Advancing Shore Power in Canada

Final Report

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dunsky Energy + Climate

Submitted to:

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About Dunsky

Dunsky supports leading governments, utilities, corporations and others across North America in their efforts to accelerate **the clean energy transition**, effectively and responsibly.

With deep expertise across the Buildings, Mobility, Industry and Energy sectors, we support our clients in two ways: through rigorous **Analysis** (of technical, economic and market opportunities) and by designing or assessing **Strategies** (plans, programs and policies) to achieve success.

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Executive Summary

This report identifies opportunities to **accelerate shore power implementation at Canadian ports**. Shore power enables ocean-going vessels to plug into the electricity grid rather than run their auxiliary engines to generate power while at berth, reducing vessels' operating expenses, greenhouse gas (GHG) emissions, air pollution and noise.

For shore power to be used, two types of infrastructure must be in place:

1. Shore supply infrastructure that provides a connection to the local electricity distribution or transmission grid.
2. Ship electrical distribution systems that can connect with the onshore supply. Newer vessels are frequently built with this infrastructure. Older vessels often require electrical retrofits to enable connection.

The IEC/IEEE 80005 is the international standard (first released in 2012) for shore power, ensuring interoperability, reliability, and safety for shore power connections. The IEC/IEEE 80005-1 currently applies to cruise ships, container ships, roll-on / roll-off ("Ro-Ro") cargo and passenger ships, and car and truck carriers. Likewise, interim guidance has been published for liquefied natural gas carriers, tankers and bulk carriers.

Shore power adoption potential in Canada

This project analyzed the potential for shore power at Canada's largest federally regulated ports – The Ports of Vancouver, Prince Rupert, Montreal, Halifax, and Saint John – for the following cases:

- **Current State** - Reflecting current levels of shore power adoption
- **Scenario 1: Cruise + Containers** – This scenario modelled the implications of all cruise and container vessels connecting to shore power while at berth by 2035.
- **Scenario 2: Full Uptake** – All cruise and container (same as Scenario 1), plus newer bulk carriers and tanker vessels (built after 2010), connect to shore power by 2035.

Scenarios 1 and 2 entail substantial GHG and air pollutant reductions compared to the current state, as seen in Figure ES1 and ES2, which quantify the annual avoided emissions and air pollutants, respectively.

By 2035, if all cruise and container ships across Canada's five busiest ports are connected to shore power (Scenario 1), we estimate annual avoided emissions of 89,000 tonnes of carbon dioxide (CO_2), which represents a sixfold increase to the current state. Expanding the ambition of shore power installation and connections across the five ports to include bulk carriers and tanker vessels built after 2010 (Scenario 2) could result in annual avoided emissions of approximately 169,000 tonnes, which is more than a tenfold increase compared to the current state. Avoided air pollution in this scenario is also significant – estimated to be 2,600 tonnes of nitrogen oxides (NO_X), 490 tonnes of sulfur dioxide (SO_2), and 70 tonnes of fine particulate matter ($PM_{2.5}$).

Achieving these outcomes requires significantly increasing the number of berths equipped with shore power connection points (see Figure ES3).

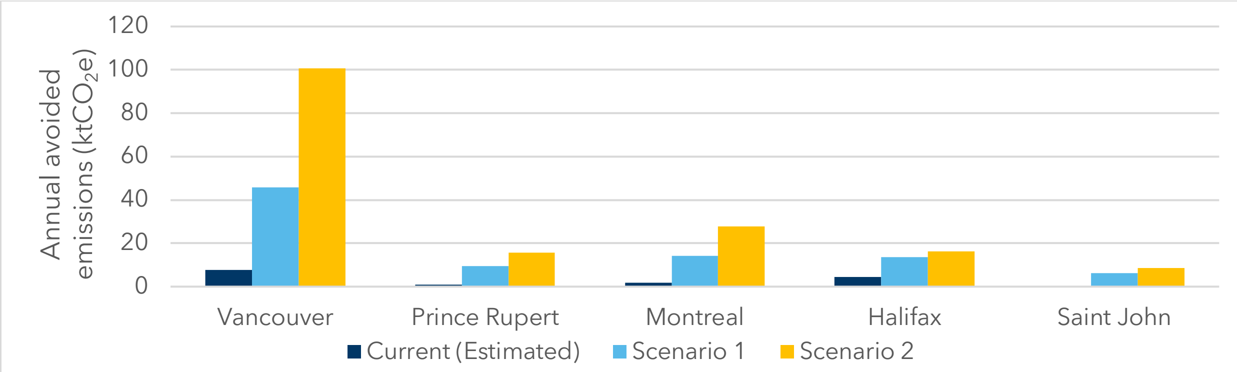

Figure ES1 - Annual avoided emissions by scenario and port

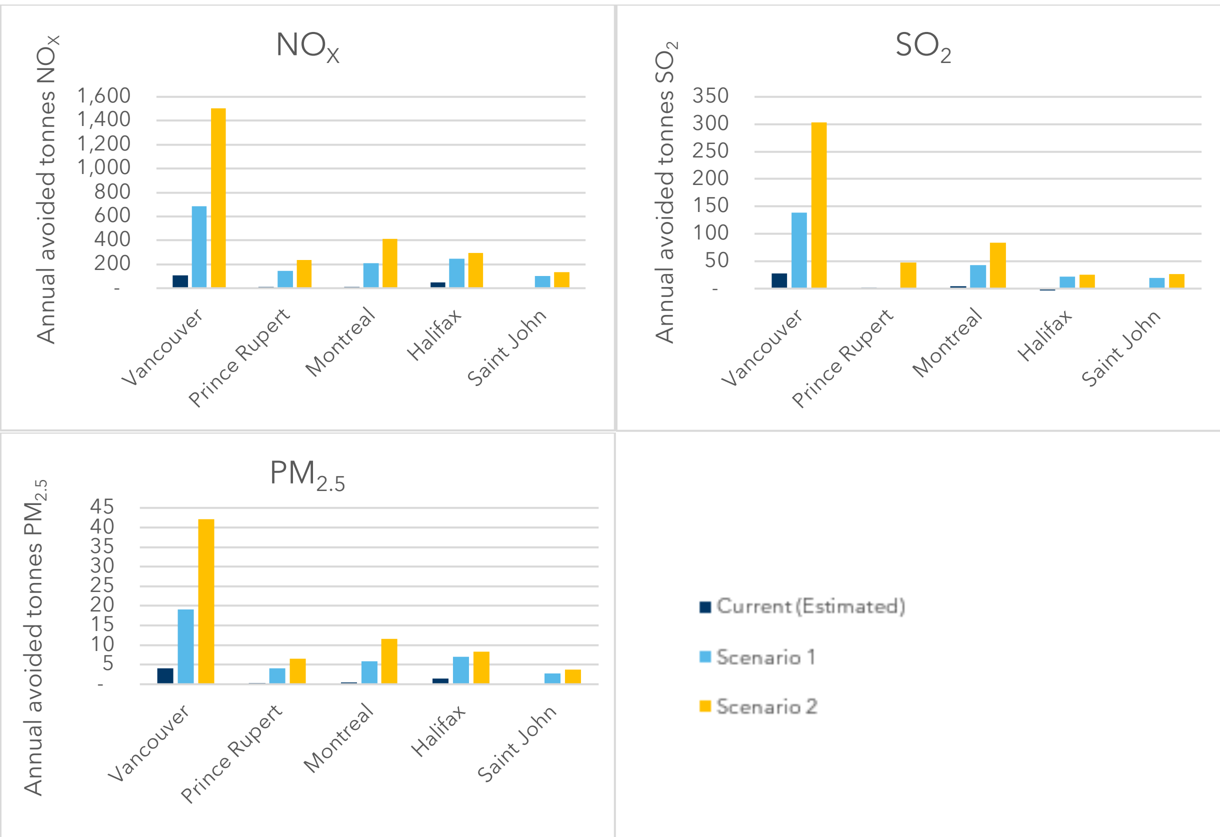

Figure ES2 - Annual avoided air pollutant emissions (NO_X, SO_2, $PM_{2.5}$) by scenario and port

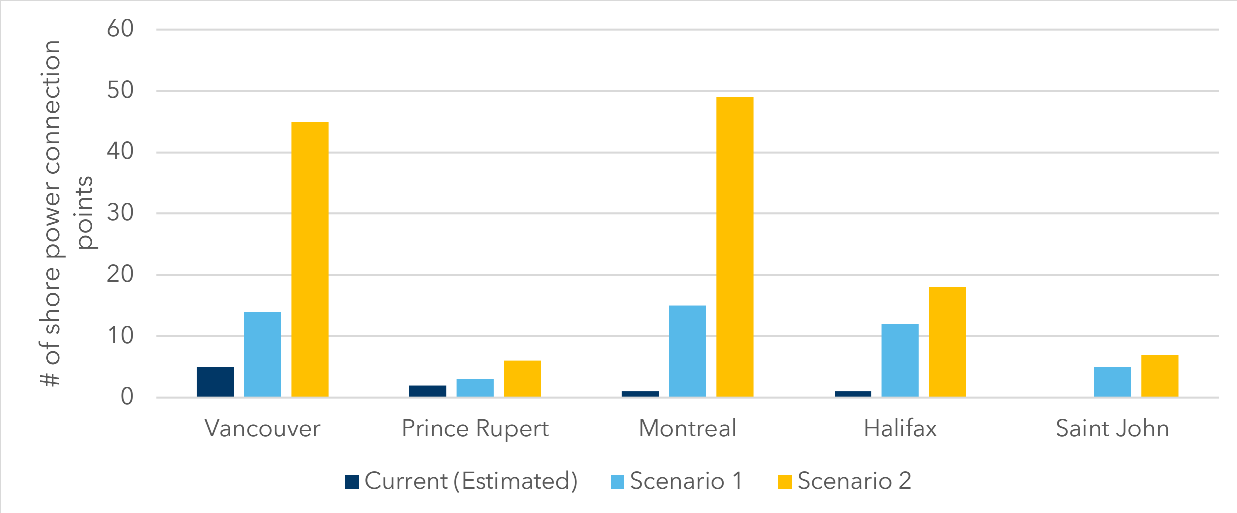

Figure ES3 - Number of shore power connections points by port and scenario

Key themes from international leaders and Canadian ports

To inform key opportunities to accelerate shore power at Canadian ports, Dunsky conducted a desktop scan of the conditions at five leading international ports, as well as interviews and case analysis of Canadian ports. Key themes from this research include:

- As noted in Figure ES3 above, shore power infrastructure has been deployed at only a small proportion of the total terminals and berthing locations necessary for widespread adoption in Canada. Cruise berths feature shore power at the ports of Vancouver, Montreal and Halifax, and the ports of Vancouver and Prince Rupert have Canada's only shore power infrastructure at container berths. No bulk carrier berthing locations in Canada have shore power.
- Several international leaders – including the Ports of Long Beach, Hamburg, and Shanghai – have established shore power connection points at most cruise and container berthing locations. The focus now for leading jurisdictions is to expand coverage beyond cruise and container and to reach full uptake among calling vessels.
- Regulations drive shore power adoption. The European Union (EU), California, and China have all introduced requirements for vessels to eliminate emissions at port (typically via shore power) and for ports to implement shore power. Canada currently lacks any such regulatory framework.
- In 2023, the IMO adopted a Net Zero Strategy to reduce greenhouse gas emissions from international shipping, with the goal of reaching net zero by 2050. Specific short and long-term measures are currently under development and, together with regional carbon pricing mechanisms such as the European Union's Emissions Trading System, could strengthen the business case for shore power in Canada. By rewarding ships that connect to shore power, these policies can help drive demand.

Recommendations

To position Canadian ports and shipping companies to attract best-in-class ships, infrastructure, and technology investments, and to keep pace with our trading partners (and competitors) in the EU, China and California it is recommended that Canada:

1. Require universal shore power availability and use of zero emissions technology while at berth by 2035

It is recommended that all berths at Canada Port Authorities (CPAs) be required to feature shore power by 2035. These requirements should include exceptions for extraordinary circumstances, such as lack of sufficient distribution/transmission system capacity or exceptionally high utility service extension fees. Likewise, it is recommended to require large vessels to connect to shore power while at berth by 2035. These regulations should match or exceed the scope of CARB's *At Berth Regulation* and the EU's *FuelEU Maritime Regulation*, including meaningful penalties for non-compliance. In parallel, provinces should consider their authority to establish such requirements if federal requirements do not materialize.

The federal government could integrate these requirements into the CPA's regulatory framework established by the Minister for Transportation pursuant to the *Canadian Marine Act*, as well as into the legislation itself. It is important that there be sufficient clarity and predictability to support investor confidence for upgrades to both ports' and ships' electrical systems.

2. Begin implementation with new builds and major terminal expansions, where shore power can be integrated at lower cost

Shore power implementation should then be planned and phased into existing berths. Cruise terminals should be prioritized first, as cruise ships are the most shore power–ready vessel segment, with the ability to pass-through costs to passengers. This should be followed by container, and then bulk and tanker vessels once standards are finalized.

Equal priority should also be given to ensuring existing shore power connections are fully functional and that operational barriers are addressed.

3. Conduct Comprehensive Port Electrification Studies at all CPAs

It is recommended to require all CPAs to develop detailed Port Electrification Engineering Feasibility and Design Studies by 2028, supported by $50M in federal funding. These studies should include a focus on high voltage shore power, as well as detailed consideration of low-voltage shore power, non-road port equipment, trucking and rail electrification. A comprehensive port-wide electrification study is preferred over a specific shore power study to capture the full range of electric loads expected in the coming decades.

4. Coordinate electrical utility works

Utilities should collaborate with CPAs to develop sufficient cost estimates for utility distribution works to supply the capacity associated as part of the Port Electrification Studies noted in Recommendation 3 above. It is recommended Provinces direct Crown corporation electrical utilities, and/or electricity sector regulators, to ensure marine sector engagement and adequate cost estimates.

5. Develop a Federal Port Electrification Investment Strategy

The mix of direct federal investment and private financing in port electrification should be considered. It is recommended that the federal government develop a Port Electrification Investment Strategy. This should consider public and private financing mechanisms, cost recovery mechanisms (e.g. connection fees), and amortization periods (long amortization is justified for port electrical works) to enable a rapid build-out of port electrification infrastructure at an attractive cost of capital.

6. Advance shore power standards

Dedicate a team of federal government officials to support and accelerate the development and adoption of IEC/IEEE 80005 standards for bulk carriers and tankers, which are not currently in place. This could include providing technical expertise and facilitating collaboration between ports, utilities, and vessel owners to ensure Canadian perspectives are represented. In the meantime, offer incentives for vessel owners and ports to begin planning and preparing for shore power readiness in these vessel segments. This effort should include the exploration of mobile shore power solutions to overcome connection alignment issues between vessels and the shore-side infrastructure.

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Introduction

1. Introduction

Oceans North is a non-profit organization supporting climate action and marine conservation. Its efforts to advance marine decarbonization efforts across Canada include a strong focus on port electrification and the adoption of shore power. Oceans North commissioned Dunsky Energy + Climate Advisors ("Dunsky") to conduct a study to identify opportunities to accelerate shore power implementation.

This report:

1. Summarizes key information about shore power, including its benefits, existing standards, and the current state of shore power deployment in Canada.
2. Estimates peak electricity demand at each port under two future uptake scenarios.
3. Estimates the shore power infrastructure and capital costs needed to meet potential demand.
4. Demonstrates the potential of shore power to reduce greenhouse gases (GHG) and air pollutant emissions.
5. Identifies challenges and opportunities for increasing uptake of shore power identified through a scan of international leaders and interviews with Canadian port authorities.
6. Provides recommendations for federal, provincial and local policy makers, port authorities, and other stakeholders.

1.1 About Shore Power

While at berth, vessels require power for lighting, heating/cooling, refrigeration, and other hotelling needs. Shore power enables vessels to plug into the electricity grid rather than run their auxiliary diesel engines to generate power while at berth. Shore power thus reduces GHG emissions; air pollutants such as nitrogen oxides (NO_X), sulfur dioxide (SOx), and particulate matter; and lessens noise for local communities. It is increasingly being adopted as part of broader maritime fuel efficiency, decarbonization and air quality strategies, especially for busy ports located in or near populous centres. A large cruise ship berthing for 10 hours uses around 114 MWh – equivalent to powering 4,600 homes for a day.

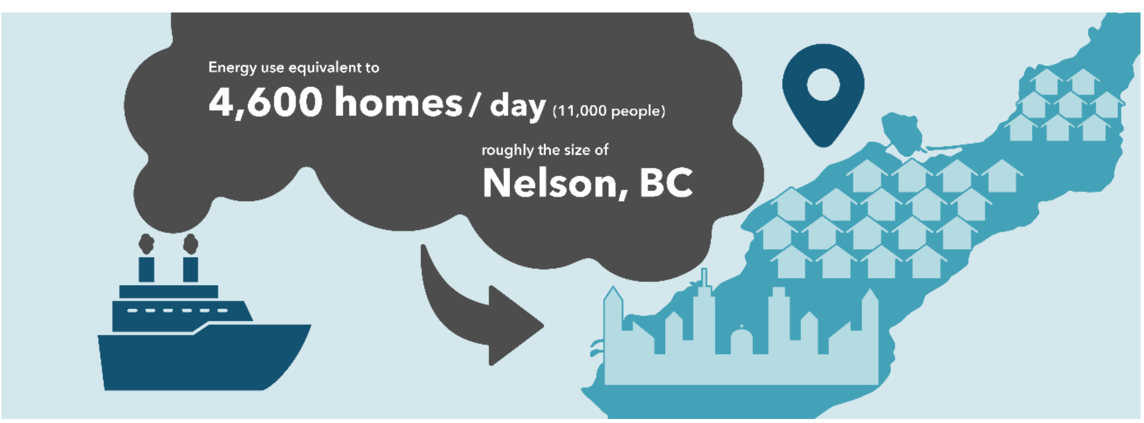

Figure 1: Energy usage equivalency for a single cruise call (assuming cruise is at berth for 10 hours)

Reducing air pollution, in fact, has been one of the main drivers for shore power regulations adoption by leading jurisdictions such as California. Health Canada identifies air pollution as one of the largest risk factors for premature death and disability, with causal links to chronic conditions such as asthma symptoms and bronchitis, as well increased mortality risk. For populous cities with ports close to communities, the marine sector is a significant source of regional air pollution. For example, a recent study in the Seattle-Tacoma area by the Puget Sound Clean Air Agency found that more that 20% of the diesel exhaust in Puget Sound comes from the maritime sector. The health benefits of shore power and the potential health-cost savings—conservatively estimated in the tens-of-millions of dollars—must be considered.

Powering down auxiliary diesel engines will also **eliminate a significant source of airborne and underwater noise**, further improving both human health and supporting healthy habitats for sea mammals.

Quebec and BC have clean grids so ships berthing there can realize reductions of carbon dioxide (CO_2) emissions and air pollutants of up to 99%. Ships at the Port of Halifax in Nova Scotia could see CO_2 emission reductions of approximately 50% and average air pollutant reductions of 30%. This is due to the higher carbon intensity of the Nova Scotia power grid and the fact that coal generation is a significant source of air pollutants. However, over time, these reductions are expected to improve as coal is phased out, and more clean generation resources are utilized.

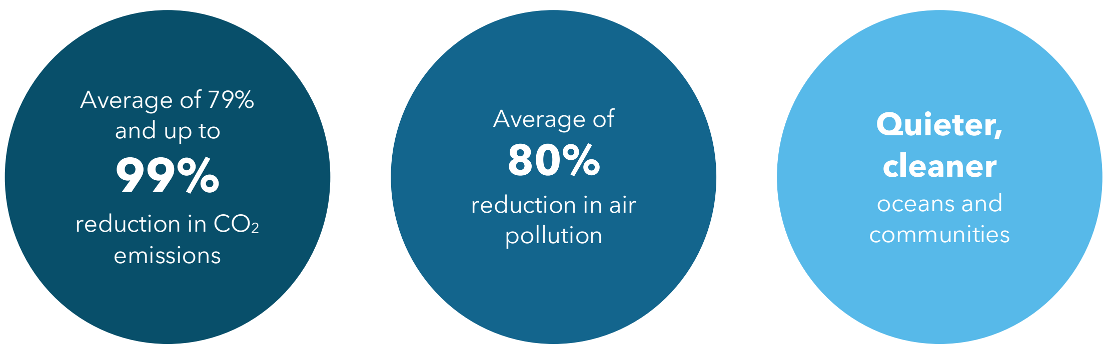

Figure 2: Shore power benefits and emissions/air pollutant reduction potential compared to marine diesel oil[1]

Shore power also offers benefits for vessel owners by reducing fuel consumption and engine wear and tear, helping to lower maintenance costs, extend equipment lifespans, and reduce overall operating expenses.

In Canada, only 4 of the 17 Canada Port Authorities (CPAs) operate standardized high-voltage shore power systems, primarily serving cruise and container ships. More information on the current state of shore power adoption can be found in Section 2.2.

[1] These reductions are calculated based on a Tier II cruise ship. Reductions will differ depending on the vessel tier.

About Canada Port Authorities

There are 17 Canada Port Authorities (CPAs) established pursuant to the *Canada Marine Act* (CMA).[2] CPAs manage commercial activities at ports, operating independently from the federal government but within the parameters of the CMA and their Letters Patent. The CMA provides the Minister of Transport the authority to establish a regulatory framework regarding marine safety, security, and environmental protection. Each CPA is governed by a board of directors, which is responsible for setting the strategic direction of the CPA and overseeing operational decisions.

CPA activities are typically confined to developing infrastructure on land designated for port operations and coordinating activities at ports, rather than directly engaging in cargo handling or storage. CPAs are typically "landlord port authorities." Terminals under CPA ownership are leased to private operators, who manage the handling and storage of goods using their own facilities and equipment.

1.1.1 Shore Power Standards

Shore power allows vessels to connect to a shore-side power source, normally the local electrical grid. Low-voltage systems are typically used for service vessels or wintering connections. High-voltage systems are capable of delivering significantly more power, which then supplies large commercial vessels such as cruise and container ships with sufficient electricity while at berth. For shore power to be used, two types of infrastructure must be in place:

7. Shore supply infrastructure that provides a connection to the local electricity distribution or transmission grid.
1. Ship electrical distribution systems that can connect with the onshore supply. Newer vessels are frequently built with this infrastructure. Older vessels often require electrical retrofits to enable connection.

These systems need to be compatible in terms of electrical voltage, frequency and other parameters. The IEC/IEEE 80005 is the international standard for shore power, ensuring interoperability, reliability, and safety for shore power connections. The IEC/IEEE 80005-1 standard specifically governs high-voltage shore power connection (HVSC) systems, which applies to vessels with main electrical systems that operate above 1,000 V or with a power demand of 1 MVA or greater.[3] The standard specifies that high voltage shore power be provided at 6.6 kV AC and/or 11 kV AC, and that operating frequency of the ship and shore systems must also match; if not, a frequency converter is required to ensure safe operations.

[2] The 17 CPAs includes the following ports: Vancouver, Nanaimo, Prince Rupert, Port Alberni, Thunder Bay, Toronto, Windsor, Hamilton-Oshawa, Trois-Rivières, Sept-Îles, Saguenay, Québec, Montréal, St. John's, Saint John, Halifax, and Belledune.
[3] Low voltage shore power (below 1,000 V), which typically applies to smaller vessels, is out of scope of IEC/IEEE 80005-1.

IEC/IEEE 80005 addresses all aspects of shore power connection, covering both the vessel and shore sides of the system. It sets out design requirements, testing protocols, maintenance procedures, operational procedures, and safety measures such as emergency shutdown systems. Figure 3 below is a schematic diagram of a typical HVSC system from the IEC/IEEE 80005-1 standard, illustrating major electrical components from the shore supply system and transformer to the vessel side (on-board) systems. On the shore side, utility distribution feeders supply power to the vessel. The shore-to-ship connection and interface equipment (#6 in Figure 3) can be either stationary or mobile; mobile systems provide added flexibility and help resolve alignment issues that may arise between the vessel and the shore connection.

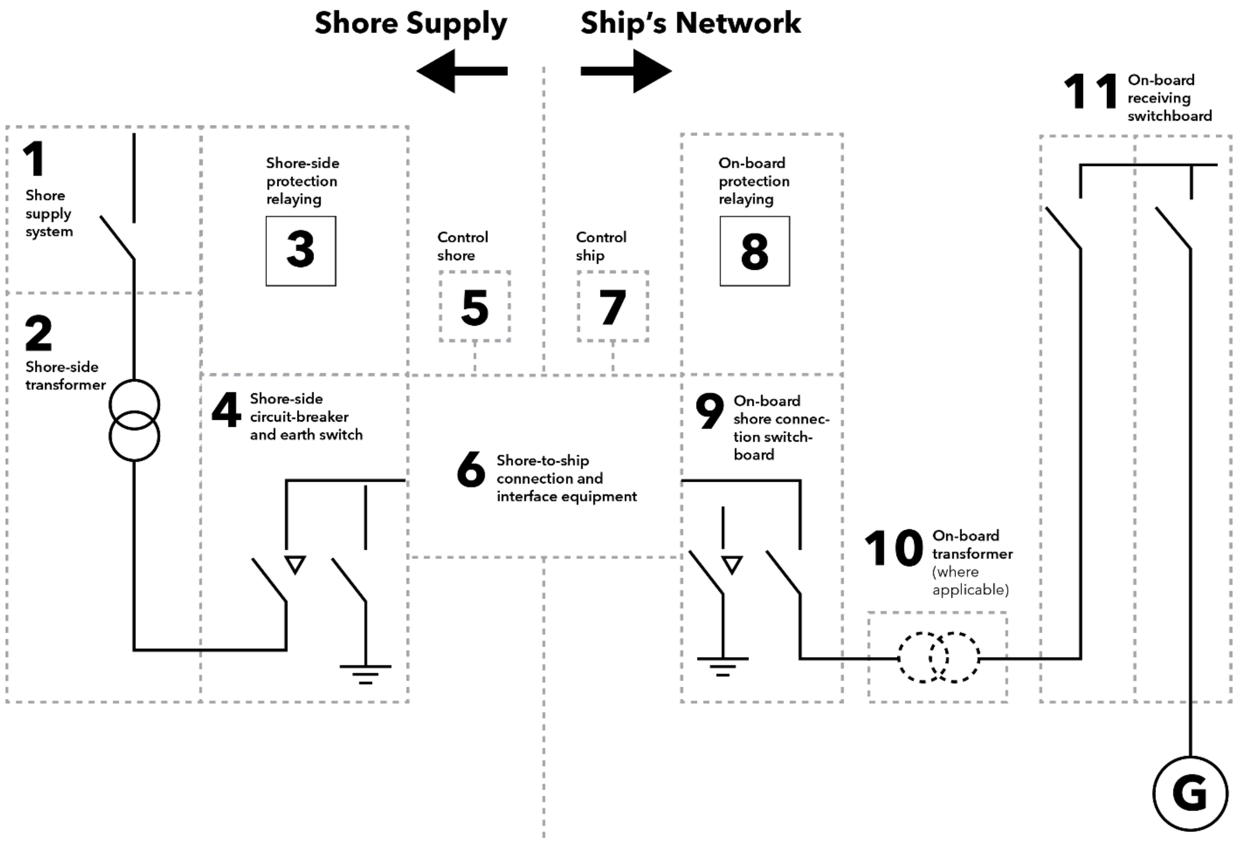

Figure 3: Typical system diagram for high-voltage shore power connection (adapted from IEC/IEEE 80005-1). "G" represents the vessels onboard generation system.

The IEC/IEEE 80005-1 currently applies to the following vessel types:

- Cruise ships.
- Container ships.
- Roll-on / roll-off ("Ro/Ro") cargo and passenger ships.
- Pure car and truck carriers.

While an official standard is not currently in place for tankers and bulk carriers, informative annexes have been published for LNG carriers and tankers to provide interim guidance. For bulk carriers, INTERCARGO (the International Association of Dry Cargo Shipowners) has submitted guidance (MEPC 83/INF.30) to the International Maritime Organization (IMO) to help vessel owners prepare for future requirements. An analysis by DNV found that, based on the vessel types currently covered in the standard, IEC/IEEE 80005-1 applies to 52% of the world's fleet.[4] This share includes all vessel types formally covered under the IEC/IEEE 80005-1 standard, as well as oil tankers, chemical tankers, and LNG carriers, which are addressed in informative annexes. The remaining 48% of the fleet consists of vessel types that have not yet been covered but are expected to be in the near future as standards are in the works, including bulk carriers, general cargo ships, refrigerated bulk carriers, and other liquid tankers.

Shore Power Readiness in Canada

In Canada, high-voltage shore power connections (HVSC) are currently only available for cruise and container ships. Bulk carrier vessel owners in Canada are starting to work with ports to assess the feasibility of high-voltage shore power connections, anticipating the release of a bulk carrier standard within IEC/IEEE 80005-1.[5] Cruise ships are the most shore power–ready segment, with nearly half of Cruise Lines International Association (CLIA) members already equipped to connect and many committing to full fleet readiness by 2035.[6] However, utilization of existing shore power infrastructure remains low, especially for container vessels. Barriers to connecting are explored in greater detail in Section 3.

The feasibility of shore power also depends on vessel age. Newer vessels are generally better candidates for shore power retrofits, given their longer remaining service life and more favourable payback periods. A study done by Eastern Research Group suggests that vessels 17 years or younger are well-suited for shore power retrofits, as they have an estimated 10 years of useful life remaining.[7]

[4] DNV. 2023. Assessment of the current draft proposal on low-voltage shore power standards.
[5] Dunsky Energy + Climate Advisors (Prepared for ECCC). 2025. Canadian Vessel Owners' Shore Power Readiness Study.
[6] International Chamber of Shipping. 2024. The race for shore power.
[7] Eastern Research Group (Prepared for ECCC). 2022. Shore Power Feasibility Study in the Salish Sea.

Shore Power Potential at Canadian Ports

2. Shore Power Potential

This section:

1. Compares the current state of shore power with two projected 2035 scenarios in terms of vessel connections and connection points
2. Quantifies the expected peak demand (MW) for the 2035 scenarios
3. Quantifies the potential contribution of shore power to maritime decarbonization
4. Provides an indicative, order-of-magnitude estimate of the capital cost of deploying shore power

2.1 Methodology

We analyzed the potential for shore power at Canada's largest federally regulated ports (Vancouver, Prince Rupert, Montreal, Halifax, and Saint John). To conduct this analysis, we utilized the U.S. EPA's Shore Power Emissions Calculator[8] and adapted it for the Canadian context. Data from Environment and Climate Change Canada's (ECCC) Marine Emissions Inventory Tool (MEIT) was used, which contains detailed berthing activity and vessel characteristics.

For each port, we analyzed the following three scenarios, summarized in Figure 4 below.

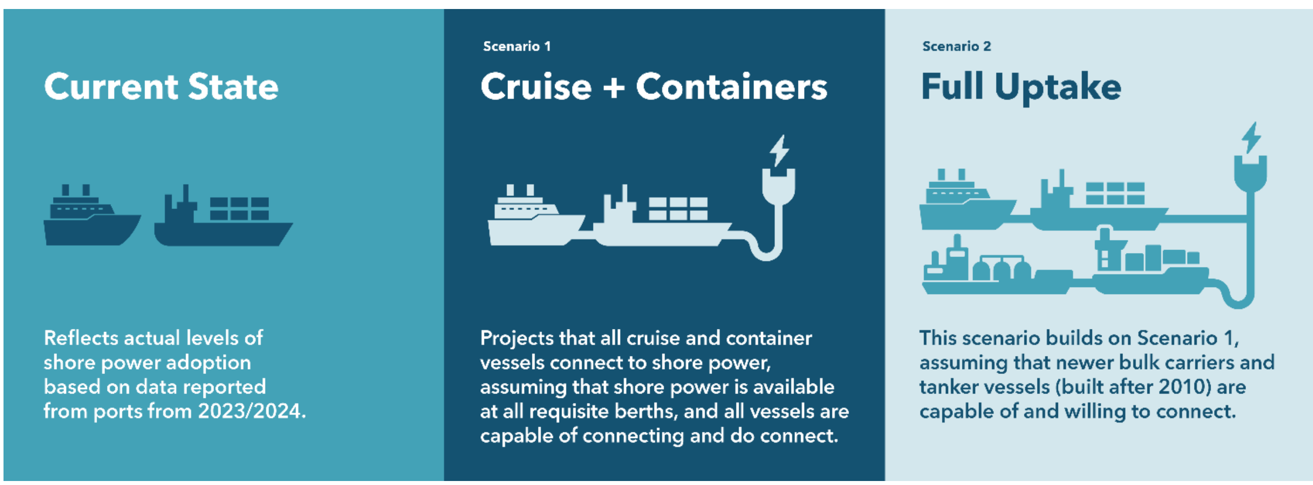

Figure 4: Summary of scenarios analyzed[9]

For each scenario, we analyzed the following metrics:

1. **Annual Shore Power Connections:** We estimated the number of annual connections assuming that all identified vessels connect. A connection refers to an individual vessel plugging into shore power.

[8] The U.S. EPA's Shore Power Emissions Calculator was created to help assess the potential of shore power to reduce emissions at ports.

[9] It is assumed that only one vessel can connect to shore power at a given time at each berthing location; where there are overlaps, the vessel with the higher demand is prioritized. These scenarios were developed by examining shore power regulations in China, the EU, and California, and adapting them to the Canadian context.

2. **Number of Shore Power Connection Points:** The total number of required connection points was estimated by assuming that each berth visited by shore power–capable vessels in a given scenario would need its own connection point. This analysis is based on current vessel traffic patterns, with no re-routing to specific berths assumed. A connection point refers to the physical shore-side infrastructure at a berth that enables vessels to connect to shore power.
3. **Peak Demand:** We estimated the peak hourly demand for each port based on vessel hotelling loads, assuming one vessel per berth connects at a time.
4. **Annual Avoided GHG and Air Pollutant Emissions:** The climate and air quality benefits of shore power are calculated by comparing the energy consumption of each vessel type in each scenario, applying emissions factors for marine fuels and for electricity, and taking the difference to determine the annual avoided emissions and air pollutants.

Scenarios 1 and 2 are built from berthing activity data from the MEIT. For Scenario 1, we only included cruise and container ships, and for Scenario 2 we included all cruise and container ships, and newer bulk carriers, and tankers. These are simple static scenarios that did not model growth, rerouting of vessels to specific terminals, or terminal expansions such as those underway at the Port of Vancouver and Port of Montreal.

This includes the Robert Banks Terminal 2 at the Port of Vancouver, which is a three-berth container terminal that is expected to add 260 container ships annually with 2.4 million twenty-foot equivalent units of capacity—an increase of approximately 30% of the port's current container capacity. The Port has planned shore power as part of the project proposal.

The new Contrecoeur project at the Port of Montreal is a two-berth container terminal expected to add between 56 and 156 ships per year with 1.15 million twenty-foot equivalent units of capacity. This port has also committed to build shore power at the new berths.

While we considered applying a vessel volume increase of 2%, discussions with all ports highlighted that the current state of trade relations, port expansions, and export projects remain highly dynamic, introducing a high degree of uncertainty. For this reason, we chose a static approach, albeit with the understanding that significant growth is still likely for several ports, which only strengthens the case for shore power.

2.2 Current State

The five ports we examined across Canada service a wide range of vessels, such as cruise, container ships, bulk carriers, and tankers. Bulk and liquid bulk terminals represent the highest number of terminals in these five ports. However, there are no shore power connections for the bulk vessel segment.

Table 1 presents the current state of high-voltage shore power connections in Canada, with shore power available for cruise and container vessels at the ports studied. Three ports support cruise ships (Vancouver, Montreal, and Halifax), while two support container ships (Vancouver and Prince Rupert).

> ***Across the five ports, about 56% of visiting cruise vessels are shore-power capable, compared with only 11% of container vessels, slightly below the global average for container ships.***

Across the five ports, about 56% of visiting cruise vessels are shore-power capable, compared with only 11% of container vessels, slightly below the global average for container ships.[10]

Table 1: Terminal mix and shore power connection data at five ports we studied

Port	Vessel Type	Total Terminals	Existing Shore Power Connection Points	Installed Shore Power Capacity	Inaugural Year of Shore Power Connection
Vancouver	Cruise	1	2 (at 1 of 1 terminal)	2 x 12 MW	2009
	Container	4	3 (at 2 of 4 terminals)	3 x 7.5 MW	2017
	Bulk/Liquid Bulk	24	None	None	N/A
Prince Rupert	Cruise	1	None	None	N/A
	Container	1	2 (at 1 of 1 terminal)	2 x 1.5 MW	2014; expansion to second berth and equipment upgrade in 2022
	Bulk/Liquid Bulk	4	None	None	N/A
Montreal	Cruise	1	1 (at 1 of 3 terminals)	1 x 13 MW	2017
	Container	5	None	None	N/A
	Bulk/Liquid Bulk	11	None	None	N/A
Halifax	Cruise	1	1 (at 1 of 1 terminals)	1 x 20 MW	2014
	Container	2	None	None	N/A
	Break-bulk and Project Cargo	2	None	None	N/A
Saint John	Cruise	2	None	None	N/A
	Bulk/Liquid Bulk	3	None	None	N/A
	Container	1	None	None	N/A
	Multiple	2	None	None	N/A

2.3 Assessing Shore Power Potential

2.3.1 Shore Power Uptake and Infrastructure Requirements

Shore Power Connections

Figure 5 shows the current estimate of annual shore power connections at each port versus the 2035 forecasts in Scenario 1 and Scenario 2. Although shore power connections are already in place for cruise and container vessels, the two vessel types

[10] Based on ECCC MEIT data.

included in Scenario 1, there remains a significant gap between the current state and Scenario 1 (Cruise and Containers). Several key factors contribute to this gap in uptake, including the fact that not all container and cruise berths are equipped with shore power, and that not all vessels visiting are shore power capable or choose to connect.

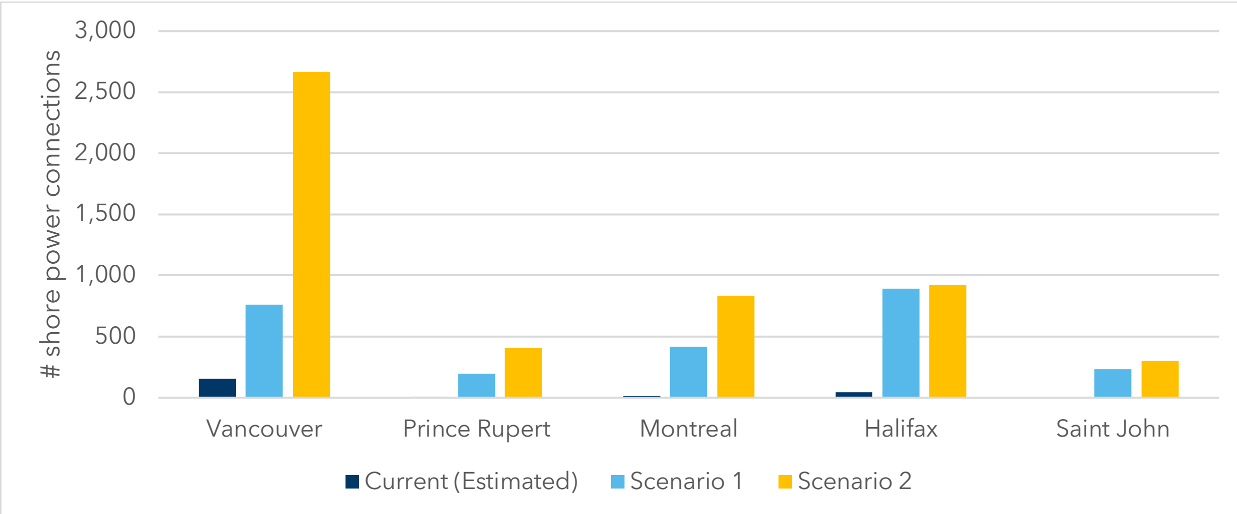

Figure 5: Annual shore power connections by port and scenario

Zooming in on Scenario 2 (Full Uptake), the mix of vessels connecting to shore power varies considerably by port, shaping the scale of change required (Figure 6). At the Port of Vancouver, the majority of vessels in Scenario 2 are bulk carrier/cargo vessels, while other ports are dominated by container ships, a segment with existing shore power infrastructure at several ports and an established IEC/IEEE 80005-1 standard in place.

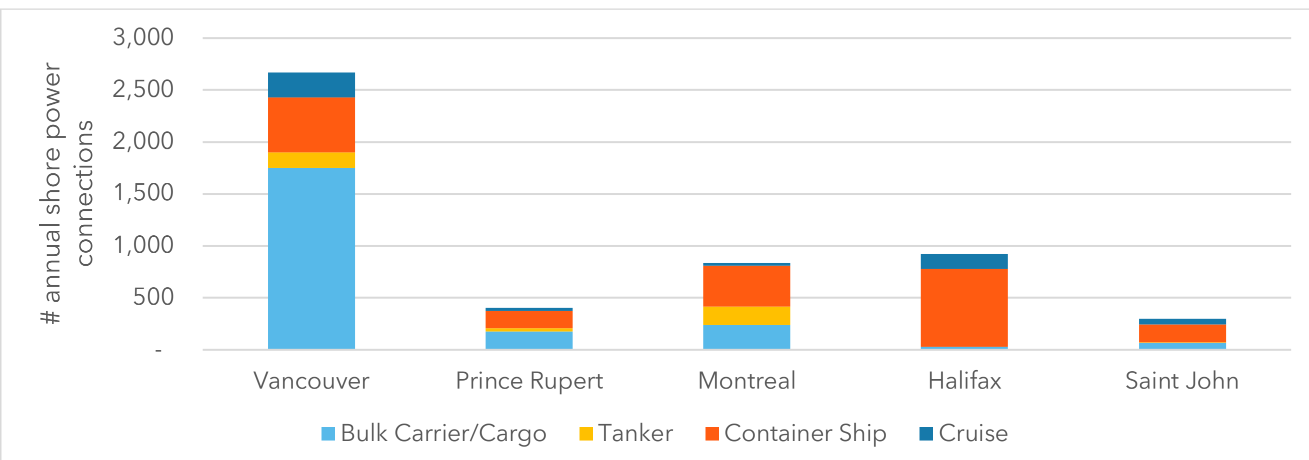

Figure 6: Scenario 2 shore power connections by port and vessel type

Shore Power Connection Points

There is a significant gap between the current number of shore power connection points and the number required under our 2035 scenarios (Figure 7). The difference between the current state and Scenario 1 is mainly driven by container berths without shore power infrastructure, since Vancouver, Halifax, and Montreal already have systems in place for cruise ships. Cruise terminals account for only a few berths per port, whereas container and bulk terminals are more widespread. The sharp increase in Scenario 2 for Vancouver (45 connection points versus 14 in Scenario 1) and Montreal (49 connection points versus 15 in Scenario 1) reflects the absence of shore power infrastructure for bulk carriers and the high number of berths that serve bulk carriers at these two ports.

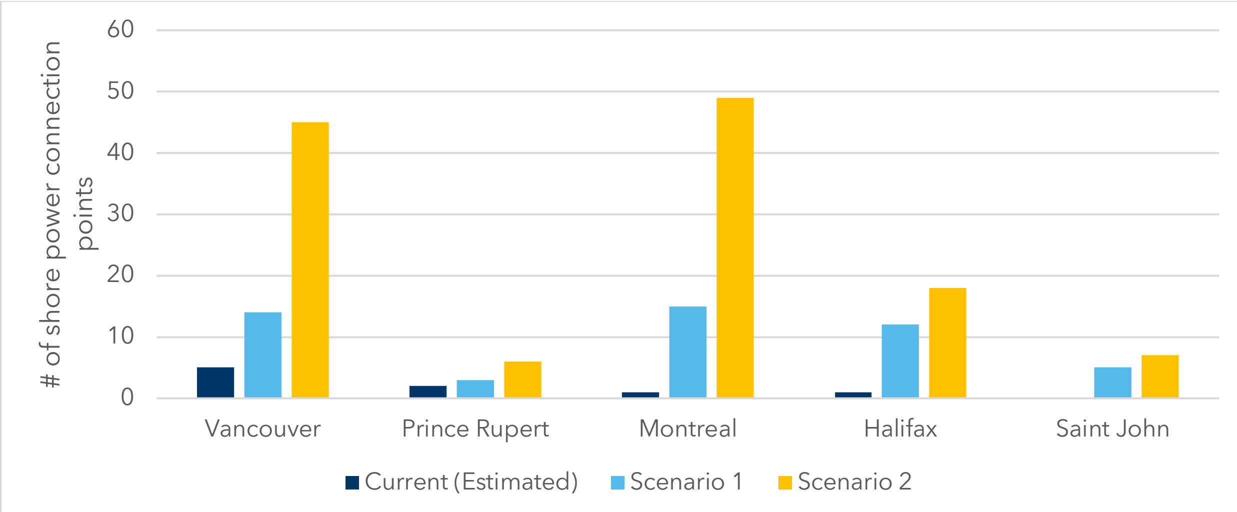

Figure 7: Number of shore power connection points by port and scenario

Peak Electricity Demand

Using hourly berthing activity data, we modelled the expected peak demand for each port in the 2035 scenarios, as shown in Figure 8. The analysis assumed no vessel rerouting or terminal expansions. At each berthing location, only one vessel was assumed to connect at a time; if multiple vessels were present, the vessel with the higher hotelling load was selected.

For each port, the peak hour was then identified. The difference between Scenario 1 and Scenario 2 is relatively small, as bulk carriers and tankers have comparatively lower and more dispersed hotelling loads.

These peaks are unlikely to coincide with the utility's coincident peak (CP), which is the single hour when the utility grid reaches its peak demand. Instead, they represent non-coincident peaks (NCPs), or the highest demand observed at the port level, without reference to the timing of peak demand. Because shore power supply is typically interruptible, the overall impact on most utility systems is expected to be limited. In addition, we modelled peak demand for each port overall, but in reality, many ports have terminals dispersed across different geographic areas and are likely connected to separate utility feeders and substations, meaning peak loads are unlikely to concentrate at a single substation.

Additionally, when comparing the current installed capacity at each port (as outlined in Section 2.2) to our peak demand analysis, the difference between current capacity and our modelled peak demand is relatively modest, even though a significant number of additional connection points need to be installed to achieve the uptake levels projected in Scenarios 1 and 2 (see Figure 7). This is because the modelled peaks reflect the coincident demand across all terminals rather than the sum of the nominal capacity of infrastructure implemented at each berthing location, and because not all vessels will call or connect simultaneously.

Current peak demand data for the five ports analyzed was not available and is not included in Figure 8.

While these modelled peaks help understand the order of magnitude of expected load growth and may help inform early planning decisions, they should be viewed as a high-level estimate. Detailed terminal-by-terminal feasibility studies conducted with the utility would still be required to assess the actual adequacy of infrastructure and plan for capacity that manages impacts on system peaks, including feeder and substation level constraints.

It is also worth noting that ports with more ambitious shore power implementation are considering and implementing on-site energy storage and renewable energy generation to increase energy capacity for the port – for example battery storage and offshore wind partnerships at the Port of Long Beach.

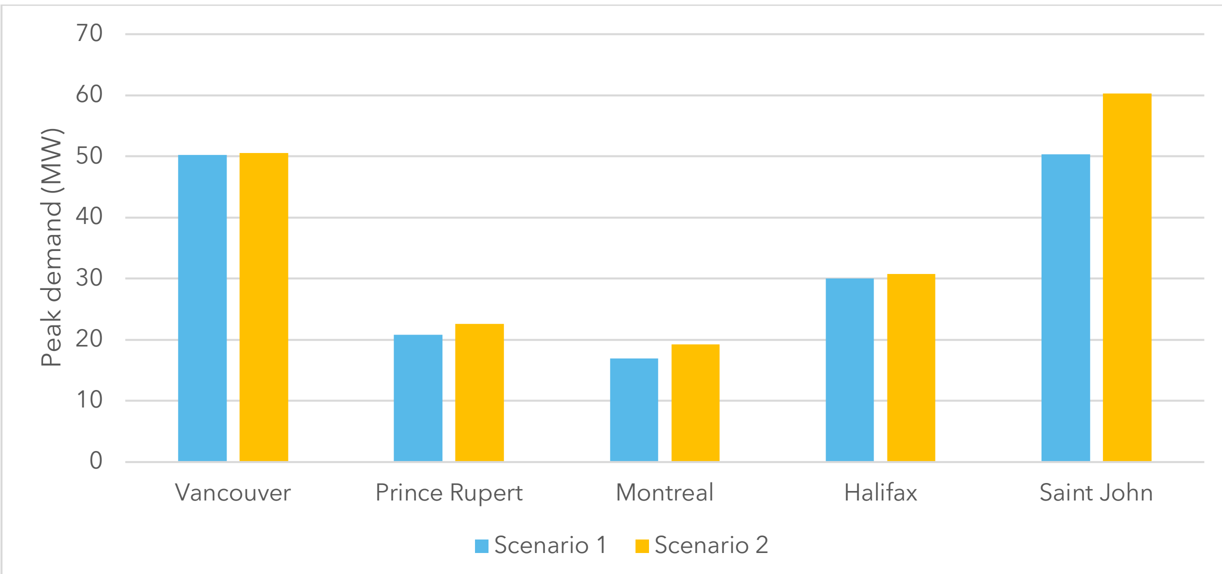

Figure 8: Peak demand for Scenario 1 and 2

2.3.2 Avoided GHG Emissions and Air Pollutants

Significant emissions reductions can occur under our scenarios (Figure 9). Under Scenario 1, 89,000 tonnes of CO_2 equivalent can be avoided annually, increasing to 169,000 tonnes of CO_2 equivalent in Scenario 2 across the five ports. This is roughly equal to removing 40,000 gasoline-powered passenger vehicles from the road for one year.[11]

[11] US EPA. Greenhouse Gas Equivalencies Calculator.

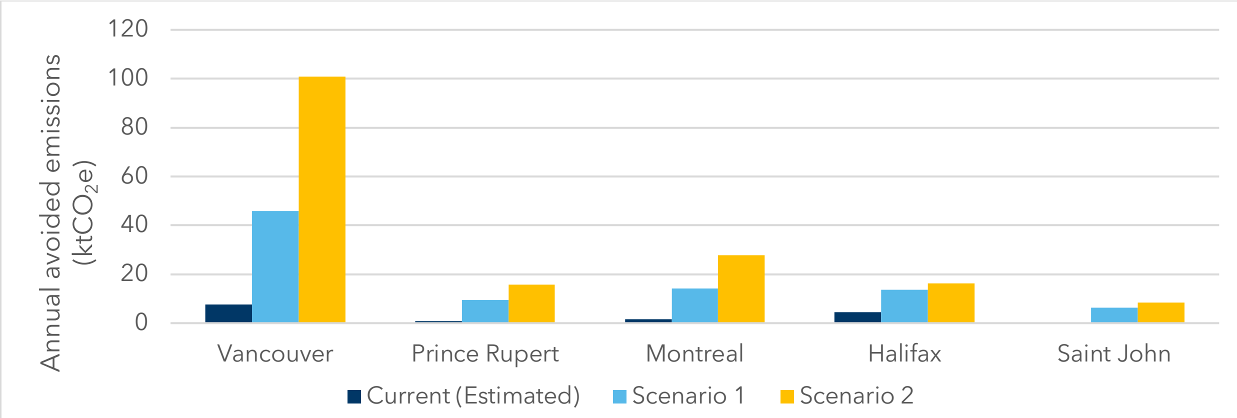

Figure 9: Annual avoided GHG emissions by scenario and port

Looking more closely at Scenario 2, the vessel types that contribute most to avoided emissions generally align with those most frequently calling at the port (Figure 10). Bulk carriers and container ships account for a large share of emissions (accounting for 70% of emissions across the five ports). Cruise ships, while making up a smaller portion of overall traffic (as seen in Figure 6), produce disproportionately high emissions because of their substantial hoteling loads while at berth. For the same time spent at berth, a cruise ship emits roughly 8 times more than a container ship.[12]

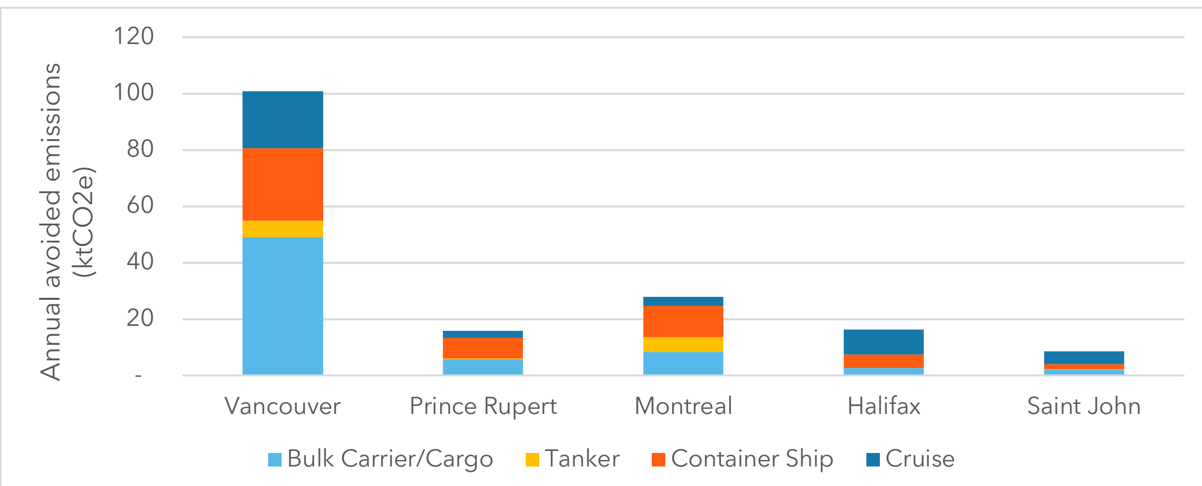

Figure 10: Scenario 2 avoided emissions by port and vessel type

Air pollutants such as NO_X, SO_2, and $PM_{2.5}$ can be significantly reduced with shore power usage (Figure 11). Many ports are located near residential communities that are disproportionately affected by emissions from vessels burning marine diesel oil. By enabling ships to plug into shore power while at berth, ports can reduce harmful air pollutants and mitigate associated health impacts on nearby populations.

[12] Based on U.S. EPA's Shore Power Emissions Calculator hotelling loads. Assumes a 100,000-ton cruise ship and the largest category of container ships.

Research finds that industrial ports in particular produce the most significant local air pollution, associated with solid and liquid bulk cargo. We also know that population effects of air pollution need to be measured, monitored, and controlled. Shore power is a very effective action at ports to limit a large point-source of emissions.

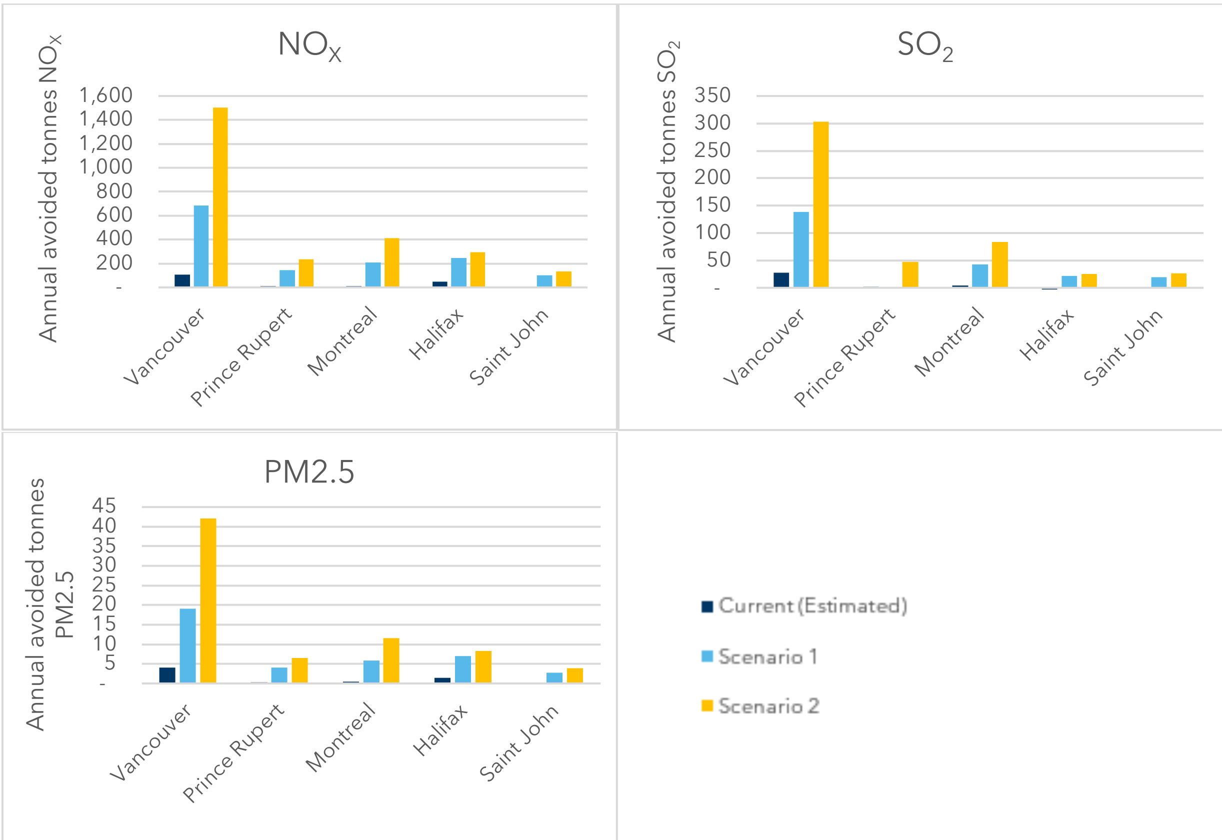

Figure 11: Annual avoided air pollutant emissions (NO_X, SO_2, $PM_{2.5}$) by scenario and port

2.4 Indicative Cost Estimate

Dunsky developed an indicative estimate of the total cost of deploying shore power at these five Canadian ports. Cost per connection point were derived by a survey by the California Air Resources Board of California ports that had implemented shore power[13]:

- $16M CAD per connection point for Cruise.
- $9M CAD per connection point for Container
- $6.3M CAD per connection point for Bulk Carriers
- $31.7M CAD per connection point for Tankers

Figure 12 presents the estimated total capital cost of deploying the additional shore power connection points across the five ports assessed. Under Scenario 1, the total cost is

[13] California Air Resources Board. 2020. At-Berth Regulation Preliminary Cost Information. Values have been escalated by approximately 15% to reflect inflation in construction costs, using the increase between 2020 and 2025 in the Stats Can Building Construction Price Index as a proxy.

approximately $427 million, with the majority attributed to container vessel connection points. Under Scenario 2, costs rise to $1.4 billion, with container ships, tankers, and bulk carriers each representing significant shares of the total.

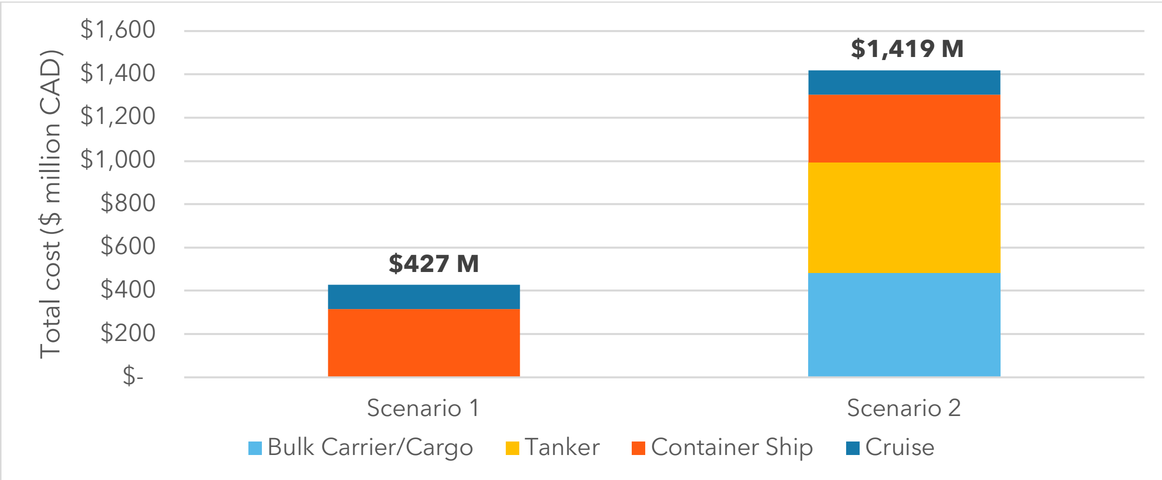

Figure 12: Total capital cost estimate of deploying shore power connection points across five ports

The actual cost of any given installation will vary significantly depending on local utility distribution grid conditions, the structure of extension fees (e.g., whether the cost of the grid work to connect is paid by the customer or rate-based), and specific design and construction procurement details. Thus, these estimates should be considered only a high-level indication of what the cost to deploy shore power across all these ports collectively would entail. Furthermore, costs in Canada may differ from those in California due to variations in labour and material costs, grid connection requirements, and regulatory processes.

Port Case Studies

3. Port Case Studies

The case studies below provide details about five Canadian federal ports profiled as part of this project and were informed by desktop research and interviews with port representatives. For each case study, the ports' commitments, plans, programs and existing shore power implementation are reviewed. The case studies also highlight lessons and opportunities to implement shore power.

3.1 Port of Vancouver

Port Overview

The Port of Vancouver is the largest port in Canada. It handles more cargo than the next four largest Canadian ports combined and the fourth most of North American ports. In 2024, 158 million metric tonnes of cargo and 1.3 million cruise passengers passed through the Port of Vancouver. The port received 3,116 vessels in 2024: 47% bulk carriers, 20% container, 11% tankers, 10% cruise, 8% Ro-Ro, and [14]miscellaneous.

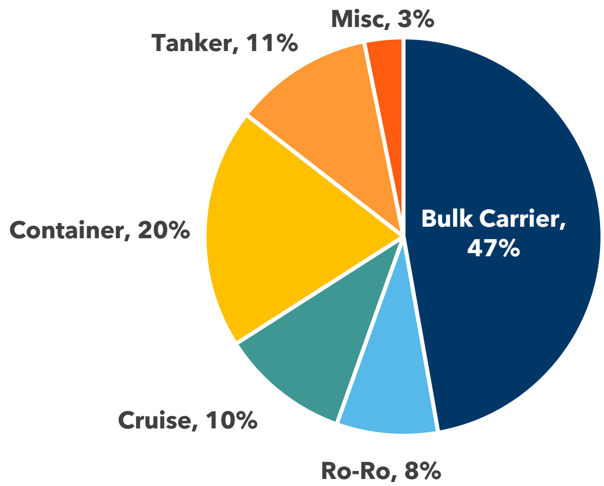

Figure 13: Breakdown of vessel types calling to Port of Vancouver

The Port is home to 29 major terminals:

- Four container terminals.
- One cruise terminal.
- 23 bulk, breakbulk and project cargo terminals.
- One Ro-Ro auto terminal.
- Planned expansion with the Robert Banks 2 container terminal, with a capacity for 260 annual vessel calls and an additional 2.4 twenty-foot equivalent units.

[14] Port of Vancouver. 2024 Statistics Overview.

The Vancouver Fraser Port Authority (VFPA) is the agency responsible for the Port under the *Canada Marine Act*. The VFPA states its "purpose is to enable Canada's trade… while protecting the environment."

The port also benefits from BC Hydro's clean electricity grid, with the GHG intensity being 14 gCO_2/kWh, enabling shore power to significantly reduce both emissions and air pollutants.
Climate & Air Quality Commitments

The VFPA undertakes a range of actions intended to reduce GHG and air pollutant emissions. These actions are guided by the *Northwest Ports Clean Air Strategy* ("Strategy")—a voluntary, collaborative effort between the port authorities of Seattle, Tacoma, the Northwest Seaport Alliance, and the Port of Vancouver, focused on reducing emissions from ocean-going vessels, harbor vessels, cargo-handling equipment, and trucks within their shared airshed. The joint Strategy was first adopted by these port authorities in 2008. In 2020, the ports updated the Strategy, including a shared goal to eliminate port-related air pollutants and GHG emissions by 2050. Furthermore, the Strategy included a commitment to installing shore power at all major cruise and container berths by 2030, noting that this would require substantial investment from port authorities and governments, as well as coordination with electric utilities and terminal operators. Subsequent statements by the Port of Vancouver have reiterated this commitment, noting it applies "where technically feasible". Expansion plans and the environmental impact assessment for Robert Banks 2 include shore power.

> ***"Commitment to install shore power at all major cruise and container berths by 2030 [where technically feasible, including Roberts Bank 2]."***

To measure progress on climate and air quality commitments, the Port produces an emissions inventory every five years to estimate air emissions from marine, rail, on-road and off-road equipment. In 2019, the VFPA and BC Hydro also co-funded and collaborated to produce a Port Electrification Roadmap.

The Port collaborates with other ports, shipping lines and various government bodies on several programs and initiatives, including:

- **Getting to Zero Coalition:** Partnership between World Economic Forum, Global Maritime Forum, and Friends of Ocean Action. The port is one of 200 members, and the coalition is working to accelerate decarbonizing viable ocean-going ships by 2030 and achieve full decarbonization by 2050.
- **International Association of Ports and Harbours:** The port participates in the Climate and Energy Committee, where they can provide feedback to the IMO on best practices in the clean energy transition.
- **North Pacific Green Corridor Consortium:** Partnership to advance projects that decarbonize bulk commodity trade between Canada, Japan, and South Korea. Members include CN (rail), Oldendorff dry bulk carriers, Teck Resources, Mitsubishi Canada Ltd, Trigon bulk terminal operators, and the Ports of Vancouver and Prince Rupert.
- **Pacific Northwest to Alaska Green Corridor:** Partnership between ports, cruise lines, and NGOs to create a cruise green corridor between Washington, British Columbia, and Alaska.
- **Northwest Ports Clean Air Strategy 2020:** together with the Ports of Seattle and Tacoma, the VFPA has committed to reaching net zero by 2050. As part of its efforts, the

Port of Seattle has made shore power connections mandatory for all homeported cruise ships.

The Port of Vancouver is currently **nearing completion of its first *Climate and Air Quality Action Plan* (Plan),** which articulates strategies to achieve its emissions reduction goals. The process to develop the Plan was initiated in 2022, and the Port reports anticipating adopting the Final Plan in 2025. A *draft* version of the Plan released in February 2025 includes the following actions that relate to shore power:

- "Implement a decision-making framework to reduce the intensity of [GHG and air pollutant] emissions… from port authority-led optimization and capacity development projects" (Action 1).
- "Participate in the investigation of opportunities to increase the use of existing shore power infrastructure by ocean-going vessels" (Action 2).
- "Conduct a port-wide alternative energy infrastructure supply/demand assessment with a focus on high impact activities" (Action 6).
- "Facilitate the development of priority alternative energy infrastructure, including the expansion of shore power for container and cruise where feasible" (Action 7).
- "Collaborate with interested parties to facilitate, coordinate, and implement green corridors" (Action 12).
- "Support port businesses, marine carriers and supply chain partners to explore potential market-based opportunities to provide low and zero-emission corridor options" (Action 13).
- "Engage with government agencies to advocate for policies, regulations, and funding that support piloting and adoption of alternative energy, technology and supporting infrastructure" (Action 15).

Shore Power Planning, Implementation & Adoption

As noted in Chapter 2, to date, the Port of Vancouver has implemented shore power at:

- Two of three cruise berths at its cruise terminal, Canada Place (each berth features a connection point with 12 MW of nominal capacity.)
- Three of 10 total container berths at two of four container terminals, Centerm and Deltaport (7.5 MW per connection point.)
- None of the berths at the 24 bulk, breakbulk, project cargo or auto Ro-Ro terminals.

These projects were supported by Transport Canada funding and other sources:

- $6M provided by government sources for the cruise terminal shore power connections built in 2009.
- Transport Canada Shore Power Technology for Ports Program (SPTP): $7.4M for Centerm and Deltaport shore power projects and shore power upgrades at Canada Place cruise terminal (2015.)
- Transport Canada Green Shipping Corridor Program: $6.6M to upgrade shore power infrastructure at Canada Place cruise terminal (2025.)

There are currently no further shore power projects in design or construction. The draft Climate and Air Quality Action Plan notes that:

- Terminal operators are identifying energy management opportunities and developing electrification roadmaps for implementation in the near future.
- The port authority and BC Hydro are working together to facilitate the development of electrical infrastructure that supports energy demands for port operations, including forecasting electrical capacity requirements for port electrification (including shore power) and low carbon fueling infrastructure.

Shore power utility rate

BC Hydro has established a dedicated shore power rate. It is an interruptible service with an energy charge of 5.054¢/kWh and no demand charge. This represents a relatively low cost for shore power compared to international jurisdictions; the energy charge is three to ten times cheaper than what is offered at USA, European and Chinese ports.

Incentives and barriers to connect to shore power

The port offers discounted harbour dues for vessels that adopt environmental measures, such as shore power, through its EcoAction program. However, these represent a very modest proportion of the overall cost of a cruise or container vessel using the Port. The economics of these modest incentives (which provide a 40% discount to harbour dues, equivalent to $0.071/gross tonnage) are unlikely to impact to decisions of shipping operators to either retrofit vessels to accept shore power nor to route vessels capable of shore power to Vancouver.

Terminal operators apply a shore power connection fee. They also apply a commissioning fee that applies the first time that a vessel connects to shore power, for example, DP World (a container terminal operator) has a first commissioning charge of $6,523 per vessel. It comprises a significant cost for a vessel, which may cause vessel operators to choose not to use shore power even if the vessel is capable of connecting, especially for container vessels that visit the Port infrequently. In contrast, cruise vessels typically call at the Port multiple times, allowing the initial investment to be spread over more visits. Limited shore power infrastructure at container berthing locations is also a key factor contributing to low utilization.

Key Opportunities to Accelerate Shore Power

The experience implementing shore power at the Port of Vancouver suggests the following lessons and opportunities:

- **Regulations and government funding are ultimately key to shore power uptake**. Despite the VFPA making strong commitments in 2020 to implement shore power at all cruise and container berths by 2030, to date there has been limited progress in deploying this infrastructure. Moreover, the proportion of container ships connecting to shore has reportedly dipped markedly, in significant part due to shippers re-routing vessels capable of shore power to ports where there are regulations that drive connection. This experience, and the comparison with international ports that *have* made greater progress (see the Interjurisdictional Scan in Appendix A – Interjurisdictional Scan) suggest that commitments are less important to driving action that regulations compelling shore power adoption and/or senior government funding.
- Providing an incentive that pays the initial commissioning costs for a vessel to connect to shore power for the first time could be valuable. This could help ensure that vessels visiting the Port infrequently still connect.

- It is noted that shore power connection of international/ocean going vessels are not eligible to generate saleable credits under the federal Clean Fuel Regulations and/or the BC Low Carbon Fuel Requirements. Inclusion in these programs may present a meaningful revenue opportunity that can improve the economics of deploying shore power.
- Detailed engineering design feasibility studies and capital cost estimates for shore power, including BC Hydro providing estimated costs for utility distribution service extension to relevant terminals/berths, is critical to estimating the likely costs of shore power works. These more detailed evaluations will help provide a more concrete basis for evaluating the business case for shore power deployment.

3.2 Port of Prince Rupert

Port Overview

The Port of Prince Rupert is competitively situated to move cargo between Asia and North American markets. It is the fastest shipping route between North America and many major Asian ports (e.g. Shanghai, Tokyo, Busan, etc.).

In 2024, the port had 502 vessel calls.[15] Of commercial vessel types calling to the port, container ships account for approximately 36%, bulk carrier 46%, cruise 9%, and tankers 9%.[16]

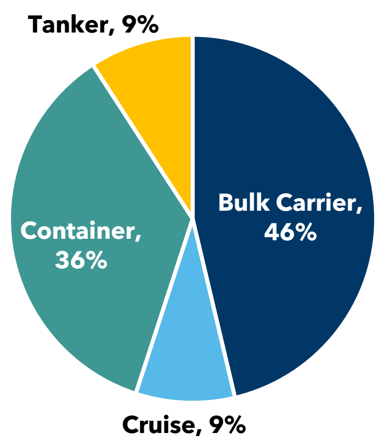

Figure 14: Breakdown of vessel types calling to Port of Prince Rupert

The Port includes six terminals:

- One container - Fairview Container Terminal.
- One cruise - Northland Cruise Terminal.
- Four specialized bulk terminals - Trigon Pacific Terminal loads metallurgical coal, thermal coal and petroleum coke; Westview Wood Pellet Terminal; Ridley Island Propane Export Terminal; and Prince Rupert Grain Terminal.

The Prince Rupert Port Authority (PRRA), established in 1997, is responsible for the Port under the *Canada Marine Act*.

The port also benefits from BC Hydro's clean electricity grid, with the GHG intensity being 14 gCO_2/kWh, enabling shore power to significantly reduce both emissions and air pollutants.

Climate & Air Quality Commitments

The PRPA is undertaking several actions to reach its target of reducing GHG emissions intensity by 30% by 2030 from 2018 levels and reaching carbon neutrality by 2050, as

[15] Port of Prince Rupert. 2024 Annual Report.
[16] Estimated based on vessel call data from ECCC's MEIT. Note that gas carriers have been classified as tankers per this dataset.

outlined in their 2022 Sustainability Report. It notes its shore power deployment at the Fairview terminal as a key element of advancing these commitments.

Key initiatives include:

- Membership in the North Pacific Green Corridor Consortium for bulk commodities.
- Development of an Electrification Roadmap in collaboration with BC Hydro, port tenants, and port users.
- Development of a Carbon Strategy in partnership with port tenants and users.
- Annual preparation of an emissions inventory to estimate air and carbon emissions from marine vessels, rail, on-road vehicles, and off-road equipment.
- Additional environmental initiatives related to port operations and cleaner fuels, including infrastructure investments to reduce truck traffic and drayage distances, pilot projects for electric and hydrogen fuel cell trucks, and a Renewable Diesel Initiative to displace conventional diesel use

Shore Power Planning, Implementation & Adoption

The Port of Prince Rupert's Fairview Container Terminal features shore power at both of its berths. Fairview Terminal was developed in 2007 as a dedicated intermodal facility capable of accommodating the largest container ships and transferring containers to rail connections to the rest of North America. It is operated by DP World.

Fairview Terminal was originally developed in 2007 with sufficient electrical capacity for shore power, and a shore power connection point was deployed in 2010 when there was a single berth at the terminal, with the first plug in occurring in 2014 (representing the first container ship plug-in in Canada). The terminal underwent expansion of a second berth, which was completed in 2017, and in 2022, through a partnership between PRPA, DP World and BC Hydro, new electrical infrastructure was installed at the Terminal's new berth and upgrades were made to the existing shore power connection. The PRPA's Green Wave program includes modest inducements to connect to shore power. However, it is unlikely these would provide sufficient economic incentive for shipping operators to accelerate retrofits of their vessels or re-route shore-power capable vessels.

The PRPA has no immediate plans to further deploy shore power at its cruise or bulk terminals. Port interviewees report that cruise patterns have changed in recent years, with fewer cruise ships landing at PRPA, which could lessen the business case for near-term deployments.

Shore power utility rate

BC Hydro has established a dedicated shore power rate. It is an interruptible service with an energy charge of 4.886¢/kWh and no demand charge.

Need for Transmission Expansion to Support Port Electrification

The Port, along with other industrial customers in BC's northwest, have unique electrical capacity limitations. To provide capacity for future load growth in the region, BC Hydro is engaging stakeholders regarding a North Coast Transmission Line project. The project would increase capacity along existing transmission corridors between Prince George and Terrace, which would then be followed by a new transmission line from Terrace to Prince Rupert. PRPA interviewees noted they are engaging with BC Hydro in this process. They noted the importance of proactive shore power planning in the coming years to ensure that they will have a timely submission for upgraded BC Hydro service, and assurance of connection in BC Hydro's queue. It was noted that funding resources supporting engineering studies could be valuable. An earlier application to Canada's Green Shipping Corridors for a port electrification feasibility study was not funded.

Considerations of Appropriate Terminals for Shore Power Deployment

Ultimately, it will be important for shore power to be available at bulk terminals. However, several of the bulk terminals at the PRPA could see reduced traffic in a GHG-constrained world, notably exports of coal, propane and perhaps wood pellets. As with all ports, consideration will need to be given to match projected export/import and ship characteristics with shore power initiatives.

Key Opportunities to Accelerate Shore Power

- There is an opportunity to ensure that sufficient electrical capacity for Port electrification is assured as part of the North Coast Transmission Line project. Potentially, the Province could direct the BC Utilities Commission and BC Hydro to ensure that capacity is reserved for such works, including shore power at applicable terminals.
- Funding for proactive port electrification and detailed engineering feasibility studies, including capital cost estimates for shore power and estimated costs from BC Hydro for utility distribution service extensions to relevant terminals and berths, would help identify priority deployment opportunities, accelerate design activities required for service requests, and provide a more robust basis for evaluating the business case for shore power.
- Regulation and government funding are required to ensure shore power uptake – despite Prince Rupert being a leader in installing container shore power capacity within Canada, uptake has been low, suggesting that regulations and funding to compel additional shore power uptake from the vessel side is required.
- Port interviewees suggested that there could be value in an incentive that pays the initial commissioning costs for a vessel to connect to shore power for the first time. This could help ensure that vessels visiting the Port infrequently still connect.
- It is noted that shore power connection of international/ocean going vessels are not eligible to generate saleable credits under the federal Clean Fuel Regulations and/or the BC Low Carbon Fuel Requirements. Inclusion in these programs may present a meaningful revenue opportunity that can improve the economics of deploying shore power.

3.3 Port of Montreal

Port Overview

The Port of Montreal serves as a critical trade hub for both Quebec and Canada as a whole. In 2024, the port handled 35 million metric tons of cargo and welcomed more than 50,000 cruise passengers.[17] The port supports approximately 600,000 jobs and contributes $93.5

[17] Port of Montreal. Traffic Summary (Last 10 years).

billion in economic activity, which represents 3.5% of Canada's GDP and 10% of Quebec's GDP.

In 2024, the port had 2,028 vessel calls.[18] Of commercial vessel types calling to the port, container ships account for approximately 27%, bulk carrier 23%, cruise 4%, and tankers 44%.[19]

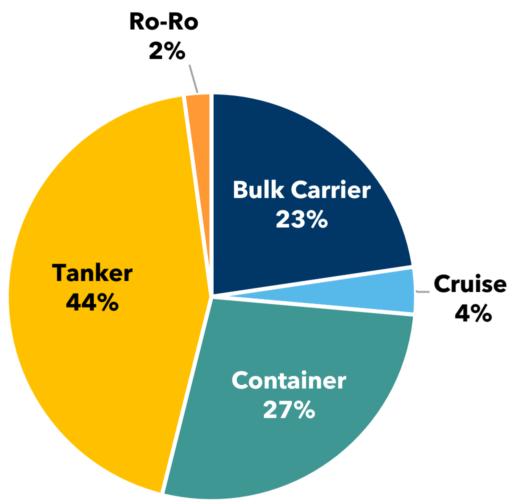

Figure 15: Breakdown of vessel types calling to Port of Montreal

The Port includes 19 terminals:

- Three cruise terminals.
- Five container terminals.
- Four liquid bulk terminals.
- Three dry bulk, two non-containerized/oversized freight, and two grain terminals.
- The port is also expanding its Contrecœur terminal, which will be able to handle an additional capacity of 1.15 million TEUs per year, representing an additional capacity of 60% of the containers that are currently handled at the Port.

The Port of Montreal is governed by the Montreal Port Authority (MPA.) The MPA is responsible for building and maintaining port facilities, which it leases to private stevedoring companies. Four main companies operate the terminals within the port's territory: QSL, Logistec, MGT, and Termont.

The port also benefits from Hydro Quebec's clean electricity grid, with the GHG intensity being 1.2 gCO_2/kWh, enabling shore power to significantly reduce both emissions and air pollutants.

Climate & Air Quality Commitments

The Port of Montreal has made commitments to sustainability and environmental leadership through its *Sustainable Development Plan 2023–2027*, which sets emissions targets for

[18] Port of Montreal. 2024 Annual Report.
[19] Estimated based on vessel call data from ECCC's MEIT.

reducing Scope 1 and 2 emissions by 55% by 2030 and achieving carbon neutrality for these scopes by 2035.

The port has also committed to reducing Scope 3 emissions by 40% by 2040 and reaching full carbon neutrality by 2050. In interviews, the port representative noted that they are prioritizing Scope 1 and 2 emissions such as fleet electrification. Shore power is expected to play a role in achieving the longer-term goal of carbon neutrality of Scope 3 emissions by 2050.

The Port collaborates with other ports and shipping lines on several programs and initiatives, including:

- **Green Shipping Corridor with Port of Antwerp**: In 2021, the Ports of Montreal and Antwerp signed a cooperation agreement to establish a green shipping corridor, with the intent of adopting new clean technologies.
- **Domestic Green Shipping Corridor with QSL and Oceanex:** In 2023, the Port of Montreal, QSL, and Oceanex announced a partnership to create a green shipping corridor between the Ports of Montreal and St. John's (served by Oceanex and QSL.) As part of this initiative, implementing alternative fuels and electrification technologies is being assessed.

Shore Power Planning, Implementation & Adoption

The port has one shore power connection point installed at its Alexandra Pier Cruise Terminal with a capacity of 13 MW, which was introduced in 2017. Shore power infrastructure is not currently in place for other vessel types such as container, bulk carrier, and tankers.

The cruise terminal connection was supported by Transport Canada funding and other government sources:

- Transport Canada Shore Power Technology for Ports Program: $5M for high voltage shore power at Alexandra Pier and wintering connections (2015.)
- Government of Quebec: $3M for high voltage shore power at Alexandra Pier and wintering connections (2015.)

The port also secured funding in November 2024 through the Green Shipping Corridor Fund to expand shore power infrastructure to its Bickerdike (container and bulk terminal) and Viterra (grain terminal) terminals, though in interviews port staff noted that it still faces financial hurdles for these projects as funding only covers half of the project costs.

Shore power utility rate

The port has a dedicated shore power rate for cruise terminals, which includes an energy charge of $0.06634/kWh.

A connection/disconnection fee of $2,900, along with commissioning and decommissioning fees ranging from $4,900 to $9,600, is charged by the Montreal Port Authority depending on the number of passengers on a cruise ship.[20] In interviews, port staff noted that these energy charges and fees have not deterred cruise ships from connecting, as it remains financially

[20] Port of Montreal. 2025. Notice N-6 Electricity Service Rates for Montreal Port Authority Facilities.

advantageous compared to using diesel, and costs can be readily recovered through passenger pricing.

Limited substation capacity to accommodate shore power expansion

In interviews, port staff noted that substation capacity poses a challenge for expanding shore power infrastructure. In addition, based on reviews of Hydro-Québec plans, it is our understanding that the utility does not currently account for maritime electrification in its planning, making it difficult to justify the capital investments needed to upgrade distribution infrastructure and allocate dedicated capacity for shore power.

Specific vessel segments less willing to connect to shore power

In interviews, port staff also noted that while cruise vessels are generally eager to connect to shore power and are willing to pay the tariff, the port has faced greater challenges engaging container and bulk carrier operators. It noted that these vessel types operate in more competitive markets, often lack consistent routes, and do not benefit from the same concentration of shore power infrastructure at other ports as cruise lines do. This makes utilization and the economics of shore power more difficult for these vessel segments.

Key Opportunities to Accelerate Shore Power

- **Increase funding for shore power infrastructure**. Port staff has indicated that projects are only viable if at least 80% of capital costs are covered. Current funding levels fall short, creating a barrier to deployment. Expanding federal and provincial funding programs and longer-term funds dedicated to port electrification, including at the Contrecoeur terminal project would help close this gap and provide the certainty ports need to plan major infrastructure investments.
- **Establish regulation and consistent price signals**. Federal regulation that requires or strongly incentivizes shore power adoption, combined with carbon pricing mechanisms, would create the demand certainty needed to accelerate uptake. Without clear and stable policy signals, port staff noted that uptake will remain driven only by ports and a handful of proactive shipping lines.

3.4 Port of Halifax

Port Overview

The Port of Halifax plays an important role in both Atlantic Canadian and national trade flows. In 2024, the port managed 4.8 million metric tonnes of cargo and processed 509,000 twenty-foot equivalent units (TEUs) of containerized goods. Halifax is also a key destination for the cruise industry, welcoming approximately 360,000 passengers in 2024. The port generates significant economic impact, contributing $2.5 billion annually to Canada's GDP and supporting more than 25,000 jobs.

In 2024, the port received 1,085 vessels.[21] Of commercial vessel types calling to the port, container ships account for approximately 67%, bulk carrier 5%, cruise 15%, Ro-Ro 12%, and tankers 2%.[22]

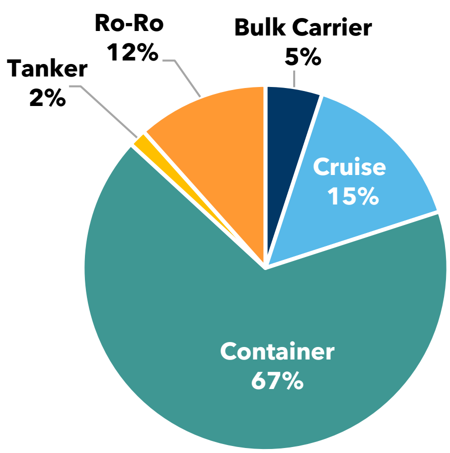

Figure 16: Breakdown of vessel types calling to Port of Montreal

The port includes the following terminals:

- Two container terminals – PSA Halifax Atlantic Hub and PSA Halifax Fairview Cove
- Two break-bulk and project cargo terminals – Ocean Terminal and Richmond Terminal
- One cruise terminal – Seaport
- Four terminals that serve a wide range of vessel types

The port is governed by Halifax Port Authority (HPA), which oversees operations and planning.

Nova Scotia's electricity grid is increasing its renewable generation, but currently still relies on fossil fuels such as coal, and as such its GHG intensity is higher than other ports at 660 gCO_2/kWh. Provincial and utility commitments to reduce emissions will help lower this intensity and enhance the attractiveness of shore power for the port. The development of

[21] Port of Halifax. 2024 Annual Report.

[22] Estimated based on vessel call data from ECCC's MEIT.

offshore wind projects in Nova Scotia has potential as a dedicated source of renewable energy at the port.

Climate & Air Quality Commitments

The port published its *Port of Halifax's Sustainability Strategy 2024-2030* in 2024. The strategy is rooted in the World Ports Sustainability Program (WPSP), and it has adopted targets across the WPSP's six themes: Climate & Energy, Community Building, Digitalization, Health, Safety & Security, Infrastructure, and Environmental Care. Within the strategy, sustainability is defined as "the balance of economics, community integration, and the environment."

Within the Climate & Energy theme, HPA has committed to ambitious GHG reduction goals. The port aims to reduce Scope 1 and 2 emissions by 40% by 2030 relative to a 2022 baseline, with a longer-term target of reaching net zero by 2050. For Scope 3 emissions, which include vessel activity and can be significantly impacted by the deployment of shore power, the port has set goals of reducing emissions by 30% by 2030 and 90% by 2050. To measure progress against these commitments, the HPA conducts a port-wide emissions inventory every 3 years to estimate emissions from marine, rail, on-road, and-offroad equipment as well as administrative emissions.

The Halifax – Hamburg Green Shipping Corridor

In 2022, the Port of Halifax entered a memorandum of understanding with the Port of Hamburg to decarbonize the route (subsequently reaffirmed in October 2025.) The commitment is in the context of remaining competitive in the face of shifting trade relationships and the IMO Net Zero Framework.

Shore Power Planning, Implementation & Adoption

The port has one shore power connection point installed at its cruise terminal. Shore power infrastructure is not currently in place for other vessel types such as containers and bulk carriers.

The Port recently received $22.5 million from Transport Canada's Green Shipping Corridor Fund to advance several decarbonization initiatives. As part of this funding, staff noted that they are considering adding a second cruise connection point, which would allow two vessels to connect simultaneously. Currently, only one vessel can connect at a time, which creates challenges when multiple cruise ships wish to plug in. According to port staff, most new cruise vessels are shore-power capable and willing to connect, while there has been limited interest from other vessel types.

Shore power utility rate

The port has a dedicated shore power rate with Nova Scotia Power, which includes an energy charge of $0.12489/kWh to $0.14268/kWh depending on the voltage used. HPA also charges a connection/disconnection fee of $1,000. Electricity provided by Nova Scotia Power is interruptible.

Detailed feasibility studies have not been completed

To date, no detailed feasibility studies have been completed. Staff emphasized that a study would be valuable given their limited in-house expertise. Discussions with Nova Scotia Power have also remained at a high level, rather than detailed technical or financial planning.

Key Opportunities to Accelerate Shore Power

- **Funding for infrastructure expansion.** Port staff emphasized that additional funding is essential to support the build-out of new shore power infrastructure.
- **Funding for feasibility studies**. A detailed study would help identify shore power opportunities, while accelerating necessary design work and clarifying utility requirements.

3.5 Port of Saint John

Port Overview

The Port of Saint John is a key driver of New Brunswick's economy and an important contributor to Canada's trade network. In 2023, the port managed 27.9 million metric tonnes of cargo, processed 153,000 TEUs of containerized goods, and welcomed 174,000 cruise passengers.

In 2024, the port received 372 vessel calls. Among commercial vessel types calling at terminals managed by the port, container ships account for approximately 56%, bulk carriers 24%, cruise ships 19%, and tankers 2%.[23]

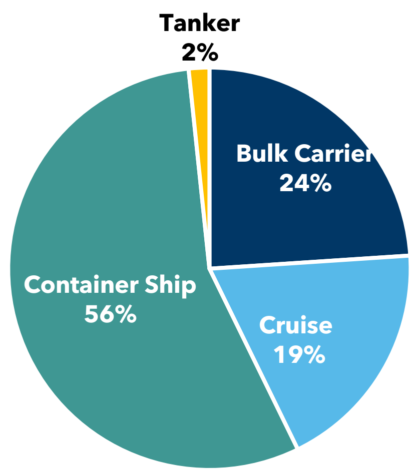

Figure 17: Breakdown of vessel types calling to Port of Saint John

The Saint John Port Authority manages and/or leases the following terminals:

- Two cruise terminals
- Three bulk/liquid bulk terminals
- One container terminal
- Two terminals that serve a wide range of vessel types

It should be noted that several other terminals within the Port of Saint John fall outside the Port Authority's operations as they are privately owned and operated. These include Irving

[23] Estimated based on vessel call data from ECCC's MEIT. Vessels berthing at Irving's terminals and Bay Ferries have been excluded as the port does not have authority over shore power implementation at these terminals.

Oil's East Saint John Terminal, Saint John LNG (formerly Canaport), and Bay Ferries. Interviewees noted that together, these terminals account for approximately 87% of the tonnage. In 2024, private terminals received 656 vessel calls, about 60% of vessel traffic to the region. Therefore, while there may be opportunities for shore power at these terminals, they fall outside of the Port Authority's scope.

New Brunswick's electricity grid is increasing in clean generation sources, but currently still relies on fossil fuels such as coal and natural gas, and as such its GHG intensity is higher than other ports at 330 gCO_2/kWh. Commitments made by the province to phase out coal by 2030 and move towards a clean grid will help reduce this.

Climate & Air Quality Commitments

The port's *Sustainability Report 2022/2023* outlines several goals to reduce emissions at the port, with an overarching target to reach carbon neutrality by 2050 across its Scope 1, 2, and 3 emissions. It also outlines interim targets for 2030, which include reducing Scope 1 and 2 emissions by 60% from 2022 levels by 2030 and reducing electricity and natural gas use at cruise terminals by 60% by 2030.

In addition to setting emission reduction targets, the port has committed to building new port-owned buildings to net-zero standards, convert all fleet vehicles to low emissions options at the end of life, and has also purchased renewable energy certificates (RECs) to offset 100% of its corporate electricity usage.

Overall, the Port of Saint John has primarily focused on reducing its Scope 1 and 2 emissions thus far. The Port recently completed its first comprehensive inventory to quantify Scope 3 emissions. Shore power has been discussed at a high level but has not yet advanced to infrastructure discussions.

Key Opportunities to Accelerate Shore Power

- **Connecting the cruise segment** offers a significant opportunity given Saint John's prominence in Eastern Canada and New England cruise itineraries.
- **Funding for feasibility studies**. A detailed study would help identify shore power opportunities at the port, while accelerating necessary design work and clarifying utility requirements.
- **Incentivizing and regulating Canaport.** As Transport Canada considers the most efficient management of ports and trade, consider regulating crude oil and LNG tanker operations at Canaport and other private terminals to require shore power connections by 2035.

Findings from International Leaders & Canadian Ports

4. Findings from International Leaders & Canadian Ports

To help identify key opportunities to accelerate shore power at Canadian ports, Dunsky conducted the following qualitative research:

- A desktop **Interjurisdictional Scan** comparing five international leader ports with five prominent Canadian ports. Appendix A – Interjurisdictional Scan presents the full scan.
- **Interviews** and **case analysis** to garner further insight from the five Canadian ports. The case studies were informed by a **Shore Power Suitability Assessment Framework** (see Appendix B: Shore Power Suitability Assessment Criteria), derived from a framework previously developed by Environment and Climate Change Canada. The Assessment Framework can be used by Canadian and international ports to assess their progress and opportunities to advance shore power. The framework was used to structure Dunsky's research, but not to qualitatively "score" ports.

Below, key lessons and themes from this research are highlighted. Further details are included in the appendices.

4.1 Lessons from Global Leaders

The Interjurisdictional Scan reviewed actions and supporting policy to deploy shore power at the Ports of Long Beach, Brooklyn, Rotterdam, Hamburg and Shanghai, comparing conditions with Canada's Ports of Vancouver, Prince Rupert, Montreal, Halifax and Saint John. This comparison makes it clear that strong regulations and funding support, at both the national and sub-national levels, are the key enabling factors that distinguish **global shore power leaders**. A summary of key insights is provided below, with further information in Appendix A – Interjurisdictional Scan.

Several leaders have established shore power connection points at most cruise and container berthing locations. Canadian Ports are behind and lack detailed plans to catch up.

The Ports of Long Beach, Hamburg, and Shanghai have sufficient connection points to support nearly all vessels berthing at these ports annually. The ports of Brooklyn and Rotterdam likewise have shore power connection points at all cruise terminals and have published plans or targets to provide full shore power coverage for container terminals. International ports have also begun to deploy shore power for non-containerized cargo.

Shore power is available at cruise terminals at the ports of Vancouver, Montreal, and Halifax, at 50% of berths. Only the Port of Vancouver and Prince Rupert have implemented shore power at container handling terminals, covering four of their combined 18 total container berths at three of the five container terminals. No Canadian ports have implemented shore power for non-containerized cargo (e.g. for the bulk, break bulk, Ro-Ro sectors.) The Port of Vancouver has a target to install shore power at all major container and cruise berths by 2030 "where technically feasible." No other Canadian ports have shore power deployment goals. No ports have detailed strategies or engineering feasibility assessments for deploying shore power across all of their terminals.

Regulations drive shore power adoption

The EU, California and China have all introduced requirements for vessels to eliminate emissions at port (typically via shore power) and for ports to implement shore power, with meaningful penalties for non-compliance:

- The **California Air Resources Board (CARB)** updated its ***At Berth Regulation*** in 2020 to require 100% of berthed ocean-going vessels to use an Emission Control Strategy (ECS) – The vast majority comply using shore power (though other strategies are allowed, e.g. capture and control systems.) Container, cruise, and reefer vessels have been required to comply from 2023 onwards, and tankers and Ro-Ros beginning in 2025. Vessels that do not comply face up to $38,000 USD ($52,000 CAD) in penalties.
- The **EU's *FuelEU Maritime Regulation*** was adopted in 2023 and requires the use of shore power (or alternative zero-emission technologies) from 2030 onward at core "Trans-European Transport Network" ports. The Regulation also requires reductions in vessels' total GHG intensity (including at sea and berth,) ratcheting down every five years to achieve 80% reductions in 2050. Vessels above 5,000 gross tonnes are included.

  Additionally, as of 2024, the EU's *Emissions Trading System* (EU ETS) covers GHG emissions from all large ships (>5,000 gross tonnage and above) entering EU ports. It also covers 100% of emissions for travel between EU ports and 50% from voyages starting or ending outside of the EU. This provides further financial incentive to reduce at-berth emissions by using shore power.
- The **People's Republic of China *Marine Environmental Protection Law*** was amended in 2024 to require use of shore power. Vessels included are container and passenger ships greater than 3,000 gross tonnes and bulk carriers greater than 50,000 gross tonnes built after 2019. Vessels that do not comply face financial penalties of 10,000 – 500,000 CNY ($1,900 - $97,000 CAD.)

In contrast, Canada lacks such requirements, and the absence of regulation undermines federal investments in shore power by limiting its use and reducing the climate and health benefits that would otherwise be achieved. Canadian ports have adopted modest financial incentives (e.g., discounted harbour dues) but these are not sufficient to drive meaningful retrofit of vessel systems to feature shore power.

The IMO's Forthcoming Net-Zero Framework will enhance the case for shore power in Canada, but does not lessen the value of additional domestic regulations.

Shore power demand is poised to grow pursuant to the International Maritime Organization (IMO's) 2023 *Strategy on Reduction of GHG Emissions from Ships* ("IMO GHG Strategy") and the forthcoming *IMO Net-Zero Framework* regulations. The IMO GHG Strategy targets a 40% reduction in the average carbon intensity of international shipping by 2030, as well as a total GHG emissions reduction of 70% by 2040 and net zero by 2050. As of 2023, ships must report their Energy Efficiency Existing Ship Index (EEXI) score and their annual operational carbon intensity indicator (CII) rating. In April 2025, the IMO's Marine Environment Protection Committee adopted the *IMO Net-Zero Framework*, with proposed regulations including a declining GHG Fuel Intensity (GFI) standard and a global pricing mechanism for GHG emissions. These measures are under consideration with ratification discussions scheduled for October 2026. This regulatory framework will increasingly reward ships that connect to shore power at berth, and in turn drive demand for shore power at Canadian ports to ensure long-term competitiveness.

While the IMO's *Net-Zero Framework* regulations will increase demand for shore power in Canada, there would still be substantial air quality and GHG reduction benefits for Canadians associated with adopting regulations similar to those in place in California, the EU and China to accelerate widespread shore power use at Canadian ports in the short to medium term.

Leaders complement regulations with sizeable investments in shore power infrastructure

Leading international ports have benefited from substantial public investment to reduce costs and de-risk shore power investment. Public investment at the Ports of Long Beach, Rotterdam, and Hamburg have been measured in the tens to hundreds of millions, which is several times greater than the levels seen at Canadian ports today. Canada has pre-existing funding programs (such as Transport Canada's Green Shipping Corridor Program) that, if sufficiently capitalized, could help close this gap and build out shore power.

Canada's relatively clean electrical grids enhance the benefits of shore power

Most Canadian provinces benefit from electrical grids that are already relatively clean compared to China and EU ports, strengthening the emissions reduction benefits for shore power. Grid intensities for the Ports of Vancouver, Prince Rupert, and Montreal are in the range of 1 – 14 gCO_2 eq/kWh, compared to 270 – 580 gCO_2 eq/kWh at the Ports of Rotterdam, Hamburg, and Shanghai. These cleaner grids could play an outsized role in assisting vessel operators with meeting IMO regulations.

Stronger Reporting is Essential

There is a need for consistent, publicly available information on the number of shore power connections at Canadian ports the power that the vessels require to enable utility planning, and the number of vessels that visit Canadian ports that can accept shore power.

Even in advanced jurisdictions, data on actual shore power uptake rates is sparse or inconsistently reported, limiting the ability to measure real-world performance and benefits. Canada can lead in transparent reporting on shore power connections.

> ***"Data on shore power uptake rates is sparse, limiting the ability to measure performance and benefits. Canada can lead in transparent reporting on shore power connections."***

4.2 Key themes from profiles of Canadian Ports

Below are key themes from the case studies of Canadian ports' actions to deploy shore power, derived from the case studies in Section 3.

Regulations and senior government funding are key to shore power uptake.

Interviewees independently acknowledged that the lack of regulations requiring that container, cruise and ultimately all vessels be zero emissions at berth would be necessary to accelerate the use of shore power in the near term.

Making international shipping eligible for clean fuel credits could improve the business case for ports to implement shore power.

Interviewees noted that making shore power connection eligible to generate saleable credits under the federal Clean Fuel Regulations and/or the BC Low Carbon Fuel Requirements may present a meaningful revenue opportunity that can improve the economics of deploying shore power.

Fees that vessels must pay to connect to shore power, such as connection and commissioning fees, can discourage shore power-capable vessels from using existing infrastructure. Absent requirements, there could be value in incentives that cover these costs.

Terminal operators' tariffs often include fees for the labour costs of connecting to shore (applied each visit) as well as an additional one-time commissioning fee for the first connection that covers the work required to test, calibrate, and ensure that shore and vessel side systems can safely integrate. It is not fully clear how frequently vessels that can use shore power do not connect at berths where it is available, nor the extent to which the economic calculus is driven by these fees. However, Port interviewees suggested that an incentive that pays the initial commissioning costs, or even regular connection costs, could help increase shore power use, especially vessels that call to the port infrequently.

There is a need for an engineering feasibility study of shore power deployment at Canadian port terminals and detailed coordination with utility distribution grid planners.

Many ports interviewed mentioned that limited power capacity is a barrier to expanding shore power infrastructure, and detailed studies would provide the granular information needed to assess the viability of shore power projects.

Detailed engineering design feasibility studies and capital cost estimates for shore power works are key to determining the financial viability of these projects. As new utility distribution system connections to ports to provide shore power, and upstream works to accommodate the necessary capacity for shore power, can easily comprise the large majority of the cost of shore power projects, it is critical that ports and utilities collaborate closely to develop these estimates.

Interviews suggested that while Canadian ports have typically liaised amicably with utilities on the capacity for shore power on existing systems, there have not been efforts for detailed energy planning on capacity needs or on the designs and costs of upgrading systems and connections to provide shore power. There is a need for all terminals to have both engineering feasibility design for onsite works, as well as utilities to provide the requisite long-term stability and short-term service quotes to inform business case consideration and final investment decisions. Interviewees noted the importance in funding from government to support such work.

4.3 Key themes from Vessel Owners

The following themes are drawn from an Environment and Climate Change Canada (ECCC) report that Dunsky developed, which included interviews with vessel owners.[24] We have considered and addressed these observations and concerns in our recommendations.

[24] Dunsky Energy + Climate Advisors (Prepared for ECCC). 2025. Canadian Vessel Owners' Shore Power Readiness Study.

International standards are lacking for some vessel segments and remain a key barrier to adoption.

Standards are needed to increase the uptake of shore power among bulk carriers and tankers. The absence of an IEC/IEEE 80005-1 standard for these vessel types remains a significant barrier to building out the required infrastructure at ports and on the vessel side.

Retrofitting existing vessels is challenging due to a variety of factors

Retrofitting existing vessels is challenging due to space constraints and the age of many ships. New builds, by contrast, can more easily incorporate shore power. Space limitations are particularly acute on older vessels designed to maximize cargo capacity, often making retrofits impractical. Substantial upfront investments are required to retrofit vessels to be shore power capable. Additional funding targeted towards vessel owners is critical to increasing uptake.

Operational behaviour, such as hotelling loads at berth and route consistency, strongly influence whether a vessel is suitable for shore power.

Cruise ships, for example, have higher hotelling loads and more consistent itineraries, providing stronger incentives for shore power adoption. In contrast, bulk carriers and container ships often have variable routes, which can limit utilization and reduce the economic case for vessel-side investments.

Emission benefits and cost savings of using shore power are widely recognized.

Plugging in at berth reduces fuel consumption and lowers maintenance costs for auxiliary engines, extending equipment lifespans and reducing operating expenses. Vessel owners also acknowledge that shore power improves air quality, reduces emissions, and enhances the competitiveness of their operations.

Recommendations

5. Recommendations

Building on the findings in Chapter 2 and 3 above, this section summarizes recommendations for Canada to catch up to the EU, China and California.

1. Require universal shore power availability and use of zero emissions technology while at berth by 2035

It is recommended that all berths at CPAs be required to feature shore power by 2035. These requirements should include exceptions for extraordinary circumstances, such as lack of sufficient electricity transmission system capacity or exceptionally high (e.g. $50M+) distribution utility service extension fees. Likewise, it is recommended to require large vessels to connect to shore power while at berth by 2035, or to use a zero emissions technology. These regulations should match or exceed the scope the CARB *At Berth Regulation* and the EU's *FuelEU Maritime Regulation*, including meaningful penalties for non-compliance. In parallel, provinces should consider their authority to establish such requirements if federal requirements do not materialize.

Consider integrating these requirements into CPA's regulatory framework established by the Minister for Transportation pursuant to the *Canadian Marine Act*, as well as legislated requirements. It is important there be sufficient investor confidence to support upgrades to both ports and ships' electrical systems.

2. Implementation should begin with new builds and major terminal expansions, where shore power can be integrated at lower cost.

Shore power implementation should then be planned and phased into existing berths. Cruise terminals should be prioritized first, as cruise ships are the most shore power–ready vessel segment, followed by container, and then bulk and tanker vessels once standards are finalized.

Equal priority should also be given to ensuring existing shore power connections are fully functional and that operational barriers are addressed.

3. Conduct Comprehensive Port Electrification Studies at all CPAs

It is recommended to require all CPAs to develop detailed Port Electrification Engineering Feasibility and Design Studies by 2028, supported by $50M in federal funding. These studies should include a focus on high voltage shore power, as well as detailed consideration of low-voltage shore power, non-road port equipment, trucking and rail electrification. Comprehensive port-wide electrification studies are preferred over a specific shore power study to capture and plan for the full range of electric loads expected in the coming decades.

4. Coordinate electrical utility works

Collaboration between utilities and ports should be mandatory. Utilities should collaborate with CPAs to development sufficient cost estimates for utility distribution works to supply the capacity associated as part of the Port Electrification Studies noted in Recommendation 2 above. It is recommended that Provinces direct Crown corporation electrical utilities, and/or electricity sector regulators, to ensure this engagement and adequate cost estimates.

5. Develop a Federal Port Electrification Investment Strategy

The mix of direct federal investment and private financing in port electrification should be considered. It is recommended that the Federal government develop a Port Electrification Investment Strategy. This should consider public and private financing mechanisms, cost recovery mechanisms (e.g. connection fees), and amortization periods (long amortization is justified for port electrical works) to enable rapid build out of port electrification infrastructure at an attractive cost of capital.

6. Advance shore power standards

Dedicate a team of Federal staff to support and accelerate the development and adoption of IEC/IEEE 80005 standards for bulk carriers and tankers, which are not currently in place. This could include providing technical expertise and facilitating collaboration between ports, utilities, and vessel owners to ensure Canadian perspectives are represented. In the meantime, offer incentives for vessel owners and ports to begin planning and preparing for shore power readiness in these vessel segments. This effort should include exploration of mobile shore power solutions to overcome connection alignment issues between vessels and the shore-side infrastructure.

6. Notable Sources

The following provides a list of key sources (non-exhaustive) that were used to inform and support the findings presented in this report.

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APPENDIXES

Appendix A – Interjurisdictional Scan

	Canada					US		Europe		Asia
City / Port, Province / State / Country	**Vancouver**, British Columbia	**Prince Rupert**, British Columbia	**Montreal**, Quebec	**Halifax**, Nova Scotia	**Saint John**, New Brunswick	**Long Beach**, California	**Brooklyn**, New York	**Hamburg**, Germany	**Rotterdam**, The Netherlands	**Shanghai**, China
Operator	Vancouver Fraser Port Authority	Prince Rupert Port Authority	Administration Portuaire de Montréal	Halifax Port Authority	Saint John Port Authority	City of Long Beach Harbor Department	Ports America	Hamburg Port Authority	Port of Rotterdam Authority	Shanghai International Port Group
Port Statistics										
Cargo Handled	158 million metric tonnes (2024)	23.1 million metric tonnes (2024)	35.4 million metric tonnes (2024)	4.8 million metric tonnes (2024)	27.9 million metric tonnes (2023)	90 million metric tonnes (average)	Not publicly available	78.7 million metric tonnes (2024)	436 million metric tonnes (2024)	727 million metric tonnes (2022)
Container Throughput	3.5 million TEUs (2024)	1.6 milion TEUs (annual average)	1.5 million TEUs (2024)	509,000 TEUs (2024)	153,000 TEUs (2023)	9.6 million TEUs (2024)	Approximately 135,000 TEUs (annual average)	7.8 million TEUs (2024)	13.8 million TEUs (2024)	50 million TEUs (2024)
Cruise Passengers	1.3 million (2024)	59,400 (2024)	50,000 (2024)	360,000 (2024)	174,000 (2023)	700,000 (2019)	250,000 (annual average)	1.3 million (2024)	545,000 (2024)	1.4 million (2024)
SHORE POWER DRIVERS										
Shore Power Regulations	✗ No shore power regulations in Canada	✗ No shore power regulations in Canada	✗ No shore power regulations in Canada	✗ No shore power regulations in Canada	✗ No shore power regulations in Canada	✓ California Air Resources Board (CARB) updated its *At Berth Regulation* in 2020 and requires 100% of ocean-going vessels to use shore power or another Emission Control Strategy while at berth (e.g. capture and control systems). Violation of CARB At Berth Regulations may result in financial penalties up to $38,000 USD ($52,000) per action violated. Vessels included are container, cruise, and reefers from 2023 onwards. From 2025 onwards, tankers and Ro/Ros apply.	✓ The New York City Council passed legislation *Int-4A* in 2024 which requires the use of shore power for cruise ships provided that: 1. Shore power is available; 2. The vessel is equipped with shore power infrastructure; 3. The use of shore power is safe and practical.	✓ The EU's *FuelEU Maritime Regulation* was adopted in 2023 and requires the use of shore power (or alternative zero-emission technologies) from 2030 onward at core "Trans-European Transport Network" ports (includes Hamburg). The Regulation also requires reductions in vessels' total (including at sea) GHG intensity, ratcheting down every five years to achieve 80% reductions in 2050. Vessels above 5,000 gross tonnes are included.	✓ The EU's *FuelEU Maritime Regulation* was adopted in 2023 and requires the use of shore power (or alternative zero-emission technologies) from 2030 onward at core "Trans-European Transport Network" ports (includes Rotterdam). The Regulation also requires reductions in vessels' total (including at sea) GHG intensity, ratcheting down every five years to achieve 80% reductions in 2050. Vessels above 5,000 gross tonnes are included.	✓ The People's Republic of China *Marine Environmental Protection Law* was amended in 2024 and requires the usage of shore power. Non-compliant vessels face fines of 10,000-500,000 CNY ($1,900-$97,000). Vessels included are container and passenger ships greater than 3,000 gross tonnes and bulk carriers greater than 50,000 gross tonnes built after 2019.

	Canada					US		Europe		Asia
City / Port, Province / State / Country	**Vancouver**, British Columbia	**Prince Rupert**, British Columbia	**Montreal**, Quebec	**Halifax**, Nova Scotia	**Saint John**, New Brunswick	**Long Beach**, California	**Brooklyn**, New York	**Hamburg**, Germany	**Rotterdam**, The Netherlands	**Shanghai**, China
Port's GHG Reduction and Shore Power Deployment Goals	**GHG Reduction Goals** Net zero by 2050, which was announced in the *Northwest Ports Clean Air Strategy* in 2020 (also includes the Ports of Seattle and Tacoma).	**GHG Reduction Goals** 30% reduction in GHG intensity by 2030 and carbon neutral by 2050, as referenced in the *2022 Sustainability Report*.	**GHG Reduction Goals** Reaching carbon neutrality for Scope 1 and 2 emissions by 2035, and Scope 3 emissions by 2050, as published in the Port of Montreal's *Sustainable Development Plan 2023-2027* in 2023.	**GHG Reduction Goals** Reduce Scope 1 and 2 emissions by 40% by 2030 compared to 2022 baseline and reach net zero by 2050. Reduce Scope 3 emissions by 30% by 2030 and 90% by 2050 (note: Scope 3 encompasses vessel emissions and is impacted by shore power). These targets were announced in the Port of Halifax's *Sustainability Strategy 2024-2030*, published in 2024.	**GHG Reduction Goals** Reaching carbon neutrality for Scope 1 and 2 emissions by 2040, and Scope 3 emissions by 2050, as referenced in Port of Saint John's *Emissions & Energy* webpage. (note: Scope 3 encompasses vessel emissions and is impacted by shore power).	**GHG Reduction Goals** 40% reduction below 1990 levels by 2030 and 80% reduction by 2050, as announced in The Ports of Long Beach and Los Angeles joint updated *Clean Air Action Plan* (*CAAP*) in 2017.	**GHG Reduction Goals** New York City Economic Development Corporation's (NYCEDC) *Vision for Brooklyn Marine Terminal* published in 2025 includes commitments to decarbonize the port (has not received formal approval, awaiting a vote), as part of broader mixed use development plan.	**GHG Reduction Goals** Reduce direct carbon emissions by 50% by 2025 compared to a baseline of 2012, and achieving carbon neutrality by 2040, as referenced in HPA's *2020 Sustainability Report*.	**GHG Reduction Goals** Climate neutral by 2050 (includes CO2 and other GHGs such as methane, nitrous oxide and ozone), as referenced in the *Climate Targets 2030* report.	**GHG Reduction Goals** The Port of Shanghai reports that it aligns with the Chinese government and Shanghai's goals of being carbon neutral by 2060.
	Shore Power Specific Goals Where deemed feasible by the port, install shore power at all major cruise and container berths by 2030.	**Shore Power Specific Goals** None	**Shore Power Specific Goals** None	**Shore Power Specific Goals** None	**Shore Power Specific Goals** None	**Shore Power Specific Goals** The Ports of Long Beach and Los Angeles' initial *CAAP* (adopted in 2006) included commitments regarding shore power. Later versions of the *CAAP* adopted in subsequent years continued to add targets, policies, actions and funding commitments to deploy shore power and enable early compliance with the CARB *At Berth Regulation* (noted above). The Port's latest shore power commitments include expansion to liquid bulk and auto carrier vessels, as outlined in the Port's *Green Port Progress Report* in 2025.	**Shore Power Specific Goals** Fully electrify port with expanded shore power, as outlined in the *Vision* document.	**Shore Power Specific Goals** Equip all major berths with the necessary shore power infrastructure by 2030, achieving complete coverage by 2040.	**Shore Power Specific Goals** By 2030, shore power used for at least 90% of visits of roll on/roll off, offshore, ferry, and cruise vessels and at least 50% of visits from largest container vessels (>10,000 TEU), as set out in the *Strategy for Shore Power in the Port of Rotterdam* published in 2021.	**Shore Power Specific Goals** Not publicly available.

City / Port, Province / State / Country	Canada					US		Europe		Asia
	Vancouver, British Columbia	**Prince Rupert**, British Columbia	**Montreal**, Quebec	**Halifax**, Nova Scotia	**Saint John**, New Brunswick	**Long Beach**, California	**Brooklyn**, New York	**Hamburg**, Germany	**Rotterdam**, The Netherlands	**Shanghai**, China
SHORE POWER IMPLEMENTATION STATUS										
High Voltage Shore Power Connection Points Total number of shore power connection points (i.e. berths where vessels can connect to shore power).*	**Cruise** 2 connections at 1 of 1 terminals **Container** 3 connections at 2 of 4 terminals	**Container** 2 connections at 1 of 1 terminals	**Cruise** 1 connection at 1 of 3 terminals	**Cruise** 1 connection at 1 of 1 cruise terminal	None	**Cruise** 1 connection at 1 of 1 terminals **Container** 15 connections at 6 of 6 terminals **Tanker** 1 connection at 1 of 5 terminals **Ro/Ro** 1 connection at 1 of 1 terminals	**Cruise** 1 connection at 1 of 1 terminals	**Cruise** 4 connections at 3 of 4 terminals **Container** 10 connections at 4 of 4 dedicated container terminals (6 multi-purpose terminals also process containers and other cargo; they do not yet feature shore power connections).	**Cruise** 1 connection at 1 of 1 terminals **Container** 1 connection at 1 of 14 terminals **Offshore Supply** 2 connections at 1 of 22 general cargo terminals **Ro/Ro** 2 connections at 1 of 5 terminals **Ro/Ro Passenger Ferry** 2 connections at 1 terminal	**Cruise** 1 connection at 1 of 3 terminals **Container** Number of connections not available. Claims "full shore power coverage" across all 43 container terminals.
Inaugural Year of Shore Power Connection Cruise Container	**2009** (Cruise) **2017** (Container) 1st in Canada and 3rd in the world to offer shore power for cruise ships.	**2014** (Container) **2022** (Container) In 2022, a second connection point was added and equipment was upgraded at the first connection point.	**2017** (Cruise) Quebec's first shore power project.	**2014** (Cruise) 1st port on the East Coast of North America to provide shore power to cruise vessels.	N/A	**2009** (Container) **2011** (Cruise) 1st tanker shore power connection in the world.	**2017** (Cruise) 1st shore power system for cruise ships installed on the East Coast of the United States and remains the only shore power capable terminal on the US East Coast.	**2016** (Cruise) **2023** (Container) 1st port in Europe to offer shore power for both container and cruise vessels.	**2025** (Cruise) Year of connection for other vessel types not publicly available. 1st shore power system in Netherlands.	**2015** (Container) **2015** (Cruise) Shore power at the cruise terminal was developed in partnership with the Port of Los Angeles, sharing expertise on standards and incentives.
Annual Number of Shore Power-Enabled Vessel Calls Number of times a vessel connected to shore power. Reported for years where available.	**130** cruise and container connections in 2023, 157 in 2024.	**7** container ship connections in 2023, 1 in 2024.	**9** cruise ship connections in 2023, 14 in 2024.	**43** cruise ship connections in 2023, 27 in 2024.	N/A	Not publicly available.	**17** cruise ship connections in 2023, 5 in 2024.	Not publicly available.	Not publicly available.	**582** connections in 2023.

*Reported in terms of total connection points, and proportion of terminals that feature at least one connection point, for cargo types where shore power is available. Connection points per total number of berths not reported due to lack of consistent data across international jurisdictions.

	Canada					US		Europe		Asia
City / Port, Province / State / Country	**Vancouver**, British Columbia	**Prince Rupert**, British Columbia	**Montreal**, Quebec	**Halifax**, Nova Scotia	**Saint John**, New Brunswick	**Long Beach**, California	**Brooklyn**, New York	**Hamburg**, Germany	**Rotterdam**, The Netherlands	**Shanghai**, China
POWER SUPPLY CHARACTERISTICS										
Grid Carbon Intensity Regional Level, in gCO2eq / kWh	14	14	1.2	660	330	191	222	381	268	582
Electricity Procurement e.g. Power Purchase Agreements, On-Site Generation	Provided by utility grid.	Provided by utility grid.	Provided by utility grid.	Provided by utility grid.	Energy from cruise terminals, corporate offices, and port operated cargo terminals are 100% credited via Renewable Energy Credits (RECs), purchased from Saint John Energy through the Burchill wind project.	Provided by utility grid.	Provided by utility grid.	Provided by utility grid.	As of 2023, the port has installed approximately 330 MW of wind capacity and 90 MWp of solar capacity.	Not publicly available.
SHORE POWER FUNDING AND PORT LEVEL INCENTIVES										
Public Funding Contributions Received Non-exhaustive	**$20M** **$6M** Various government sources. For the cruise terminal shore power connections built in 2009 (date undisclosed). **$7.4M** Transport Canada Shore Power Technology for Ports Program (SPTP). For Centerm and Deltaport shore power projects and shore power upgrades at Canada Place cruise terminal (2015). **$6.6M** Green Shipping Corridor Program. To upgrade shore power infrastructure at Canada Place cruise terminal (2025).	**$4.9M** **$0.7M** Western Economic Diversification Canada. For Fairview terminal shore power infrastructure (2010). **$0.2M** Government of British Columbia. For Fairview terminal shore power infrastructure (2010). **$1.8M** Transport Canada Marine Shore Power Program. For Fairview terminal shore power infrastructure (2010). **$2.2M** ECCC Low Carbon Economy Challenge Fund (date undisclosed).	**$8M** **$5M** Transport Canada SPTP. For high voltage shore power at Alexandra Pier and wintering connections (2015). **$3M** Government of Quebec. For high voltage shore power at Alexandra Pier and wintering connections (2015).	**$7.5M** **$5M** Transport Canada SPTP. For shore power infrastructure at cruise terminal (2013). **$2.5M** Government of Nova Scotia. For shore power infrastructure at cruise terminal (2013).	N/A	**$41M** **$41M** ($30M USD) State of California's Proposition 1B Goods Movement Emission Reduction Program. For installation of shore power at 12 berths (2010). UNDISCLOSED AMOUNT US EPA Clean Ports Program (undisclosed date). UNDISCLOSED AMOUNT State of California's Port and Freight Infrastructure Program (undisclosed date).	**$9.8M** **$3.9M** ($2.9M USD) US EPA National Clean Diesel Funding Assistance Program. For cruise terminal shore power infrastructure (2009). **$5.9M** ($4.3M USD) Empire State Development Corp. For cruise terminal shore power infrastructure (2012).	**$67.8M** **$67.8M** (€42.4M) German Ministry of Economics and Energy via Energy and Climate Fund. For expansion of shore power at container and cruise terminals (2020).	**$144M** **$144M** (€90M) European Investment Bank. For expansion of shore power to deep sea container terminals (2025). UNDISCLOSED AMOUNT Ministry of Infrastructure and Water Management. To expand shore power at several terminals (2023).	Not publicly available.

	Canada					US		Europe		Asia
City / Port, Province / State / Country	**Vancouver**, British Columbia	**Prince Rupert**, British Columbia	**Montreal**, Quebec	**Halifax**, Nova Scotia	**Saint John**, New Brunswick	**Long Beach**, California	**Brooklyn**, New York	**Hamburg**, Germany	**Rotterdam**, The Netherlands	**Shanghai**, China
Port-Level Incentives	Discounted harbour dues are available through the EcoAction Program for vessels adopting environmental measures. Shore power qualifies for a "Gold" award, providing a 47% discount, equivalent to $0.029/GT. For example, a 100,000 GT cruise ship would save approximately $2,900 per call.	Discounted harbour dues through Green Wave program for vessels adopting emission reduction measures. Shore power qualifies a "Tier 3" measure, which provides a 50% discount, which is equivalent to $0.055/GT. For example, a 100,000 GT cruise ship would save approximately $5,500 per call.	None	None	None	Rewards vessel owners for deploying green initiatives through its Green Ship Incentive Program between $600 - $6,000 USD ($830 - $8,300) (shore power amount not specified). Vessels are penalized for not using shore power through CARB regulations, creating both a financial reward for compliance and a cost for non-compliance.	None	Discounted harbour dues based on environmental performance, up to €1,000 ($1,700) per ship via the Environmental Ship Index (ESI) (shore power amount not specified).	Discounted harbour dues through Green Award program for vessels adopting environmental measures. Up to 70% discount based on measures adopted (shore power amount not specified), equivalent to €0.0393/GT ($0.063/GT). For example, a 100,000 GT cruise ship would save approximately €3,900 ($6,300).	Not publicly available.

Data presented in this report was collected through a desktop scan. Information for international ports has not been verified by the port authority.

All monetary values are in CAD unless otherwise specified.

Appendix B: Shore Power Suitability Assessment Criteria

#	Component	Factor	Description	Examples of Indicators / Metrics
1	Technical and Operational Viability	Future-proofing Technology	The extent to which the shore power system is planned/designed to meet international standards, serve diverse vessel types, and accommodate future technological and market changes for sustaine operational effectiveness.	Existing shore power system design meet ISO/IEC/IEEE standards (Yes/No) and can accommodate future changes e.g., moveable connectors (scale from rigid to flexible); % of vessel types supported by shore power
2		Electrical Infrastructure Readiness	Assessment of the port's electrical infrastructure capability to support shore power systems, including engineering feasibility and grid capabilities, along with existing utility relationships for potential upgrades.	% of distribution grid capacity currently used; planned infrastructure upgrades account for X% of ports needs for shore power;
3		Clean Energy Access	Availability and reliability of clean energy sources to support the development of an emission-free shore power infrastructure.	% of clean energy sources in grid connected to port (current and in 2030)
4		Behind-the-fence Capacity	The degree to which plans are in place to incorporate on-site clean energy generation and storage a the port to mitigate grid limitations.	Existing and planned total megawatts (MW) of on-site generation capacity and megawatt-hours (MWh) of energy storage
5		Operational Efficiency and Scalability	Evaluation of available resources and systems for the integration, operation, maintenance, and expansion of shore power services without disrupting regular port activities.	Evaluation of resourcing and system needs for the operation, maintenance, and expansion of shore power has been conducted (Yes/No)
6	Market Drivers and Project Economics	Market Demand	The level of current and projected future demand for shore power among vessel-owning companies to justify and support its adoption and expansion.	% of annual growth in demand for shore power; Total anticipated demand by 2030 (in MWh)
7		Funding Availability	The availability and accessibility of financial resources, including public and private funding, subsidie and incentives, for shore power development and implementation.	Amount of funding available/obtained (e.g., in millions of dollars) for shore power project development; Extent to which funding can cover expected funding required (scale from minimal to full coverage)
8		Pricing and Incentives	Assessment of the financial viability of shore power through established pricing structures (including shore power-specific rates negotiated with local power utility) and incentives designed to appeal to potential users.	Shore power rate provides savings compared to existing fuel costs for vessel owners (Scale from no savings to high savings)
9	ESG	Environmental Impact	Potential environmental benefits, specifically the reduction in greenhouse gas emissions and air pollutants, associated with the adoption of shore power.	Total reduction in greenhouse gas emissions (e.g., reduction in CO2, NOx emitted) due to shore power
10		Sustainability Alignment	The degree to which shore power initiatives align with the port's overall sustainability goals and ESG commitments.	Shore power is mentioned in the port's Sustainability Strategy as a key enabler to its energy transition (Yes/No)
11		Safety Culture	The adequacy of the port's safety measures and procedures for the installation and operation of shore power systems.	Number of safety incidents or accidents per year related to shore power; Documented procedures for the safe installation and operation of shore power exist (Yes/No)
12		Community Impact	The degree to which the port can elevate its social responsibility and public image through shore power adoption, considering its impact on local communities.	Proximity of residential areas to the port and potential effect of shore power implementation on improvin residents air quality/living conditions (scale from minimal to high impact)
13		Stakeholder Collaboration	The extent to which the port engages with regulatory bodies, local authorities, and community stakeholders to effectively support shore power initiatives.	Number of working groups and task forces joined by the port, specifically focused on shore power; Frequency of meetings with key stakeholders on shore power initiatives (scale from low to high)
14	Strategic Objectives	Regulatory Awareness	The port's ability to align with existing and anticipated regulatory requirements affecting shore power development and implementation.	Documented procedures or policies developed to address anticipated regulatory requirements (Yes/No); Internal assessments conducted to anticipate future regulatory changes (Yes/No)
15		Competitive Positioning	Assessment of how adopting shore power enhances the port's competitiveness in attracting environmentally-focused clientele.	Number and quality of inquiries or expressions of interest from shipping companies and other stakeholders regarding the port's future shore power capabilities
16		Partnership Development	The capacity to establish and maintain strategic partnerships with relevant stakeholders (including technology providers, energy companies, and other port authorities) to support the development and implementation of shore power systems.	Total number of strategic partnerships formally established; Port authority's relationship with utility (scale from limited to strong)