



SNC · LAVALIN

Experiences conducting port emissions inventories in Canada



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Unit conversion – USA vs. Canada

- 1 metric tonne = 1.0231 US (short) tons
 - 1 kilometre = 0.6213 miles
 - 1 hubble-barn = 3.45 gallons (or 13.1 litres)
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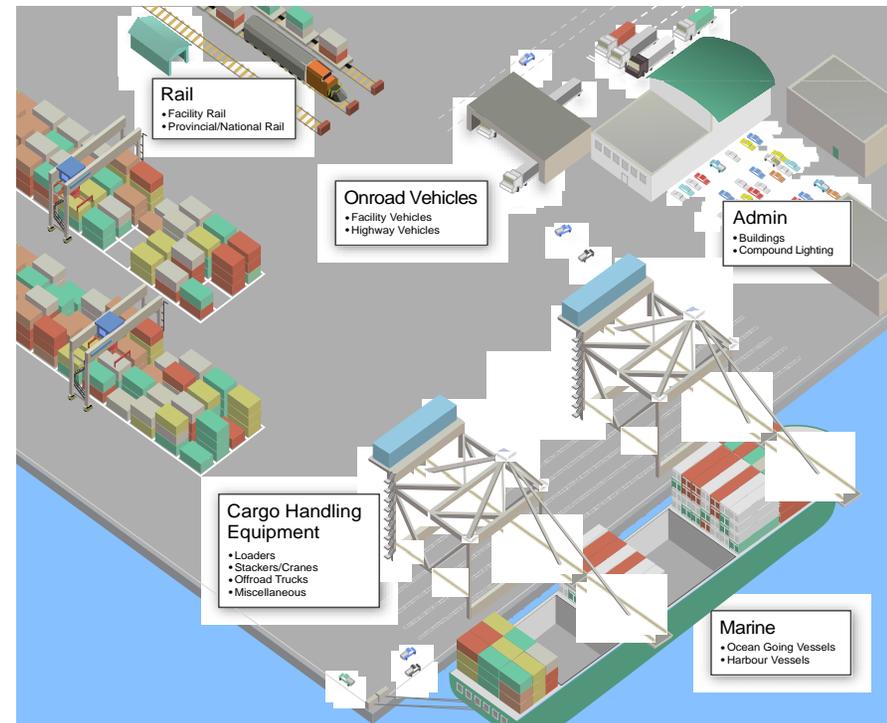
Overview

- History - Port Emissions Inventories
 - Framework for a Ports Emissions Inventory Model
 - Experiences from Port Metro Vancouver Landside Emission Inventory
 - Current and Future Works of Interest
-

What is a Port Emissions Inventory?

An activity-based EI of significant port sources:

- Marine vessels
- Rail
- Trucks
- Cargo handling equipment
- Admin





History – Port Emissions Inventories in USA

Non-attainment in areas with major ports

Marine and port emissions were known major contributors of SO₂, NO_x, PM

First inventory conducted by Houston in 2000

EPA developed a guidance document in 2006, updated in 2009

History – Port Emissions Inventories in Canada

Gateway ports competing against US ports for containers and cruise:

- Metro Vancouver
- Montreal
- Prince Rupert

Early Canadian port EIs

- Metro Vancouver (2005)
- Montreal (2007, with funding from Transport Canada)





Framework – Canadian Ports Protocol

Protocol applies uniformly to all Canadian ports.

Components include:

- Activity data collected.
- Methods of emissions calculations by source group
- Emission factors
- Port commodity and forecast data.

Written 2009, updated 2012.



TC Canadian Ports Model

The screenshot displays the 'TC Port Emissions Inventory Model' software interface. The main window features a map of Canada with port locations marked, including Vancouver, Montreal, and Toronto. The interface includes a 'Welcome - Bienvenue' header, a 'Quit/Exit' button, and a central navigation area with buttons for 'Read In Surveys', 'Perform Calculations', and 'View Results'. A 'Database Status' section is visible at the bottom. To the left, a 'Port Emissions Inventory Activity Questionnaire' window is open, showing a 'Cargo-handling equipment' section. To the right, three bar charts display emission data for different years (2007, 2008, 2009) across various port categories. Below the charts, a detailed data table is visible, listing various emission sources and their corresponding values for different pollutants.

Source	Equip	SubFuel	TermName	year	ComDesc	ComGen	2007	2008	2009
							CO2	CH4	N2O
							tonnes	tonnes	tonnes
Marine	Tanker						295.48	294.95	36.81
Marine	Merchant						594.06	609.79	73.24
Marine	Tug						53.67	17.0	4.45
Marine	Total						943.21	912.34	114.51
CHL	Auto/Mac						27.49	3.22	14.66
CHL	Loader						22.71	0.47	18.88
CHL	Truck Offroad						90.49	1.29	34.44
CHL	Stack/Crews						69.27	0.86	20.17
CHL	Total						200.96	2.83	88.14
Rail	MPA						67.47	0.02	7.66
Rail	CP						23.32	0.55	1.93
Rail	GT						11.49	0.27	0.96
Rail	Total						104.63	0.89	10.74
Trucking	Truck						26.8	0.02	17.25
Trucking	Bus						0.01	0.0	0.0
Trucking	Taxi						0.0	0.0	0.04
Trucking	LD Diesel						0.81	0.0	0.43
Trucking	LD Gas						0.66	0.01	3.57
Trucking	Propane						0.04	0.0	0.02
Trucking	Total						28.22	0.03	21.3



Ports Model Questionnaire

Item	Vehicle type	Fleet age	Number of similar vehicles	Relative intensity of use	Fuel type (refer to Table 10)
Sample	Van / Pickup - small utility	2005 - 2009	5	3 - Medium (average)	1 - Gasoline
1	<input type="text"/>	<input type="text"/>			
2	<ul style="list-style-type: none">Heavy commercial truckMedium commercial truckLight commercial truckBus (transit or passenger)Van / pickup - small utilityTaxiCarHybrid	<input type="text"/>			
3					
4					
5					
6					

Hint
Select a vehicle type from the drop-down menu.

Ports Model Activity Data

Source Group	Equipment	Modes	Metric	Fuel	Engine Type
Marine	OGVs	Berthing, anchoring, maneuvering, and transit.	Hours of engine use, boiler fuel consumption.	HFO, MDO, and MGO.	2 stroke (ME), 4 stroke (ME, AE), boilers, and turbines.
	Harbor Vessels				
Cargo Handling Equipment	Stacker/ Crane	All modes represented in equipment-specific duty cycles.	Hours of engine use.	Diesel, electricity, gas, propane, natural gas.	2 stroke (gasoline), 4 stroke spark ignition, and 4 stroke compression ignition.
	Off road truck				
	Loader				
	Aux/Misc				
Locomotive	Line Haul locomotives	All modes represented in duty cycles established for each type of locomotive.	Hours of engine use.	Diesel.	2 and 4 stroke compression ignition.
	Switch locomotives				
	Facility locomotives				
Truck	Highway Vehicle	Driving cycle queuing/idling.	VkT or hours of engine use.	Diesel, electricity, gas, propane, and	4 stroke spark and compression ignition.
	Facility Vehicle	All modes represented in	VkT or		4 stroke spark and compression



Canadian Ports Model Emission Factors

Marine: EC Marine Emissions Inventory Tool (MEIT)

Rail: Locomotive emission data and EPA tier standards

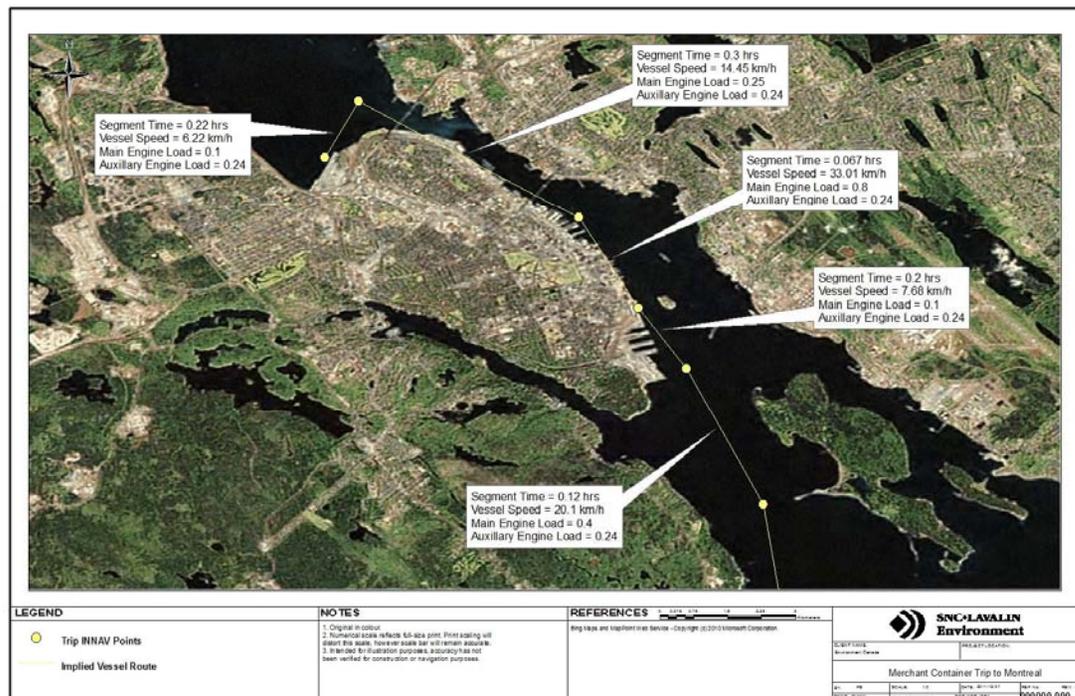
CHE: EPA NONROAD 2008

Onroad: EPA MOBILE, version 6.2.3C

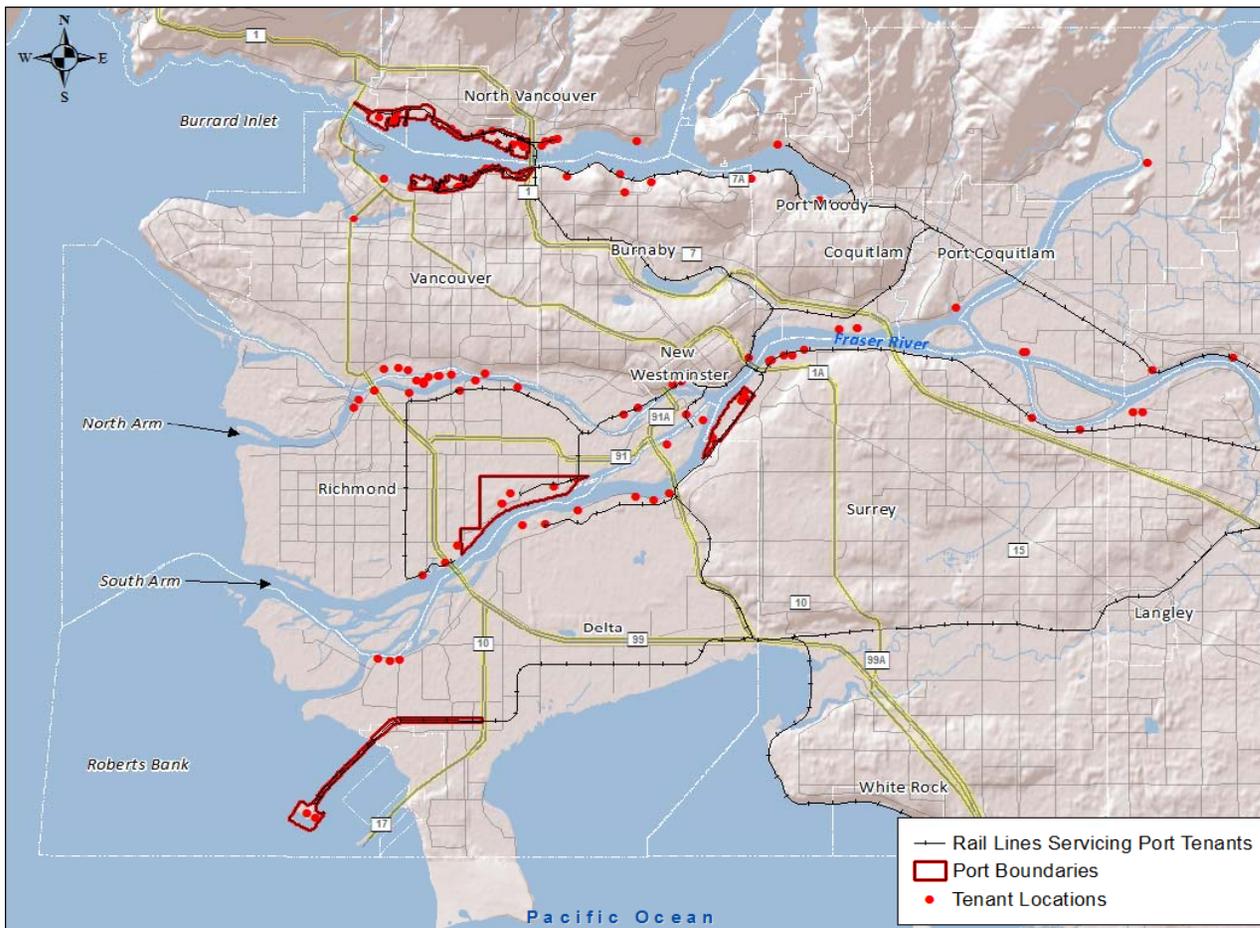
Admin: EPA AP-42

Environment Canada Marine Emission Inventory Tool

EC 2010 National Marine Inventory used MEIT to estimate emissions. Included all commercial marine vessels within Canadian waters.



Port Metro Vancouver 2010 Landside Emission Inventory





PMV 2010 LEI – Activity Summary

10 baseline:

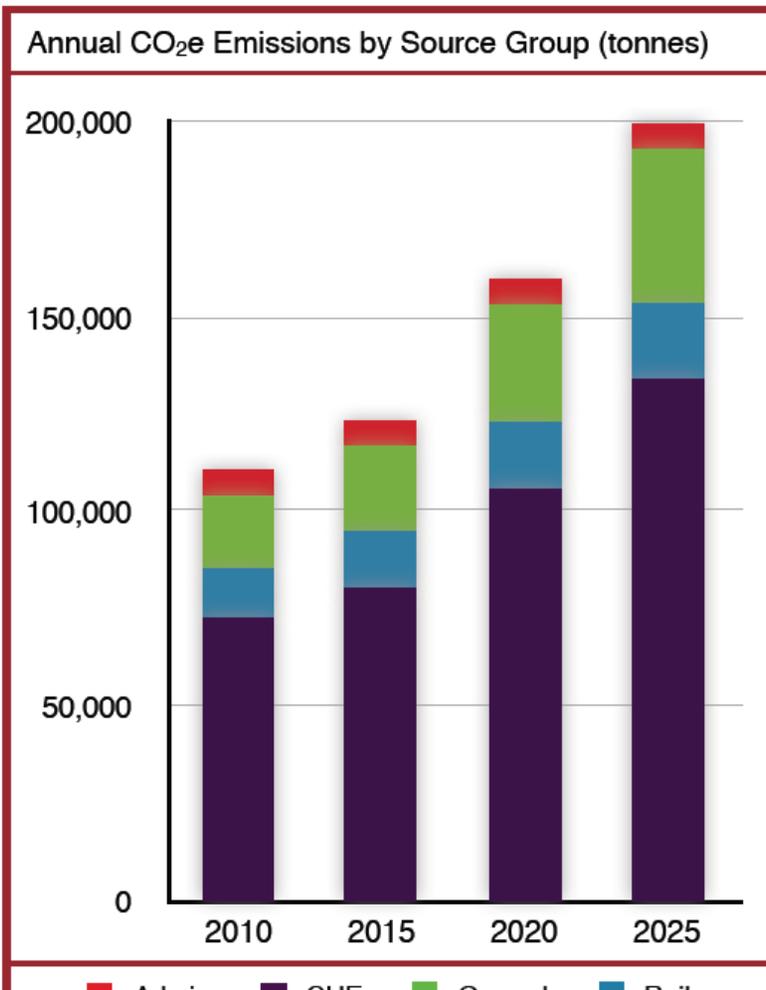
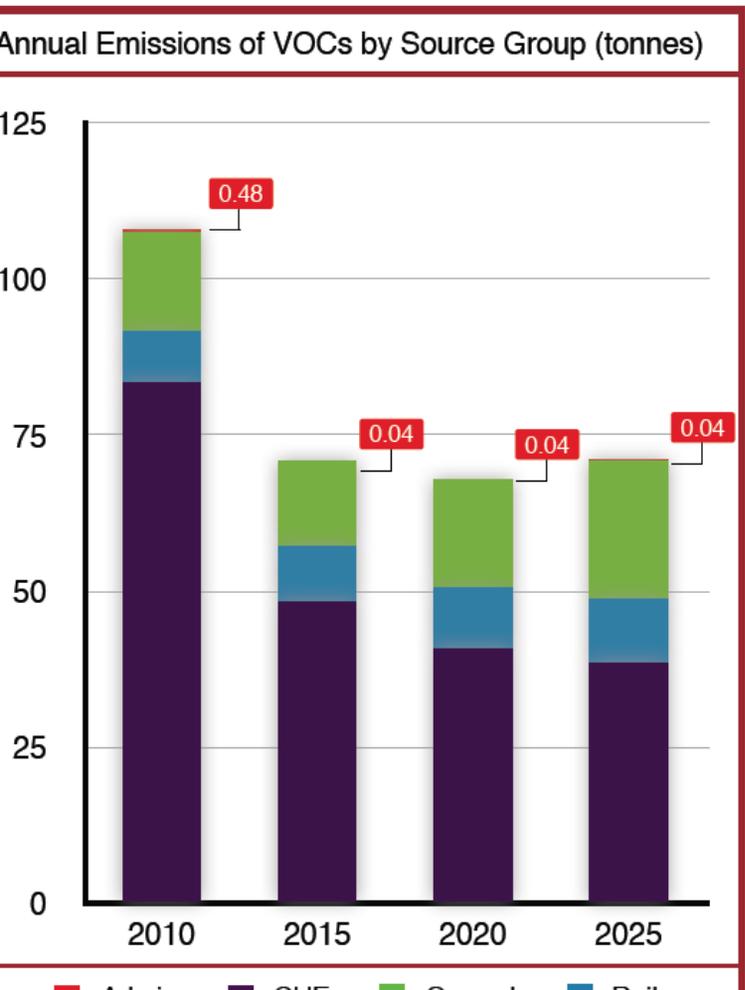
- CHE: 2,086 units, 1.2 million reported hours
- Rail: 108,000 hours of activity
- Total diesel: 2.1 million Hubble-barns (7.4 million gallons)
- Total electricity: 182 GWh

25 forecasts:

- Total diesel: 4.0 million Hubble-barns (14.0 million gallons)
- Total electricity: 252 GWh



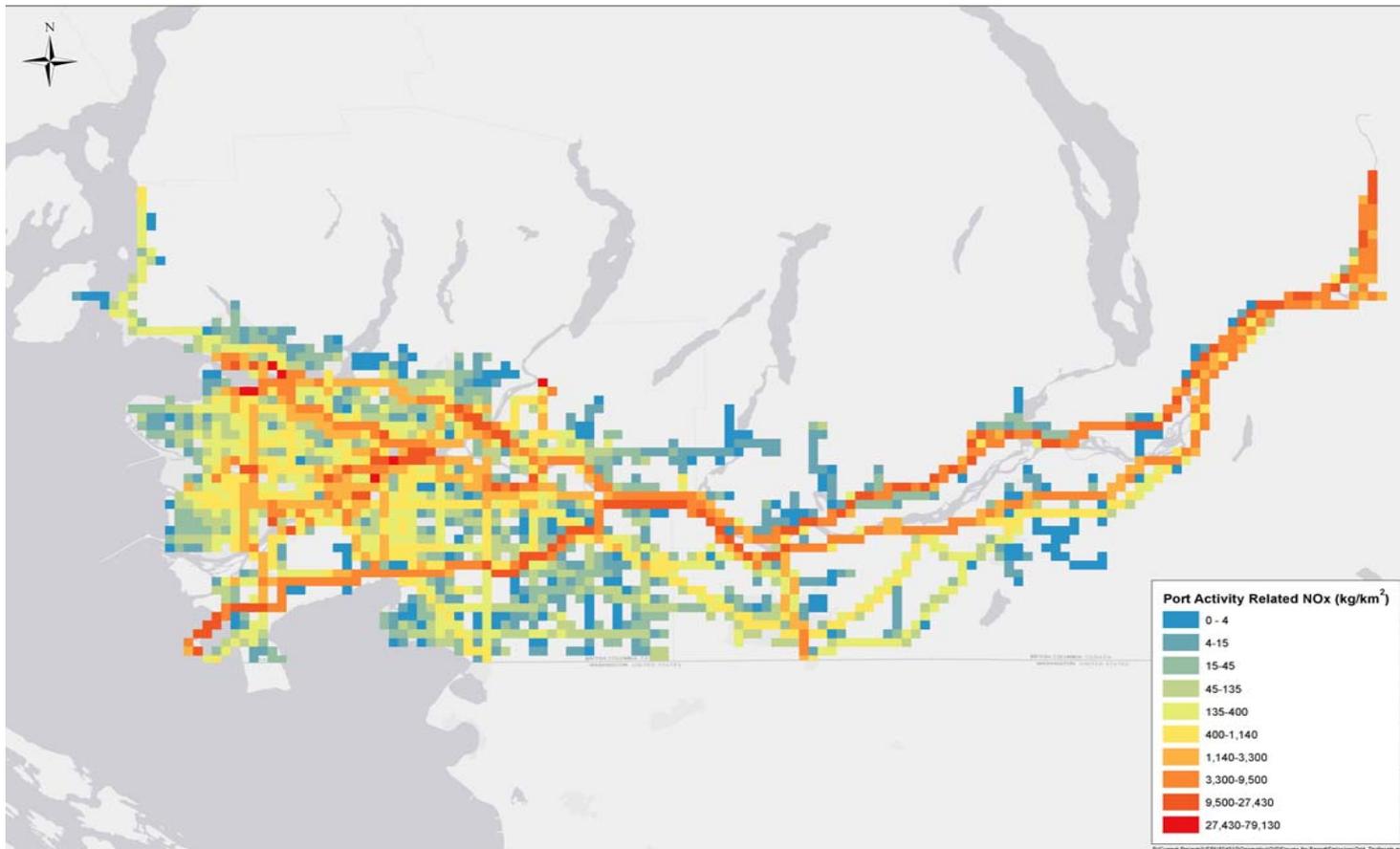
PMV 2010 LEI – Forecasts



PMV 2010 LEI – Regional Rail Activity Model

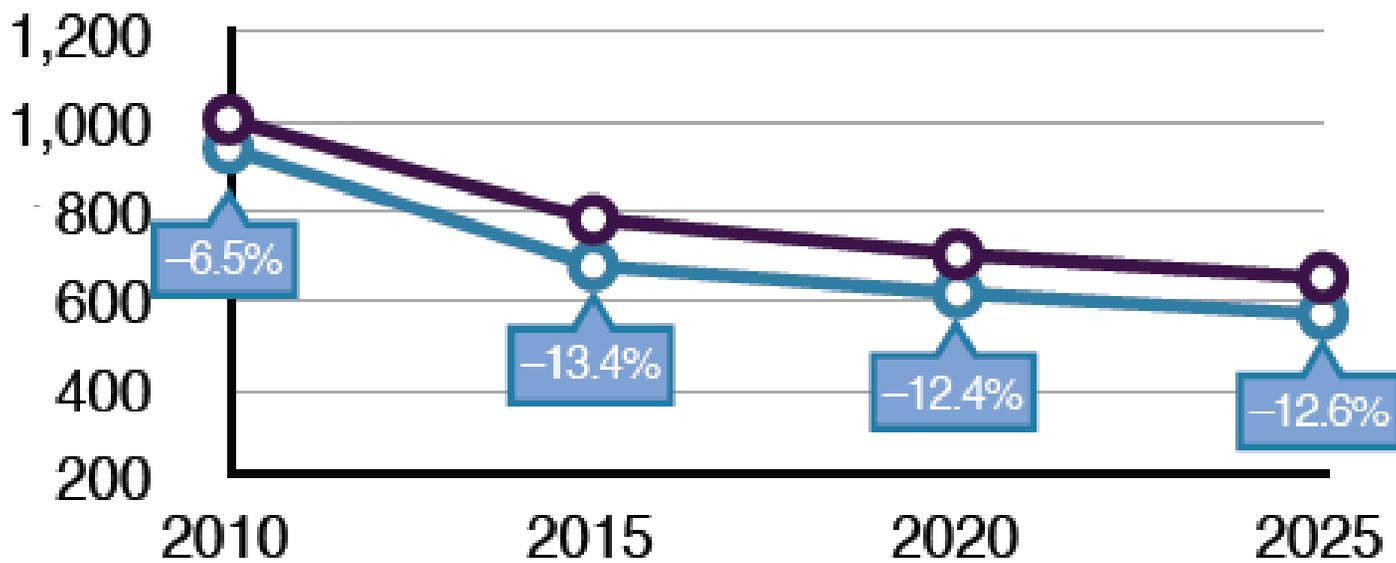


PMV 2010 LEI – Gridded Emissions



PMV 2010 LEI – Emission Reduction Initiatives

Effect of Reduction Initiatives (ERIs) on NO_x (tonnes)



BAU

ERIs

% Change

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Future Work – Transport Canada Funding Programs

CoFREIGHT (2007 – 2011):

- Locomotive retrofits for auto shut down, auxiliary power units
- Genset locomotives
- Variable speed cranes for cargo handling

Shore Power Technology for Ports (2012 – 2015):

- \$27 million funding program to install shoreside power for large ocean-going vessels and cruise ships
- Recently completed PMV cruise ship installation reduced CO₂e emissions by 1,500 tonnes per year

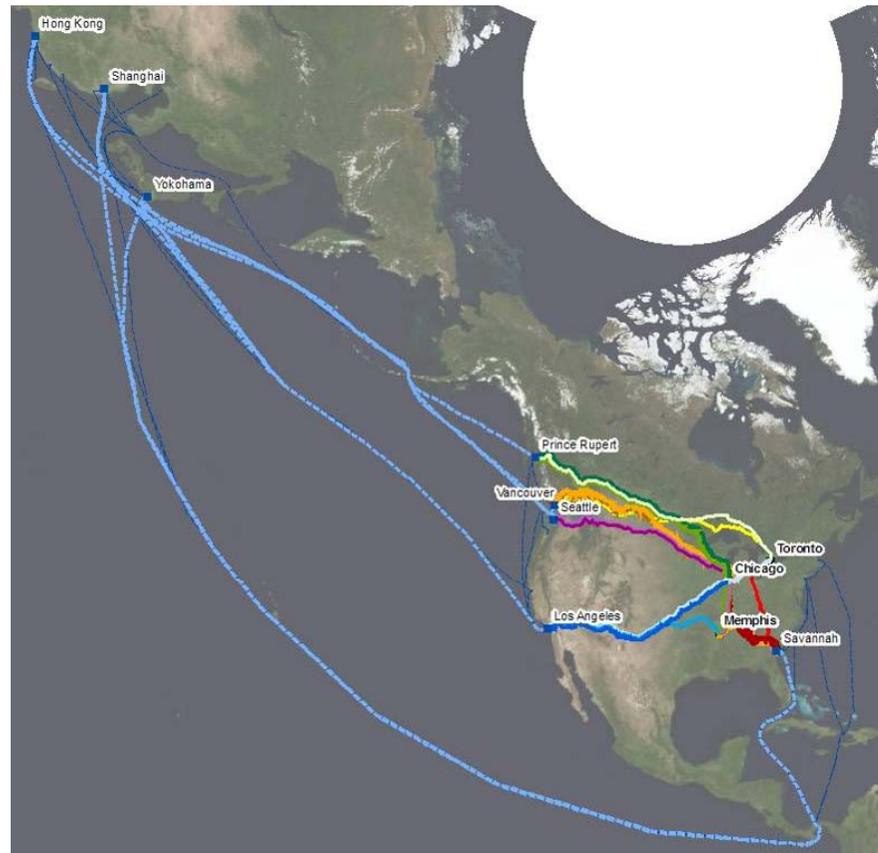
Future Work – TC National Ports EI project



Future Work – Modelling Supply Chains

Comparison study of West coast gateway ports:

- Container shipments through entire supply chain from Asia to eastern seaboard (marine, port, rail)
- Intensity metric of tonnes GHG per TEU moved





Conclusion

The Canadian Ports Model is a convenient tool for consistency among Canadian ports:

- Emissions tracking and reporting over time
- Allows port authorities to assist tenants with emission reduction projects, including applying for financial support
- Facilitates energy planning decisions (further electrification, alternative fuels, logistical changes)
- Supports complementary port environmental programs (e.g., Northwest Ports Clean Air Strategy, Green Marine, etc.)

Questions or comments?



Thank you!
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