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**Northwest Ports Clean Air Strategy Implementation Plan**



**THE NORTHWEST**  
SEAPORT ALLIANCE



Produced by the Northwest Seaport Alliance

June 30, 2021

**Executive Summary:**

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## 1. Purpose

The Northwest Seaport Alliance (NWSA) is committed to reducing, and ultimately eliminating, the air and climate pollution emissions of diesel particulate matter (DPM) and greenhouse gases (GHG) – that are associated with the cargo shipping operations that we manage on behalf of the ports of Tacoma and Seattle. That is why The NWSA, at its inception in 2015, joined the Northwest Ports Clean Air Strategy (NWPCAS). The NWPCAS is a voluntary collaboration between the four largest port entities of the Pacific Northwest – NWSA, Port of Tacoma (PoT), Port of Seattle (PoS), and Port of Vancouver (VFPA) – to reduce air and climate pollution from their respective seaport activities throughout the Puget Sound – Georgia Basin Airshed. The NWPCAS constitutes a shared strategic framework for clean air and climate actions and investments that creates a “level playing field” across the four participating port entities, and helps them coordinate, collaborate, and hold each other accountable.

The participating ports updated and renewed the NWPCAS in 2020, strengthening their commitment to reducing air and climate pollution. The 2020 NWPCAS puts forth an ambitious, aspirational, joint vision to phase out emissions from seaport activities by 2050, and a suite of high-level joint objectives and actions to advance that vision.

In addition, each of the four participating port entities committed to developing a detailed implementation plan tailored to their particular policy environments, governance structures, lines of business, emissions profiles, and community priorities.

This is the NWPCAS Implementation Plan for The NWSA, outlining The NWSA’s commitment to work towards the aspirational vision and objectives laid out in the NWPCAS. It describes the workplans for The NWSA’s air quality and climate programs with a primary focus on actions to be taken over the next five years (2021-2025).

### 1.1. Implementation Plan Applications

Broadly, The NWSA’s NWPCAS Implementation Plan is designed to document and communicate our air quality and climate action plan for the next five years. The following summarizes the intended audiences of the plan and how we intend for it to be used.

- A. Staff of The NWSA** – The Implementation Plan summarizes our workplan for the next five years. It includes a detailed summary of the air quality and climate actions and investments we plan to make and a suite of milestones for measuring success. The plan also includes an adaptive management framework that will guide us in making adjustments over time as new information becomes available and circumstances change.
- B. NWPCAS Partner Ports** – For our partner ports, the Implementation Plan transparently demonstrates our commitment to working towards the joint vision and objectives and feeds into our joint reporting.

- C. **Industry Partners** – The Implementation Plan serves as both a mechanism to communicate our intentions and a call for collaboration, daylighting areas of joint interest where we can work together.
- D. **Government Partners** – The Implementation Plan seeks to clearly communicate our near term workplan to partner governments. This provides transparency, daylighting opportunities for partnerships, and highlights our funding needs. External funding will be vital if we and our industry partners are to be successful in achieving the NWPCAS vision. In addition, external funding can help accelerate our timelines in many areas.
- E. **Near Port Communities and the General Public** – The NWSA is dedicated to clearly and transparently communicating our plans for reducing our contributions to air pollution and climate change and partnering with near-port communities on clean air and climate solutions. The Implementation Plan serves as our method for communicating our near term workplan and identifying partnership opportunities. We will report our progress via annual progress reports as defined later in the Implementation Plan.

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## 2. NWPCAS Background

The NWPCAS was created in 2008 by the PoS, PoT, and VFPA to set joint aspirational goals to reduce air pollutant and GHG emissions from seaport related operations associated with the four ports. When it was created in 2015, the NWSA joined the collaboration. The geographic and operational scope are described below.

### 2.1. Operational Scope:

The NWPCAS covers emissions from ocean-going vessels, harbor vessels, heavy duty trucks, locomotives, cargo-handling equipment, and port administration and tenant facilities (fleets and facilities). These sectors are explained in more detail in chapter 5.

### 2.2. Geographic Scope:

The geographic scope of the NWPCAS is the same of the port emission inventories, shown in Figure 1. For the NWSA, this includes all truck, vessel, rail, and cargo handling equipment activities that are directly part of moving cargo to from and through facilities managed by the NWSA within the green shaded area. For example, an ocean-going vessel calling an NWSA terminal would be counted from when it enters the Strait of Juan de Fuca until it exits.



Figure 1. Geographic scope of the NWPCAS.

### 2.3. NWPCAS Vision

Responding to the urgent need to minimize environmental health impacts and disparities and address climate change, the 2020 NWPCAS sets a common vision among the participating ports to ultimately phase out air pollutant and GHG emissions. This vision is aligned with the latest guidance from the Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup>, which indicates that global carbon neutrality by 2050 is necessary to limit global temperature increase to 1.5 degrees C, thereby avoiding the most catastrophic impacts of climate change. Phasing out emissions also will help reduce regional environmental health impacts associated with diesel exhaust. The joint vision statement is:

***“Phase out emissions from seaport-related activities by 2050, supporting cleaner air for our local communities and fulfilling our shared responsibility to help limit global temperature rise to 1.5 degrees.”***

This implementation plan defines how The NWSA will begin working towards achieving this joint vision and reducing emissions in the interim.

### 2.4. NWPCAS Objectives

Supporting the joint vision, the NWPCAS also puts forth a suite of objectives that outline the major action themes along the pathway to achieving zero emissions. These objectives are:

- 1) *“Implement programs that improve efficiency, phase out old high emitting equipment, and increase use of lower emission fuels.”*

The intent of this objective is for ports to work towards minimizing emissions from the existing fleet as we wait for zero emission technology to become fully demonstrated, commercially available, and cost competitive.

- 2) *“Facilitate collaboration among governments, utilities, fuel providers, and industry to ensure that infrastructure needed to enable zero emission technologies is in place at the right time, addressing key constraints by 2030”*

The intent of this objective is for ports to work with other stakeholders to ensure that infrastructure is not an impediment to adoption of zero emission technologies as they become available and affordable. This does not mean that all infrastructure will be in place by 2030, but that the right infrastructure investments will be made at the right time based on need.

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<sup>1</sup> [Global Warming of 1.5 °C — \(ipcc.ch\)](https://www.ipcc.ch)



3) *“Facilitate collaboration toward commercialization and drive adoption of zero emission technology before 2050”*

This objective articulates the pathway for deploying zero emission technologies in day-to-day operations, recognizing that the ports have a role to play in demonstration and commercialization of these technologies as well as the ultimate deployment of them.

In the first five years of NWPCAS implementation, The NWSA’s effort will likely be more heavily weighted towards cleaning up the existing fleets, improving efficiency, and infrastructure planning. However, we recognize that engagement and collaboration towards the longer-term vision for zero emission vision must start now and that there may be opportunities in some areas to jump straight to zero emissions, where technology is commercially available and is cost competitive, or incentives are available.

## **2.5. NWPCAS Conditions for Success**

Recognizing that the most of the NWPCAS scope is out of the ports’ direct operational control, the NWPCAS puts forth a suite of conditions for success that will need to be satisfied to reach zero emissions. While the ports play an important role in working towards these conditions, significant action will be needed from others if they are to be satisfied. An abbreviated summary of the conditions for success is provided below, while a full description of the conditions is provided in the full NWPCAS strategy document.

1. “Enabling policy is in place domestically and internationally to support investment in zero emissions technology and infrastructure.”
2. “Funding and/or access to capital [is available] to support adoption of zero emission technology and infrastructure development where [the] business case is insufficient”.
3. “Adequate electricity and/or fueling infrastructure is available when and where needed.”
4. “Technology is commercially available and demonstrated for port applications, and total cost of ownership is competitive [with diesel] which may require enabling regulation and funding.”
5. “Industry commitment [is made] to transition to zero emission operations through investments and business planning.”
6. “Workforce is trained to operate and maintain zero emissions technology.”

### 3. Northwest Seaport Alliance Background

The NWSA was created in 2015 to manage the cargo shipping operations at the ports of Seattle and Tacoma. While the PoT and PoS rely on the NWSA to manage commercial relationships and agreements among other things, the NWSA relies on the home ports to manage facilities development projects, fleet maintenance, facilities maintenance, and furnishment of administration office facilities, among others.

#### 3.1. Description of the NWSA

The Northwest Seaport Alliance (NWSA) is a marine cargo operating partnership of the Ports of Seattle and Tacoma, which formed in 2015 to increase the competitiveness of the cargo operations at these ports. The NWSA is an independent port development authority that constructs, maintains, and operates marine terminals, and addresses related transportation and air quality issues.

The NWSA supports 58,400 jobs, produces more than \$4 billion in labor income, and generates \$135.9 million in state taxes (2017). Trade at the NWSA enables \$5.9 billion in direct business revenue, \$2.9 billion in indirect business revenue, and \$3.7 billion in additional household spending. Figure 2 further describes the NWSA’s relationship to its home ports and how the emission sources are distributed between the three entities.



Figure 2. Sectors under Operational Control of the NWSA and its two “home ports”.

### **3.2. Role of the NWSA and Operating Model**

The NWSA is what is typically referred to as a “landlord” port, meaning that we do not directly operate the port terminals ourselves (in most cases). Instead, we lease the land to private operators who directly manage operations themselves, own the equipment and vehicles that operate on the terminals, and contract with shipping lines and trucking companies that pick up or drop off cargo at the terminal. Therefore, we do not have direct control of the day-to-day operations that occur on our properties, but instead, set the rules when lease agreements are signed and renewed. These long-term lease agreements are where we have the best opportunity to influence terminal operating practices. That said, all terms of the lease agreements are negotiated and agreed upon by The NWSA and the tenant.

It is important to note that a significant fraction of the cargo coming through the NWSA gateway, about 75%, is discretionary cargo. Discretionary cargo is cargo that is not destined for local residents and businesses, which means it could be shipped through a number of different ports to reach its final destination. Discretionary cargo is particularly susceptible to potential diversion to other ports if costs through another gateway are comparatively lower. In addition to the economic impacts associated with our region losing cargo, diverting cargo to ports that are farther from the Asia and/or have lower environmental standards could lead to increasing emissions. Because such a large percentage of the cargo coming through the NWSA gateway is discretionary, our ability to impose standards through leases without significant risk of cargo diversion, especially those that increase costs of operation, is limited.

### **3.3. Emissions and Impacts**

Emission inventories have been the foundation of the goals of the NWPCAS since its inception, providing an analytical basis for how to prioritize emission reduction measures across the operational sectors to maximize impact. Every five years, The NWSA participates in an emissions inventory study with other ports and maritime stakeholders in the region to produce the Puget Sound Maritime Air Emissions Inventory (PSEI)<sup>2</sup>. The most recent inventory was completed for activity occurring in calendar year 2016 and the next one will be conducted for activity occurring in 2021. Because The NWSA implemented its Clean Truck Program requirement for drayage trucks calling its international container terminals on January 1, 2019, after the most recent PSEI, NWSA staff have modelled estimated emission reductions associated with this policy and incorporated them into the data shown in this implementation plan. In addition to the PSEI, The NWSA conducted a supplemental GHG inventory to understand the GHG emissions associated with activities not covered by the PSEI such as facility energy use and corporate emissions (like business travel and employee commuting). Data from the supplemental GHG Inventory has been included for completeness.

While we track a full suite of criteria air pollutants as part of the PSEI, we generally focus on diesel particulate matter (DPM) as an indicator of air pollutant burden, as it carries the biggest

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<sup>2</sup> <https://pugetsoundmaritimeairforum.org/>

human health risk of air pollutants that we track. In addition, we focus on GHG emissions as an indicator of our contribution to climate change. In total, operations connected to cargo and corporate activities of The NWSA resulted in the emissions of 171 tons of diesel particulate matter based on our most current estimates (incorporating Clean Truck Program requirement reductions into the 2016 PSEI) and 657,719 tons of GHG emissions. This includes all emissions throughout the airshed shown in Figure 1 above.

Figure 3 and Figure 4 show the distribution of DPM and GHG emissions respectively across the airshed depicted in Figure 1 for activities associated with NWSA business in the Tacoma and Seattle harbors combined. Ocean Going Vessels (OGVs) are clearly the largest source of both DPM and GHG emissions, especially the transiting segment. For DPM emissions, locomotives are the second largest source and the other sources are similar in magnitude, while trucks are the second largest source of GHG emissions, followed by locomotives, CHE, and then harbor vessels.

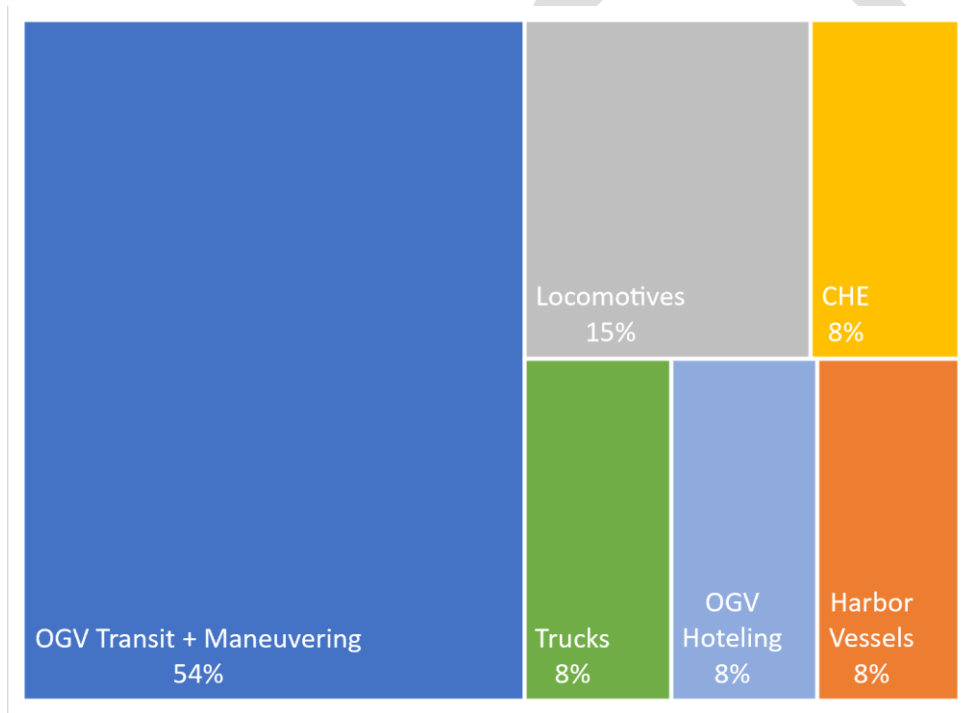


Figure 3 NWSA DPM emissions by sector.

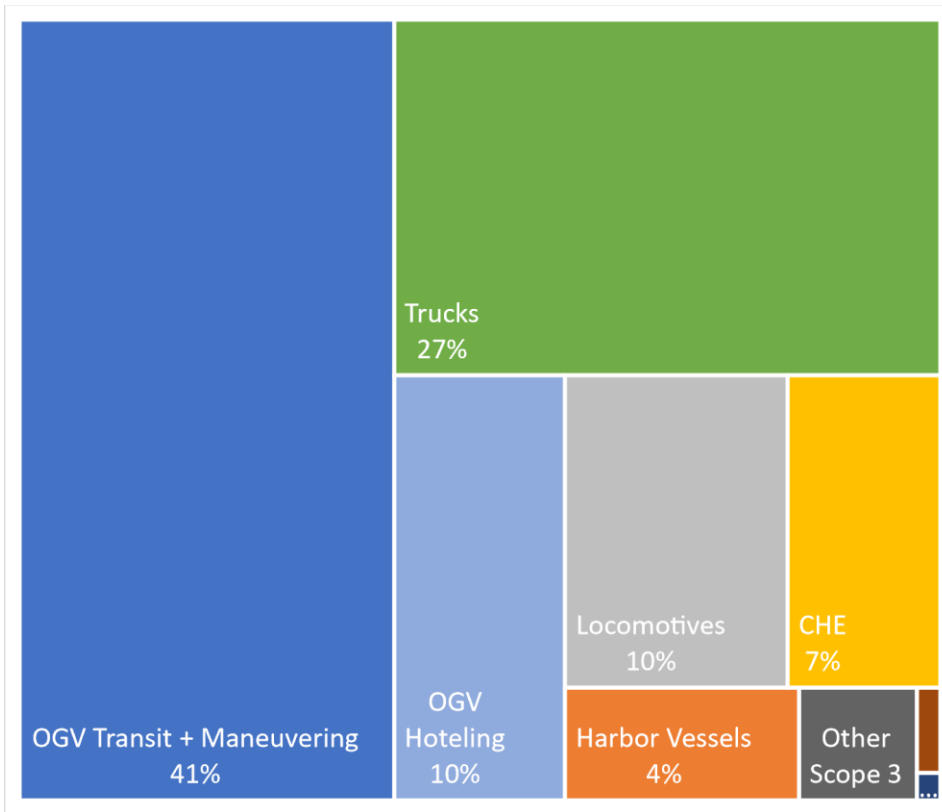


Figure 4. NWSA GHG emissions by sector. The red rectangle represents tenant facility energy use (less than 1% of total emissions) and the purple rectangle represents light duty fleets (less than 1% of total emissions).

### 3.3.1. Emissions in the Tacoma Harbor

The following figures detail the emission distributions for port related sources associated with port business in The NWSA's Tacoma Harbor that occur across the airshed. This includes more than just the emissions that physically occur in the Tacoma Harbor. For example, vessel emissions are tracked from when they enter the Strait of Juan de Fuca to the berth in Tacoma and back out. Truck trips are included from the port terminal to its destination, which may be outside of Pierce County. Because our corporate GHG Inventory was not broken out by harbor, only cargo transport emissions are included here. In total, activities associated with activities in the Tacoma Harbor emit 127 tons per year of DPM and 395,195 tons per year of GHGs.

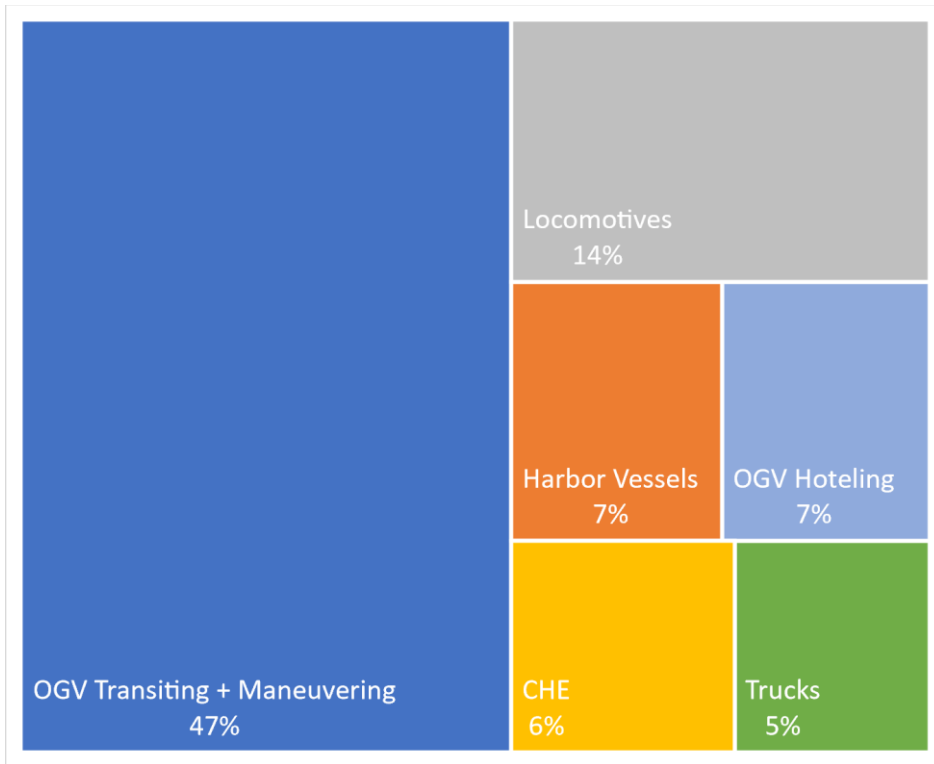


Figure 5. DPM emissions by sector associated with Tacoma Harbor NWSA business.

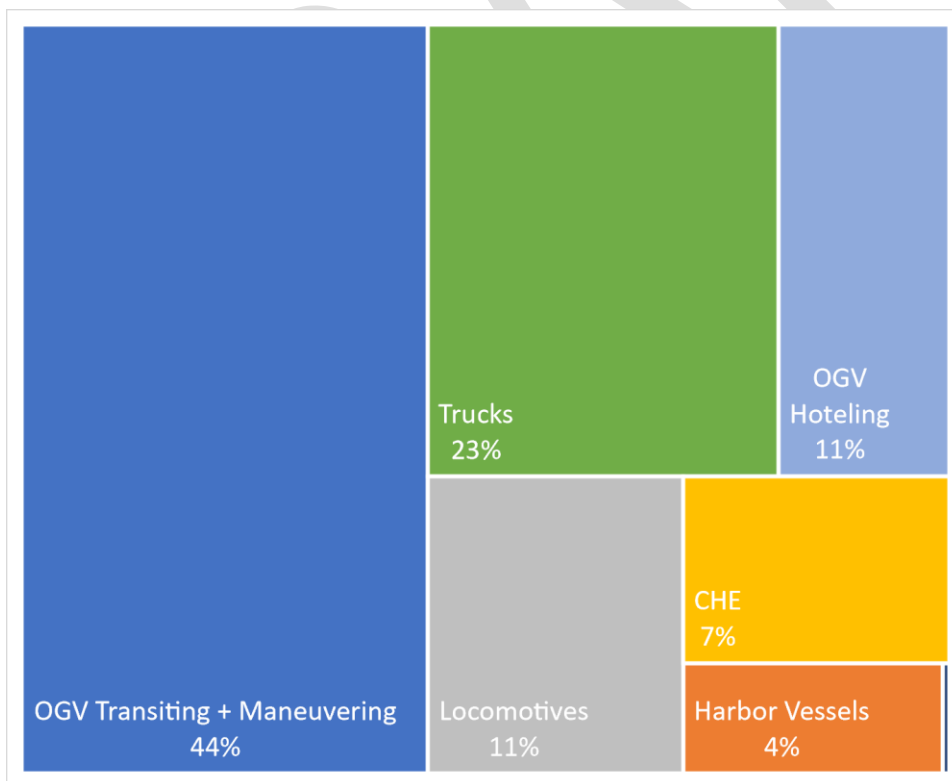


Figure 6. GHG emissions by sector associated with Tacoma Harbor NWSA business. The purple rectangle represents light duty fleets (less than 1% of total).

### 3.3.2. Emissions in the Seattle Harbor

The following figures detail the emission distributions for port related sources associated with The NWSA's business in The NWSA's Seattle Harbor that occur across the airshed. This includes more than just the emissions that physically occur in the Seattle Harbor. For example, vessel emissions are tracked from when they enter the Strait of Juan de Fuca to the berth in Seattle and back out. Truck trips are included from the port terminal to its destination, which may be outside of King County. Because our corporate GHG Inventory was not broken out by harbor, only cargo transport emissions are included here.

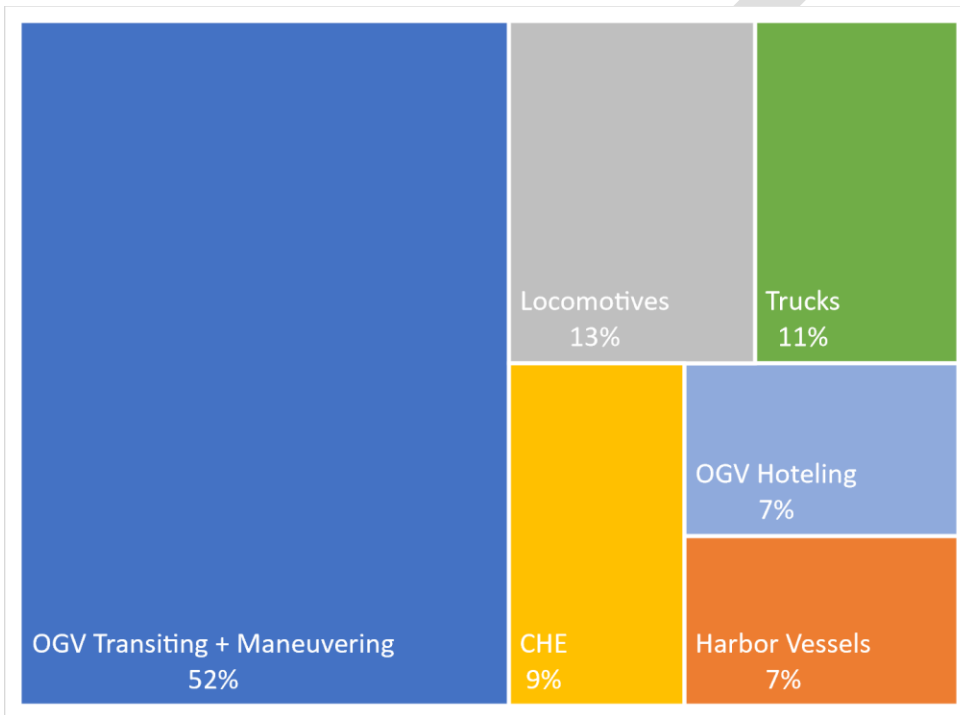


Figure 7. DPM emissions by sector associated with Seattle Harbor NWSA business.

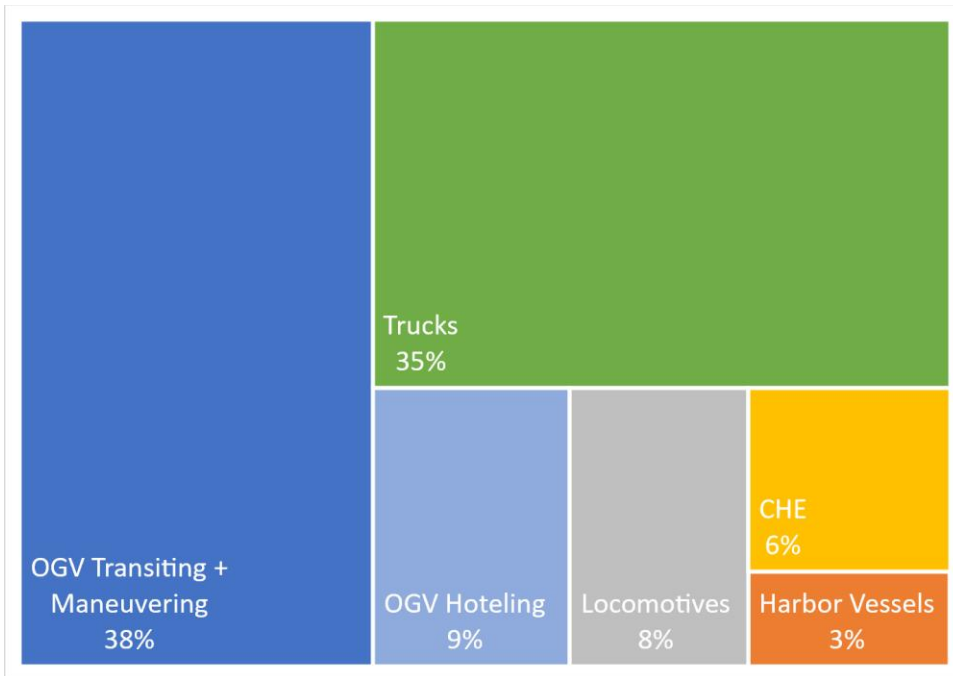


Figure 8. GHG emissions by sector associated with Seattle Harbor NWSA business.

### 3.3.3. Exposure Modeling

While absolute emissions have been our most commonly used indicator of air pollution and climate impacts, we recognize that total emissions do not tell the whole story for air pollution impacts, as the physical location of the emissions and how they disperse are significant, impacting human health differently. For example, a vessel that emits 10 pounds of particulate matter in the Strait of Juan de Fuca, far away from population centers, is less likely to contribute to adverse health impacts than a fleet of trucks that emit 10 pounds of particulate matter on city streets. Along with technical feasibility, financial feasibility, GHG emissions, The NWSA's level of influence, and others, air pollution impacts are an important criteria we will consider to prioritize our work. Therefore, the actions pursued may not always follow the prioritization listed above.

In order to better understand the impacts of each port related emission source on regional air pollutant exposure, we commissioned an air modeling study by Washington State University to estimate how much each source contributes to exposure. The study was conducted using WSU's regional air quality forecasting model, AIRPACT 5<sup>3</sup>, to estimate the concentrations of fine particulate matter (PM<sub>2.5</sub>) across our airshed associated with each source's emissions. PM<sub>2.5</sub> was modeled rather than DPM based on the capabilities of WSU's model. Since PM<sub>2.5</sub> emitted from diesel engines is all DPM, considering PM<sub>2.5</sub> is roughly equivalent to using DPM for port related sources. Annual average concentration contributions were correlated with population data as a metric to indicate impacts on population.

<sup>3</sup> <http://lar.wsu.edu/airpact/gmap/ap5/ap5smoke.html>



The results of the study indicate that controlling emissions from OGVs at berth, trucks, and cargo-handling equipment (CHE) are the most impactful means of reducing the population impacts of PM<sub>2.5</sub> from port related sources. A summary of the WSU study results are shown below in Table 1. These sources are physically much closer to our near-port communities, and spend almost all their time situated right beside residents.

The largest contributor to population impacts are OGVs. Qualitative assessment of the concentration “heat maps” indicate that the majority of these impacts occur near the port areas, which suggests that control measures for vessels at berth are the best strategies for reducing these impacts. Trucks are the next highest on the list for population impacts. In addition, it is informative to evaluate population impacts per unit of emissions, as this metric can indicate sectors where there are lower total impacts, but reducing emissions can still have a high relative impact. Using this metric (Impact/Emission in Table 1), trucks and CHE score the highest indicating that reducing a ton of emissions from either of these sources will be most impactful for reducing impacts on population. These results indicate that reducing emissions from OGVs while transiting and line-haul rail are likely to be less impactful and should be prioritized less heavily than vessels at berth, trucks, and CHE. It should be noted, however that there may be smaller scale air quality issues that do not conform to the conclusions made here. For example, there may be a community located near a rail line for which efforts to reduce emissions from those locomotives are more important than the other sources. These individual community concerns will need to be addressed on a case-by-case basis. The modeling data from the WSU study may be used in many cases to evaluate concentrations in specific neighborhoods.

Table 1. Results from the WSU Port Air Modeling Study

<b>Source</b>	<b>Emissions (tons/year)</b>	<b>Population Impacts (conc. x pop.)</b>	<b>Impact/Emission</b>
<b>OGV</b>	157.81	50,285	319
<b>Trucks</b>	25.76	39,025	1,515
<b>Locomotives</b>	22.75	16,172	711
<b>CHE</b>	9.66	14,334	1,484

## **4. Adaptive Management Framework**

An adaptive management approach to implementation of the NWPCAS is critical because there is a high degree of uncertainty around the timelines for zero emission technologies to become fully demonstrated, commercially available and affordable in each sector and because The NWSA is very early in the process of planning for the infrastructure that will be needed to support the transition. We know things will be changing fast in the zero emissions technology space and we need the flexibility to adapt to exciting new technology developments, policies, and funding opportunities, as well as constraints and project delays. We plan to update our Implementation Plans on an annual basis to incorporate new information and progress from the previous year and renew the Implementation Plans every five years in parallel with renewals of the Northwest Ports Clean Air Strategy.

### **4.1.1. Timeframe and Interim Targets**

This Implementation Plan covers the actions that The NWSA plans to take over the next five years to implement the Northwest Ports Clean Air Strategy. This timeframe aligns with The NWSA's financial and capital planning horizons, allowing us to budget appropriate resources for the specific actions and programs identified. Additionally, the tremendous amount of uncertainty that exists in the zero emission space makes it extremely difficult to predict what the right actions will be five or more years down the road. A few examples of these uncertainties are:

- It is presently unclear when zero emission technology will be cost competitive with diesel powered technologies in most port related sectors.
- We need to do significantly more planning work to understand the costs and realistic timelines for deploying the infrastructure needed to support zero emission technologies.
- The funding pathways for transitioning to zero emissions are unclear. Presently there is not enough funding to drive this transition in Washington State.
- The future policy landscape is uncertain and changing rapidly.
- Business drivers to adopt zero emission technology are uncertain.

These uncertainties also make it extremely challenging to set aggressive yet achievable interim milestones between now and 2050. Therefore, the five year milestones presented in section 6 of this Implementation Plan serve as our interim targets for measuring the success of our action plans. As part of each five year NWPCAS update, we will set new five year milestones to serve as our interim targets. We will also remain open to setting longer reaching interim milestones if they make sense based on evaluation of the technology, policy, and funding landscapes.

### **4.1.2. Annual Updates**

The annual update process for this Implementation Plan will focus on revising priorities and annual workplans and budgets based on progress to date and the changing political, funding,

commercial, and technology landscape. The primary goal of the annual review is to create the workplan and budget for the coming year. This will be done as part of the NWSA's budget process which culminates in late fall of each year, before public approval by our Managing Members, allowing the workplan to be in place before the start of the next year. As part of the Implementation Plan update, new actions may be added that support the existing milestones and timelines for existing actions may be adjusted. Engagement will be performed as needed to inform the annual implementation updates. A summary of the upcoming year's projected implementation actions will be published in our annual report, described in section 8.

#### **4.1.3. Five Year Renewals**

When the NWPCAS reaches the end of its five-year implementation period, the participating ports will collaboratively renew the NWPCAS. After this renewal is complete, this Implementation Plan will need to be renewed as well, to ensure that it aligns with the updated strategic direction. Depending on the outcome of the NWPCAS renewal process the Implementation Plan renewal may be limited to minor revisions, or may require a full rewrite if required by the renewed NWPCAS. As part of this renewal, all milestones, actions, and workplans will be revisited.

The NWPCAS and this Implementation Plan will be renewed through a robust engagement process that will seek to incorporate perspectives across from community, industry, government, tribal government, and environmental non-government organizations. We will strive to make engagement on the NWPCAS and Implementation Plans as accessible as possible to ensure that all perspectives are considered.

When renewing the NWPCAS and Implementation Plan, we will consider the following criteria as we consider new strategies, actions, and milestones:

- ***GHG emission reductions*** – Achieving our vision will require that we achieve carbon neutrality by 2050, critical for doing our part to limit climate change.
- ***Air pollutant emission reductions*** – Air pollutant emissions, especially those from diesel engines, result in negative health impacts for those exposed. Our actions will strive to reduce air pollutant emissions, prioritizing emissions of diesel particulate matter, which are thought to have the most significant health implications of port related air pollutant emissions. We will prioritize air pollutant emission reductions based on results of the WSU air modeling study described in section 3.3.3., placing emphasis on sources that have more impacts on populations.
- ***Address environmental health disparities*** – We will continue to refine our understanding of The NWSA's relationship to environmental health disparities and prioritize air emission reduction efforts in areas that are disproportionately impacted.

- **Level of influence** – We will prioritize actions for which the NWSA has more influence over success. For example, the NWSA has more influence over infrastructure installed on our property than the locomotives purchased by private companies.
- **Technical feasibility** – It is important that technologies to be implemented in an action can “do the job” and can be reasonably integrated into operations.
- **Cost** – The cost of the action and funding available to offset those costs will be a critical consideration both for The NWSA and our industry partners. We will seek to prioritize actions that get the largest benefit for the lowest cost.
- **Alignment with commercial goals** – We will prioritize actions that increase, or at least maintain the competitive position of the Puget Sound cargo gateway in the global marketplace. This means we will need to be conscientious about adding additional costs and prioritizing actions that cargo owners find desirable.
- **Advancement of the pathway to zero** – Our ultimate goal is to transition to zero emissions. We will prioritize actions that push us farther down the path towards achieving the desired end state.

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## 5. NWSA Sector Action Plans

This section lays out the five year action plan in each activity sector for working towards the NWPCAS vision and joint objectives as well as major milestones we hope to meet within.

### 5.1. Cross Sector Actions

Cross sector actions are those that apply broadly across more than one operational sector. They include community engagement and partnerships, industry engagement and partnerships, public policy engagement, infrastructure planning and development, and technology assessment and advancement.

#### 5.1.1. Community Engagement and Partnerships

Improving air quality for workers and near-port communities through reduced emissions from port related sources is a central priority of the NWPCAS and this implementation plan. Communicating, engaging, and partnering with near-port residents and community groups is an essential component of this work. The NWSA will continue and strengthen our efforts to engage and partner with near port residents and communities in both our Tacoma and Seattle harbors, to ensure that our clean air and climate work incorporates community experience, perspectives, priorities, and ideas.

Based on the Washington State Department of Health's Environmental Health Disparities Map<sup>4</sup>, significant environmental health disparities exist along the I-5 corridor and in and around the Tacoma and Seattle industrial centers, of which the ports are a part. Quantifying environmental health is a complicated exercise; the Washington State Department of Health uses 19 indicators including environmental exposures, proximity to certain activities that are thought to elevate risk to human health, population sensitivity, and socioeconomic factors<sup>5</sup>. Diesel emissions from port activities is one of many contributors to these long-standing environmental health disparities that will need to be addressed by a wide consortium of stakeholders. The NWPCAS and this Implementation Plan are The NWSA's effort to reduce our diesel exhaust contributions to these disparities.

As part of our efforts to reduce our impacts we will work with communities and other agencies to refine and expand our analysis of how port related air emissions contribute to environmental health disparities and identify the highest impact strategies for reducing and mitigating those contributions.

The main programmatic priorities for our air quality and climate community engagement programs over the next five years are:

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<sup>4</sup> [Information by Location | Washington Tracking Network \(WTN\)](#)

<sup>5</sup> [Washington Environmental Health Disparities Map :: Washington State Department of Health](#)

1. Increase mutual understanding of port related air quality and climate opportunities and challenges in the Tacoma and Seattle harbors.
2. Continue to build mutual trust and capacity for collaboration.
3. Better understand the NWSA’s relationship to air quality related environmental health disparities experienced by near port communities in the Tacoma and Seattle harbors.
4. Collaborate on the development and implementation of port related air quality and climate solutions.

The following list of actions seeks to describe in general terms how we will approach our partnerships with near port communities in Tacoma and Seattle. Individualized actions will be identified in close partnership with each community group during implementation.

Table 2. Community Engagement and Partnerships Action Plan

Action	Timeline	Roles and Responsibilities
<p><b>1. Gateway-Wide:</b></p> <p>a. Rely on targeted analytical work and community consultations to better understand and address port related air quality impacts in near port communities.</p> <p>b. Develop mechanisms for more systematically and effectively communicating with and engaging near-port residents and community groups in both harbors. Examples include organizing periodic Clean Air &amp; Climate Action Round Table (C-CART) discussions; and publishing an e-newsletter.</p>	2021-2025+	<p>Lead: AQSP Support: PoS Sustainability, PoS Public Affairs, PoT Public Affairs, Communications</p>
<p><b>2. Tacoma Harbor:</b></p> <p>a. Continue to collaborate with Citizens for a Healthy Bay on clean air and climate solutions.</p> <p>b. Collaborate with Port of Tacoma staff to expand the network of near port residents and community groups with whom we communicate, engage, and partner.</p> <p>c. Collaborate with Port of Tacoma staff to identify and implement partnership opportunities that advance near port community priorities and the NWPCAS in the Tacoma Harbor.</p>		<p>Lead: AQSP Support: PoT Public Affairs, Communications</p>
<p><b>3. Seattle Harbor:</b></p> <p>a. Continue to participate actively in the development and implementation of the Duwamish River Clean-Up Coalition-led Clean Air Program.</p> <p>b. Collaborate with Port of Seattle staff to expand the network of near port residents and community groups with whom we communicate, engage, and partner.</p>		<p>Lead: AQSP Support: POS Sustainability, POS Public Affairs, Communications</p>

c. Collaborate with Port of Seattle staff to identify and implement partnership opportunities that advance near port community priorities and the NWPCAS in the Seattle Harbor.		
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### 5.1.2. Industry Engagement and Partnerships

Achieving the 2020 NWPCAS vision will require action across all industry stakeholders in the port networks including terminal operators, ocean carriers, tug operators, rail operators, and truck owners and operators. Because The NWSA directly controls very few of the assets that will need to be upgraded to zero emissions, engagement and partnerships with industry stakeholders is vitally important to motivate action and align external funding needed to make investments in clean technology. The NWSA will continue and strengthen its efforts to engage and partner with its industry partners by providing information, assistance, and incentives to facilitate and encourage the transition to zero-emission technologies.

The main programmatic priorities for air quality and climate industry engagement over the next five years are:

1. Inspire, enable and empower our industry partners to implement cleaner technology, especially zero emission technology.
2. Identify partnerships through which The NWSA can enable implementation of zero and near zero emission technology by facilitating external funding.
3. Maximize the use of zero emission infrastructure installed by The NWSA, especially shore power infrastructure.

Based on these priorities, the actions to be taken are summarized in Table 3 below.

Table 3. Industry Engagement and Partnerships Action Plan

<b>Action</b>	<b>Timeline</b>	<b>Roles and Responsibilities</b>
<b>1. Strengthen tenant engagement and support:</b> Develop a robust tenant engagement and support program to: share information about infrastructure and technology developments; communicate grant and other funding opportunities; identify project and partnership opportunities; and provide technical support to tenants related to clean air/climate efforts and/or zero emission technology.	Develop tenant engagement framework in 2021  Implement engagement program 2022-2025+	Lead: AQSP Support: Commercial, Operations

<p><b>2. Partner with tenants and industry partners on funding applications:</b> Lead grant applications and other efforts to secure external funding to support tenant and other industry led projects to implement clean technology.</p>		
<p><b>3. Identify and pursue additional clean air/climate partnership opportunities with key industry partners:</b> Conduct a thorough review of the climate and sustainability goals and programs of major customers (e.g. BCOs, ocean carriers, etc.) and identify additional industry partnership opportunities to be pursued.</p>	<p>Complete review in 2021</p> <p>Engage BCOs and act on partnership opportunities: 2022-2025+</p>	
<p><b>4. Strengthen ocean carrier engagement and partnerships:</b> As needed, engage with major ocean carriers and the PMSA on air pollution reduction programs like shore power and potential new programs for reducing emissions while underway.</p>	<p>2021-2025+</p>	
<p><b>5. Strengthen rail operator engagement:</b> Partner with PSCAA to engage with Tacoma Rail and the Class 1 rail lines to identify opportunities for emission reduction projects and partnerships like repowers.</p>	<p>Working group established in 2021</p>	

**5.1.3. Public Policy Engagement and Advocacy**

Supportive public policy that both advances air quality and climate policy will be critical to achieving the 2020 NWPCAS vision by establishing appropriate market signals, creating new revenue streams, creating new funding pathways, and creating a level playing field for air quality and climate action across ports. In particular, we know that transitioning to zero emissions will come at significant cost beyond “business as usual”. Therefore, it is critical that these incremental costs be offset by external funding. Additionally, there are many areas in which federal and international policy will need to be more aggressive for us to meet our goals. This should be done in a uniform way that both increases ambition and creates a level playing field across ports to avoid creating a competitive disadvantage for adopters.

The NWSA will increase its efforts under the 2020 NWPCAS, in partnership with the other participating ports and government agency, industry, and community partners, to promote policies that enable emission reductions and the transition to zero emissions while maintaining a competitive cargo gateway. The following are the main programmatic priorities for the NWSA’s air quality and climate policy engagement program.



1. Advocate for increased funding opportunities for implementation of zero and near zero emission technologies in the port and maritime sectors and direct as much of that funding as possible to the Tacoma-Seattle gateway.
2. Advocate for international and federal policies that increase ambition on air pollutant and greenhouse gas emissions in ways that create a level playing field across ports.
3. Build relationships with local, state, federal, and international agencies and policy makers to advance deployment of lower emission technologies and direct funding towards these projects in the Tacoma-Seattle gateway.

Based on these priorities, the actions to be taken are summarized in Table 4 below.

Table 4. Policy Engagement Action Plan

Action	Timeline	Roles and Responsibilities
<p><b>1. Strengthen International Engagement</b></p> <p>a. Continue to implement and refine our international engagement program, advocating for more aggressive action on air quality and climate in international shipping. More specific details are provided in the OGV section below (Table 8).</p> <p>b. Strengthen cross-port collaboration on international engagement with the other NWPCAS partner ports.</p>	2021-2025+	<p>Lead: AQSP Support: Commercial, Government Affairs</p>
<p><b>2. Strengthen Federal Engagement</b></p> <p>a. Continue to implement and refine our federal engagement program, advocating for strengthened air quality and climate policies that create a level playing field between ports across the US and for more funding for port emission reduction efforts.</p> <p>b. Maintain and strengthen working relationships with Federal agencies.</p> <p>i. Continue partnership with EPA through the Ports Initiative and DERA program.</p> <p>ii. Strengthen relationship with US DOE, PNNL, and US DOT.</p>		<p>Lead: Government Affairs Support: AQSP, Planning, Commercial, Operations</p>
<p><b>3. Strengthen State Engagement</b></p> <p>a. Continue to implement and refine our state engagement program, advocating for policies that create increased funding opportunities for port related emission reduction efforts.</p> <p>b. Maintain and strengthen relationships with state agencies.</p>		<p>Lead: Government Affairs Support: AQSP, Planning, Commercial, Operations</p>

<ul style="list-style-type: none"> <li>i. Department of Ecology through the Diesel Program, VW Settlement Program, Low Carbon Fuel Standard Program, and others.</li> <li>ii. Department of Commerce through the Clean Energy Fund; Electrification of Transportation program, energy efficiency program, etc.</li> </ul>		
<p><b>4. Strengthen Local Engagement:</b></p> <ul style="list-style-type: none"> <li>a. Puget Sound Clean Air Agency: support rail and tug repower programs, partner on clean truck initiatives, serve on Advisory Council, and others.</li> <li>b. Utilities: Seattle City Light and Tacoma Public Utilities. Collaborate on energy planning and deployment of infrastructure to support zero emission operations.</li> <li>c. City of Seattle: engage with Office of Sustainability and Environment, on ICCT zero emission truck study, other clean truck initiatives, and other zero emission initiatives.</li> <li>d. City of Tacoma: Continue partnership with Office of Sustainability and Sustainable Tacoma Commission and participate in development and implementation of Environmental Action Plan.</li> <li>e. Pierce County: Track Sustainability 2030 Pierce County and look for partnership opportunities.</li> <li>f. King County: Build relationship with the sustainability office.</li> <li>g. Regional freight flow strategy: Work with local and regional partners, via infrastructure investments and/or traffic flow strategies to reduce congestion and improve freight flow regionally, with a focus on near port.</li> </ul>		<p>Lead: AQSP Support: Government Affairs</p>

**5.1.4. Infrastructure Planning and Development**

The transition to zero-emission vehicles and equipment will require charging and fueling infrastructure that is accessible and affordable to a wide range of owners and operators including ocean carriers, truck owners, marine terminal operators, railyard operators, rail companies, and tug companies. Facilitating the planning and installation of this infrastructure is one of the most important roles that port authorities will play in NWPCAS implementation. It also is one of the most challenging given the monumental cost, likely constraints of the power distribution grids, and uncertain trajectory of zero emission technology advancement and affordability.

The following are the main priorities for infrastructure planning and deployment.

1. Plan for the infrastructure needed to support zero emission operations.
2. Facilitate installation of infrastructure as needed to support adoption of zero emission technologies.

Based on these priorities, the actions to be taken are summarized in Table 5 below.

Table 5. Infrastructure Planning and Development Action Plan

Action	Timeline	Roles and Responsibilities
<p><b>1. Develop the South Harbor Electrification Roadmap</b> In partnership with Tacoma Power, evaluate infrastructure needs to support zero emission cargo handling equipment, shore power, drayage trucks, and rail in the Tacoma harbor. This study will take a detailed look at the infrastructure needed on port property as well as in the distribution networks as well as investigating innovative solutions.</p>	<p>Begin in 2021 Complete by end of 2022</p>	<p>Lead: AQSP + POS Sustainability Support: Commercial, NWSA Real Estate, PoT Real Estate, PoT Facilities Development, Operations, Finance, Planning</p>
<p><b>2. Support the Seattle Waterfront Clean Energy Strategic Plan</b> Evaluate infrastructure needs to support zero emission cargo handling equipment, shore power, drayage trucks, and rail. The study will be performed in close partnership with Seattle City Light to address the complicated constraints that exist in the grid near the NWSA’s facilities in the Seattle harbor.</p>	<p>Begin in 2021 Complete by end of 2022</p>	<p>Lead: AQSP + POS Sustainability Support: Commercial, NWSA Real Estate, POS Facilities Development, Operations, Finance, Planning</p>
<p><b>3. Facilitate Infrastructure Installation</b> Implement the recommendations of the infrastructure planning studies outlined in the first two actions. The timelines and specifics of this action will depend on the outcome of the studies and will need to be adaptable based on the state of technology and tenant needs.</p>	<p>TBD</p>	<p>Lead: PoT, NWSA, and POS facilities development Support: AQSP, Commercial, Operations, PoT maintenance</p>

**5.1.5. Technology Assessment and Advancement:**

Achieving the 2020 NWPCAS vision will require a transition to zero-emission technologies that are in varying stages of development – and in some cases don’t yet exist. For example, zero-emission class 8 tractor trucks (the type of truck that hauls port cargo over the roads) exist, but still are in the early stages of commercialization and are about three times as expensive

as their diesel counterparts as of early 2021. Zero-emission container ships do not yet exist; the Maersk-led Getting to Zero Coalition has a goal of getting the first commercially viable deep sea zero emission vessel powered by zero emission fuels into operation by 2030. The NWSA’s role in advancing these new, zero-emission technologies focuses primarily on tracking the development and total cost of ownership of relevant technologies, keeping the owners and operators of vehicles and equipment with whom we partner informed about these developments, and looking for strategic opportunities for “early adoption” of zero-emission technologies as they are commercialized and as funding becomes available.

The following are our main priorities for technology assessment and advancement.

1. Track the state of zero and near zero emission technology in each operational sector including purchase price and total cost of ownership.
2. Facilitate demonstration and early adoption of zero emission technologies.

Based on these priorities, the actions to be taken are summarized in Table 6 below.

Table 6. Technology Assessment and Advancement Action Plan

Action	Timeline	Roles and Responsibilities
<p><b>1. Collaborate with other ports to assess zero emission technology feasibility and readiness</b></p> <p>a. In collaboration with other NWPCAS ports, determine the appropriate breadth depth and frequency for technology assessment in each sector. Assemble a framework for jointly delivering and sharing these technology assessments.</p> <p>b. Perform technology assessments to analyze the cost and state of commercialization of zero emission technologies in the PNW market.</p>	<p>Develop technology assessment framework in 2021. Begin implementing in 2022.</p>	<p>Lead: AQSP Support: Operations, Commercial</p>
<p><b>2. Collaborate with partners to assess innovative energy technologies like on-site solar, energy storage, hydrogen fueling, microgrids, etc.</b></p> <p>a. PNNL port microgrids study.</p> <p>b. PNNL H2 @ Scale Study</p> <p>c. Pursue, advocate, and support other energy innovation assessments.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Planning</p>
<p><b>3. Facilitate zero-emission technology demonstration projects</b></p> <p>a. Work with industry partners to facilitate zero-emission technology demonstration projects and support early adoption, with emphasis on CHE and heavy-duty trucks.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Operations, Commercial</p>

These efforts are described in greater detail in the individual sector sections below.		
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## 5.2. Ocean-going Vessels (OGVs)

The OGV source category typically consists of cargo carrying vessels equipped with large marine propulsion engines, auxiliary engines, and boilers. The most common origins and destinations of ships calling The NWSA are Asia and Alaska. The ocean-going vessel types most frequently calling The NWSA are: articulated tug barge, auto carriers, bulk vessels, container vessels, and roll on/roll off (ro/ro) vessels. A summary of vessel call that occurred in 2020 by type is provided in Table 7 below.

Table 7. 2020 Vessel Calls by Type

Vessel Type	Seattle Harbor	Tacoma Harbor	Total
<b>Autos</b>	0	121	121
<b>Barge</b>	101	99	200
<b>Bulk</b>	221	0	221
<b>Containers</b>	531	524	1055
<b>RoRo/Breakbulk</b>	0	66	66
<b>Total</b>	853	810	1663

### 5.2.1. Emissions from OGVs

OGVs are the NWSA's largest source of emissions for both DPM and GHGs. The majority of emissions occur when vessels are in transit (i.e. traveling between the airshed boundary and the port terminals), but the at dock (hoteling) segment also makes up a significant fraction of NWSA's emissions. The maneuvering segment, i.e. when vessels transition between transit and hoteling, often under tug assist, results in the least emissions of the three, given the relatively short time vessels spend maneuvering.

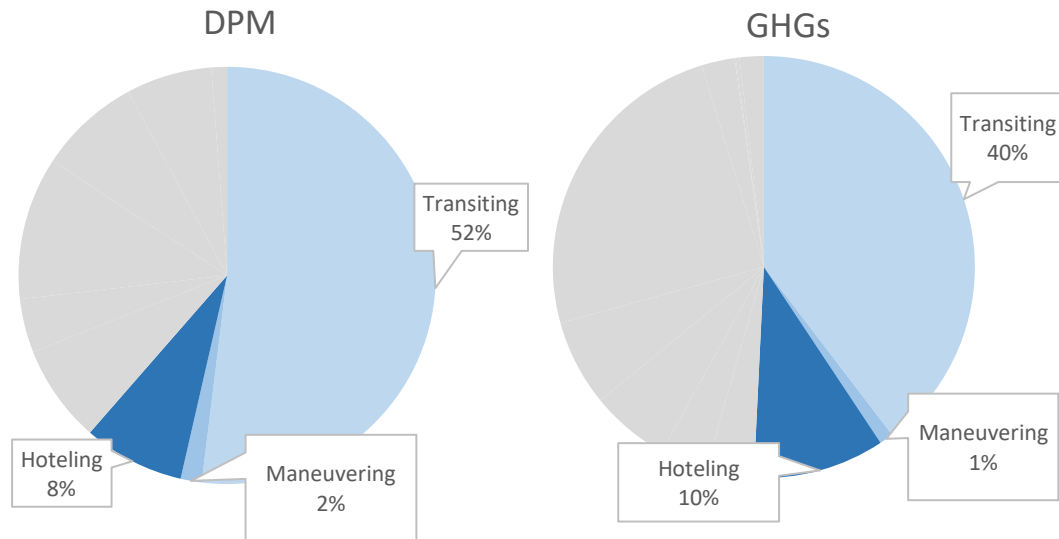


Figure 9. OGV Emissions

### 5.2.2. Level of Influence

The NWSA's ability to influence emissions from OGVs depends greatly on the segment of operation. We have greatest influence over operational practices of vessels while they are at berth, since they have a direct business agreement with the terminal operating tenant, who use port owned facilities to load and unload cargo. Therefore, The NWSA can work with the terminal operators and shipping lines to encourage cleaner operating practices and install infrastructure (such as shore power) to enable cleaner practices.

The NWSA has much less influence when vessels are in transit and when maneuvering, as The NWSA has no jurisdictional control over vessels as they transit through Puget Sound and the Strait of Juan de Fuca. State, Federal, and international regulations govern the operation of vessels in transit. The NWSA does have indirect commercial relationships with the shipping lines and therefore are limited to influencing them through incentives and voluntary programs. However, even these avenues are limited because the terminal operators, not The NWSA, make berthing arrangements with the shipping lines. Unlike other ports, The NWSA does not charge dockage fees and therefore does not have a direct financial avenue through which to offer incentives. Most other ports that have incentive programs run them by charging dirtier vessels more and cleaner vessels less on their dockage fees, thereby creating a revenue neutral program.

The NWSA can also advocate internationally, particularly with the International Maritime Organizations (IMO) that sets these policies and other organizations that influence the IMO, such as the International Association of Ports and Harbors (IAPH). While we are just one of many voices, this international engagement targets what is likely the most significant driver of change in the industry and the one that will best maintain a level playing field while doing so.

### 5.2.3. State of Technology and Outlook

The state of zero emission technology is also significantly different depending on operational mode and type of improvements targeted.

For vessels at berth, shore power technology has been robustly demonstrated at other ports in the Pacific trade specifically at California ports and some ports in China. Shore power is the provision of electricity to a vessel from the local distribution grid, that allows the vessel to shut down its engines while at berth, greatly reducing emissions. It is important to note that for a ship to be able to use shore power, it must have infrastructure installed onboard to accept shore side power. Installing this infrastructure costs hundreds of thousands to over a million dollars per vessel. Installation of shore power systems on port terminals can cost tens of millions of dollars per terminal; cost is a significant barrier to ports making these investments. Though implementing shore power is quite challenging, a growing number of container vessels have been installing capacity to accept shore side power, indicating an opportunity to leverage this infrastructure in the Pacific Northwest. It should be noted that non-container vessels have generally not yet begun being equipped with shore power capabilities.

Emission capture and treatment systems (“bonnet” or “hood” systems) have also been under development in recent years and are an option for reducing air pollutant emissions from OGVs while at berth. The upside to these types of systems is that the vessel does not need special onboard infrastructure to use it, which makes it an option for vessels that aren’t shore power capable<sup>6</sup>. However, shore power is generally favored because the emission capture systems don’t reduce GHG emissions, and emission capture and treatment systems have not been demonstrated as broadly. Additionally, the operational cost of emission capture and treatment systems will likely be higher than shore power, as vessel operators may even save money by plugging in in Tacoma and Seattle. Fuel cell and battery energy storage systems are also being evaluated within the industry<sup>7</sup> that could allow vessels to operate with zero emissions while at dock but have not yet been demonstrated or commercialized on large international container ships to our knowledge.

The best targets for installing shore power systems in the NWSA gateway are the major international container terminals (Husky, WUT, PCT, T-5, T-18, and T-30), where the greatest number of shore power capable ships call and where the container business is expected to remain long into the future, minimizing the possibility of stranded assets. Table 8 summarizes the number of vessel calls by shore power capable ships and the shore power capable vessel hoteling hours at each of these facilities in 2020. It is important to note that Terminal 5 in the

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<sup>6</sup> <https://shipandbunker.com/news/am/985727-long-beach-backs-sock-on-a-stack-emissions-reduction-technology#:~:text=ACTI%20say%20it%20works%20by%20first%20sealing%20a.Oxide%2C%20Sulfur%20Oxides%2C%20and%20Particulate%20Matter%2C%20are%20removed.>

<sup>7</sup> <https://www.seatrade-maritime.com/technology/energy-storage-solutions-are-future-suppliers-must-do-more>



Seattle harbor is not yet operational and will most likely see a subset of the vessel traffic that is currently calling Terminal 18 and Terminal 30.

Table 8. 2020 Shore Power Capable Stats at NWSA Major International Container Terminals

	Total Calls	Shore Power Capable Calls	Percent Shore Power Capable Calls	Hours per Shore Power capable call	Shore Power Capable Hours
Husky	86	67	78%	68	4,574
PCT	103	72	70%	35	2,497
WUT	83	39	47%	53	2,061
<b>Tacoma Harbor</b>	<b>272</b>	<b>178</b>	<b>65%</b>	<b>51</b>	<b>9,132</b>
T-18	398	197	49%	32	6,393
T-30	97	47	48%	30	1,395
<b>Seattle Harbor</b>	<b>495</b>	<b>244</b>	<b>49%</b>	<b>32</b>	<b>7,788</b>
<b>Gateway Total</b>	<b>767</b>	<b>422</b>	<b>55%</b>	<b>40</b>	<b>16,919</b>

While significant research and development is underway within the industry, the technology for zero emission vessels capable of trans-pacific transits remains nascent. Given the large energy requirements of the trans-pacific transit, liquid fuels such as hydrogen, ammonia, bio fuels, and synthetic renewable fuels, are most likely to be part of the suite of solutions. However, to date there has not been a single zero emission trans-pacific transit, nor is there consensus in the industry on what the fuel or fuels of the future will be. While this uncertainty exists, some of the major ocean carriers are making commitments to decarbonize by 2050 taking strides towards developing and deploying lower emission and carbon neutral vessels. For example, Maersk has committed to being fully carbon neutral by 2050 and will be piloting a small container ship that is capable of carbon neutral operations in 2023<sup>8</sup>. CMA-CGM has made a similar commitment to carbon neutrality by 2050 and has been aggressively adding LNG vessels to their fleet<sup>9</sup>.

While zero emission vessels are not likely to be fully commercialized for some time, the shipping industry has made important strides to improve efficiency and thereby emissions in recent years and will continue to do so. These include but are not limited to: increasing vessel size which reduces the total number of vessel trips required to move the same cargo, upgrading propellers, engines, and hull coatings to improve vessels efficiency, and slow steaming, among others. More cutting edge measures some ocean carriers are taking include

<sup>8</sup> [World's first carbon neutral liner vessel by 2023 | Maersk](#)

<sup>9</sup> [CMA CGM Group Targets Carbon Neutrality by 2050 \(maritime-executive.com\)](#)

piloting rotor sails to reduce fuel consumption, and piloting use of biofuel and/or renewable fuel blends to reduce carbon emissions.

International policy, driven by the IMO, is likely to continue to advance through the IMO's Initial Strategy to Reduce Emissions from Ships<sup>10</sup>, by which the IMO seeks to achieve a goal of reducing the carbon intensity of international shipping by 75% and the absolute emissions by 50% by 2050. Implementation plans for achieving these goals are still in progress. While a step in the right direction, these targets are not aligned with our vision to phase out emissions by 2050.

To reduce air pollution, the IMO enacted the North American Emissions Control Area in 2015, which requires vessels to burn fuel with sulfur content of 0.1% when within 200 miles of shore in North America<sup>11</sup>. This policy has greatly reduced air pollutant emissions, particularly sulfur oxides and DPM. Additionally, the IMO enacted a global limit on fuel sulfur content in 2020<sup>12</sup>, lowering the standard from 3.5% to 0.5%, greatly reducing emissions of sulfur oxides and particulate matter.

#### **5.2.4. OGV Sector Action Plan**

Container ship shore power is the most significant effort the ports can make towards zero emission operations today, as the technology has been robustly demonstrated elsewhere and vessel hoteling emissions represent a significant fraction of DPM and GHG emissions, especially when just on port emissions are considered where we have greater influence. We have shore power installation projects underway at Terminal 5 in Seattle and Husky Terminal in Tacoma, which will allow vessels to connect at our gateway's "big ship ready" terminals and Totem Ocean Trailer Express (TOTE) has been using shore power at their Tacoma operation since 2010.

In addition to installing the infrastructure on the terminals, there will be a significant and challenging body of work associated with coordinating the operational and commercial aspects of connecting shore power capable ships to shore power. The NWSA will need to work with the terminal operators, and labor to organize the labor required to execute the shore power connection. We will also need to work with the ocean carriers, utilities, and terminal operators to create billing procedures for passing electricity costs to the ocean carriers. If shore power is eligible to generate credits under the new low carbon fuel standard that was enacted in Washington during the 2021 legislative session, we will need to determine how the revenue will be shared. Finally, The NWSA must work with the ocean

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<sup>10</sup> <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx>

<sup>11</sup> [Designation of the North American Emission Control Area for Marine Vessels | Regulations for Emissions from Vehicles and Engines | US EPA](#)

<sup>12</sup> <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Sulphur-2020.aspx#:~:text=Known%20as%20E2%80%9CIMO%202020%20E2%80%9D%2C%20the%20rule%20limits%20the%20control%20areas%20the%20limits%20were%20already%20stricter%20280.10%25%29.>

carriers and terminal operators to ensure that there is intent to use shore power once it is installed.

To implement shore power beyond the two projects currently underway, it is vital that we update planning work to assess the costs and impacts of installing shore power at our major international container terminals. A critical component of this planning effort is to work with the utilities to understand network capacity and needs for upgrades, which will be accomplished via the energy planning studies described in section 5.A. In addition, securing substantial external funding is a necessity.

In addition to shore power, it is also important that we maximize our influence to reduce emissions from vessels while not at our docks, particularly through engagement on the international level and by implementing voluntary emission reduction measures as practicable within our airshed.

The main programmatic priorities in the OGV sector over the next five years are:

1. Complete shore power installations at Terminal 5 and Husky Terminal.
2. Update our shore power planning work including completing the South Harbor Electrification Roadmap, Completing the Seattle Waterfront Clean Energy Strategic Plan, constructing a plan of finance for delivering shore power to all major container terminals, and identifying external funding needs.
3. Aggressively pursue external funding to support the updated shore power plan.
4. Engage internationally to advance environmental standards for vessels and support the industry as it develops zero emission fuels.
5. Explore methods to encourage vessels to reduce emissions in our airshed while transiting.

Based on these priorities, the actions to be taken in the next five years are summarized in Table 9 below.

Table 9. Actions to be taken by 2025 to reduce emissions from OGVs.

Action	Timeline	Roles and Responsibilities
<i>Shore Power Planning</i>		
<p><b>1. Update cost estimates for container terminal shore power projects</b></p> <p>a. Hire engineering consultants to develop detailed cost estimates for the WUT, PCT, and T-30 shore power projects based on site exploration and existing conditions.</p> <p>b. Include timeline to design and construct</p>	<p>Begin and complete work in 2022</p>	<p>Lead: PoT Engineering, POS Facilities Development Support: NWSA Facilities</p>

<p>c. To the extent possible, combine with electrification planning studies</p>		<p>Development, AQSP, Commercial</p>
<p><b>2. Update our shore power plan with new timelines based on results of planning efforts</b></p> <p>a. Projects will be prioritized based on cost, projected project timelines, emission reduction benefits, commercial strategy, and other factors.</p> <p>b. Prepare capital plan that can be incorporated into the 5 year capital investment plan.</p> <p>c. Consider incorporation of domestic terminals that do not already have shore power infrastructure installed based on the potential usage and commercial considerations.</p>	<p>2022-2023</p>	<p>Lead: AQSP Support: PoT Engineering, NWSA Facilities Development, Commercial</p>
<p><b>3. Apply for grants and pursue other funding mechanisms to support the updated shore power plan</b></p> <p>a. Work shore power into other large redevelopments and funding asks.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Government Affairs, PoT Engineering, POS Facilities Development</p>
<p><b>4. Capital planning</b></p> <p>a. Integrate the shore power projects into the 5 year capital investment plan, aligning and integrating with major redevelopment efforts.</p>	<p>2023</p>	<p>Lead: Finance Support: AQSP, Commercial</p>
<p><i>Shore power infrastructure installation</i></p>		
<p><b>5. Install shore power infrastructure at two berths at T-5 as part of the redevelopment project.</b></p>	<p>Berth 1 by early 2022</p> <p>Berth 2 by end of 2023</p>	<p>Lead: POS Facilities Development Support: NWSA Facilities Development, Commercial, Operations, AQSP</p>
<p><b>6. Install shore power at two berths at Husky Terminal by the end of 2022</b></p> <p>a. Design complete by spring 2021</p> <p>b. Begin construction summer 2021</p>	<p>Design ongoing as of early 2021</p> <p>Begin construction by Q3 2021</p> <p>Complete construction</p>	<p>Lead: PoT Engineering Support: AQSP, Commercial, Operations</p>

	by end of 2022	
<b>7. Complete design of shore power infrastructure at T-18 by 2025</b>	Begin planning in 2021 Complete design by 2023	Lead: POS Facilities Development Support: AQSP, Commercial, NWSA Facilities Development
<i>Shore power implementation and tracking</i>		
<b>8. Work with terminal operators and labor to organize labor arrangement for connecting and disconnecting vessels from shore power.</b> a. Begin a year before each shore power system is operational to ensure labor arrangements are in place when the system is complete.	2021-2025+	Lead: Operations Support: Commercial, AQSP
<b>9. Work with terminal operators, ocean carriers, and the utilities to ensure that billing procedures are in place to pass power costs to the ocean carriers.</b> a. Begin a year before each shore power system is operational to ensure billing arrangements are in place when the system is complete.	2021-2025+	Lead: Operations Support: Commercial, AQSP
<b>10. Work with the ocean carriers to secure commitment to use shore power where it is provided in our gateway.</b>	2021-2025+	Lead: Commercial Support: AQSP, Operations
<b>11. Annually analyze the vessel fleet at major international and domestic container terminals to assess the fraction of calls shore power capable</b>	2021-2025+	Lead: AQSP
<b>12. Track shore power usage.</b> a. Track shore power usage. b. Track reasons that vessels do not connect and seek to mitigate factors that prevent shore power connections.	2021-2025+	Lead: AQSP Support: Operations
<i>Develop program to reduce emissions from transiting vessels</i>		
<b>13. Perform a study by the end of 2021 to identify voluntary and/or incentive-based initiatives that would increase fuel efficiency and/or reduce air emissions from cargo ships transiting through the Puget Sound to NWSA and PoT terminals.</b> a. Survey of what other ports do and the estimated effectiveness of each action	Complete study by end of 2021	Lead: AQSP Support: Commercial, Operations

<ul style="list-style-type: none"> <li>b. Analysis of co-benefits from “quiet-sound” underwater noise program</li> <li>c. Analysis to slow steaming efficacy in Puget Sound</li> <li>d. Analysis of NWSA governance structure to analyze possibility for incentives</li> <li>e. Analysis of shore power incentives and LCFS revenue</li> <li>f. Program recommendations</li> </ul>		
<p><b>14. In 2022 and beyond, implement recommendations from study</b></p> <ul style="list-style-type: none"> <li>a. Create program(s)</li> <li>b. Develop activity metric(s)</li> </ul>	2022-2025+	<p>Lead: AQSP Support: Commercial, Operations</p>
<i>Strengthen international engagement and advocacy</i>		
<p><b>15. Advocate for policies to reduce emissions from international vessels</b></p> <ul style="list-style-type: none"> <li>a. Closely track the IMO’s Marine Environment Policy Committee (MEPC) and Intersessional Working Group (ISWG) on GHG Emission Reduction, and look for strategic opportunities to influence IMO climate policy (e.g. strategically timed letters to the US delegation and/or the IMO Secretariat).</li> <li>b. Participate in IAPH Climate and Energy Committee</li> <li>c. Collaborate more closely with the Ports of Tacoma, Seattle, and Vancouver BC – and, potentially, California ports as well – to bolster influence with the IMO and IAPH.</li> </ul>	2021-2025+	<p>Lead: AQSP Support: Commercial</p>
<p><b>16. Support industry efforts to develop and demonstrate cleaner fuels including zero and near zero emission options</b></p> <ul style="list-style-type: none"> <li>a. IMO Green Voyage 2050 project</li> <li>b. IAPH/WPSP/WPCAP Clean Marine Fuels Working Group</li> </ul>	2021-2025+	<p>Lead: AQSP Support: Commercial</p>

### 5.3. Trucks

The port trucking sector is made up of heavy duty (class 8) combination tractors that move cargo to and from port marine terminals and railyards. Trucks that serve the port exist within a much broader regional trucking “ecosystem” and serve many functions within the regional economy, many of which are not directly involved with hauling cargo to and from the port. These trucks are owned by a large number of different trucking companies that vary in size from small, independent owner-operators with fleets as small as one truck to large logistics companies with expansive fleets. Many of the owner operators are new Americans and people of color. It is also important to note that many of the trucks calling the port are purchased second or third-hand and have little residual value, especially those owned by smaller fleets. Because larger companies generally have much more access to capital than the smaller owner operators, we must take extra care to ensure that our programs in the trucking sector are developed and implemented equitably.

When the ports estimate emissions from these trucks, we isolate the truck trips that are made to and from port terminals as they move on the terminals and on public roads. We do not estimate emissions or other impacts from non-port related truck trips.

Though the actual number fluctuates month to month, there are roughly 4000 unique trucks doing business at The NWSA’s international container terminals. Since implementation of The NWSA’s Clean Truck Program requirement on January 1, 2019 all of these trucks meet EPA engine year 2007 emission standards, meaning that they are equipped with diesel particulate filters. The NWSA’s terminal operators enforce this requirement at their gates, turning away trucks that do not comply, using radio frequency identification, denoting (RFID) technology that The NWSA installed in 2018. RFID technology uses a “tag” on each truck to identify each truck when it pulls up to a terminal gate with RFID readers installed. The RFID tag information is cross referenced with The NWSA’s truck registry, which determined whether the truck complies with the Clean Truck Program requirements and gives the gate guard a red light or a green light, indicating whether the truck may enter the terminal.

There is also a fleet of about 500-600 trucks that do business at the TOTE and West Sitcum domestic container terminals. Roughly half this fleet also call the international terminals, while the other half are unique and only serve these domestic terminals. Of these approximately 300 unique trucks calling the domestic container terminals, about 80-100 do not meet the model year 2007 standard. The NWSA is able to monitor the age of this fleet by using optical character recognition (OCR) camera data at TOTE and SSA-West Sitcum terminals. In addition to TOTE and West Sitcum, The NWSA also manages T-115 which moves domestic containerized cargo from barges. Because this is a barge operation that experiences less traffic than the other two domestic container terminals, the focus of the next phase of the Clean Truck Program has been on the other domestic terminals, which have a different business model than T-115, which is very unique. Neither RFID nor OCR infrastructure are installed at T-115, meaning The NWSA currently does not have any data on the age of trucks entering this terminal. The NWSA’s emissions inventory also includes truck calls at railyards,

and other non container cargo facilities in Tacoma and Seattle, but at this time we do not have the ability to collect data on these fleets.

To our knowledge, there are currently no zero emission trucks calling the NWSA gateway.

### 5.3.1. Emissions from Trucks

Trucks are the second largest source of GHG emissions in The NWSA’s airshed and tied for the third largest source of DPM (with CHE and harbor vessels). The majority of truck emissions occur off port property, on the regional road network. This has implications for exposure, as trucks driving near residential areas are more likely to expose communities to air pollution. However, The NWSA has much less influence over operational and routing decisions that occur away from our property.

It should be noted that The NWSA’s DPM emissions from trucks reported in the 2016 Puget Sound Maritime Air Emissions Inventory were much greater than reported here, as the inventory occurred before implementation of the model year 2007 requirement in 2019. We have re-estimated the DPM emissions from trucks to incorporate expected emission reductions from this high impact program, which resulted in reducing the DPM emissions estimate for trucks by 71% from what was reported in 2016. The Puget Sound Maritime Air Emissions Inventory will be conducted again in 2022 on 2021 annual emissions, where these emissions will be updated.

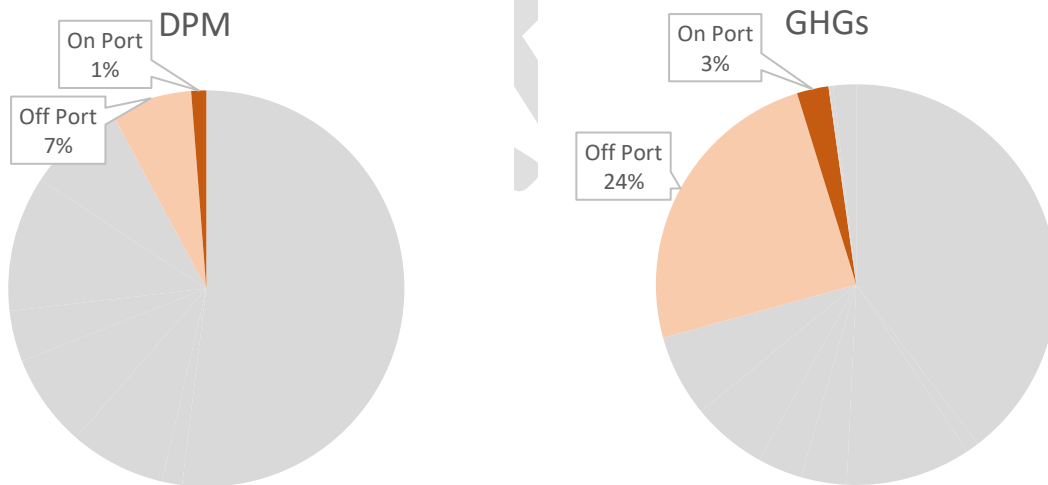


Figure 10. Truck Emissions

### 5.3.2. Level of Influence

The NWSA does not have direct operational control over trucks, nor does The NWSA have direct business relationships with trucking companies but we do have an ability to influence emissions from them while on port property through our relationships with terminal



operators. The mechanism through which we can exercise this influence is the lease agreements between The NWSA and the terminal operator. For example, in order to implement the Clean Truck Program requirement starting in 2019, The NWSA re-negotiated lease agreements with the operators of the international container terminals to insert an agreement to enforce the 2007 engine year standard and turn away those that don't comply. While we were successful in negotiating this lease change, it is important to note that re-negotiating lease terms is voluntary on the part of the terminal operators and does not come without cost to The NWSA. The NWSA is also able to install RFID technology on terminals and on port property around both harbors to collect data on individual truck information, turn times, and queue lengths.

It is important to note that the majority of emissions from trucks occur off port property, on the regional road network. The NWSA's programs that facilitate the replacement of older dirtier trucks with newer cleaner ones will reduce emissions both on and off port property, since the newer engines and emission controls are permanent installations on these newer trucks. In addition, The NWSA can partner with agencies and private partners across the region to increase freight flow efficiency. For example, as of 2021, The NWSA is working on several projects with a number of partners to improve freight flow through major freight corridors near our terminals by installing closed circuit cameras and connecting traffic signals to each other and partner agencies' traffic centers. In addition, we are working with the Seattle Area Joint Operations Group to implement a Virtual Command Center that is designed to improve cooperation, coordination, and communication among partner agencies and with the public (including truck drivers) to minimize the impact of incidents on the roadway system.

### **5.3.3. State of Technology**

Culminating in 2010, clean diesel emission standards for new engines were phased in by the EPA<sup>13</sup>. The most notable of these standards for The NWSA's efforts to reduce emissions in the trucking sector are the engine year 2007 particulate matter standards, which reduce emissions 90% when compared with the prior standard and the 2007 NO<sub>x</sub> standard (phased in completely by 2010), which reduces NO<sub>x</sub> emissions by 95% when compared with the prior standard. Meeting these standards required use of emission control technology that was new at the time but is now industry standard, specifically diesel particulate filters (DPF) to address particulate emissions and selective catalytic reduction to address NO<sub>x</sub>. Since 2010, there has not been significant advancement in federal new engine emission standards, save for incremental fuel efficiency requirements<sup>14</sup> that require a 3% increase in engine fuel efficiency between model year 2014 and 2017. Therefore, there is much greater emissions benefit from upgrading pre-2007 trucks, ideally to 2010 or newer, than for upgrading post 2007 trucks to newer models. The largest local air quality improvement to be gained is from transitioning

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<sup>13</sup> <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100O9ZZ.pdf>

<sup>14</sup> <https://www.govinfo.gov/content/pkg/FR-2011-09-15/pdf/2011-20740.pdf>

old, pre-2007 trucks to 2010 or newer trucks. Renewable diesel is a drop-in fuel that could significantly reduce GHG emissions from trucks, but is not currently broadly available in the Puget Sound Region<sup>15</sup>.

Zero emission trucks are beginning to become commercially available and we expect their availability to continue to expand in the coming years, in part due to the California Advanced Clean Truck Rule<sup>16</sup> which requires dealers and manufacturers to make an increasing proportion of their trucks available for sale zero emission models. We expect a similar rule to be adopted in Washington. Relevant to port trucking, the rule will require 40% of class 8 tractor sales to be zero emission by 2035. Regional haul is projected to be a viable use case for zero emission trucks according to the CARB Advanced Clean Truck Rule Market Assessment<sup>17</sup>. The primary technologies emerging for class 8 tractors are battery electric and hydrogen fuel cell, each of which has its own advantages and disadvantages. Battery electric trucks are generally cheaper to purchase and operate, but have more range limitations, take longer to fuel, and are significantly heavier. Hydrogen fuel cell trucks are more expensive to purchase and fuel, but do not have the time to fuel constraints that battery electric trucks do. Neither battery electric nor hydrogen fuel cell trucks have an established regional fueling/charging network to support them in Washington State.

Currently, zero emission trucks are much more expensive than new diesel trucks to purchase and by total cost of ownership, but battery electric trucks are projected to have a lower total cost of ownership by 2030 than diesel, and hydrogen trucks are projected to be close to parity<sup>18</sup>. While CARB predicts cost parity with new diesel trucks by 2030, many of the trucks calling NWSA terminals are purchased as second or third-hand models, as opposed to brand new. This means that cost parity with used diesel trucks is unlikely to be achieved for trucks that call The NWSA on this predicted timeline and will likely only occur when a robust used zero emission truck market develops. There is still tremendous uncertainty as to when used zero emission trucks will be available and when their cost will allow them to be competitive in short to regional haul.

#### **5.3.4. Action Plan**

Given that zero emission trucks are not likely to be cost effective in the next five years, especially for NWSA drayage operators, it is important that we continue our work to clean up the existing diesel truck fleet in the short term, with a focus on those remaining trucks that are engine year 2007 and older. The implementation of The NWSA Clean Truck Program relied on the installation of RFID technology at the international container terminal gates – included in this 5 year Action Plan is to expand the installation of RFID technology to our domestic container terminals by 2023 and expand the Clean Truck Program requirement that all trucks meet the 2007 standard to these terminals.

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<sup>15</sup> <https://www.wcleancities.org/alternative-fuels/renewable-diesel>

<sup>16</sup> [Advanced Clean Trucks Fact Sheet \(ca.gov\)](#)

<sup>17</sup> <https://ww3.arb.ca.gov/regact/2019/act2019/appe.pdf>

<sup>18</sup> <https://ww3.arb.ca.gov/regact/2019/act2019/apph.pdf>

Looking towards the adoption of zero emission trucks in the gateway, it is clear that transition of the fleets that call The NWSA must happen within a broader regional, state-wide, and national transition to be successful. At a minimum it will be essential that a renewable fueling/charging network is built out across the region, zero emission truck technology is commercialized and cost effective, and policies are in place to incentivize adoption of zero emission trucks. Therefore, a collaboration between all agency and trucking partners must be established to address these issues that are much bigger than just the NWSA.

Demonstrating zero emission truck technology in the Pacific Northwest is on the critical path to getting the entire fleet to zero emissions by 2050. Because the port does not own or operate drayage trucks, this technology demonstration will need to be a collaboration between the port, a trucking company and a manufacturer. The NWSA will seek to encourage and facilitate demonstration projects of zero emission truck technology as soon as possible.

The main programmatic priorities in the trucking sector over the next five years are:

1. Implement The NWSA Clean Truck Program at our domestic container terminals.
2. Reduce the number of pre-2007 trucks calling our domestic terminals through grant funded scrap and replace incentives.
3. Influence partners to establish a statewide collaboration for advancing commercialization of zero emission trucks and installing an infrastructure network to support them.
4. Support partners in demonstrating zero emission trucks in our region.
5. Improve operational efficiency and reduce idling.

Based on these priorities, the actions to be taken in the next five years are summarized in Table 10 below.

Table 10. Actions to be taken by 2025 to reduce emissions from Trucks.

Action	Timeline	Roles and Responsibilities
<i>Cleaning up the diesel fleet</i>		
<p><b>1. Expand scrap and replace programs using grant funds targeting non-compliant trucks at the domestic terminals</b></p> <p>a. In 2021-2022, scrap and replace 20 trucks using City of Seattle grant funds and Department of Ecology Clean Diesel grant funding.</p> <p>b. In 2021 – 2023, look for new grant funding opportunity to fund another round of scrap bonuses to fund at least 40 trucks.</p>	2021-2023	Lead: AQSP Support: Finance, Operations, Communications

<p><b>2. Actively explore increased use of renewable fuels</b></p> <ul style="list-style-type: none"> <li>a. Track the availability of renewable and bio diesel in the Puget Sound region and report out annually.</li> <li>b. Annually, consider methods to encourage use of renewable and bio diesel depending on policy landscape, cost, and availability.</li> </ul>	<p>2021-2025+</p>	<p>Lead: AQSP</p>
<p><i>Existing Clean Truck Program standards</i></p>		
<p><b>3. Continue enforcing the 2007 engine year standard at international terminals.</b></p> <ul style="list-style-type: none"> <li>a. Work with tenants to ensure that RFID infrastructure is maintained and used to enforce the clean truck program standard at the gates.</li> <li>b. Monitor RFID data to ensure that non-compliant trucks are being turned away at the terminal gates</li> </ul>	<p>2021-2025+</p>	<p>Lead: Operations Support: AQSP</p>
<p><b>4. Expand the Clean Truck program to domestic terminals.</b></p> <ul style="list-style-type: none"> <li>a. Install RFID gate infrastructure or other method of compliance verification at TOTE and West Sitcum.</li> <li>b. Implement Clean Truck Program requirement for TOTE and West Sitcum that all trucks entering the terminals have a 2007 engine or newer, or equivalent emission control system.</li> <li>c. Communicate program requirements to trucking community.</li> <li>d. Assess the age of the truck fleet serving T-115.</li> <li>e. Based on truck fleet size and level of compliance create a plan for enforcing the Clean Truck Program standard at T-115.</li> </ul>	<p>Install compliance mechanism at TOTE and West Sitcum: By end of 2023</p> <p>Enforce Requirement at TOTE and West Sitcum: By end of 2025</p> <p>Assess T-115 truck fleet: By end of 2022</p> <p>Create a plan for implementing requirement at T-115: Mid 2024</p>	<p>Lead: AQSP Support: Operations, Engineering, IT, Commercial, Communications</p>

<p><b>5. Continue programs to discourage diesel filter tampering.</b></p> <p>a. Continue work with PSCAA and Ecology to encourage EPA to increase efforts to enforce anti tampering rules for emission systems.</p> <p>b. Continue to work with others to provide information and outreach about DPF maintenance.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Operations</p>
<p><i>Collaboration towards getting to zero</i></p>		
<p><b>6. Lead the creation of a regional or state Clean Truck Collaborative</b></p> <p>a. Starting in 2021, work with other trucking and environmental stakeholders in the region and state to form a collaboration around getting the trucking sector to zero by 2050. A goal of this effort is for an agency or other stakeholder that has broader reach and influence, and more resources, to lead this collaboration.</p> <p>b. Regional ZE truck infrastructure needs assessment: An important component of the regional collaboration will be to assess, plan, and deliver infrastructure to support a zero-emission trucking fleet. We will advocate for completing such an analysis by 2025.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Operations, Commercial</p>
<p><b>7. Partner with the City of Seattle and ICCT on the Seattle Zero-Emission Drayage project</b></p> <p>a. Provide data and insight into the city’s project.</p> <p>b. Incorporate findings into our own strategies.</p> <p>    i. Cost and financing options for zero emission trucks.</p> <p>    ii. Driver demographics</p> <p>    iii. Truck routes and potential infrastructure locations.</p> <p>c. Collaborate with the City on potential demonstration projects to deploy zero emission trucks in Seattle and Tacoma.</p>	<p>2021-2022</p>	<p>Lead: AQSP Support: Operations</p>
<p><b>8. Help develop and implement one or more zero-emission drayage truck demonstration projects</b></p> <p>a. Support and/or facilitate partnerships between trucking companies and manufacturers to demonstrate zero emission class 8 trucks in the Puget Sound Region.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Operations, Commercial</p>
<p><b>9. Complete a port truck fleet and trip analysis</b></p> <p>a. To inform both the regional clean truck collaboration and our own efforts, perform a detailed analysis of the port truck fleet origins and destinations, along with</p>	<p>2022</p>	<p>Lead: AQSP Support: Operations, Commercial</p>

truck age statistics by origin and destination. This will help inform where infrastructure is needed and what segments the oldest trucks operate in.		
<p><b>10. Develop truck parking solutions</b></p> <ul style="list-style-type: none"> <li>a. Work with trucking stakeholders to understand and plan for truck parking needs including conducting a parking needs survey.</li> <li>b. Include parking needs and potential locations in assessment of port role in providing infrastructure to support ZE trucks on port property.</li> <li>c. Prioritize parking solutions that will reduce truck parking in neighborhoods.</li> </ul>	2021-2025+	Lead: Planning Support: Operations, AQSP, Commercial
<i>Increase efficiency and reduce idling</i>		
<p><b>11. Increase Gate queue efficiency and anti-idling program</b></p> <ul style="list-style-type: none"> <li>a. Work with the Operations Service Center and terminal operators to develop a set of best management practices to minimize idling at the gates.</li> <li>b. Develop in 2021, begin implementation in 2022</li> </ul>	2021-2025+	Lead: Operations Support: Planning, AQSP
<i>Trucking community engagement and support</i>		
<p><b>12. Strengthen trucking community outreach and capacity-building support</b></p> <ul style="list-style-type: none"> <li>a. Use the NWSA website and “trucker blasts” to communicate key program information to the trucking community.</li> <li>b. Use the WTA Trucker Outreach Forum to communicate program information to the trucking community and report out on key milestones, opportunities, and policies.</li> <li>c. Work with the African Chamber of Commerce or other capable organizations to ensure that our communications are equitably available.</li> </ul>	2021-2025+	Lead: Communications Support: AQSP, Operations
<ul style="list-style-type: none"> <li>d. Beginning in 2022, make a financial counselor available to truckers on a regular basis, with the goal of enabling truckers to improve their credit and increase access to capital for truck upgrades.</li> </ul>	2021-2025+	Lead: AQSP Support: Operations

#### 5.4. Cargo-handling equipment

Cargo handling equipment (CHE) are nonroad equipment (i.e. not licensed for over the road use) that are used for moving cargo (containers, general cargo, and bulk cargo) around terminals and to and from marine vessels, railcars, and on-road trucks. The main types of CHE working at The NWSA’s facilities are terminal tractors, top handlers, side handlers, reachstackers, rubber-tired gantry cranes (RTGs), straddle carriers, and forklifts. A summary of cargo handling equipment counts across the NWSA gateway is shown below in Table 11. Range of engine horsepower ratings by equipment type are included as an indicator of engine size and impact. In total, there were 722 pieces of cargo handling equipment operating across the gateway in 2019, and 68 of them were owned by the NWSA or Port of Tacoma (Port of Tacoma owned CHE work NWSA cargo facilities). Terminal tractors are the most abundant type of cargo handling equipment by a wide margin, followed by forklifts and top handlers. The majority of CHE is diesel powered, while some of the smaller forklifts are powered by propane or electricity. As of the 2019, 50% of the CHE within The NWSA’s scope met Tier 4 emission standards or equivalent.

Table 11. 2019 Gateway Cargo Handling Equipment Counts by Type

Equipment Type	Total Number	Port Owned <sup>a</sup>	Engine Rated Horsepower <sup>b</sup>
Forklift	136	34	45-375
Reachstacker	11	2	200-375
RTG	22	0	300-972
Side Handler	24	0	152-250
Straddle Carrier	79	29	185-455
Terminal Tractor	347	3	110-275
Top Handler	103	0	200-365
<b>Total</b>	<b>722</b>	<b>68</b>	-

<sup>a</sup> Equipment owned by The NWSA and Port of Tacoma

<sup>b</sup> Equipment horsepower range taken from the 2016 Puget Sound Maritime Air Emissions Inventory.

\*\* Excludes data from T-46, as container handling activities were ceased early in 2019.

##### 5.4.1. Emissions from CHE

When considering The NWSA’s emissions across the airshed compared with other sectors, cargo handling equipment contributes the fourth most GHGs and tied for third most DPM. However, when just emissions on port property are considered, CHE is the second largest source of both GHG and DPM emissions.

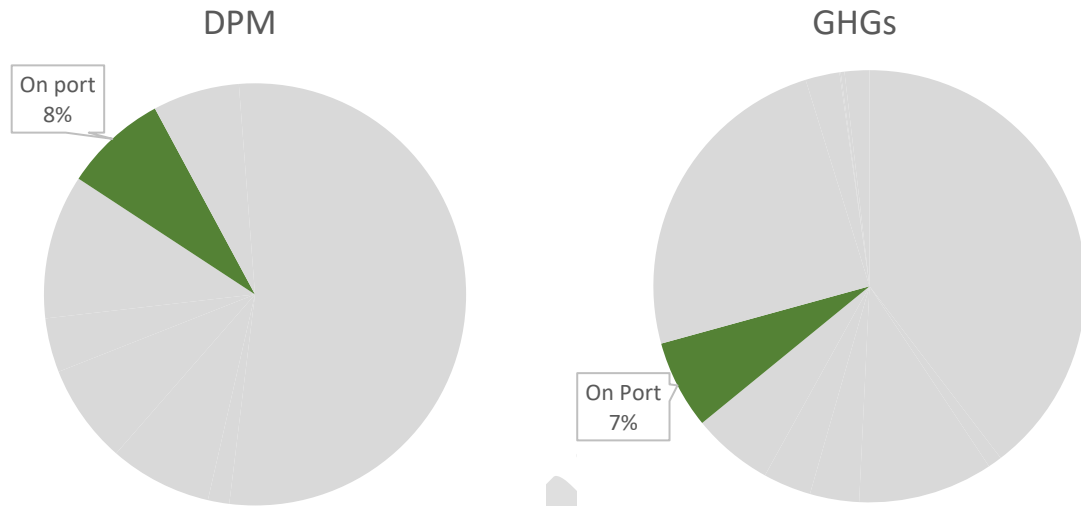


Figure 11. CHE Emissions

#### 5.4.2. Level of Influence

The NWSA, in partnership with the Port of Tacoma, has direct operational control over the CHE that are owned by The NWSA and Port of Tacoma and serve NWSA’s cargo operations, primarily at the East Blair One (EB1) Terminal and the North Intermodal (NIM) Yard. While the Port of Tacoma owns most of the existing equipment, The NWSA purchases and retains ownership of this equipment as the old PoT equipment is replaced. This equipment makes up about 9% of the overall CHE fleet serving the gateway.

The remainder of the CHE are privately owned by terminal operating tenants and the NWSA has moderate control over this equipment through lease agreement requirements. While The NWSA can negotiate requirements for CHE into the leases as they are renewed, the tenant must agree for these requirements to be included in the lease. Additionally, The NWSA has limited ability to alter existing agreements to include stricter requirements, as the tenants are under no obligations to renegotiate their lease agreements nor an obligation to accept the addition of new requirements.

#### 5.4.3. State of Technology

Clean diesel requirements for new nonroad engines were implemented by the EPA starting in the 1990s and culminated in the implementation of “Tier 4” requirements in the mid 2010s. Tier 4 requirements are the strictest nonroad engine standards, requiring emission control technology for particulate matter, NO<sub>x</sub>, and organic compounds. While the phase in period of Tier 4 requirements varies by engine size, Tier 4 requirements were broadly applied to all



new engines built after 2015<sup>19</sup>. In recent years, hybrid technologies have started to hit the market, greatly improving the fuel efficiency of diesel equipment. Notably, RTG diesel-electric hybrid retrofit systems can decrease GHG emissions by more than 50% and particulate matter emissions by greater than 70%<sup>20</sup> and can be installed at relatively low cost. We will pursue implementation of near zero solutions, especially in areas where zero emission options are not yet demonstrated or prohibitively expensive.

Zero emission CHE is still largely in the demonstration stage for port applications, especially for larger, heavy-duty models, though some smaller equipment types have zero emission options commercially available. Battery electric terminal tractors have been deployed in a number of logistics applications in recent years<sup>21</sup> and there are deployments ongoing at Port Terminals in California<sup>22</sup>. The 2018 San Pedro Bay Ports' CHE Technology Assessment<sup>23</sup> classifies battery electric terminal tractors as in the demonstration stage for port applications as of 2018, but predicts that the technology will be approaching 'fully demonstrated' (i.e. proven to work) by 2021. Hydrogen fuel cell terminal tractors are also being demonstrated but are farther from being commercialized. While the technology is nearing fully demonstrated, the purchase price of a battery electric terminal tractor is still about three times the price of a comparable diesel machine and the total cost of ownership is about twice that of a diesel machine without incentives. Incentives of roughly 60% of the cost of the battery electric terminal tractor and charging infrastructure are currently required to achieve cost parity with diesel.

The availability of zero emission forklifts depends on the engine size and lift capacity, with battery electric and fuel cell forklifts widely available for smaller forklift sizes. As engine and lift capacity increases, the options and cost of zero emission equipment becomes more limited. The San Pedro Bay Ports' Technology Assessment classifies the state of technology for large-capacity forklifts as in development, projecting that demonstrations will be occurring by 2021. Battery-electric lifts are generally more expensive to purchase than diesel lifts, especially those with larger batteries.

Zero emission top-handlers were solidly in the development stage as of the 2018 technology assessment, as the first real-world demonstration of a battery electric unit began in 2019<sup>24</sup>. The technology is not yet broadly commercially available and is substantially more expensive than diesel equivalents. This technology is likely years away from being fully commercialized, with significant uncertainty as to when this will occur. Similar equipment such as reach stackers and side handlers will likely follow a similar timeline.

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<sup>19</sup> [Nonroad Compression-Ignition Engines: Exhaust Emission Standards \(EPA-420-B-16-022, March 2016\)](#)

<sup>20</sup> <https://www.epa.gov/verified-diesel-tech/mj-ecopower-hybrid-systems-inc-ecocrane-hybrid-system>

<sup>21</sup> <https://orangeev.com/deployed-markets/>

<sup>22</sup> <https://www.presstelegram.com/2019/10/02/ports-of-long-beach-l-a-unveil-new-zero-emission-vehicles/>

<sup>23</sup> [https://www.gladstein.org/wp-content/uploads/2019/09/Final-CHE-Feasibility-Assessment\\_August-2019-Master.pdf](https://www.gladstein.org/wp-content/uploads/2019/09/Final-CHE-Feasibility-Assessment_August-2019-Master.pdf)

<sup>24</sup> [https://www.portoflosangeles.org/references/news\\_100219\\_top\\_handler](https://www.portoflosangeles.org/references/news_100219_top_handler)

Grid electric RTG cranes are fully commercially available and demonstrated, for example, Georgia Ports has converted 19 RTGs from diesel to electric, using a bus bar system to connect the RTGs to the grid<sup>25</sup>. Cable reel systems can also be used to power grid connected electric RTGs. While this technology is well demonstrated, significant terminal redevelopment is required to install busbar or cable reel track infrastructure to support the technology and reduced operational flexibility by confining the RTGs to fixed, straight movement paths. Therefore, it is likely only a fit where terminal layout and operational strategy aligns with the constraints. Battery electric and fuel cell powered RTGs are still in the development stage.

#### **5.4.4. Action Plan**

Given that The NWSA and the PoT have direct control over our own CHE fleet purchases, the top priority is to ensure that we are implementing the cleanest technology practicable as new equipment is purchased. In addition, it is important that we maximize our influence to help tenants modernize their fleets and implement zero emissions where possible, identifying suitable grant funding to help our tenants bridge the cost gap between zero emissions and diesel versions. Since zero emission technology is not likely to be cost effective in the short term, it is important that the cleanest diesel equipment is purchased in the interim as fleets turn over.

With the passage of a low carbon fuel standard in Washington State, the availability of renewable diesel may increase in the coming years. Dropping in renewable diesel can significantly reduce the carbon footprint of CHE and would significantly reduce air pollutant emissions from older equipment (i.e. Tier 3 and older) that does not have the latest emission control technology. We will work to closely track the availability of renewable fuels and periodically assess the efficacy of encouraging and/or incentivizing its use.

Demonstrating zero emission cargo handling equipment is a critical step towards broad adoption throughout our gateway; demonstrating that the technology works for our duty cycles in our climate. Across the Tacoma and Seattle harbors, battery electric terminal tractors will be an area of focus since they are commercially available. We expect that grant funding will be needed to advance battery electric terminal tractor projects, given the substantial price difference between battery electric and diesel versions. Near-zero emission, diesel hybrid RTGs are another technology that can be implemented today given adequate external funding and will also be an area of focus. Beyond these two technologies, any zero emission technology deployments would be early-stage demonstrations that carry more risk. Given their prevalence in The NWSA and Port of Tacoma's own fleets, small scale demonstration of zero emission straddle carriers could be an opportunity for the NWSA to be a leader in the zero emission space. However, this technology is not yet commercially available, so such opportunities will need to be evaluated in the latter part of this five year implementation period.

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<sup>25</sup> <https://www.epa.gov/ports-initiative/georgia-ports-authority-reduces-diesel-emissions-improves-efficiency-and-saves>

The main programmatic priorities in the CHE sector over the next five years are:

1. Pursue opportunities in our own fleet to invest in zero and near zero emission technology, seeking to offset incremental cost with external funding.
2. Pursue opportunities with our business partners to invest in zero and near zero emission technology, seeking to offset incremental cost with external funding.
3. Maximize our influence to ensure that when diesel equipment is purchased in our gateway, it is the cleanest feasible.
4. Continue to build collaborative relationships with our terminal operators.

Based on these priorities, the actions to be taken in the next five years are summarized in Table 12 below.

Table 12. Actions to be taken by 2025 to reduce emissions from CHE.

Action	Timeline	Roles and Responsibilities
<i>Cleaning up the existing CHE fleet</i>		
<p><b>1. Continue implementing and enforcing clean CHE requirements for new equipment purchases and hold ourselves to the same standard.</b></p> <p>a. Require all new CHE and replacement purchases or lease to meet Tier 4 emission standards or better.</p> <p>b. Recognizing the long length of lease agreements, also include language requiring zero emission equipment if the purchase price is equivalent to diesel if commercially feasible.</p> <p>c. Ensure this requirement is in all new and amended leases.</p> <p>d. Monitor annual fleet reports from tenants to ensure they are following the rules.</p> <p>e. Apply the same policy to port owned equipment purchases</p>	2021-2025+	Lead: Commercial Support: AQSP
<p><b>2. Actively explore increased use of renewable fuels</b></p> <p>a. Track the availability of renewable and bio diesel in the Puget Sound region and report out annually.</p>	2021-2025+	Lead: AQSP

<p>b. Annually, consider methods to encourage use of renewable and bio diesel depending on policy landscape, cost, and availability.</p>		
<p><i>Tenant engagement and support</i></p>		
<p><b>3. Institute meetings/forums [2 per year] inviting all terminal operators to build support and partnerships to work towards NWPCAS goals.</b>  <b>Topics include:</b></p> <p>a. Update on NWPCAS implementation. Chance for port and tenants to share successes and challenges</p> <p>b. Upcoming funding opportunities and matchmaking with tenants</p> <p>c. Infrastructure needs to support future zero emission equipment</p> <p>d. State of technology and opportunities for adoption of zero/near zero emission equipment</p>	<p>2021-2025+</p>	<p>Lead: AQSP  Support: Operations, Commercial</p>
<p><b>4. Provide technical support and develop partnerships.</b></p> <p>a. Provide technical support to help construct the business case for zero emission equipment, calculate potential emission reductions, and identify projects that would be competitive for grant funding.</p> <p>b. Jointly identify projects that fill a need for tenants and would be competitive for grant funding.</p> <p>c. Facilitate collaboration with agencies that can provide funding.</p>	<p>2021-2025+</p>	<p>Lead: AQSP  Support: Operations, Commercial</p>
<p><i>Implementing zero and near zero technology</i></p>		
<p><b>5. Prioritize zero and near zero emission options as NWSA owned equipment is replaced.</b></p>	<p>2021-2025+</p>	<p>Lead: AQSP, Maintenance  Support: Finance, Operations, Commercial</p>
<p><b>6. Facilitate implementation of the SIM yard truck project with RMS to implement 6 battery electric yard tractors at the SIM yard.</b></p> <p>a. The NWSA and PoT will manage design and construction of the charging infrastructure.</p>	<p>Complete by end of 2021</p>	<p>Lead: Engineering, AQSP  Support: Commercial, Finance</p>

<p>b. The NWSA manages pass through of grant funds to RMS to partially fund remanufacture of 6 yard tractors, managed by RMS.</p>		
<p><b>7. Complete the EB1 lift truck project to replace a heavy lift forklift with an electric version.</b></p> <p>a. The NWSA and PoT will manage design and construction of the charging infrastructure</p> <p>b. The NWSA will manage the existing grants and incentives from the WA Department of Ecology, PSCAA and Tacoma Power</p> <p>c. Scrap existing old diesel forklift</p>	<p>Complete by end of 2021</p>	<p>Lead: Maintenance, AQSP Support: Operations, Commercial, Finance</p>
<p><b>8. Identify and execute significant additional zero and near zero cargo handling equipment projects in each harbor.</b></p> <p>a. Write grant applications and facilitate other external funding.</p> <p>b. Assist with cost estimating and engineering for charging infrastructure.</p> <p>c. Provide cost share on charging infrastructure upgrades.</p> <p>d. Focus on zero emission yard truck deployments across both harbors.</p> <p>e. Focus on hybrid RTGs across both harbors.</p> <p>f. Evaluate demonstration of zero emission straddle carriers in NWSA's own fleet.</p> <p>g. Evaluate zero emission top pick demonstration.</p> <p>h. Evaluate hybrid options that could reduce emissions.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Commercial, Operations, Finance</p>

## 5.5. Locomotives

The railroad system is a nationwide enterprise consisting of national and local railroad companies that together serve to move a diverse variety of cargo over long distances. The two major “Class 1” railroad companies that serve the Gateway are Burlington Northern Santa Fe and Union Pacific, who move all rail cargo into and out of the region. The rail activities included in the NWPCAS scope are those that take place within and between ports and the near-dock rail yards that handle port-related cargos, and between these places and the airshed boundary.

Port related cargo is transferred to and from rail cars at on-dock railyards (such as those at PCT, WUT, the NIM, T-18, and T-5) and near dock rail facilities like the South Intermodal (SIM) yard and the BNSF and UP facilities in both Seattle and Tacoma. Many railyards in the region also accommodate “transload” cargo, or cargo that is truck to a warehouse and repacked into 53-foot domestic containers before being loaded on to railcars.

Locomotives are generalized into two categories based on their operational scope: switching (switchers) and line-haul locomotives. Switchers operate primarily on port terminals and railyards, sorting rail cars and assembling and disassembling trains. Switchers are generally stationed locally, especially those owned by local operators (Tacoma Rail), but the switchers owned by the Class 1 railroads are periodically moved between facilities in different regions as needed. Switching locomotives generally have smaller engines than linehaul locomotives, typically between 1,000 and 3000 horsepower and sometimes originate as older linehaul locomotives that have been converted. Line-haul locomotives are used by the railroads to haul trains over long distances and are the ones that move cargo into and out of the region. Locomotives used for line-haul operations are typically large, powerful diesel engines of 4,000 hp or more.

Locomotives have very long lifetimes (30-50 years), are very expensive, and are more often remanufactured than fully replaced (which does not require them to implement the strictest emission controls). As a result, very few conform to the latest (Tier 4) emission standards and many remain from the era when emissions were unregulated and earlier emission standards, based on data from California<sup>26</sup>. This is true of both switchers and line-haul locomotives.

While we have limited insight into the switching and line-haul locomotive fleets owned by the Class 1 railroads, detailed information on the fleet of switchers that are owned by local operators has been gathered as part of the Puget Sound Maritime Air Emissions Inventory. A summary of switching locomotive numbers by Tier, excluding the Class 1 railroads, can be found in Table 13 below. These locomotives operate both on and off port property.

Table 13. Switching Locomotives Excluding Class 1s by Emission Tier

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<sup>26</sup> [https://ww2.arb.ca.gov/sites/default/files/2020-06/final\\_rail\\_tech\\_assessment\\_11282016%20-%20ADA%2020200117.pdf](https://ww2.arb.ca.gov/sites/default/files/2020-06/final_rail_tech_assessment_11282016%20-%20ADA%2020200117.pdf)

Emission Tier	Number
Unregulated	5
Tier 0	6
Tier 1	0
Tier 2	2
Tier 3	4
Tier 4	0
<b>Total</b>	<b>17</b>

### 5.5.1. Emissions from Locomotives

Locomotives are a significant source of emissions, especially DPM, ranking second behind OGVs in DPM emissions across the airshed. Locomotives are the largest source of DPM emissions of those that occur on port property. However, locomotives are just the third largest source of GHGs, both across the airshed and on port property. This reflects that as other sectors, (such as trucks and CHE) have adopted emission control measures for air pollutants, locomotives have not made similar progress.

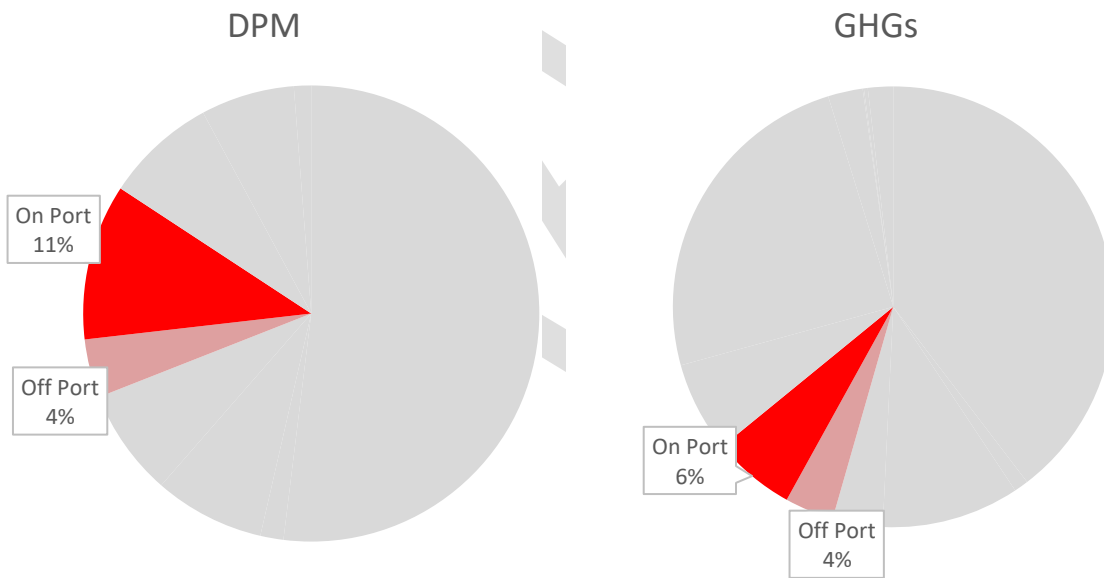


Figure 12. Locomotive Emissions

### 5.5.2. Level of Influence

Our ability to influence emissions from locomotives is extremely limited. Because the options for line-haul and switching services are limited to the two major Class 1 Railroads and Tacoma Rail, The NWSA has little to no ability to drive use of cleaner locomotives through lease agreements with terminal operators, as any such requirements would severely hamper a terminal's ability to move cargo. Additionally, the choice of rail operators is driven by the

beneficial cargo owner, who is not part of lease and operating agreements – The NWSA is not involved in that business relationship.

Switching locomotives owned by local operators represent the most significant opportunity to influence emission reductions, particularly those owned and operated by Tacoma Rail, which is an agency of the Tacoma city government. For example, the Port of Tacoma partnered with Tacoma Rail in 2014 to facilitate federal grant funding to support a repower project for one of their switching locomotives. Tacoma Rail has also worked with the Puget Sound Clean Air Agency on repower projects for their switcher locomotives. In addition, Tacoma Rail has been proactive about installing devices to improve efficiency like automatic stop/start technology to reduce idling. There will likely be opportunities to work with Tacoma Rail and the Puget Sound Clean Air Agency in the future to encourage and support further upgrades to cleaner diesel technology. Since they are owned by a local agency, upgrades to locomotives owned by Tacoma Rail are much more likely to be competitive for grant funding than those owned by the Class 1 Railroads, since they will not be moved out of the region – air quality benefits would stay within Tacoma.

The switcher fleets owned and operated by the Class 1 railroads are generally housed at railyards owned by the railroad companies, but also provide some service to on-dock rail facilities, particularly in the North Harbor (Tacoma Rail is the primary provider of switching services in the South Harbor). Regulatory control over these engines is held by the federal government, state, and Puget Sound Clean Air Agency. Because these locomotives can often be rotated region to region, it is much more challenging to secure grant funding to support replacements, and without grant funding there is little to no incentive for the railroads to voluntarily upgrade their engines. Our partners at the Puget Sound Clean Air Agency are working on advancing voluntary efforts to reduce rail emissions from the Class 1 railroads, using their influence and reputation as the regulatory entity.

Similar challenges exist for the line-haul locomotives but are exacerbated by the fact that individual line-haul locomotives spend a relatively small proportion of their time within our airshed and may or may not regularly visit our facilities. Therefore, a broader national or continental approach to reducing rail emissions is likely needed if significant progress is to be made. For this sector, engagement at the federal level is likely the most impactful way to influence change.

### **5.5.3. State of Technology**

Since 2015, new locomotives built have been required by federal law to meet Tier 4 emission standards, which for particulate matter, allow 95% less emissions than pre-Tier 0 standards. Given that there are no known Tier 4 locomotives operating in our region and a majority of the switching locomotives for which we have data are Tier 0 or unregulated, significant progress can be made by replacing or repower locomotives to conform with the latest standards. In many cases, older locomotives can't be upgraded to Tier 4 (or in some cases Tier 3) due to space constraints on board the locomotive, but significant emission reductions



can still be achieved by upgrading the older engines to Tier 2 or Tier 3. In addition, CARB believes that implementing aftertreatment devices on Tier 4 locomotives is a cost effective and impactful way to further reduce emissions. Further emission reductions can be achieved by installing onboard batteries to augment the power supply for diesel-electric locomotives, reducing emissions and allowing for temporary zero emission capabilities to be applied nearest to population.

Electric locomotives have been around since the 1800s<sup>27</sup> and electric rail systems power by catenary wires or electrified “third rail” systems exist in many locations around the world. While it is physically possible to electrify the whole American freight rail system, the staggering cost is prohibitive<sup>28</sup>. Change on this scale will require action on the federal policy level, and significant federal funding. Since most locomotives use electric drivetrains powered by diesel generators, one method of creating a zero emission locomotive is to replace the diesel generator with a zero emission power source such as batteries or a fuel cell. Both of these technologies are in the relatively early stages of research and development, though early stage pilots are beginning to get underway. For example, BNSF is beginning a pilot of a battery electric locomotive in California<sup>29</sup>. Given the early stage of technology development and commercialization, it will likely be some time before clarity is achieved as to which zero emission technology is best for each rail application.

#### **5.5.4. Action Plan**

Given our limited influence in the locomotive sector, our best methods for reducing emissions are to support, facilitate, and advocate for financial incentives for operators to repower their engines and implement fuel efficiency measures. Drop-in renewable fuels may also be an option for reducing emissions in the short term. The Puget Sound Clean Air Agency is an important partner in this effort, as they have been successful in building partnerships with rail operators and facilitating grant funded repower projects in the past and have broader reach to address these regional sources of pollution that extend beyond port boundaries than we do. Drop in renewable fuels, like renewable diesel, may also be a method for achieving short term emission reductions. We will encourage the City of Tacoma to consider its use in their locomotive fleet if availability and affordability expands as a result of the Washington State low carbon fuel standard.

The main programmatic priorities in the locomotive sector over the next five years are:

1. Work with our agency partners and rail operators to encourage repowers of the oldest switching locomotives in the fleets serving the NWSA facilities.
2. Support agency partners and rail operators in efforts to improve locomotive energy efficiency.

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<sup>27</sup> <https://www.american-rails.com/electric.html>

<sup>28</sup> [https://ww2.arb.ca.gov/sites/default/files/classic/railyard/docs/uoi\\_rpt\\_06222016.pdf?\\_ga=2.229875544.519388810.1612913378-65149391.1570662747](https://ww2.arb.ca.gov/sites/default/files/classic/railyard/docs/uoi_rpt_06222016.pdf?_ga=2.229875544.519388810.1612913378-65149391.1570662747)

<sup>29</sup> <https://chargedevs.com/newswire/bnsf-railway-and-wabtec-begin-battery-electric-locomotive-pilot-in-california/>

3. Advocate for more funding to support locomotive repowers and for advancement of federal rules on air emissions from locomotives.

Based on these priorities, the actions to be taken in the next five years are summarized in Table 14 below.

Table 14. Actions to be taken by 2025 to reduce emissions from Locomotives.

<b>Action</b>	<b>Timeline</b>	<b>Roles and Responsibilities</b>
<i>Support partner efforts to implement cleaner engine technologies and increase efficiency</i>		
<b>1. Meet with Tacoma Rail and PSCAA annually to assess opportunities for locomotive repowers or implementation of other measures to reduce emissions.</b>	2021-2025+	Lead: AQSP Support: Commercial
<b>2. Support PSCAA’s efforts to engage Class 1 railroads on opportunities to repower or otherwise reduce emissions from switching locomotives.</b>	2021-2025+	Lead: AQSP Support: Commercial
<b>3. Support or lead efforts to secure external funding to support switching locomotive repowers or other emission reduction measures.</b> a. Provide letters of support. b. Lead grant application and management if necessary.	2021-2025+	Lead: AQSP Support: Government Affairs
<b>4. Support an encourage the use of renewable diesel in existing locomotive fleets.</b>	2021-2025+	Lead: AQSP
<i>Advocate for funding to support locomotive repowers and advance federal emission requirements</i>		
<b>5. Develop an advocacy agenda to increase funding for locomotive repowers and advance federal standards</b>	Develop advocacy agenda by end of 2022  Continue to refine and implement through 2025	Lead: AQSP Support: Government Affairs

## 5.6. Harbor Vessels

The harbor vessel sector for The NWSA's scope includes assist tugs that help ocean-going vessels maneuver into and out of their berths. In total, there are 14 tugs operated by two companies that serve vessels calling NWSA terminals. These tugs are all powered by large diesel propulsion engines up to 4,100 horsepower. They also have auxiliary engines to supply power for onboard processes that can be as large as 500 horsepower. Most of the propulsion engines of these assist tugs are from the 1990s or older, while auxiliary engines tend to be newer. Assist tug emissions are calculated for their activity throughout the airshed and apportioned to each port proportional to its number of OGV calls.

### 5.6.1. Emissions from Harbor Vessels

Harbor vessels are the 5<sup>th</sup> largest source of GHGs and roughly tied for the third largest source of DPM emissions across the airshed. They do not operate on port property and therefore do not contribute to the on-port totals.



Figure 13. Harbor Vessel Emissions

### 5.6.2. Level of Influence

Assist tugs are typically hired by the ocean-carrier when their vessels need to maneuver into berth and therefore, The NWSA does not have a direct business relationship with them when they are performing their work. The NWSA has one tug company as a tenant, but that lease is expected to expire at the end of 2021. For tug companies that are tenants, the NWSA can help provide shore power for their vessels while they are at berth and can use lease agreements to influence at berth operating practices. In the future, when zero emission tugs are available and affordable, The NWSA can help provide charging and/or fueling infrastructure for tug operating tenants with zero emission vessels. Our partners at the Puget Sound Clean Air Agency have a long history of working with the tug operators to incentivize

engine repower projects. Supporting the Agency in these repowers is an impactful way we can help drive tug emission reductions.

### 5.6.3. State of Technology

The most current emission standard for diesel tugs is Tier 4 and would be installed on any tugboat built today. However, due to the size of emission control equipment that is required for Tier 4 engines, older tugboats may not be able to accommodate Tier 4 engine systems and Tier 3 engine repowers may be the best that can be done in many cases. Renewable diesel and biodiesel blends, while not currently widely available in the Puget Sound region, are drop in fuels that could be used to reduce emissions. Additionally, diesel electric hybrids are currently available<sup>30</sup> and can substantially reduce emissions. Shore power for tugs is also another demonstrated technology for reducing emissions while at dock, though the NWSA does not lease tug docking locations.

Zero emission tug boats are still in the concept to research and development phase. However, the debut of zero emission technology in the tug sector is likely to occur in the next few years, for example, there are reports that a battery-electric tug is slated to be delivered at Port of Auckland in 2021<sup>31</sup>. In addition, hydrogen fuel cell tugs are also being developed<sup>32</sup>. Crowley has completed the first U.S. design of a zero emission tug<sup>33</sup>. Until real world testing has occurred, it will be impossible to determine which technology will be technologically and financially feasible.

### 5.6.4. Action Plan

Because zero emission technology is not commercially available, the most impactful emission reduction measure that can be taken over the next five years is repower of tug propulsion engines to Tier 3 or better. Transitioning to this cleaner diesel will still provide significant air quality benefits in the region. Given our limited influence in this sector, our most efficient course of action is to support the Puget Sound Clean Air Agency's tug repower program. Should any new tug operators become NWSA tenants over the next five years or existing tenants expand their tug operations on NWSA facilities, we will work to support installation of shore power infrastructure and would support installation of infrastructure to support zero emission tugs if desired.

The main programmatic priorities in the harbor vessel sector over the next five years are:

1. Support Puget Sound Clean Air Agency's tug repower program to repower the oldest tug engines.

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<sup>30</sup><http://sanmartugboat.com/hybridtugboats/#:~:text=The%20use%20of%20hybrid%20tugboats%20is%20increasing%20in,providing%20the%20latest%20hybrid%20technology%20to%20its%20customers.>

<sup>31</sup><https://maritime-executive.com/magazine/the-zero-emissions-tug>

<sup>32</sup><https://www.electrive.com/2019/05/23/ballard-abb-developing-fc-tugboat/>

<sup>33</sup>[Crowley Completes First U.S. Design for Fully Electric Tug](#)

2. Advocate for more funding opportunities to support tug repowers.

Based on these priorities, the actions to be taken in the next five years are summarized in Table 15 below.

Table 15. Actions to be taken by 2025 to reduce emissions from Tugs.

Action	Timeline	Roles and Responsibilities
<i>Support the Puget Sound Clean Air Agency tug repower program</i>		
<b>1. Support efforts by others to secure grant funding to support tug repowers.</b> a. Provide letters of support b. Contribute to application writing if necessary	2021-2025+	Lead: AQSP
<i>Tug Shore Power</i>		
<b>2. Support installation of tug shore power for any future NWSA tenants</b> a. NWSA does not currently have any tug companies as tenants. This action would apply if this were to change in the future.	TBD	Lead: AQSP Support: Real Estate, Commercial, Facilities Development
<i>Advocate for funding opportunities for tug repowers</i>		
<b>3. Develop an advocacy position to increase funding opportunities for tug repowers, while not compromising other priorities.</b>	Develop advocacy agenda by end of 2022 Continue to refine and implement through 2025	Lead: AQSP Support: Government Affairs

## 5.7. Administration: Light Duty Fleets and Facilities

The administration sector includes emissions from port and tenant fleets and facilities. Because The NWSA relies on the home ports for fleet and facility services, the administration sector for The NWSA in the implementation plan focuses on fleets and facilities operated by tenants. Tenant fleets include passenger cars, pickup trucks, passenger vans, and other vehicles necessary for administration and maintenance. Tenant operated facilities include office buildings, equipment maintenance bays, yard lighting, fueling, among others. Emission impacts from fleets and facilities include fuel combustion and energy use.

### 5.7.1. Emissions from Fleets and Facilities

Fleets and facilities are the smallest source of emissions in NWSA's scope. DPM emissions from fleets and facilities are negligible and GHG emissions are less than one percent of NWSA's total.

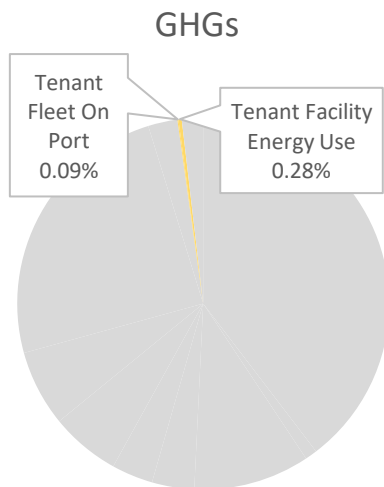


Figure 14. Fleets and Facilities Emissions

### 5.7.2. Level of Influence

The NWSA does not have direct operational control over buildings or facilities, as this control is given to tenants and operating partners in leases and operating agreements. In some of these agreements, however, The NWSA is responsible for maintenance of certain facilities. The NWSA can influence fleet purchase decisions in a similar manner as can be done in the CHE sector, by negotiating requirements into the lease agreements. The NWSA can also install EV charging at facilities during renovations to enable tenants to purchase electric vehicles. The NWSA can also encourage and facilitate energy efficiency improvements by performing analytical work to help tenants identify opportunities to save money by investing in energy efficiency improvements.

### 5.7.3. State of Technology

Battery electric, zero emission versions of light duty vehicles are broadly commercially available, and pickup trucks are nearing commercial availability<sup>34</sup>. While zero emission vehicles are, or will soon be, commercially available, they are still more expensive than gasoline and diesel vehicles to purchase and require charging infrastructure to support. Some projections have stated that 2025 is roughly the year that passenger cars will reach price parity<sup>35</sup>, while price parity is likely further away for pickup trucks and other heavier vehicles.

There are a large number of types of energy efficiency measures that can be taken on port buildings and facilities including but not limited to: upgrading yard and interior lighting to modern light emitting diode (LED), upgrading building HVAC systems, upgrading windows and switching from natural gas heating to electric heating. As new buildings and facilities are built, energy codes generally prescribe best practices in energy efficiency. However, efficiency improvements can also be retrofitted to existing buildings and facilities. Utilities' conservation programs are often a good source of incentive funding to help make energy efficiency retrofits cost effective.

### 5.7.4. Action Plan

Facility energy use contributes the most emissions from the administration sector and presents the greatest opportunity for energy cost savings. Therefore, identifying and facilitating energy efficiency improvements is a primary focus of this sector. The NWSA does not currently own light and medium duty vehicles (relying on the Port of Tacoma for those services), but if The NWSA were to purchase vehicles in the future,

The main programmatic priorities in the administration sector over the next five years are:

1. Work with tenants to identify cost effective energy efficiency projects and incentive funding.
2. Encourage and assist tenants to adopt zero emission fleet vehicles.

Based on these priorities, the actions to be taken in the next five years are summarized in Table 16 below.

Table 16. Actions to be taken by 2025 to reduce emissions from fleets and facilities.

Action	Timeline	Roles and Responsibilities
<i>Facilities</i>		

<sup>34</sup> <https://www.caranddriver.com/ford/f-150-electric>

<sup>35</sup> <https://about.bnef.com/blog/electric-cars-reach-price-parity-2025/>

<p>1. <b>Complete the EB1 and NIM yard LED lighting upgrade projects.</b></p>	<p>2021</p>	<p>Lead: Engineering, maintenance Support: AQSP, operations, commercial</p>
<p>2. <b>Create a program for systematically identifying opportunities for energy efficiency upgrades at NWSA operated facilities.</b></p> <p>a. Establish an internal working group. b. Maintain small pool of funds for energy audits. c. Conduct walkthroughs by utilities' conservation teams. d. Work with the utility to secure incentive funding to support energy efficiency projects.</p>		<p>Lead: AQSP Support: Real Estate, Maintenance</p>
<p>3. <b>Create a program to help tenants identify and finance opportunities for cost-effective energy efficiency and clean energy improvements</b></p> <p>a. Engage tenants annually on potential for energy efficiency or clean energy upgrades. b. Maintain a small pool of funding for energy efficiency audits conducted by a consultant. c. Conduct walkthroughs by utilities' conservation teams. d. Work with the utility to secure incentive funding to support energy efficiency projects.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Commercial/Real Estate, Operations</p>
<p><i>NWSA-Owned Light and Medium Duty Fleets</i></p>		
<p>4. <b>Purchase zero emission vehicles for any future fleet purchases if practicable (currently the NWSA does not own any light or medium duty vehicles)</b></p>	<p>2021-2025+</p>	<p>Lead: Maintenance Support: AQSP, Finance, Engineering</p>
<p><i>Tenant Light and Medium Duty Fleets</i></p>		
<p>5. <b>Develop a program to accelerate adoption of zero emission vehicles in tenant-owned fleets (light and medium duty)</b></p> <p>a. Engage with tenants to understand infrastructure needs. b. Connect tenants with incentive funding to support infrastructure installation.</p>	<p>2021-2025+</p>	<p>Lead: AQSP Support: Commercial/Real Estate, Operations</p>



## 6. Milestones

The following table summarizes the major milestones we will strive to achieve during our five year implementation plan. For each milestone, we have provided a timeframe over which we will seek to achieve it. It is important to note, however, that achieving most of these milestones in the timeframe described is not fully in the control of The NWSA and will need certain external conditions to be met. In some cases, significant external funding is needed. The major external conditions are described in the conditions for success column of the Table 17 below.

Table 17. NWPCAS Implementation Milestones

Milestone	Targeted Timeframe	Conditions for Success	Benefits
<b><i>Cross Cutting</i></b>			
Establish strong community partnerships in both harbors and begin implementing community partnership programs	By the end of 2022	- Willing and able community partners	<ul style="list-style-type: none"> <li>- Build trust and collaborative relationship with our communities</li> <li>- Target emission reduction efforts where they will have most community benefit</li> <li>- Mitigate community air pollution impacts</li> </ul>
Complete the South Harbor Electrification Roadmap	By the end of 2022	- Partners are willing to share data in a timely manner	<ul style="list-style-type: none"> <li>- Allow development of a capital program to deliver infrastructure as needed.</li> <li>- Be prepared to apply for external funding to support this capital program.</li> </ul>
Complete the Seattle Waterfront Clean Energy Strategic Plan	By the end of 2022	- Partners are willing to share data in a timely manner	<ul style="list-style-type: none"> <li>- Allow development of a capital program to deliver infrastructure as needed.</li> <li>- Be prepared to apply for external funding to support this capital program.</li> </ul>
<b><i>OGVs</i></b>			

Complete shore power installation at Husky Terminal	By the end of 2022	<ul style="list-style-type: none"> <li>- Unforeseen delays in procurement of long lead time items are not experienced</li> <li>- Unforeseen construction delays are not experienced</li> </ul>	<ul style="list-style-type: none"> <li>- Reduce GHG emissions up to 3,660<sup>a</sup> tons per year</li> <li>- Reduce DPM emissions up to 1.2<sup>a</sup> tons per year</li> </ul>
Complete shore power installation at T-5	By the end of 2023	<ul style="list-style-type: none"> <li>- Unforeseen construction delays are not experienced</li> </ul>	<ul style="list-style-type: none"> <li>- Reduce GHG emissions 1,666<sup>b</sup> tons per year</li> <li>- Reduce DPM emissions 0.55<sup>b</sup> tons per year</li> </ul>
Complete <i>design</i> of the T-18 shore power system	By the end of 2023	<ul style="list-style-type: none"> <li>- Grant funding to cover 50% of the costs is secured</li> </ul>	<ul style="list-style-type: none"> <li>- Enable construction of shore power infrastructure at T-18</li> <li>- Increase competitiveness of grant applications and other bids for external funding</li> </ul>
Complete <i>construction</i> of T-18 shore power system	Not currently feasible within 5 years	<ul style="list-style-type: none"> <li>- This project is currently underfunded. We believe that we can move installation of shore power at T-18 into the five year plan if \$25 million in external funding is secured by the end of 2022.</li> </ul>	<ul style="list-style-type: none"> <li>- Reduce GHG emissions up to 5,065<sup>a</sup> tons per year</li> <li>- Reduce DPM emissions up to 1.7<sup>a</sup> tons per year</li> </ul>
Update long term shore power capital investment plan	By the end of 2022	<ul style="list-style-type: none"> <li>- No significant external conditions</li> </ul>	<ul style="list-style-type: none"> <li>- Plan for future capital expenditures</li> <li>- Prepare for future applications for funding</li> <li>- Enable detailed advocacy for funding</li> </ul>
Commercial agreements, billing arrangements, and labor arrangements are in place to enable and	By the time shore power infrastructure is installed at	<ul style="list-style-type: none"> <li>- Ocean carriers are willing to use shore power.</li> <li>- Terminal operators are willing to work</li> </ul>	<ul style="list-style-type: none"> <li>- Enable shore power connections</li> <li>- Maximize shore power use</li> </ul>

maximize shore power connections.	each terminal.	with us to facilitate shore power connections.	
50% of shore power capable vessel calls at terminals with shore power infrastructure plug in.	By two years after shore power installation is complete	- Ocean carriers and terminal operators agree to connect vessels to shore power	- Maximize emission reductions from investments in shore power infrastructure
80% of shore power capable vessel calls at terminals with shore power infrastructure plug in.	By three years after shore power installation is complete	- Electricity rates ensure that plugging in to shore power does not significantly increase operational costs	
Complete vessel emission reduction study.	By the end of 2021	- No significant external conditions	- Inform development of clean vessel program to reduce emissions from vessels underway
<b>Trucks</b>			
Replace 60 pre 2007 trucks that serve our domestic terminals through our scrap and replace program	By the end of 2025	- External grant funding is awarded to continue the program past the end of 2021 to fund at least 40 more truck replacements - enough drivers are willing to partner with us to scrap and replace their trucks.	- Reduce DPM emissions by 3.9 tons <sup>c</sup> per year - Support trucking community
Install RFID gate infrastructure at TOTE and West Sitcum Terminals	By the end of 2022	-Sufficient funding is available for installation. -Tenants are willing to reopen leases	-Will allow enforcement of Clean Truck Program requirements at domestic terminal gates. -Additional data availability on truck turn times will be available to trucking community
Implement Clean Truck Program requirement for all trucks entering	2023	-RFID infrastructure is installed at gates	-All NWSA container terminals would enforce the Program

TOTE and West Sitcum Terminals		<ul style="list-style-type: none"> <li>-Communications to truckers ensure awareness of changes</li> <li>-Enough trucks meet the 2007 standard</li> <li>-Tenants are willing to reopen leases</li> </ul>	
State level clean truck collaboration is established	By the end of 2022	<ul style="list-style-type: none"> <li>- Other stakeholders are willing and able to establish the collaboration</li> <li>- Adequate resources are allocated across the collaboration to facilitate meetings and joint actions</li> </ul>	<ul style="list-style-type: none"> <li>- Begin collectively addressing challenges associated with transitioning to zero emissions.</li> </ul>
Support and/or facilitate at least one zero emission truck demonstration in the NWSA gateway targeting at least 10 trucks.	By the end of 2025	<ul style="list-style-type: none"> <li>- Grant funding is awarded to sufficiently incentivize the project for the operator, including truck and any necessary infrastructure</li> <li>- Trucking partner is willing to partner with us on a grant funded zero or near zero emission truck project.</li> <li>-Truck manufacturer willing to work with NWSA and trucking partner</li> </ul>	<ul style="list-style-type: none"> <li>- Demonstrate viability of using zero emission trucks in drayage</li> <li>- Learn what works and does not work in zero emission drayage – lessons learned can improve future demonstrations</li> <li>- Reduce DPM emissions 0.38 tons per year</li> <li>- Reduce GHG emissions 838 tons per year</li> </ul>
<b>CHE</b>			
Complete the SIM yard electric terminal tractor project: 6 electric terminal tractors are in operation	By the end of 2021	<ul style="list-style-type: none"> <li>- No unforeseen delays are experienced in design and construction of the</li> </ul>	<ul style="list-style-type: none"> <li>- Reduce DPM emissions 0.33 tons per year</li> </ul>

		charging infrastructure or terminal tractor remanufacture	<ul style="list-style-type: none"> <li>- Reduce GHG emissions 670 tons per year</li> <li>- Provide first demonstration of zero emission cargo handling equipment in our gateway</li> </ul>
Complete purchase of an all-electric lift truck for our EB1 terminal	By the end of 2021	<ul style="list-style-type: none"> <li>- Lead time on purchasing the machine allows completion in 2021</li> <li>- No unforeseen construction delays on charging infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>- Reduce DPM emissions 0.013 tons per year</li> <li>- Reduce GHG emissions 35 tons per year</li> <li>- Provide first demonstration of zero emission heavy forklift equipment in our gateway</li> </ul>
25 pieces of zero and/or near zero emission cargo handling equipment are operating in the gateway. Seek to balance equipment deployed between the Tacoma and Seattle harbors.	By the end of 2025	<ul style="list-style-type: none"> <li>- Grant funding is awarded to sufficiently incentivize projects for the operator, including rolling stock and any necessary infrastructure</li> <li>- Tenant partners are willing to partner with us on a grant funded zero or near zero emission project.</li> </ul>	<ul style="list-style-type: none"> <li>- Reduce DPM emissions ~1.38<sup>d</sup> tons per year</li> <li>- Reduce GHG emissions ~2,792<sup>d</sup> tons per year</li> <li>- Demonstrate zero and near zero emission cargo handling equipment in our gateway</li> </ul>
<b>Locomotives</b>			
Support partners in completing at least one locomotive repower project	By the end of 2025	<ul style="list-style-type: none"> <li>- Locomotive operating partners are willing to partner with our agency partners on a repower project.</li> <li>- Agency partners are willing to</li> </ul>	<ul style="list-style-type: none"> <li>- Reduce DPM 0.1 tons per year</li> </ul>

		administer the grant, or we are able to dedicate staff resources to administer the grant -Funding is awarded	
<b>Harbor Craft</b>			
Support partners in completing at least one tug repower project	By the end of 2025	- Tug operating partners are willing to partner with our agency partners on a repower project. - Agency partners are willing to administer the grant, or we are able to dedicate staff resources to administer the grant -Funding is awarded	- Reduce DPM 0.1 tons per year
<b>Administration (Fleets and Facilities)</b>			
Complete the EB1 and NIM Yard lighting upgrade project	By the end of 2021	- No unforeseen delays are experienced	- Reduce energy consumption and costs - Small reduction in GHG emissions associated with reduced consumption
Identify and complete one additional energy efficiency or clean energy project	By the end of 2025	- Adequate incentive funding is awarded to ensure that the project satisfies rate of return requirements laid out in our master policy - Where electricity bills are not paid by NWSA, tenants are willing to partner with us to fund the project	- Reduce energy consumption and costs - Emission benefits likely small but non-zero, magnitude depends on project.

<sup>a</sup> The upper bound presented assumes all shore power capable hoteling hours observed in 2020 use shore power. An increase in shore power capable vessel hoteling hours would

increase the upper bound and less than 100% connection rate would reduce emission reductions.

<sup>b</sup> The emission reductions follow assumptions made in the T-5 Modernization project's Environmental Impact Statement. If actual vessel traffic is greater than projected and connection rate is greater than 30%, then emission reductions could be larger.

<sup>c</sup> These projected emission reductions assumes that we approach zero pre 2007 trucks serving the domestic terminals

<sup>d</sup> Assumes the same emission reductions per piece of equipment as the SIM yard project. Actual emission reductions will depend on the projects implemented.

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## 7. Budget and Funding Strategy

The NWSA's operating and capital budgets are approved on an annual basis at a public meeting and voted on by The NWSA Managing Members. Although a project may be included in this annual budget and approved by the Managing Members, individual projects have to undergo an additional project authorization process by the relevant Port Department, Executive Director, or Managing Members at a subsequent public meeting, dependent on the level of funding required. All public meeting materials are posted beforehand on The NWSA's website, and meetings are open for public comment<sup>36</sup>.

External funding will be critical if we are to meet the 2020 NWPCAS vision. We project that the transition to zero emissions for just trucks, CHE, and vessels at berth (i.e. shore power) could cost upwards of \$4 billion beyond business as usual for the port and industry partners combined using today's prices, including infrastructure and equipment costs. This section details the projected costs of NWPCAS implementation over the next five years, what The NWSA is prepared to fund and invest in and where external funding will be needed to implement specific program elements.

### 7.1. External Funding Sources

Historically, we have funded air quality and climate projects through grants from the federal Diesel Emission Reduction Act (DERA) program, the Congestion Mitigation and Air Quality grant program, the Washington State Department of Ecology's Clean Diesel Program, the Washington State Clean Energy Fund, and the state and federal Volkswagen Mitigation Settlements. Continuing to win grant funding through these programs will be important as we look forward to the next five year NWPCAS implementation period.

While these programs have helped make significant progress in improving air quality in our region, the challenge of transitioning to zero emissions will require even larger investments that will require larger funding sources. A significant difference from previous air quality efforts which focused primarily on scrapping and replacing diesel equipment and replacing them with newer diesel equipment, transitioning to zero emissions will require significant investments in infrastructure. Infrastructure funding is not often available in traditional air quality grant programs. As a result, we plan to apply for a broader set of grants to support our air quality and climate work including Washington State Clean Energy Fund grants and Federal Infrastructure grants such as the Port Infrastructure Development Program (PIDP) and the Rebuilding American Infrastructure with Sustainability and Equity (RAISE) program. These larger federal programs will allow us to combine infrastructure projects that support the transition to zero emissions with seaport infrastructure development projects. We believe this combination will yield competitive applications.

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<sup>36</sup> [The Northwest Seaport Alliance \(veconnect.us\)](https://veconnect.us)



Finally, we are excited to participate in and see the results of rulemaking processes for the recently passed Washington State Low Carbon Fuel Standard and Cap and Invest Program, as we hope that significant funding from the revenues of these programs will be directed towards decarbonization of port operations. In addition, there may be opportunities for The NWSA and our business partners to claim credits under the low carbon fuel standard rule, which can generate revenue that will help offset the costs of implementing zero emission technologies. In addition to policies enacted on the state level, the Biden Administration is working on its infrastructure funding package. Decarbonization is a key component of this legislative package and we are hopeful that significant funding will be directed towards port decarbonization as a result.

We will seek to leverage any and all of these new funding opportunities to support this NWPCAS Implementation Plan, and also advocate for additional new sources of funding.

## **7.2. Funding Needs**

There are several projects that we would like to progress as part of the NWPCAS Implementation Plan that will need external funding to move forward. In some cases, both external funding (i.e. grants, incentives, or other contributions) and industry partner funding will be needed. Table 17 details our best estimate of the industry and other external funding (i.e. grants, public funding, other private funding, etc.) needed to move forward with each action. The funding gap indicates the total of these funding needs not yet secured. This section details the items for which we have an existing funding gap.

### **South Harbor Electrification Roadmap:**

**Total cost:** \$500k

**NWSA funds:** \$250k [50%]

**Port of Tacoma Funds:** \$50k [10%]

**External funds:** \$200k [40%]

This study is a critical element of our transition to zero emission port operations in the Tacoma harbor. It will provide a flexible plan to deliver energy infrastructure to support future needs that include ocean-going vessel shore power, zero emission cargo handling equipment, and charging for electric drayage trucks, light duty fleets, and others. We will be partnering with the utility to ensure that the plan identifies and will address key grid constraints and to build a partnership by which we can work together to explore new business models and ways to expedite the investments needed. We believe that we have enough funding to do the baseline planning work. External funding and support will allow us to do more in depth engineering on specific short-term projects identified as high priority in the plan and allow us to take a more comprehensive look at innovative energy solutions like storage, on-site generation, and connected microgrids.

### **Husky Terminal Shore Power**

**Total cost:** \$11.6M

**Port funds:** \$4.8M [50%]  
**State funds:** \$1.1M [11%]  
**Private grant funds:** \$1.0M [10%]  
**Federal funds:** \$1.0M [10%]  
**Additional external funding sought:** \$1.7M [18%]

This project would bring shore power to The NWSA's recently modernized Husky Terminal in the Tacoma harbor. Husky Terminal is a premier facility equipped with new ship-to-shore cranes that can accommodate the largest ships operating in the Pacific trade. The design of the shore power system for Husky Terminal is nearing completion and construction is currently scheduled to get underway in fall of 2021. Funding support has already been provided by the EPA's Diesel Emission Reduction Act (DERA) program, the Washington State Volkswagen Settlement, and the TransAlta Centralia Coal Transition Grant Program. We are seeking to fill a \$1.7 million funding gap in this shovel ready project by the fall of 2021.

**Terminal 18 Shore Power:**

**Total cost:** \$32.1M  
**Port funds:** \$14M [44%]  
**State funds:** \$2.0M [6%]  
**Other external funds sought:** \$16M [50%]

This project would bring shore power to The NWSA's highest volume container terminal. We are advancing design for the project so that it will be ready to build when funding is secured. Of all our terminals, bringing shore power to T-18 would have the largest emissions reduction impact given its substantial vessel volumes. It will also be one of the more expensive terminals to electrify, which presents an obstacle to prompt implementation. A \$2 million grant has been offered for this project from the Washington State Department of Ecology. We will be seeking additional funding through the large federal infrastructure grant programs and new funding opportunities that may emerge from recent legislative actions.

**RFID for Clean Truck Rule Enforcement at Domestic Terminals**

**Total cost:** \$750k  
**Port funds:** \$375k [50%]  
**External funds sought:** \$375k [50%]

This project would install RFID technology at the TOTE and West Sitcum Terminals, which allows detailed truck registration information to be read by terminal gate guards and for data to be synched with the eModal terminal management platform. This would allow us to enforce our clean truck rule at our major domestic terminals, which requires trucks entering our international container terminals to meet model year 2007 emission standards. In addition to supporting enforcement of our clean truck rule, use of the eModal platform would allow for more efficient traffic flow through terminal gates. This project has been on hold due to lack of funding and could be initiated within a year if external funding was awarded.

### **Seattle Harbor Zero and Near Zero Emission Cargo Handling Equipment Demonstration:**

**Total cost:** 14.8M

**Port funds:** \$1.2M [50% of infrastructure costs]

**Marine terminal operator funds:** \$3.1M [25% of equipment costs]

**Other external funds sought:** \$10.5M [72%]

Demonstrating zero emission cargo handling equipment is a critical step towards broad adoption throughout our gateway; demonstrating that the technology works for our duty cycles in our climate. In addition to demonstrating zero emission technology, hybrid technologies for rubber-tired gantry cranes can reduce fuel consumption up to 85% while demonstrating the efficacy of hybrid systems. Given that zero emission equipment is at least 2-3 times more expensive than diesel and necessitates expensive infrastructure upgrades, offsetting these incremental costs and buying down the risk of piloting new technology is critical to making these demonstrations happen.

While the actual details of the project may change based on the advancement of zero emission technologies and tenant needs, we have scoped a hypothetical project based on the current state of technology and existing fleets. This project would purchase and implement 10 battery electric terminal tractors and associated charging infrastructure, retrofit two rubber-tired gantry cranes with hybrid equipment, and purchase four new hybrid rubber-tired gantry cranes. This equipment would be owned by a private marine terminal operator and put into service at a major international container terminal in Seattle. The port would help fund and manage the infrastructure installation and the terminal operator would purchase the equipment with external funding support.

### **Tacoma Harbor Zero Emission Cargo Handling Equipment Demonstration:**

**Total cost:** \$17.2M

**Port funds:** \$3.3M [25% of equipment costs for straddle carriers and 50% of infrastructure costs]

**Marine terminal operator funds:** \$1.9M [25% of equipment costs for top handlers and terminal tractors]

**Other external funds sought:** \$12.0M [72%]

While the actual details of the project may change based on the advancement of zero emission technologies and tenant needs, we have scoped a hypothetical project based on the current state of technology and existing fleets. The Tacoma Harbor presents a unique opportunity for cargo handling equipment demonstration, as the Port of Tacoma and Northwest Seaport Alliance own and operate a fleet of straddle carriers. Zero emission straddle carriers have not been broadly demonstrated, presenting an impactful leadership opportunity. The Tacoma Harbor Demonstration would include purchasing two electric straddle carriers to be owned by the NWSA and supporting marine terminal operators to purchase and demonstrate 10 electric terminal tractors and 2 electric top handlers. The port would support infrastructure installation for the equipment purchased by the marine

terminal operators. External funding will be critical to making these demonstrations happen, offsetting incremental cost and mitigating risk.

**Zero Emission Drayage Truck Demonstration:**

**Total cost:** \$8.4M

**Port funds:** \$420k [5%]

**Trucking company funds:** \$1.7M [20%]

**Other external funds sought:** \$6.3M [75%]

Demonstrating zero emission truck technology in the Pacific Northwest is on the critical path to getting the entire fleet to zero emissions by 2050. Because the port does not own or operate drayage trucks, this technology demonstration will need to be a collaboration between the port, a trucking company and a manufacturer. The demonstration project scope here is for 10 units, but can be scaled up or down based on trucking company and manufacture interests. Since the private trucking company we partner with will own the trucks, they would be responsible for providing the majority of match funding, with the port providing a relatively small motivating contribution and technical support.

**Zero Emission Truck Collaborative**

**Total cost:** \$500k

**Port funds:** \$40k [8%]

**Local/State/Regional partner funds:** \$210k [42%]

**Other external funds sought:** \$250k [50%]

Because port trucking is a relatively small segment of a broader trucking industry, our success in transitioning port trucking to zero emissions will be contingent on the broader industry moving in that direction. Specifically, robust state-wide, and ideally west coast wide, charging and hydrogen fueling networks will need to be developed to support zero emission trucking. This challenge is much bigger than the ports. Collaboration across local, regional, and state government agencies, industry groups, utilities, and more will be needed to make this a reality. Currently, planning and deployment efforts for heavy-duty zero emission vehicles are fragmented and may not be fully considering all segments of the trucking community. We believe that creating a collaborative to bring the critical Washington State stakeholders together to create a unified plan for developing this infrastructure, working jointly on technology demonstrations, and sharing information would accelerate and increase the efficiency of the transition to zero emissions. Funding for this collaborative would help cover consulting costs to convene and support the collaborative for its first two years, matched jointly by the participants.

**Diesel Truck Scrap and Replace Program**

**Total cost:** \$930k

**Port funds:** \$20k

**City of Seattle Funds:** \$110 [12%]

**Other external funds:** \$800k [88%]

Removing pre-2007 trucks from the fleet serving our gateway is a critical action in this Implementation Plan for reducing diesel particulate matter emissions. Our Scrap and Replace program provides bonuses to owners of these older trucks to scrap their pre-2007 trucks and purchase a 2012 or newer truck. The scrap bonuses are sourced from grant funds, we used grant funds from the Washington State Department of Ecology to scrap 6 trucks in early 2021. We have \$110k in grant funding from the City of Seattle to scrap about 12 more trucks. The NWSA’s main contribution to this program is staffing to support this program, which we estimate is about 50% of a full-time employee. In addition, we have been awarded a DERA grant in 2021 for \$720k to add to the bonus pool which would allow us to scrap 36 more trucks.

**Lighting and Building Energy Efficiency Project**

**Total cost:** \$1.0M

**Port funds:** \$250k [25%]

**Tenant funds:** \$250k [25%]

**Other external funds:** \$500k [50%]

Improving the energy efficiency of our facilities is also a critical component of our strategy to reduce environmental impacts by reducing emissions associated with energy usage and by reducing existing demand on the grid. The \$1 million estimate reflects the approximate costs of a terminal lighting upgrade. The NWSA and tenant actual contributions would need to be scaled based on the distribution of resulting cost savings.

**7.3. Summary of Budget and External Funding Needs**

Table 18 provides an estimate of the cost of the projects and programs described within this implementation plan. Included are the amounts that The NWSA is prepared to invest and the funding needed from external partners.

Table 18. Summary of Five Year NWPCAS Implementation Costs and Funding Needs

Action	Total Cost	NWSA Funding	Industry Partner Funding Needed	Industry Partner Funding Secured	External Funding Needed	External Funding Secured
<i>Crosscutting</i>						
Industry engagement	\$125,000	\$125,000	\$0	\$0	\$0	\$0
Community engagement and partnerships	\$250,000	\$250,000	\$0	\$0	\$0	\$0

Policy engagement – International, Federal, State, and Local	\$250,000	\$250,000	\$0	\$0	\$0	\$0
South Harbor Electrification Roadmap	\$500,000	\$250,000	\$0	\$0	\$250,000	\$50,000
Seattle Waterfront Clean Energy Strategic Plan Contribution	\$50,000	\$50,000	\$0	\$0	\$0	\$0
Technical and strategic support	\$250,000	\$250,000	\$0	\$0	\$0	\$0
Annual reporting and communication	\$100,000	\$100,000	\$0	\$0	\$0	\$0
Puget Sound Maritime Air Emissions Inventory <sup>a</sup>	\$450,000	\$200,000	\$0	\$0	\$0	\$0
Annual technology assessment	\$100,000	\$100,000	\$0	\$0	\$0	\$0
<b>OGV</b>						
Install shore power at T-5	Included in ongoing redevelopment project					
Install shore power at Husky Terminal	\$9,600,000	\$4,800,000	\$0	\$0	\$4,800,000	\$3,100,000
Complete design of shore power system at T-18	\$1,100,000	\$600,000	\$0	\$0	\$500,000	\$500,000
Install shore power at T-18	\$31,000,000	\$6,200,000	\$0	\$0	\$24,800,000	\$1,500,000
Shore power preliminary design and capital planning	\$75,000	\$75,000	\$0	\$0	\$0	\$0

Vessel emission reduction initiatives assessment	\$15,000	\$15,000	\$0	\$0	\$0	\$0
Vessel emission reduction initiatives implementation	TBD	TBD	TBD	TBD	TBD	TBD
<b>Trucks</b>						
Zero emission truck demonstration	\$8,400,000	\$420,000	\$1,700,000	\$0	\$6,300,000	\$0
Domestic terminals RFID infrastructure	\$750,000	\$375,000	\$0	\$0	\$375,000	\$0
Zero emission truck collaborative	\$500,000	\$40,000	\$0	\$0	\$460,000	\$0
Trucking community engagement and capacity building	\$100,000	\$100,000	\$0	\$0	\$0	\$0
Port truck trip analysis	\$50,000	\$50,000	\$0	\$0	\$0	\$0
Scrap and replace program bonus pool	\$930,000	\$20,000	\$0	\$0	\$910,000	\$850,000
Enforce clean truck standard at international terminals	\$25,000	\$25,000	\$0	\$0	\$0	\$0
Truck parking needs assessment	\$10,000	\$10,000	\$0	\$0	\$0	\$0
OCR at T-115	\$70,000	\$70,000	\$0	\$0	\$0	\$0
<b>CHE</b>						
SIM Yard Electric Terminal Tractor Project	\$2,200,000	\$0	\$1,290,000	\$1,290,000	\$910,000	\$910,000

EB1 Lift Truck Project	\$439,000	\$247,000	\$0	\$0	\$190,000	\$192,000
Seattle Harbor CHE Demonstration Projects	\$14,800,000	\$1,200,000	\$3,100,000	\$0	\$10,500,000	\$0
Tacoma Harbor CHE Demonstration Projects	\$17,200,000	\$3,300,000	\$1,900,000	\$0	\$12,000,000	\$0
<b>Facilities and Fleets</b>						
EB1 Lighting Upgrade	\$210,000	\$190,000	\$0	\$0	\$20,000	\$20,000
NIM Yard Lighting Upgrade	\$480,000	\$360,000	\$0	\$0	\$120,000	\$120,000
TBD Energy Efficiency Project	\$1,000,000	\$250,000	\$250,000	\$0	\$500,000	\$0
Energy Audits	\$100,000	\$100,000	\$0	\$0	\$0	\$0
<b>TOTAL</b>	<b>\$91,129,000</b>	<b>\$20,022,000</b>	<b>\$8,240,000</b>	<b>\$1,290,000</b>	<b>\$62,885,000</b>	<b>\$6,502,000</b>

<sup>a</sup>The PSEI is funded by a consortium of stakeholders including government agencies, industry, and other ports. The \$250k not funded by The NWSA will be funded by these other entities.



## 8. Reporting

The NWSA will use two reporting media to communicate our progress. First is the annual Progress Report jointly produced by the four NWPCAS participating ports. The purpose of the joint report is for the ports to collectively report progress towards shared objectives, actions, and metrics, hold each other accountable, as well as for each port to report individual progress towards actions in their own implementation plans. This reporting is described in the full NWPCAS strategy document<sup>37</sup>.

In addition to the joint NWPCAS report, The NWSA will construct an abbreviated digest (called The NWSA Clean Air and Climate Digest) on an annual basis, detailing our progress in a concise and accessible way. This digest will focus on the highlights of our local implementation actions and achievements over an implementation year and give a brief preview of the year to come. As part of this digest, The NWSA will work with the Ports of Tacoma and Seattle to produce summaries of implementation in each harbor (including NWSA and home port actions), to provide a more targeted summary for both of our communities. The digest will include a summary of progress towards milestones laid out in this implementation plan.

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<sup>37</sup> [FINAL 2020 NWPCAS Strategy.pdf \(amazonaws.com\)](#)