collaboration on Ship Emission Reductions. In partnership with other ports and industry stakeholders, the intention is to develop an approach that aims to increase participation in vessel incentive programs and use of environmental infrastructure such as shore power, supporting further reduction of impacts from international shipping.</p> <p>VFPA joined the World Ports Climate Action Program. In this new international initiative, the port authorities of Vancouver, Los Angeles, Long Beach, Rotterdam, Antwerp, Hamburg, and Barcelona will be joining forces and working together on a several projects that address the issue of global warming.</p>
Port:	Port of Seattle
How is the Port of Seattle doing?	<p>OGV-1: In 2018, 14% of calls (41 of 285), and 5% (4 of 83) of vessels met this target. Zero calls were made by vessels with Tier 3 engines or cleaner fuels. The Port has two cruise terminals with a total of three berths. The two berths at T91 are equipped with shore power. Of the homeport ships that can plug in to shore power, 63% (41 of 65) of vessel calls connected in 2018.</p> <p>OGV-2: POS continued participating in Green Marine as a port. In 2018, 35% of vessel calls were made by ships participating in at least one third-party certification program, including ESI or RightShip (verified data only).</p>
Program for OGVs:	None to report for 2018.
Other initiatives:	In 2018, Port of Seattle updated a preferential berthing agreement with one cruise line to include new terms for environmental stewardship starting in 2019, including language calling for its ships to connect to shore power when available.

Port:	Port of Tacoma
How is the Port of Tacoma doing?	<p>OGV-1: In 2018, none of the 71 ship calls to Port of Tacoma had Tier 3 engines, used shore power or implemented other emission-reducing technologies.</p> <p>OGV-2: The Port of Tacoma is not participating in a third-party certification program. 55 of the 71 ship calls to POT (77%) participated in at least one third-party certification program, including ESI and RightShip (where data is verified only). The Port of Tacoma has surpassed the 2020 target of 40% of calls participating in port-designed or third-party certification program ahead of the 2020 target.</p>
Program for OGVs:	None to report for 2018.
Other initiatives:	None to report for 2018.
Port:	The Northwest Seaport Alliance
How is the Northwest Seaport Alliance doing?	<p>OGV-1: In 2018, 5% of container ships calls to NWSA terminals used shore power at TOTE terminal in NWSA's South Harbor. No calls were made to any NWSA terminals by vessels with Tier 3 engines or cleaner fuels.</p> <p>OGV-2: In 2018, the NWSA continued to participate in Green Marine, a third-party environmental certification program for ports in North America.</p> <p>In 2018, 53% of vessel calls (975 of 1,853 total calls) were from vessels participating in at least one third-party certification program, including ESI and RightShip (where data is verified only). This is an increase on 2017 results (2017: 49% of total calls).</p>
Program for OGVs:	TOTE Maritime Alaska continues to use shore power at berth for the Midnight Sun and the Northern Star.
Other initiatives:	None to report for 2018.



4. Harbor Vessels

Harbor vessels include harbor and ocean tugs; there are approximately 140 such vessels providing service at the ports. There are other types of harbor vessels operating near ports (e.g. ferry vessels, excursion vessels, and government vessels) but these are not directly related to port activity and are not included in the scope of this report. Performance is tracked based on reporting best practices and engine upgrades, and participation in programs that promote continuous improvement.

Context

Port-related harbor vessels account for approximately 8% of DPM emissions and 8% of GHG emissions from activities related to the ports, based on the 2015/16 emission inventories. Since 2012, regulations have required the use of ultra-low sulfur diesel (ULSD) fuel, resulting in significant reductions in emissions from harbor vessels. Table 4 summarizes the number of harbor vessel companies and vessels at each port. Because the tug fleet for NWSA, POS and POT are the same companies operating in the same waters of Puget Sound, harbor vessel data for NWSA, POS and POT are reported together.

Table 4. Number of harbor vessel companies and vessels at the ports in 2018

Port	Number of harbor vessel companies	Number of harbor vessels
POS, POT & NWSA	2	14 ¹¹
Vancouver	16	126

Performance Targets

Harbor-1: Strategy partners conduct annual outreach to port-related harbor vessel companies and recognize best practices and engine upgrades

<i>2015 Target</i>	<i>By 2015, partners conduct outreach and 50% of harbor vessel companies report best practices and engine upgrades</i> [WORKING TOWARDS TARGET]
2020 Target	By 2020, partners conduct outreach and 90% of harbor vessel companies report best practices and engine upgrades
What is being measured?	<p>In the 2013 Strategy, Ports and Strategy partners committed to identifying activities that increase fuel efficiency and reduce emissions, and to share this information with harbor vessel owners and operators. This measure reports whether partners conducted outreach with these owners and operators during 2018, including workshops, brown bag sessions, and meetings to discuss efficiency ideas, practices or projects.</p> <p>To support this measure, Ports and Strategy partners collect data directly from harbor vessel companies, or from relevant continuous improvement programs. The percentage of harbor vessel companies that reported and the percentage that undertook engine upgrades and best practices during 2018 are also reported.</p>
Why is this important?	<p>One way to reduce emissions from harbor vessels is to replace the vessels or repower them (replace their engines), but these efforts are expensive and beyond the control of the Ports. The Strategy partners believe promoting increased vessel fuel efficiency and best practices is the best way to work with this sector. Through annual outreach the Ports and Strategy partners will help keep harbor vessel owners and operators informed of best practices that reduce emissions.</p> <p>Tracking what companies are doing to incorporate best practices and upgrade or replace their engines provides an annual snapshot of emission reduction activities.</p>
How did we do?	<p><i>Partners conduct outreach:</i> In 2018, one Port hosted six outreach sessions, while the Washington State Department of Ecology sent out a survey to determine the universe of companies that would be interested in engine replacement grants.</p> <p><i>Harbor vessel companies report on best practices and engine upgrades:</i> 50% (nine) companies reported their progress through participation in EcoAction, through submissions to Green Marine or through communication with Strategy partners.</p> <p><i>Companies undertook best practices and engine upgrades:</i> 44% (eight of 18) companies undertook best practices or engine upgrades – four through their participation in the Green Marine program and use of shore power, three through EcoAction and the use of shore power, and one by completing an engine upgrade to Tier 3 auxiliary engine.</p>

¹¹ Note: In 2017, the number of harbor vessels was 37. In 2018, a company with 16 tugs no longer performed assists for the U.S. ports and therefore are not included in the count of harbor vessels.

	Ecology funded a project for a tug company to install three plug-in pedestals on landside allowing up to seven vessels to plug in. This project will carry over into 2019. Total estimated project cost is \$130,000.
Definition of terms	<p><i>Best practices:</i> Participation in Green Marine or in EcoAction, or using shore power are counted as following best practices.</p> <p><i>Engine upgrades:</i> This includes replacing the engine (also known as “repowering” the vessel), replacing the auxiliary engine, or installing a kit that reduces emissions by 25% (called a 1042 kit). Installing a 1042 kit is not counted as a best practice if the harbor vessel owner is required to install it (i.e. in the U.S. a kit is required if the owner is overhauling the engine, if the old engine was manufactured on or after 1973, and if the engine is greater than 800 horsepower).</p>

Harbor-2: Ports and harbor vessels participate in Port-designed or third-party certification programs that promote continuous improvement

2015 Target	By 2015, Ports and 10% of harbor vessels participate in Port-designed or third-party certification programs that promote continuous improvement [TARGET COMPLETE]
2020 Target	By 2020, Ports and 40% of harbor vessels participate in Port-designed or third-party certification program that promote continuous improvement
What is being measured?	<p>This measure identifies whether the Ports participate in the Green Marine program (currently the only third-party certification program available for tugs) with respect to providing incentives to tug operators.</p> <p>This measure also reports the percentage of harbor vessels that participate in the Port of Vancouver EcoAction Program or in the third-party Green Marine Program, which both promote continuous improvement for harbor vessels.</p>
Why is this important?	<p>Programs that promote continuous improvement provide a consistent framework for companies to report progress on achieving various environmental measures. Participants either get higher scores for or must go beyond regulatory compliance in these programs.</p> <p>Although the Ports have little to no control over harbor vessel engines and fuel-efficiency practices, the Ports can influence these measures by providing incentives to companies that join and annually participate in third party certification programs, or by developing their own program to promote continuous improvement.</p>
How did we do?	<p>In 2018, three of the four Ports (Northwest Seaport Alliance, Seattle and Vancouver) participated in the Green Marine program. The Vancouver Fraser Port Authority also provided discounted harbor dues to those tugs operated by companies who are Green Marine certified, or that have shore power. POS, POT and NWSA did not offer incentives to tug companies, and no tug companies in Puget Sound were Green Marine certified.</p> <p>38% of harbor vessels participated in third-party certification programs. One port-related harbor vessel company reported engine upgrades.</p>
Definition of terms	<p><i>Certification programs:</i> Includes programs applicable to ports and harbor vessel companies that promote continuous improvement, either Port-designed or by a third party. The Port of Vancouver currently offers the Port-designed EcoAction program for harbor vessels.</p> <p><i>Third-Party Certification:</i> Currently Green Marine offers the only third-party environmental certification program for harbor vessels.</p>

Implementation Efforts in 2018 by Port: Harbor Vessels

Port:	Port of Vancouver
How is the Port of Vancouver doing?	<p>Harbor-1: VFPA hosted six outreach events in 2018: two Port Environmental Managers Breakfast Sessions for tenants, including tug companies, which were forums for sharing information on environmental best practices and evolving regulations, and four sessions for Climate Smart Program participants. 2018 marked the fourth year that VFPA partnered with Climate Smart to offer training to tenants, including tug companies, on measuring, managing and communicating reductions in GHG emissions. Training was offered as a three-part series, with an additional information and follow-up session also offered.</p> <p>Harbor-2: VFPA participated in Green Marine as a port and offered discounted fees to harbor vessels through its EcoAction Program. The primary harbor vessel companies at VFPA reported on air emission and other best practices in 2018 through Green Marine. 42% of tugs operating within the Port of Vancouver participated in Green Marine,¹² with 4 of 16 companies representing 53 of 126 tugs being members (Seaspan, Saam Smit, North Arm Transportation and Ledcor Resources).</p>
Other initiatives:	Three tug companies received the Blue Circle Award for 2018, for their continuous leadership in air emissions reduction and environmental performance. Seven tug companies reported using shore power with their vessels.

Port:	Port of Seattle
	Port of Tacoma
	The Northwest Seaport Alliance
How are the ports doing?	<p>Harbor-1: The Washington Department of Ecology prepared and sent out an information request for vessels in the state to determine potential propulsion engine replacement projects.</p> <p>Harbor-2: Two of the three ports participated in Green Marine. None of the U.S. harbor companies participated in third-party continuous improvement programs, however, one of the two completed an engine upgrade.</p>
Other initiatives:	Puget Sound Clean Air has been administering a \$650,000 grant from EPA to replace up to 18 marine engines on eight harbor craft. This project was 30% complete in 2018. Puget Sound Clean Air Agency also partnered with a harbor company and applied for and received a grant from Ecology to install shore power for up to six harbor vessels.

¹² Harbor companies participate in Green Marine, not individual tugs.



5. Cargo-Handling Equipment

Cargo-handling equipment (CHE) moves goods on marine terminals between ships, railcars, and trucks. Examples of CHE include: straddle carriers, rubber-tired gantry (RTG) cranes, reach stackers, top and side picks, forklifts, skid loaders, yard tractors / yard trucks, etc. Performance targets focus on achieving more stringent engine emission standards, recognizing the conversion of equipment to cleaner engines and improving fuel-efficiency practices.

Context

The CHE sector contributes 8% of DPM emissions and 6% of GHGs from activities related to the four ports, as summarized in the 2015/16 inventories. Table 5 summarizes the number of terminals operating CHE, and the total number of equipment at each port. Note that all CHE that was previously operated at POT is now accounted for under NWSA, as well as most POS CHE.

Table 5. Number of terminals with CHE, and number of units in 2018

Port	Number of CHE ¹³	Number of terminals with CHE	Total number of terminals
NWSA	752	13	15
Seattle	90	3	3
Tacoma	0	0	1
Vancouver	1,393	27	27 and other operations

¹³ Number of CHE excludes equipment that is exclusively electric (e.g. conveyor belts and ship-to-shore cranes) but includes electric equipment that could operate on other fuels. Note that Vancouver data includes other non-road equipment.

Performance Targets

CHE-1: CHE meets Tier 4 interim (T4i) emission standards or equivalent

2015 Target	By 2015, 50% of CHE meets Tier 4 Interim [TARGET COMPLETE]
2020 Target	By 2020, 80% of CHE meets Tier 4 Interim
What is being measured?	This performance target tracks the percentage of CHE that has Tier 4i or better engines on a port-wide basis, regardless of terminal size or type of operation. This target recognizes engines with retrofits or repowers that result in Tier 4i equivalent PM emission rates and replacement of equipment (for example, replacing diesel with electric, gasoline, propane or natural gas-fueled equipment). Where emission reduction technology has been installed that reduces emissions but does not achieve Tier 4i emission levels, partial credit is given (for example, Diesel Oxidation Catalysts or Diesel Particulate Filters on older equipment).
Why is this important?	Older diesel equipment, especially non-road engines, generate significantly more emissions per volume of fuel used. This target tracks the proportion of the fleet that meets Tier 4 Interim emission levels or better. It includes emission reductions achieved through retrofits or engine replacements.
How did we do?	52% of CHE met Tier 4 Interim across all ports (see chart below), which represents 8% increase over 2017 (44%). The ports have collectively achieved the 2015 target of 50% and continue to work toward the 2020 target of 80%.
Definition of terms	<i>Tier 4 Interim or T4i:</i> The Tier 4 Interim emissions standards required lower PM emissions prior to final Tier 4 standards that also required lower NO _x /HC emissions.

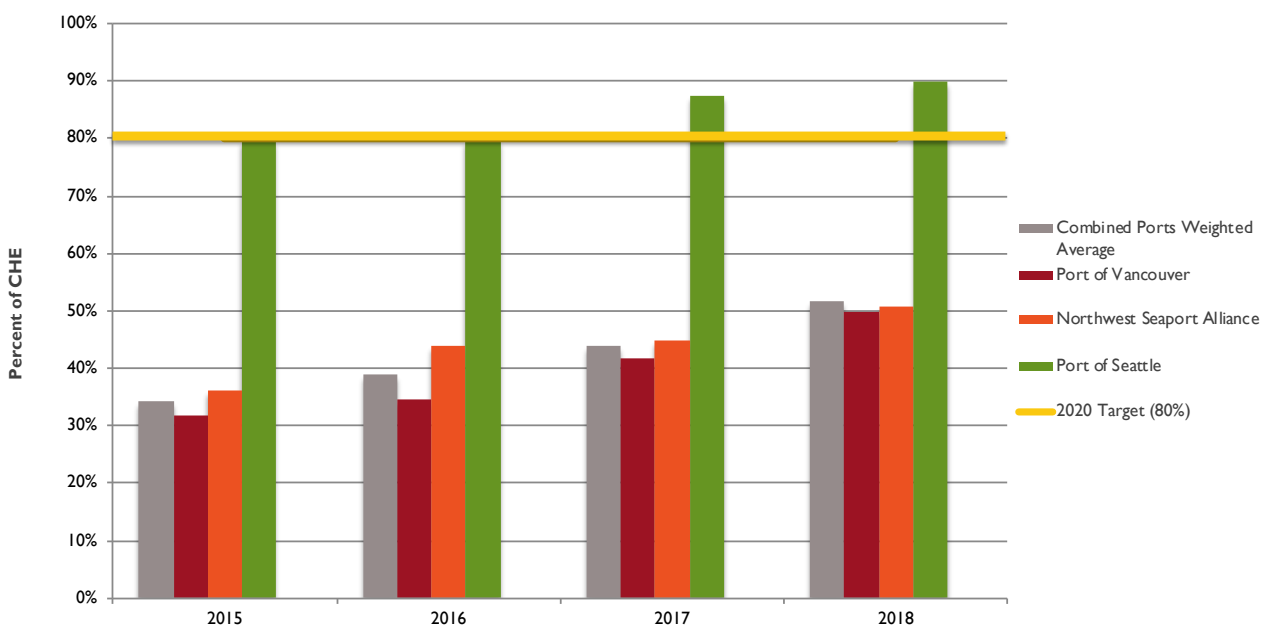


Figure 4. CHE-1: Percent of CHE meeting Tier 4 interim emission standards or equivalent¹⁴

¹⁴ Since 2015, POT has not operated any terminals with CHE.

CHE-2: Ports and terminals have fuel-efficiency plans in place that promote continuous improvement

<i>2015 Target</i>	<i>By 2015, Ports and 50% of terminals have fuel-efficiency plans</i> [WORKING TOWARDS TARGET]
2020 Target	By 2020, Ports and 100% of terminals have fuel-efficiency plans
What is being measured?	<p>This measure reports on whether each of the Ports had plans in place to address fuel efficiency of CHE.</p> <p>The measure also reports the percent of terminals that had fuel-efficiency plans for CHE, to the best of the Ports' knowledge.</p>
Why is this important?	Significant emission reductions come from replacement, repowering or exhaust retrofits, however these can be expensive, have limited available options, and can increase other operating and maintenance costs. Implementing fuel-efficiency plans promotes emission reductions in all equipment, including older equipment.
How did we do?	<p>In 2018, two of three ports with CHE had fuel-efficiency plans in place. The Ports facilitated fuel efficiency in relation to CHE in the following ways: VFPA runs a program that requires tenants to have fuel-efficiency plans to be eligible for fee rebates; NWSA aims to reduce fuel consumption under their CHE idle-reduction plans.</p> <p>23% of terminals (10 out of 43) had a known fuel-efficiency plan for CHE in place, which is the same as 2017 and 2016.</p>
Definition of terms	<i>Fuel-efficiency plans:</i> A fuel-efficiency plan sets out goals or objectives to increase operational efficiency, reduce use of fuels, and/or seek alternative sources of fuel that improve efficiency and reduce emissions from equipment operating on port land. The plan may also identify policies or actions that will be put into place to achieve the goals or objectives.

Implementation Efforts in 2018 by Port: CHE

Port:	Port of Vancouver
How is the Port of Vancouver doing?	<p>CHE-1: In 2018, 50% of non-road equipment within the Port of Vancouver met Tier 4i equivalent standards or better.</p> <p>CHE-2: VFPA does not have operational control over CHE. As a result, its approach is to address fuel efficiency in this sector through the Non-Road Diesel Emissions (NRDE) Program.</p> <p>30% (8 of 27 terminals) plus 1 shipyard had known fuel-efficiency plans in place, based on participation in Green Marine.</p>
Program for CHE:	<p><i>Non-Road Diesel Emissions (NRDE) Program</i></p> <p>VFPA's NRDE Program, in place since 2015, requires tenants to pay fees for operating Tier 1 and older non-road diesel equipment. The program also includes requirements around reporting, labelling, opacity and auditing. To be eligible for fee rebates of up to 80% when the equipment is upgraded, retired and/or replaced with a Tier 2 or newer or equivalent engine, tenants are also required to maintain a fuel efficiency plan.</p>
Other initiatives:	<p>For the fourth year in a row, VFPA partnered with Climate Smart Businesses Inc. to offer training to tenants on measuring, managing and communicating reductions in GHG emissions. Training is offered as a three-part series, with an additional information and follow-up session. Since VFPA started offering the program in 2015, 22 tenants have participated since the program began, with many repeating year over year, and have recorded a reduction of 21,262 tonnes of carbon dioxide equivalent.</p> <p>Two terminals received the Blue Circle Award for 2018. The award is given to those companies that demonstrate leadership and achievements in energy conservation. VFPA joined the World Ports Climate Action Program. In this new international initiative, the port authorities of Vancouver, Los Angeles, Long Beach, Rotterdam, Antwerp, Hamburg, and Barcelona will be joining forces and working together on a number of projects that address the issue of global warming.</p>
Port:	Port of Seattle
How is the Port of Seattle doing?	<p>CHE-1: In 2018, 90% of CHE at POS terminals met Tier 4i equivalent standards or better; with 86% using electricity or propane as fuel.</p> <p>CHE-2: POS terminal operators did not have fuel efficiency plans in place for CHE in 2018.</p>
Program for CHE:	None to report for 2018.
Other initiatives:	None to report for 2018.
Port:	Port of Tacoma
How is the Port of Tacoma doing?	CHE is accounted for under NWSA below. The only terminal remaining under the POT umbrella is a grain terminal, which has no CHE.

Port:	The Northwest Seaport Alliance
How is the Northwest Seaport Alliance doing?	<p>CHE-1: In 2018, 51% of CHE at NWSA terminals met Tier 4i equivalent standards or better. This is an increase on the results of the previous year (45% of CHE in 2017). As NWSA leases are updated, these require the use of newer, cleaner equipment.</p> <p>CHE-2: Two of 13 terminals have a fuel efficiency plan in place.</p>
Program for CHE:	None to report for 2018.
Other initiatives:	<p>Electric cargo-handling equipment: Four new hybrid diesel electric straddle carriers arrived in Tacoma in December, shortly after the arrival of a fully-electric hostler as part of a pilot program. NWSA staff also are exploring the potential of fully-electric straddle carriers and rubber-tired gantry cranes</p> <p>The NWSA partnered with the Environmental Defense Fund (EDF) in 2018 to examine the development of a Clean Cargo-Handling (CHE) Equipment framework. EDF examined how the NWSA and its tenants can work towards a zero-emission CHE fleet, and developed a 'CHE Modernization Plan' focused on accelerating the adoption of zero-emission technology, and a 'CHE Smart Strategy' focused on how tenants use this equipment in the most efficient way. EDF's work will guide the NWSA direction in the upcoming NWPCAS update.</p>



6. Trucks

The truck sector covers on-road heavy-duty container trucks that move cargo to and from marine terminals. Performance is reported through the age of the fleet of container trucks serving port activities, and the prevalence of fuel-efficiency plans. Since 2015, trucks hauling containers are reported for the Port of Vancouver and the Northwest Seaport Alliance only (containerized cargo of Ports of Seattle and Tacoma is now managed by the NWSA).

Context

Trucks account for 17% of DPM emissions and 20% of GHGs from activities related to the four ports, as summarized in the 2015/16 inventories. Table 6 summarizes the number of container terminals, and the total number of container truck companies and trucks operating at the Port of Vancouver and the Northwest Seaport Alliance terminals.

Table 6. Number of container terminals, truck companies, trucks in 2018

Port	Number of container terminals	Number of truck companies	Number of trucks
Northwest Seaport Alliance	10	128	3,644
Vancouver	4	104	1,807

Table note: Ports of Seattle and Tacoma do not operate container terminals and therefore are not included here.

Performance Targets

Truck-1: Trucks meet or surpass EPA emission standards or equivalent for model year 2007

2017 Target	By 2017, 100% of trucks meet or surpass 2007 EPA emission standards [WORKING TOWARDS TARGET]
What is being measured?	This measure tracks the percentage of trucks that have engines that meet the equivalent PM emission standard of a 2007 or newer engine, including engines with retrofits or repowers that result in equivalent emission rates or lower.
Why is this important?	Newer truck engines generate significantly lower emissions due to more stringent federal vehicle standards. Model year 2007 engines are 10 times cleaner than 1994 to 2006 truck engines for PM emissions. This measure tracks how many trucks are being replaced with those that have newer, low-emission engines and associated emission controls. It also recognizes emission reductions achieved through retrofits or engine replacements.
How did we do?	The combined ports' average in 2018 is 67% (see chart below), which has increased annually since it was first reported for 2011 (when it was 15%).
Definition of terms	<i>2007 emission requirements:</i> The U.S. and Canadian federal governments set emission standards for heavy-duty diesel engines. In 2007, the allowed PM emissions dropped to 0.01 grams/brake horsepower-hour, 1/10 th of the 1994 to 2006 standard for PM emissions.

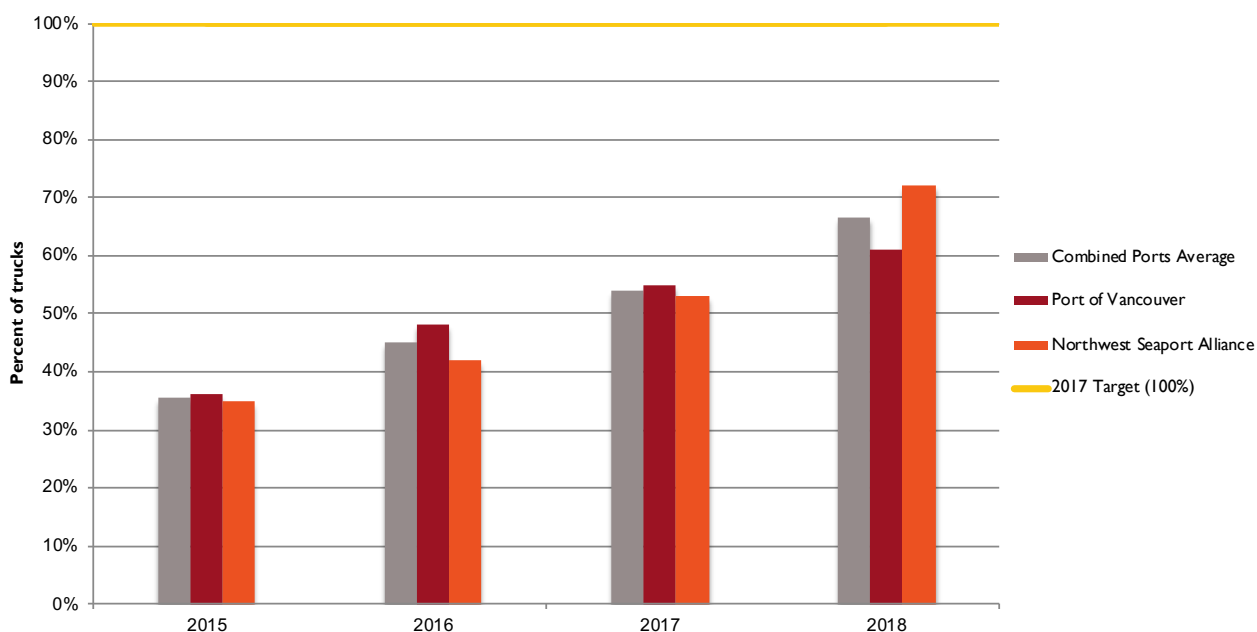


Figure 5. Truck-1: Percent of trucks that meet or surpass U.S. EPA emission standards or equivalent for model year 2007

Truck-2: Ports, terminals, and truck companies have fuel-efficiency plans in place that promote continuous improvement¹⁵

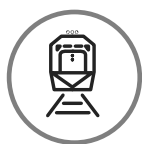
<i>2015 Target</i>	<i>By 2015, Ports have fuel-efficiency plans [WORKING TOWARDS TARGET]</i>
2020 Target	By 2020, Ports, terminals, and 50% of truck companies have fuel-efficiency plans
What is being measured?	This measure reports on whether each of the Ports and truck companies has adopted fuel-efficiency plans, based on participation in the EPA SmartWay Program. Port programs that facilitate fuel efficiency in trucks are also highlighted.
Why is this important?	Effective methods of reducing DPM emissions are to replace vehicles or repower them with engines (and corresponding emission controls) that are model year 2007 or newer, or to install exhaust retrofits. However, emission standards addressing GHGs did not take effect for new vehicles until 2014. Since trucks contribute almost 20% of the port-related GHG emissions, another way of reducing these emissions is to adopt fuel-efficiency practices.
How did we do?	<p>In 2018, none of the Ports had fuel-efficiency plans in place. However, the Ports facilitated fuel efficiency in trucks through the following initiatives: The Truck Licensing System and Smart Fleet Initiative at the Port of Vancouver, and the Northwest Seaport Alliance FRATIS project.</p> <p>In 2018, 23% of trucking companies that service NWSA terminals participated in EPA's SmartWay Program, which has a focus on fuel efficiency.</p>
Definition of Terms	<i>Fuel-efficiency plan:</i> A fuel-efficiency plan sets out goals or objectives to increase operational efficiency, reduce use of fuels, and/or seek alternative sources of fuel that improve efficiency and reduce emissions from equipment operating on port or terminal land. The plan may also identify policies or actions that will be put into place to achieve the goals or objectives.

¹⁵ In the 2013 Strategy, Truck-2 states that the number of trucks with fuel-efficiency plans will be tracked. Due to the difficulty of tracking individual trucks, the Ports will track the number of truck companies that have fuel-efficiency plans.

Implementation Efforts in 2018 by Port: Trucks

Port:	Port of Vancouver
How is the Port of Vancouver doing?	<p>Truck-1: At the end of 2018, 61% of the entire drayage fleet met particulate matter engine emission limits of a 2007 or newer engine, based on trucks of model year 2008 or newer.</p> <p>Truck-2: VFPA does not have operational control over container trucks. Its approach to addressing fuel efficiency in this sector is to continue to implement a program that moves the fleet toward newer, cleaner models, coupled with good maintenance and idling limits.</p>
Program for Trucks:	<p><i>Truck Licensing System (TLS)</i></p> <p>VFPA continued to implement increasingly stringent environmental requirements on drayage trucks accessing the port through the TLS Program.</p> <p>Requirements in 2018 included:</p> <ul style="list-style-type: none"> • 2006 and older model year trucks and 2007 model year trucks with 2006 engines already in the TLS need to have an eligible emission reduction measure (e.g. diesel oxidation catalyst) installed, applicable to those trucks already in the TLS. 2005 and older trucks were previously required to install similar measures. • Trucks new to the TLS to be 2010 or newer.
Port:	The Northwest Seaport Alliance
How is the Northwest Seaport Alliance doing?	<p>Truck-1: At the end of 2017, 53% of trucks had 2007 or newer engines, or equivalent, and by the end of 2018, this had increased to 72% of approximately 3,600 drayage trucks visiting the port.</p> <p>The substantial increase in trucks with 2007 or newer engines, or equivalent, during 2018 was the result of the Clean Truck requirement for all trucks entering NWSA international container terminals to comply with this as of January 1, 2019. The original deadline was January 1, 2018, however, the NWSA Managing Members voted to extend the deadline to give drivers additional time to purchase compliant trucks and ensure efficient movement of cargo through the gateway. During 2018 there was a dramatic increase in the number of 2007 or newer trucks, as truck owners upgraded in preparation for the deadline at the end of the year.</p> <p>The additional time to meet the Truck-1 goal of the Strategy during 2018 allowed drivers extra time to procure financing and secure an appropriate compliant truck; allowed the NWSA to negotiate lease amendments with international container terminal operators; and allowed the NWSA to offer additional resources, workshops and support to drivers to help them become compliant and install a unified RFID truck tracking technology across both Harbors.</p> <p>Truck-2: NWSA did not have a fuel-efficiency plan in place for trucks in 2018. NWSA does not have direct operational control over drayage trucks and has focused on upgrading the truck fleet to newer, cleaner engines, and reducing idling through improved terminal efficiencies.</p> <p>Two of the 13 terminals have fuel efficiency plans that include drayage trucks. 23% of listed NWSA drayage providers participate in EPA's SmartWay program as truck carrier partners, a slight increase from 2017 (21%).</p>

Port:	The Northwest Seaport Alliance
Program for Trucks:	<i>Temporary Access Pass</i> To continue to access NWSA terminals during 2018, a driver with a non-compliant truck was required to apply for a Temporary Access Pass, an orange sticker as a visual identifier on non-compliant trucks. The Temporary Access Pass granted access until December 31, 2018 and any non-compliant truck without a Temporary Access Pass was turned around at the gate. This pass required a commitment from the trucker to become compliant by the end of 2018. The NWSA and the African Chamber of Commerce of the Pacific Northwest held workshops throughout 2018 for truckers enrolled in this pass to offer financial and training resources.
	<i>Drayage truck registry</i> In 2018, the NWSA continued to register drayage trucks serving the international container terminals at both the ports of Seattle and Tacoma. The drayage truck registry is the reference database to verify the age of a truck. NWSA’s South Harbor continued to issue stickers to trucks as a visual compliance identifier, and the North Harbor used RFID (radio frequency identification) tags.
	<i>RFID program</i> RFID technology was installed at international container terminals in the South Harbor, to ensure the Clean Truck Program deadline could be enforced uniformly gateway-wide, using one technology. RFID infrastructure was also installed at the out-gate at each terminal (North and South Harbor) to collect data on on-terminal turn times (in-gate to out-gate), providing NWSA further visibility on terminal efficiency.
Other Initiatives:	<hr/> In Spring 2018, NWSA Managing Members authorized for the NWSA to establish a Clean Truck Fund and to partner with certified Community Development Financial Institutions (CDFIs) to ensure all drivers have access to fair and affordable financing in the additional time to purchase a compliant truck. The NWSA partnered with WA Department of Ecology, PSCAA and the City of Seattle to provide a Loan Loss Reserve (LLR) to CDFIs to administer higher-risk loans to truck owners, and additional ‘scrap bonuses’ of \$6,000 to truck owners willing to scrap their non-compliant truck, as a down-payment for their truck loan. The Clean Truck Fund was designed by the port to help drivers avoid predatory lending practices as the Clean Truck deadline approached. Operations Service Center: A dedicated NWSA team works with port users daily to improve efficiency, including measures to reduce truck idling. After discontinuing the DrayQ app at the end of 2017, the service center turned its attention to research alternative technologies that can track port traffic and improve turn times.



7. Locomotives and Rail Transport

The port-related rail sector consists of locomotives that move railcars within a rail yard (switching or yard locomotives, also known as "switchers") or move trains across the airshed and beyond (line-haul locomotives). Performance is reported through the prevalence of fuel-efficiency programs among owners or operators, and the rate of upgrade or replacement of unregulated engines.

Context

Locomotive emissions contribute approximately 20% of DPM emissions and 14% of GHGs from activities related to the four ports, as summarized in the 2015/16 inventories. Since 2012, regulations have required the use of ULSD fuel and this has resulted in significant reductions in emissions from locomotives. Table 7 summarizes the number of locomotive operators and switcher locomotives operating at each port.

Table 7. Number of switcher locomotive operators and switcher locomotives in 2018

Port	Number of switcher locomotive operators	Number of switcher locomotives
NWSA	4	50
Seattle	1	2
Tacoma	1	3
Vancouver	16	22

Performance Targets

Rail-1: Switcher locomotive owners/operators participate in a fuel-efficiency program

2015 Target	<i>By 2015, 100% of owners/operators participate in a fuel-efficiency program</i> [WORKING TOWARDS TARGET]
2020 Target	By 2020, 100% of owners/operators achieve performance measures of chosen program
What is being measured?	As stated in the 2013 Strategy, Strategy partners will focus on reducing emissions from locally managed switcher locomotives operating at ports. This measure identifies the percent of owners/operators of switcher locomotives that participate in a fuel-efficiency program. Operators that publish fuel-efficiency programs, including goals/objectives, actions, and progress on their websites are considered to participate in a fuel-efficiency program.
Why is this important?	Locomotives require significant investment to replace or upgrade the engines. Fuel-efficiency programs are useful for reducing emissions from both older engines that have not yet been replaced and newer engines.
How did we do?	In 2018, one owner/operator is known to have participated in a fuel-efficiency program with published goals and results at U.S. ports, and two owners/operators at the Port of Vancouver had known fuel-efficiency plans in place based on participation in Green Marine.
Definition of Terms	<p><i>Automatic Engine Stop Start (AESS) technology:</i> This technology enables the engines to be safely shut down when not in use by ensuring engines do not freeze, charging batteries, and maintaining air pressure at 90 psi or greater.</p> <p><i>Fuel-efficiency program:</i> A fuel-efficiency program sets goals or objectives for improving fuel-efficiency, undertakes actions that achieve those, and reports progress. Examples of fuel-efficiency actions include: idle-reduction policies, equipping locomotives with AESS technology, installing Eco-Tip fuel injectors, engaging or training employees on fuel-efficiency practices, and improving maintenance practices.</p> <p><i>Class 1 Railroads:</i> Class 1 Railroads are the largest railroads in the industry including BNSF, UP, CN and Canadian Pacific.</p>

Rail-2: Switcher locomotive owners/operators upgrade or replace unregulated engines (engine replacement will be Tier 2 or better)

2015 Target	<i>By 2015, 10% of unregulated locomotive engines are replaced with Tier 2 or better engines</i> [WORKING TOWARDS TARGET]
2020 Target	By 2020, 20% of unregulated locomotive engines are replaced with Tier 2 or better engines
What is being measured?	This measure reports the percentage of unregulated locomotive engines that were present in fleets as of December 31, 2013 (when the 2013 Strategy came into effect) that are replaced with Tier 2 or better engines.
Why is this important?	Many locomotives in operation have old engines (pre-1973) that are exempt from emission standards and from requirements to install engine upgrade kits when overhauling engines. Older engines have a life expectancy of 10 to 50 years. Retiring or upgrading engines to Tier 2 or better significantly reduces emissions.

How did we do?	<p>Two unregulated locomotive engines have been repowered since 2013, both by Tacoma Rail (one in 2015 and one in 2016).</p> <p>Of the 77 port-related switcher locomotives operating at or near the four Ports, 35 are known to be unregulated, 22 are Tier 0 or Tier 1, and 13 are known to be Tier 2 or better.</p> <p>Note that the Vancouver Fraser Port Authority does not have information about the Class 1 railroads.</p>
Definition of Terms	<p><i>Unregulated locomotive engine:</i> An engine that was manufactured before the first set of U.S. EPA Emissions Standards for Locomotives were in effect (1973). Tier 0 standards apply to equipment manufactured from 1973 through 2001, Tier 1 standards apply to engines manufactured from 2002 through 2004, Tier 2 standards apply to 2005 through 2010, and Tier 3 apply to 2011 through 2014.</p> <p><i>Class 1 Railroads:</i> Class 1 Railroads are the largest railroads in the industry including BNSF, UP, CN, and Canadian Pacific.</p>

Implementation Efforts in 2018 by Port: Rail

Port:	Port of Vancouver
Rail initiatives:	<p>Rail-1: Effective 2015, all terminal operators are required to conform to the NRDE Program, which includes reporting, fees, labelling, opacity and auditing. It also includes a requirement to maintain a fuel-efficiency plan applicable to non-road diesel equipment including switcher locomotives, to be eligible for fee rebates. Additionally, two terminal operators with locomotives were participants in Green Marine, which includes a fuel efficiency component for the terminal.</p> <p>Rail-2: No new engine replacements to report. VFPA does not have data for Class 1 operated locomotives, however, for the 16 tenant-owned/operated locomotives, eight are estimated to be unregulated (pre-tier) and the remaining are made up of one Tier 2, and seven Tier 3 multi-gen sets. In addition, there are four VFPA tenant owned/operated pushers that do the work of switcher locomotives but with a much smaller engine thereby reducing emissions. Of the four pushers, two are estimated to be unregulated with the remaining two being Tier 1 and Tier 2.</p> <p>Other: The six tenant-owned Tier 3 multi-genset locomotives are very fuel efficient in that they bring on only the number of engines (power) needed for the work at hand. Many also have automatic start-stop systems. VFPA is participating in the Gateway Transportation Collaboration Forum (GCTF), a collaborative effort focused on the development and delivery of critical gateway related infrastructure projects of national significance. Working with the GTCF, the port authority has applied for and received over \$200 million in federal funding commitments through the National Trade Corridors Fund, which will allow for the development and delivery of projects that are beneficial to local communities and overall gateway sustainability.</p>

Port:	Port of Seattle
Rail initiatives:	<p>Rail-1: The rail companies did not have fuel efficiency plans in place in 2018.</p> <p>Rail-2: Both switcher locomotives in use in 2018 were unregulated. There were no engine replacements to report.</p> <p>Other: Switcher locomotives employed idle reduction technology and used B20 fuel.¹⁶</p>
Port:	Port of Tacoma
Rail initiatives:	<p>Rail-1: The rail company does not have a fuel efficiency plan.</p> <p>Rail-2: All three locomotives' engines are unregulated. No new engine replacements to report.</p> <p>Other: Rail company employs idle reduction technology.</p>
Port:	The Northwest Seaport Alliance
Rail Initiatives:	<p>Rail-1: One Class 1 rail company has published goals but did not meet the goals for 2018.</p> <p>Rail-2: It is estimated that 22 of the 50 locomotives are unregulated. The Class 1 rail companies move around their locomotives so the NWSA can only estimate what is typical. No new engine replacements to report.</p> <p>Other: All rail companies have idle reduction technology on some or all of their switcher locomotives.</p>

¹⁶ B20 fuel is a blend of 80% diesel fuel with 20% biodiesel fuel. This blend can be used in most conventional diesel engines.



8. Port Administration

The administration sector encompasses the Ports' own sources such as Port-owned or leased vehicles and vessels, office buildings, support facilities and employee functions that are needed for the administration of port activities. The associated activity-related emissions include fleet fuel use, facility energy consumption, employee commuting, materials use, waste management and maintenance and construction projects.

Context

The proportion of DPM and GHG emissions associated with port administration have not been fully quantified independently of the other sectors, however, they are a very small portion of total port-related emissions (e.g. fleet vehicles accounted for 0.1% of DPM and 0.7% of GHG in the 2015/16 port emissions inventories). Table 8 outlines the number of vehicles and equipment by type in each Port's administrative fleet. Each Port has different operational and service models with different fleet needs. Table 9 provides a summary of the quantity of fuel used in each Port's administration. Because NWSA operated out of POT and POS facilities and utilized their vehicle fleets, NWSA operated no vehicles and accounted for no fuel consumption.

Table 8. Admin-1: Number of engines used in Port operations by equipment and fuel type

Port	Marine vessels		On-road vehicles						Non-road equipment					
	D	G	D	B20	G	C	H	E	D	B20	G	H	P	E
Seattle	1	11	5	27	167	2	34	1	3	32	15	1	16	20
Tacoma	0	1	1	0	110	0	8	0	57	0	23	0	19	0
Vancouver	5	2	4	0	10	0	5	0	2	0	3	0	8	0

D=diesel, B20=20% biodiesel; G=gasoline, C=compressed natural gas, H=hybrid gasoline-electric, E=electric, P=propane

Table 9. Admin-1: Quantity of fuels used in equipment for Port operations by fuel type

Port	Diesel (gal) ^[A]	Biodiesel 20 (gal)	Gasoline (gal) ^[B]	Propane (gal)	CNG or LNG (gal)	Electricity
Seattle	14,506	21,981	68,951	1,317	566	Unknown
Tacoma	14,500	0	57,116	3,466	0	0
Vancouver	24,449 ^[C]	0	5,050	114	0	0

[A] Diesel fuel sold in Washington State and British Columbia contained an average 2% and 4% renewable fuel, respectively

[B] Gasoline sold in Washington State and British Columbia contained an average of 2% and 5% renewable fuel, respectively

[C] This includes diesel from VFPA's marine vessels. Historically, it has not been included.

Performance Targets

Admin-1: Ports own and operate cleaner vehicles and equipment and have fuel-efficiency plans in place that promote continuous improvement

2015 Target	By 2015, Ports report cleaner vehicles and equipment and other relevant information [TARGET COMPLETE]
2020 Target	By 2020, Ports increase use of cleaner vehicles and equipment
What is being measured?	<p>This measure reports how the Port fleets are incorporating use of cleaner vehicles and equipment over time. "Cleaner" means that the PM and/or GHG emissions per distance traveled are lower for the same activity, measured as follows:</p> <p>(a) replacement or modification of vehicles, equipment or procedures to increase use of cleaner vehicles and equipment,</p> <p>(b) percentage of vehicles and equipment that use non-conventional fuels (fuels other than diesel or gasoline),</p> <p>(c) proportion of total fuel used that is non-conventional (alternative), and</p> <p>(d) fuel-efficiency plans and other efficiency measures in place.</p>
Why is this important?	Reducing emissions from vehicles and equipment contributes to improving air quality and reducing contributions to climate change. These actions also illustrate the Ports' commitment to achieving the Strategy goals.
How did we do?	<p>(a) Overall fleet size decreased at POT, through the retirement of old equipment, while VFPA retired four vehicles and replaced them with new models. POS increased its on-road fleet by nine vehicles.</p> <p>(b) The percentage of vehicles and equipment that use alternative fuels across all Port fleets did not change significantly between 2017 and 2018, with no change for on-road and increase from 47% to 48% for non-road.</p> <p>(c) The proportion of total fuel used that is non-conventional (i.e. not gasoline or conventional diesel) decreased from 15% to 13% between 2017 and 2018.</p> <p>(d) Two of three Ports who own vehicles and equipment have fuel-efficiency plans in place for their fleets.</p>
Definition of Terms	<i>Port-owned and operated vehicles and equipment:</i> The scope of equipment reported includes all equipment (on and non-road) that is owned, rented or leased and operated by the Ports. At the Port of Vancouver, non-mobile equipment is

included in the non-road category. Starting in 2017, the Ports of Seattle and Tacoma included non-mobile equipment in the non-road category.¹⁷

Cleaner vehicles and equipment: Vehicles and equipment are considered "cleaner" under a few circumstances: (1) the vehicle or equipment is altered or replaced to use a fuel that is cleaner than the previous fuel used; (2) the vehicle or equipment is replaced with a new unit that is cleaner; (3) the Port puts in place measures to prioritize use of cleaner vehicles and equipment. Examples of cleaner vehicles and equipment include:

- Switching to use of B20 diesel to replace standard diesel fuel
- Replacing a gasoline vehicle with a hybrid or electric vehicle
- Replacing a Tier 1 diesel engine with a higher Tier engine
- Installing a diesel particulate filter on an engine
- Creating a fleet management system that prioritizes use of electric vehicles before gasoline or diesel vehicles

Fuel-efficiency plan: A fuel-efficiency plan sets out goals or objectives to increase operational efficiency, reduce use of fuels, and/or seek alternative sources of fuel that improve efficiency and reduce emissions from equipment operating on port or terminal land. The plan may also identify policies or actions that will be put into place to achieve the goals or objectives.

Admin-2: Ports apply clean construction standards to engines used on Port-led construction projects

2015 Target	By 2015, Ports adopt clean construction practices for Port-led construction projects including idle-reduction requirements and enact a plan to address Tier 2 engine emission requirements [TARGET COMPLETE]
2020 Target	By 2020, Ports continue to apply clean construction practices for Port-led construction projects including idle-reduction requirements and enact a plan to address Tier 4 engine emission requirements
What is being measured?	This measure captures efforts to reduce emissions from equipment used in Port-led construction projects. The Ports identify whether clean construction practices have been adopted, including idle-reduction requirements and requirements for the use of Tier 4 engines.
Why is this important?	Ports can directly support the Strategy goals through appropriate clean construction practices and requirements.
How did we do?	All Ports have adopted clean construction practices in various forms, including: sustainable procurement guidelines, use of the Envision Sustainable Infrastructure rating system, and the West Coast Ports Sustainable Design Checklist. All the Ports have requirements for Tier 2 non-road equipment in contracts (at least for major projects), but none of the Ports have a plan to require Tier 4 non-road engines in contracts currently.
Definition of Terms	<i>Clean construction standards:</i> For example, American Association of Port Authorities Sustainability Checklist, EPA Best Practices for Clean Diesel Construction, Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (prepared for Environment Canada), or equivalent best management practices.

¹⁷ The 2016 Puget Sound Emissions Inventory included non-mobile equipment such as compressors, welders, and pressure washers in the non-road category of equipment.

Admin-3: Ports facilitate energy studies and conservation projects at Port operations or tenant facilities to identify and address energy conservation opportunities in building systems, operations, and yard lighting

2015 Target	By 2015, each Port conducts 3 energy studies [TARGET COMPLETE]
2020 Target	By 2020, each Port completes 3 energy conservation projects
What is being measured?	This measure includes energy conservation projects resulting in reduced energy use for Port or tenant operations.
Why is this important?	Reducing energy use in facilities can contribute to reducing GHG and air quality emissions.
How did we do?	Each of the three Ports has exceeded this target by completing more than three projects since 2014. In 2018, the Ports collectively completed 16 energy studies and 13 energy conservation projects for Port or tenant facilities.
Definition of Terms	<p><i>Energy study:</i> A study that identifies a facility's current energy use and opportunities for reducing energy use in future through conservation activities and technologies, or through alternative energy technologies.</p> <p><i>Energy conservation project:</i> A project that implements identified opportunities for reducing energy consumption in a Port or tenant facility. Facilities may include building systems, operations, or yard lighting.</p>

Implementation Efforts in 2018 by Port: Port Administration

Port:	Port of Vancouver
How is the Port of Vancouver doing?	<p>Admin-1: a) Four vehicles were upgraded in the on-road fleet, 3 gasoline-fueled vehicles and 1 diesel-fueled vehicle. The non-road fleet stayed the same. (b) The proportion of the on-road fleet using non-conventional fuels stayed the same at 26%, the non-road fleet remained the same at 62%. (c) The proportion of fuel used that is non-conventional decreased significantly in 2018 compared to 2017 (2.7% to 0.4%). This is due to the inclusion of diesel from VFPA's marine vessels. Historically, it has not been included. (d) VFPA does not currently have a fuel efficiency plan in place for its fleet.</p> <p>Admin-2: For 2018, VFPA continued to apply Green Infrastructure Guidelines to Port-led infrastructure projects, considering the economic, environmental and social impacts that the projects may impart. In 2018, there were seven Port-led projects valued at \$500k+, for which metrics were recorded and reported via the Corporate Balanced Scorecard. For these seven projects, 65% of the applicable Green Infrastructure Guidelines were implemented.</p> <p>Admin-3: In 2018, three tenant engagement activities (one of which included four sessions), 12 energy studies and five energy conservation projects were undertaken. Much of this work falls under VFPA's Energy Action Initiative, established in 2012 in partnership with BC Hydro.</p>

Port:	Port of Vancouver
Other initiatives:	<p>VFPA has reported corporate energy consumption and associated GHG emissions annually since 2010 in accordance with the ISO 14064-Part 1 standard for reporting GHG emissions and the Global Reporting Initiative's G4 Sustainability Reporting Guidelines, core.</p> <p>Since 2010, VFPA has purchased carbon offsets to render its operations carbon neutral, with emissions assertions assured by Ernst & Young and KPMG. This captures the use of fleet vehicles, patrol vessels, and other equipment, electricity and heating at facilities, employee commuting, paper consumption, waste, and air and other travel. Progress toward targets for waste and sustainable commuting is also tracked, reported to staff, and integrated into individual incentive plans.</p> <p>VFPA continued to participate in the Green Marine Program as a port authority and participated in the Green Marine West Coast Advisory Committee.</p> <p>In 2018, 31% of employees took part in a Commuter Challenge to encourage sustainable commuting.</p> <p>VFPA continued its SortSmart waste management program in 2018, which includes organic waste composting and recycling of paper, glass, metal, plastics and cardboard. Collection and recycling of binders, pens, markers, batteries and ink cartridges is also conducted through its stationary supplier. In 2018, VFPA achieved an overall 86% waste diversion rate.</p>
Port:	Port of Seattle
How is the Port of Seattle doing?	<p>Admin-1: There were nine gasoline-power vehicles added to the POS fleet in 2018. Minor differences reported in on-road and non-road fleets over the past three years are due to anomalies in port records. POS continued to improve its fleet data. In 2018, POS hired a new fleet manager and continued development of a Sustainable Fleet Plan to address air quality and climate impacts associated with the Port's vehicle and equipment fleet. The Sustainable Fleet Plan will provide measurable strategies to reduce vehicle energy use and emissions and will incorporate innovative technologies, advanced fuels and best management practices such as vehicle procurement guidance and telematics. The Plan is expected to be completed by the end of 2019 with implementation beginning in 2020.</p> <p>Admin-2: In 2018, the Port continued its study of capital project and design review procedures to increase focus on sustainable building practices, carbon reduction, DPM reduction, renewable energy and energy efficiency, resilience and social equity. Revised procedures and implementation will begin in late 2019.</p> <p>Admin-3: POS conducted two energy assessments in 2018 (one study and one pilot project). Additionally, POS completed installation of solar arrays at its Pier 69 headquarters building, and on one Net Shed at Fishermen's Terminal, installed four Level 2 electric vehicle charging stations at Fishermen's Terminal, and completed LED lighting retrofits at Bell Harbor Marina.</p>

Port:	Port of Seattle
Other initiatives:	<p>The Port's Commute Trip Reduction Steering Committee continued its multi-year process to develop alternatives and shared mobility strategies to reduce employees' needs to drive alone to and from work, including Port sponsorship of a waterfront shuttle designed to improve first and last mile connections for Port employees.</p> <p>The Port completed a GHG Accounting project to include Scope 3 sources into its current and prior years' Maritime GHG inventories.</p> <p>POS completed waste audits at four facilities, developed targeted waste diversion strategies at two facilities, added compost pick-up services at several sites and continued port-wide employee education.</p> <p>POS continued to participate in the Green Marine Program as a port authority and participated in the Green Marine West Coast Advisory Committee.</p> <p>POS also continued its sustaining membership in Washington State Maritime Blue by participating in development of the State's Maritime Blue 2050 Plan, which aims to decarbonize the maritime industry, and continuing its plans to develop a Maritime Innovation Center on POS property.</p>
Port:	Port of Tacoma
How is the Port of Tacoma doing?	<p>Admin-1: The size of the administrative fleet decreased at Port of Tacoma during 2018, achieved predominantly through retiring and scrapping old equipment.</p> <p>Admin-2: The Port of Tacoma uses standard contract language that requires a minimum emission standard of Tier 2 equipment for Port construction contracts.</p> <p>Admin-3: In 2018, the Port conducted two energy use assessments – one of energy and fuel use by the overall port fleet, conducted by EDF, and one of available electrical power for one tenant. The Port undertook four energy conservation projects in 2018, installing LED lighting and occupancy sensors at four leased properties.</p>
Other initiatives:	<p>The POT Corporate Social Responsibility team (Green Team), made up of members from across the Port, meets monthly and hosts information sessions on topics ranging from electric vehicles to recycling.</p> <p>POT encourages telecommuting and van and car pools under its Commuter Trip Reduction program. Employees are incentivized to share trips by logging trips on 'Pierce Trips' to enter a monthly prize draw. POT uses GPS tracking to reduce vehicle idling and improve efficient use of POT-owned and operated vehicles.</p> <p>Since 2008, the Port maintains an agreement with Tacoma Power to purchase 100% green power for the administrative services facility. Tacoma Power's Evergreen Options service plan allows the Port to buy electricity produced from renewable energy sources, including non-polluting wind or solar generators in the Northwest.</p>
Port:	The Northwest Seaport Alliance
How is the Northwest Seaport Alliance doing?	<p>Not applicable because NWSA operated out of Port of Seattle and Port of Tacoma offices and facilities.</p>

9. Pilot Studies and Demonstration Projects in 2018

Pilot studies and demonstration projects are important for advancing new and existing emission-reduction technology for the maritime industry. In the 2013 Strategy, each Port committed to evaluating or engaging in at least one pilot study or demonstration project each year to advance knowledge. The Ports also committed to convening workshops, webinars, or meetings among relevant stakeholders to share information and results. Findings from pilot studies and demonstration projects that took place in 2018 are summarized in this section.

Pilot studies refer to preliminary desktop studies that evaluate feasibility, time, cost, adverse events, and other factors prior to engaging in a full-scale project. **Demonstration projects** are small-scale implementation projects that test feasibility and effectiveness of a technology or change in operation in a real-world application. Overall, four pilot studies were undertaken at the ports in 2018.

Port of Vancouver: Low Carbon Drayage Study

In 2018, the Port of Vancouver undertook a low carbon drayage study. The objective of this study was to conduct a preliminary assessment of low carbon technologies, fuels, and infrastructure applicable to heavy duty class 8 trucks that serve the Port of Vancouver drayage market. The study compares technology options and discusses respective considerations to help inform planning of next steps.

The alternative technology options selected for consideration in this study were:

- Diesel truck as benchmark for industry
- Natural Gas Truck (NGT)
- Plug-in Hybrid Electric Truck (PHET)
- Fuel Cell Electric Truck (FCET)
- Overhead Catenary Electric Truck (OCET)
- Battery Electric Truck (BET)

The study compared the following for each technology option:

- Carbon intensity, air pollutant emissions
- Truck range and weight/payload capacity
- Truck cost, fuel and maintenance cost, and infrastructure cost

Several technologies emerged that are likely to meet the majority of the drayage operator needs and reduce GHG emissions. Natural gas technologies provide modest benefits (~20% reduction) in terms of GHG reductions but are available from an incumbent manufacturer in common trucks models using proven technology. These factors, along with relatively modest infrastructure costs and existing incentive program make it a near term option. The introduction of renewable natural gas and plug-in hybrid technology can make this technology option a flexible pathway to a low carbon solution. Battery electric and catenary electric technologies offer greatest environmental benefits in terms of GHG and air pollutant emissions reductions, and the lowest per km fuel cost, but upfront truck and infrastructure

costs are significant barriers. Each of the technology options has advantages and drawbacks which will need to be assessed in light of drayage operator needs and available financial incentives.

Pilot project is being developed in cooperation with BC Provincial Government and TransLink for available low carbon technologies including renewable diesel, natural gas, and battery electric options. The pilot is expected to start in 2020. Also, demonstration project is under design for 2 fuel cell electric trucks that will use local Hydrogen Fuel Cell provider – Ballard – latest technology. The FCET trucks will be available for demonstration in 2021.

Port of Seattle: Electric Vehicle Charging Station Pilot

In 2018, POS installed four, level 2 charging stations in its Fisherman's Terminal parking lot. The charging station pilot is intended primarily as a tenant amenity however stations are also open to the public and port fleets. The purpose of the pilot program is to evaluate use cases and demand for EV charging in this location, identify the costs versus revenues and to understand benefits of certain charging station types and features, technology, and pricing models.

Port of Tacoma: Waste Audit 2018

In November 2018, the Port of Tacoma performed a waste audit to provide a baseline waste profile for the Port of Tacoma Administration Building and identify opportunities to decrease the environmental impact of waste disposal from the office. All the garbage and recycling material generated in a 24-hour period at the office was collected and labeled by its point of generation—either bathroom, kitchen, office spaces, or exterior spaces.

Key findings were that across both the garbage and recycling streams, the Administration Building generates over 430 pounds of waste every week – over 300 pounds of which was sent to landfill. 70% of waste was sent to the landfill and 30% was recycled. Of the 70% of waste that was sent to the landfill, 48% of it could have been composted and 11% could have been recycled.

The results of this 2018 waste audit will influence a composting demonstration to be held during 2019.

Northwest Seaport Alliance: Shore Power for OGVs

Building on the shore power operational cost pilot study from 2017, NWSA performed two pilot studies related to installing and implementing shore power for ocean-going vessels. First, NWSA analyzed the existing container vessel fleet to determine how many vessels and the proportion of vessel calls that can use shore power. This analysis was performed using NWSA's call logs and data from the Port of Oakland, Port of LA, the Port of Long Beach, and the Environmental Ship Index. At NWSA's major international container terminals, approximately 51% of vessel calls were by ships that can use shore power. Using the vessel call duration information from NWSA's vessel call log, it was also possible to estimate the potential emission reductions associated with implementing shore power, thereby providing a quantitative evaluation of the effectiveness of a potential program.

NWSA also led a research and engineering study, in collaboration with the engineering teams at Port of Tacoma and Port of Seattle to understand the power and infrastructure requirements to install shore power at NWSA's international container terminals and estimate the costs. As part of the analysis NWSA worked with the utilities (Tacoma Power and Seattle City Light) to understand the capabilities of the local energy grid to accommodate shore power and the upgrades required to do so.

With both analyses complete, NWSA is now able to evaluate the cost effectiveness as an emission reduction measure on a dollar spent per emission reduction basis to weigh it against other possible programs. In addition, the results of these pilot studies can be used to communicate the benefits and costs of installing shore power at NWSA's major container terminals to external funding partners.

10. Port Initiatives for 2019

The key air initiatives that are planned by the Ports for 2019 include:

Port of Vancouver

- Clean Truck Initiative: VFPA, in collaboration with the Province of British Columbia and TransLink, has proposed a new initiative to explore alternative fuel source container trucks with the participation of the container trucking community who will be invited to drive the alternative fuel source container trucks. The program will explore and trial new technologies, and the accompanying infrastructure, to support the evolution of the industry and the future of the gateway. Over a dozen expressions of interest were received from respondents by the March 1, 2019 deadline. VFPA is currently in a phase of exploratory meetings with proponents eligible for program participation.
- Complete annual corporate GHG emission inventory and purchase carbon offsets to maintain carbon neutrality.
- Undertake a fifth year of partnering with Climate Smart Businesses Inc. to support tenants in tracking their GHG emissions, implementing emission reductions, and communicating successes to stakeholders.
- Complete the fifth year of the Non-Road Diesel Emissions Program, targeting Tier 1 and Tier 0 equipment and initiate discussions to update program for beyond 2020.
- Review and update eligible criteria for vessel incentives under the EcoAction Program, ensuring the continued recognition of the most progressive vessels at reducing air emissions and underwater noise.
- Complete commissioning of shore power infrastructure at Centerm container terminal.
- Complete Phase I of the International Collaboration on Ship Emission Reductions (ICSER) Initiative, focused on broader stakeholder engagement to validate and refine next steps in optimizing vessel incentive programs and environmental infrastructure.
- Lead the Policy and Sustainable Fuels workgroups under the World Ports Climate Action Program. In 2019, 5-year action plans will be developed and first deliverables initiated.
- Join the Getting to Zero Coalition, to support having commercially viable zero emission ocean going vessels in use and scalable fueling infrastructure in place.
- Participate in the Maritime Hydrogen Safety Joint Development Project (MarHySafe) – Phase I, focused on developing a handbook as an important first step to establish code requirements for hydrogen fueled vessels.
- Partner with FortisBC Energy Inc. to support the use of natural gas for international marine carriers, domestic fleet operators and the heavy class 8 trucking drayage sectors operating at the Port of Vancouver.

- With collaboration from BC Hydro, develop a Port Electrification Roadmap to identify and prioritize activities that are suitable candidates for electrification.

Port of Seattle

- Launch development of a Seattle Waterfront Clean Energy Strategic Plan.
- Support a study led by Ecology, via a joint memorandum of understanding between Washington Department of Ecology, Port of Seattle and Cruise Lines International Association—Northwest and Canada, to evaluate the environmental impacts associated with Exhaust Gas Cleaning Systems' impact on Puget Sound water quality and their efficacy as an environmentally beneficial solution to comply with the North American ECA.
- Evaluate opportunities to increase and improve access to shore power for cruise ships visiting POS at Terminal 91 and evaluate strategies to deliver shore power to the Pier 66 cruise terminal.
- Begin planning and development of a new cruise facility at Terminal 46, which will be Port of Seattle's 4th cruise berth and will include shore power infrastructure.
- Complete the Port of Seattle's Sustainable Fleet Plan, to guide emission reduction efforts and air quality improvements in POS fleets.
- Continue updating the Port's Commute Trip Reduction program to improve first and last mile connections to transit, reduce roadway congestion, and enable alternative work arrangements to reduce Port employee commute times and drive-alone rates.
- Continue ongoing energy efficiency improvements, including LED lighting retrofit work across Port facilities; work with utilities to capture incentive dollars based on energy savings; and complete plans for a deep energy retrofit at the Port's World Trade Center West building; initiate a cross-departmental employee team and draft a plan to address energy efficiency and renewable energy opportunities and strategies for POS- and tenant-occupied facilities..
- Conduct initial planning and budgeting to add additional electric vehicle charging stations to support future EV fleets at Port properties.
- Complete a sustainable project evaluation framework to ensure that the port systematically incorporates environmental sustainability elements into project design and construction.
- Comply with City of Seattle's Building Tune-Up ordinance by completing or supporting tune-up audits at four facilities, conduct benchmarking at all buildings and facilities over 20,000 square feet, and identify low cost/no cost operational improvements to improve building energy efficiency.
- Continue design of a Maritime Innovation Center, which will serve as an incubator and/or business accelerator to promote maritime innovations including decarbonization technologies.

Port of Tacoma

- Complete Port Fleet Replacement Plan for Port-owned vehicles and equipment.
- Continue installation of LED lighting upgrades at tenant facilities.
- Complete Port Building Needs Assessment, examining current and future administrative facilities for use by port staff.
- Based on results of the 2018 Waste Audit, establish a pilot composting program at port administrative offices.

Northwest Seaport Alliance

- Implement NWSA Clean Truck Program deadline on January 1, 2019, turning away non-compliant trucks from international container terminals.
- Roll out gateway-wide truck RFID program in both North and South Harbors.
- Continue to provide trucker support through the Clean Truck Fund, scrap bonuses and education/workshops.
- Assess domestic terminal Clean Truck Program and provide staff recommendation to Managing Members.
- Review and update NWSA lease language to include requirements for Tier 4 cargo-handling equipment.
- Develop Terminal 5 Air Quality Management Program.
- Trial use of Generation 2 BYD electric yard truck at North and South Harbor facilities.
- Update analysis of shore power capable vessels calling at NWSA terminals.
- Assess opportunities and costs/benefits of installing shore power at NWSA major international container terminals.
- Pursue grant funding for shore power infrastructure at NWSA major international container terminals.
- Conduct third assessment of NWSA operations for Green Marine certification.

Collectively, the Ports are in the process of renewing this Strategy, building on the strong collaboration established among the Ports and strategy partners over the last decade. As part of this process, the Ports will identify opportunities for measuring, tracking, and reducing sources of GHG emissions and black carbon, recognizing the increasing importance of black carbon and its potential impacts on air quality and climate change.

After eleven years of collaboration on reducing port-related air emissions in the Northwest, the Ports are committed to continued and renewed efforts to invest in studies, projects, programs, and other efforts that result in improved air quality and reduced contributions to climate change.

Acknowledgements

The Vancouver Fraser Port Authority, Port of Seattle, Port of Tacoma and the Northwest Seaport Alliance are thankful to all partners and stakeholders that contributed to the implementation of both the 2007 and 2013 Strategies over the last eleven years. Significant investment is required to undertake each of the initiatives identified in the Strategy. Funding made available by various agencies in 2018 continues to move forward initiatives that are valuable in reducing port-related air emissions in the Northwest. The Ports also recognize that numerous stakeholders and equipment owners have made significant investments of private resources into cleaner technologies, without which the achievements of the Northwest Ports Clean Air Strategy would not have been possible. The Ports look forward to the ongoing support of their partners and stakeholders during the renewal and implementation of the Strategy through 2019 and 2020.

Preparation of this report was supported by Pinna Sustainability Inc.

