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# 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)

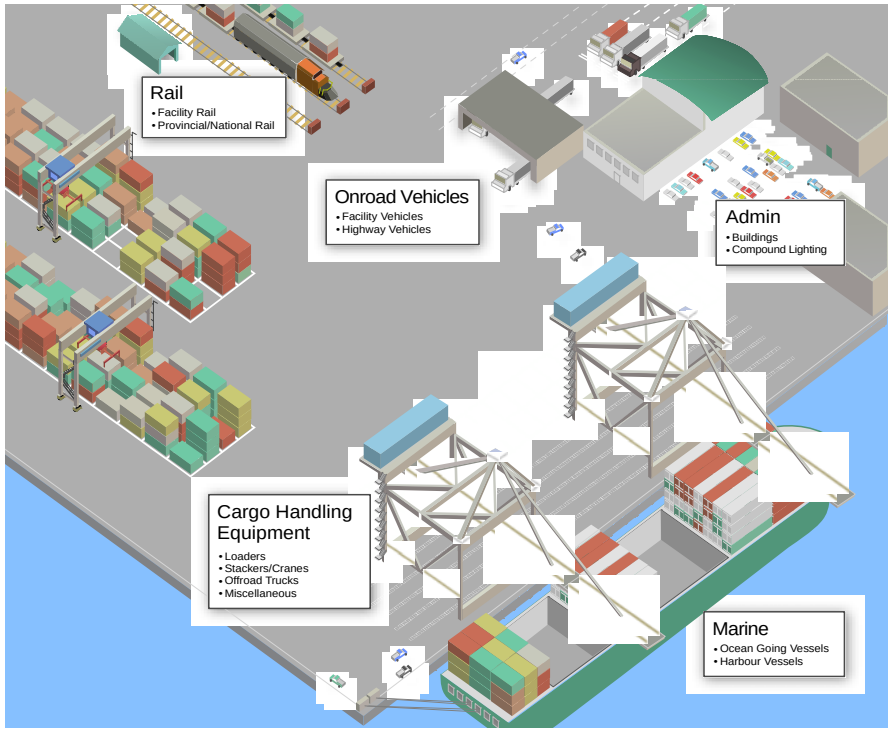
# Overview

- 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 $SO_2$, $NO_x$, PM
- First inventory conducted by Houston in 2000
- EPA developed a guidance document in 2006, updated in 2009

# History – Port Emissions Inventories in Canada

ateway ports competing against
S ports for containers and cruise:

- Metro Vancouver
- Montreal
- Prince Rupert

arly Canadian port EIs

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

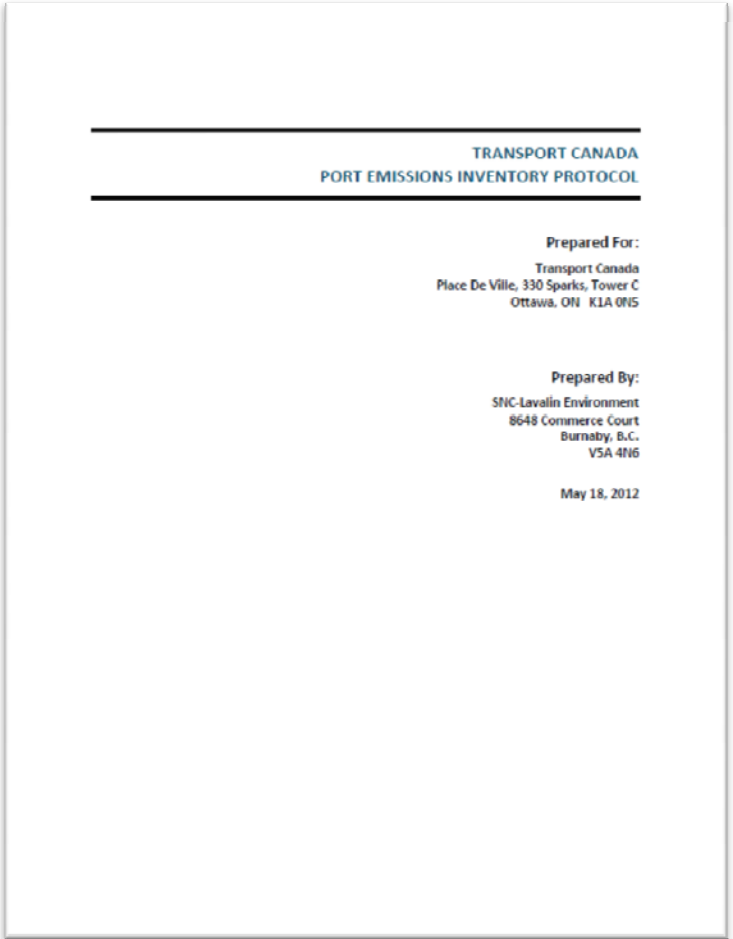
# Framework – Canadian Ports Protocol

rotocol applies uniformly to l Canadian ports.

omponents include:

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

Written 2009, updated 2012.



TRANSPORT CANADA
PORT EMISSIONS INVENTORY PROTOCOL

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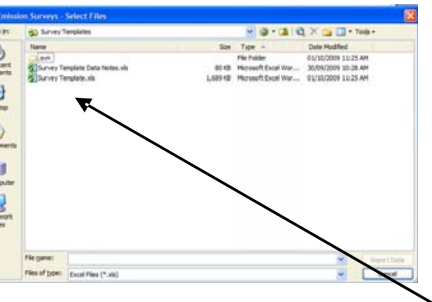
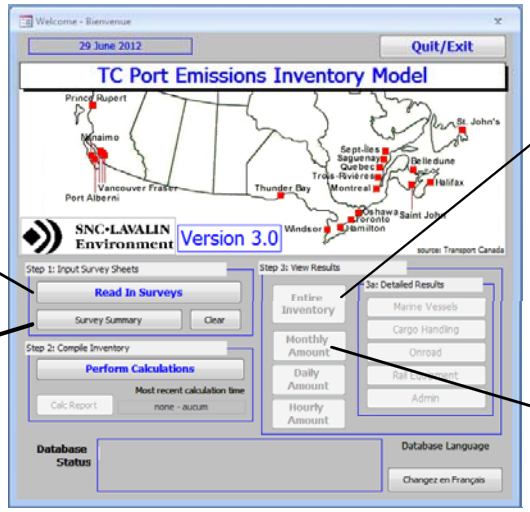
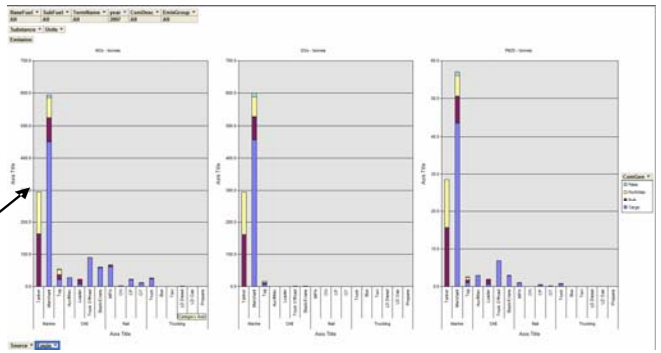
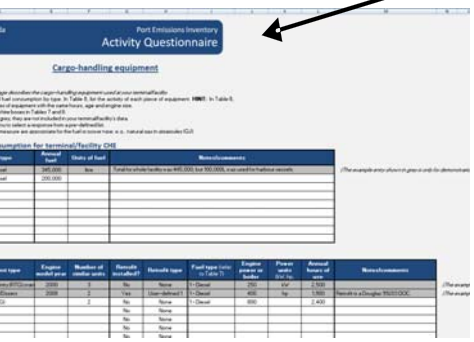
May 18, 2012

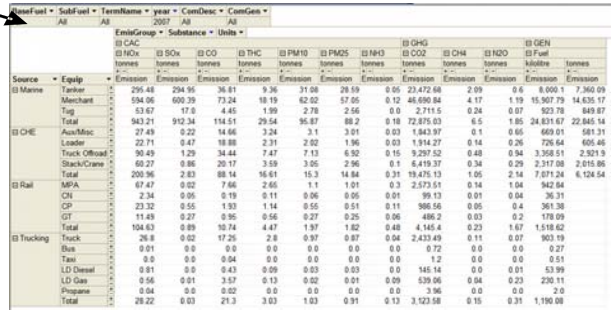
# TC Canadian Ports Model







# Ports Model Questionnaire

| em | Vehicle type | Fleet age | Number of similar vehicles | Relative intensity of use | Fuel type (refer to Table 10) |
|---|---|---|---|---|---|
| mple | Van / Pickup - small utility | 2005 - 2009 | 5 | 3 - Medium (average) | 1 - Gasoline |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |

Heavy commercial truck
Medium commercial truck
Light commercial truck
Bus (transit or passenger)
Van / pickup - small utility
Taxi
Car
Hybrid

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

# Ports Model Activity Data

| ource Group | Equipment | Modes | Metric | Fuel | Engine Type |
|---|---|---|---|---|---|
| rine | 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 | | | | |
| go ndling uipment | 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 | | | | |
| l | 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 | | | | |
| ck | 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

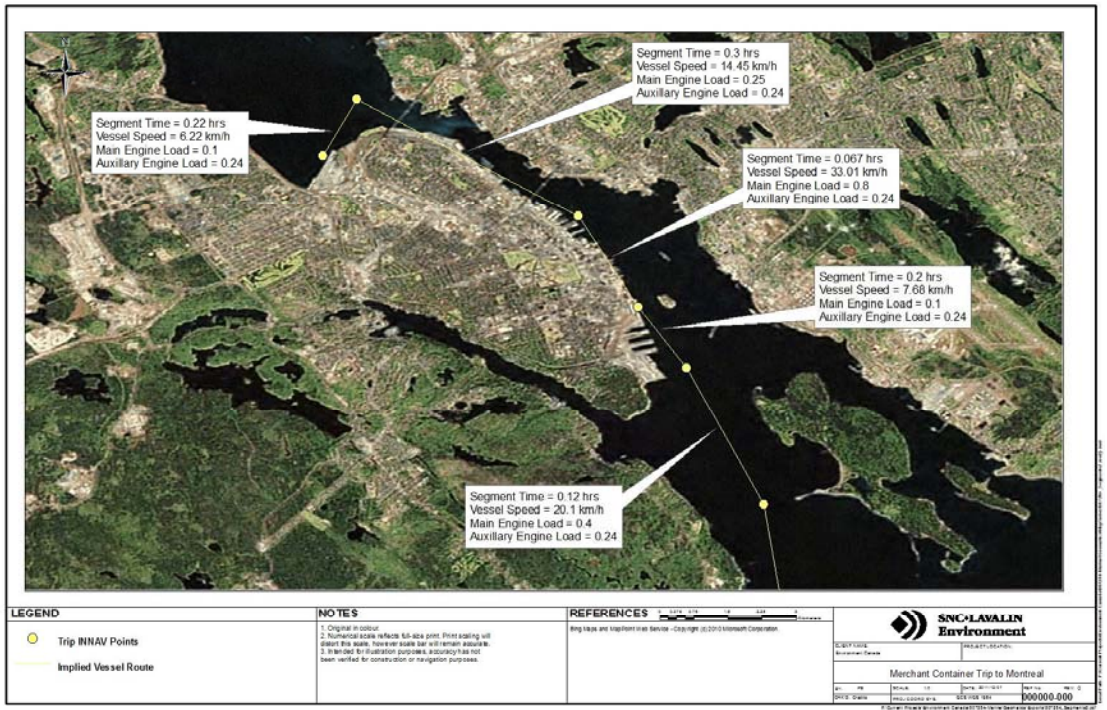
CHE: EPA NONROAD 2008

Onroad: EPA MOBILE, version 6.2.3C

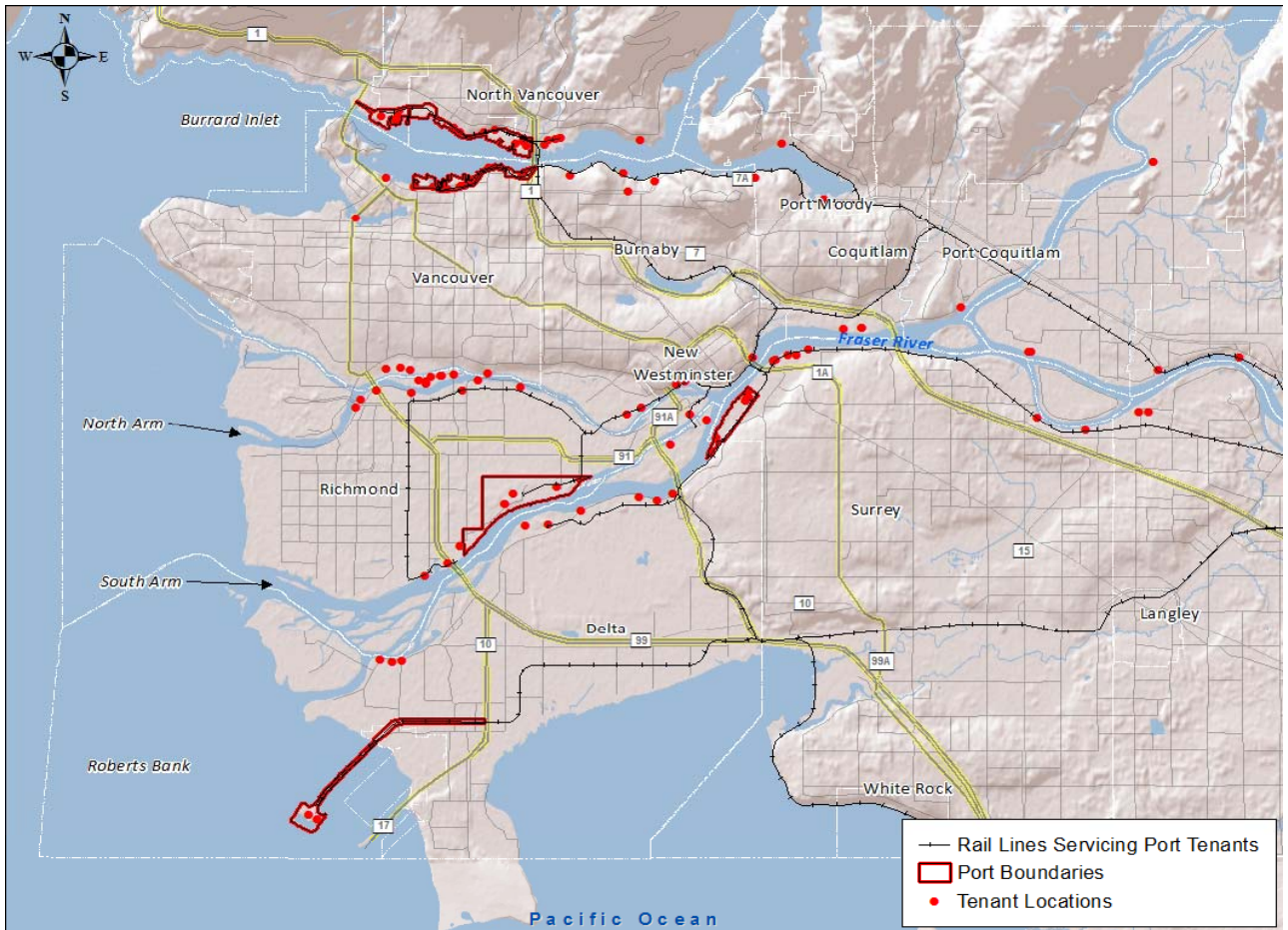
Admin: EPA AP-42

# 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

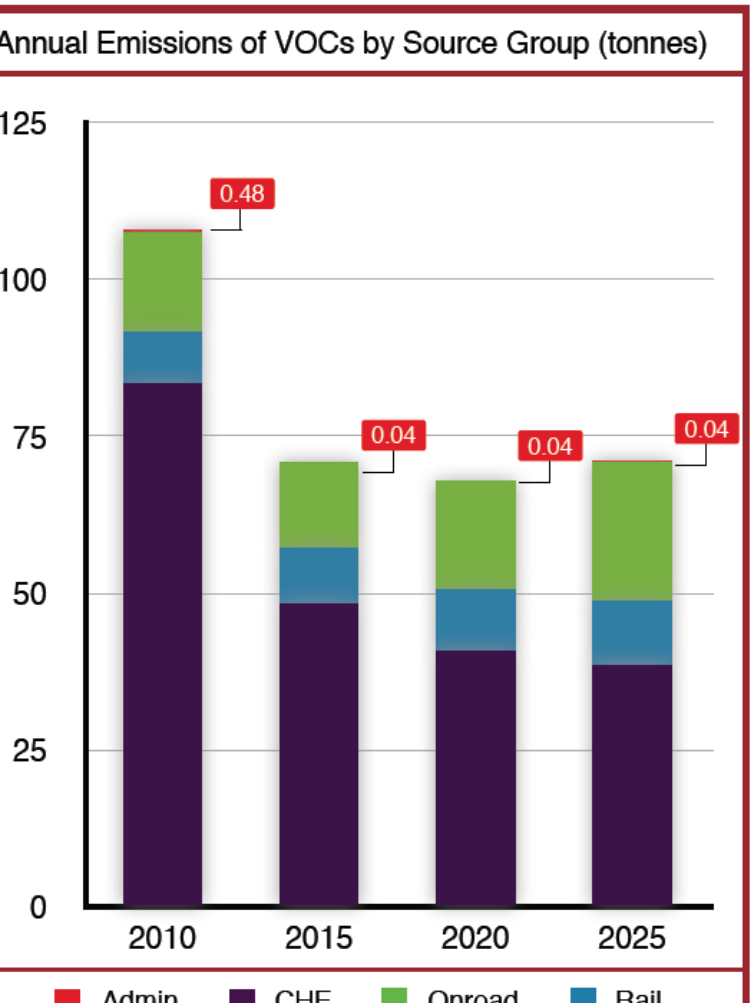
## 10 baseline:

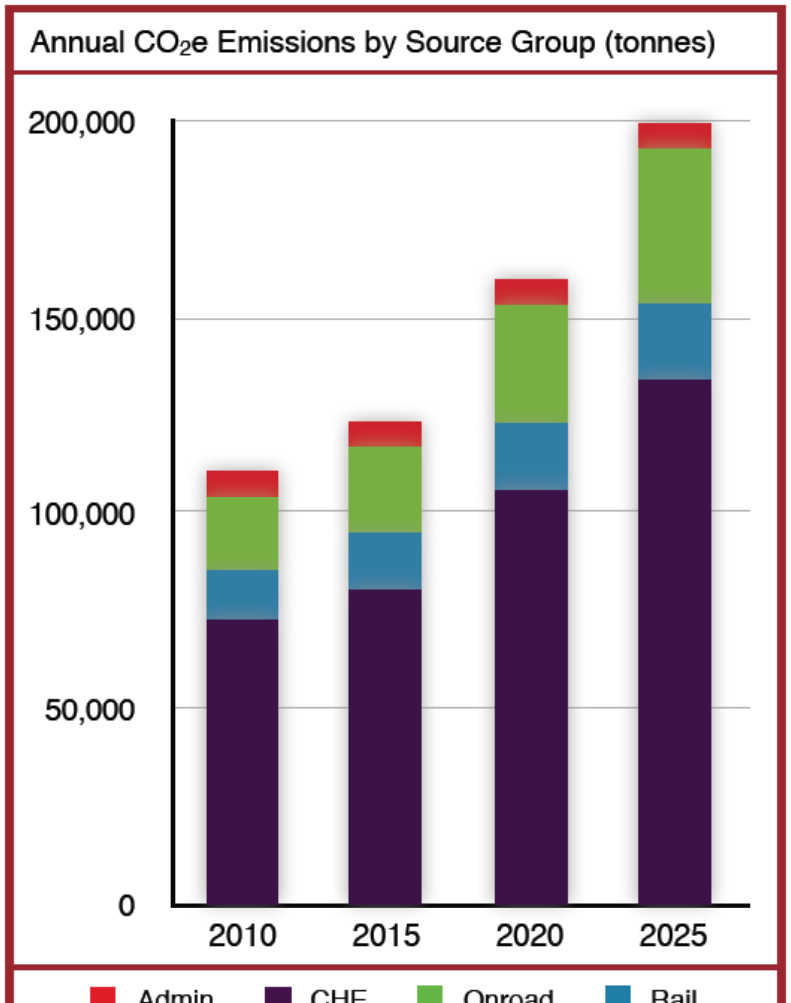
- CHE: 2,086 units, 1.2 million reported hours
- Rail: 108,000 hours of activity
- Total diesel: 2.1 million Hubble-barns (7.4 million gallons)
- Total electricity: 182 GWh

## 25 forecasts:

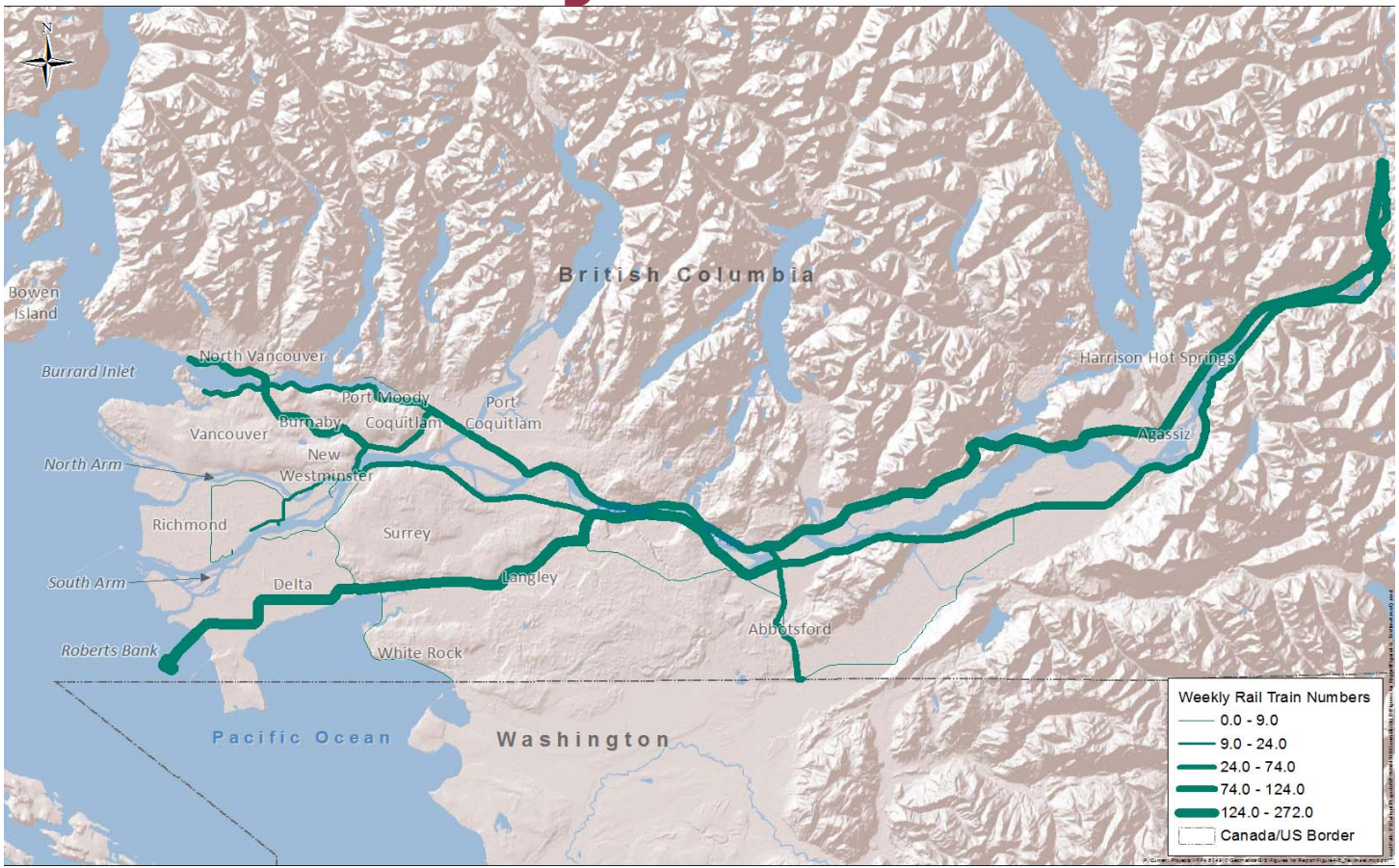
- Total diesel: 4.0 million Hubble-barns (14.0 million gallons)
- Total electricity: 252 GWh

# PMV 2010 LEI – Forecasts

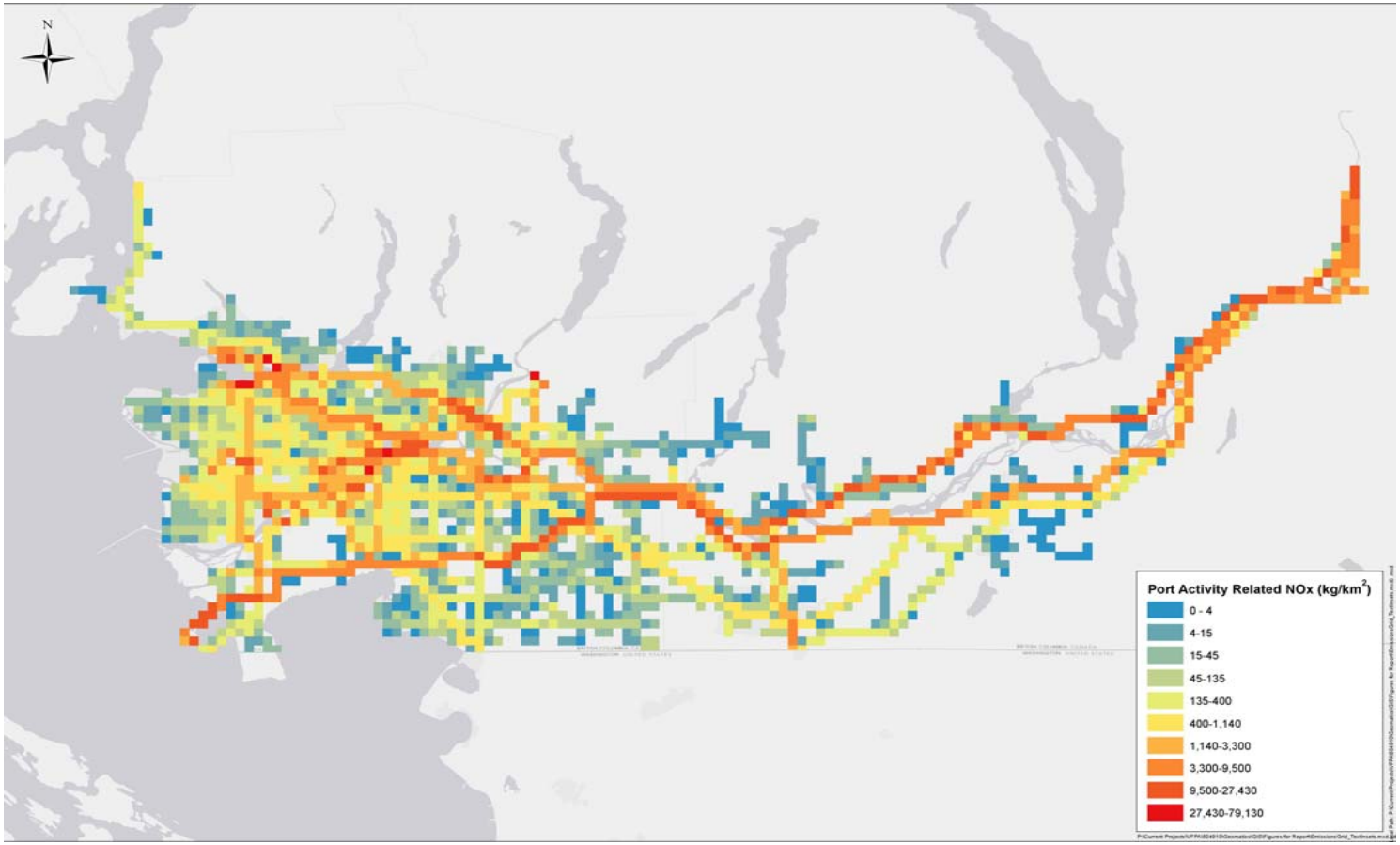


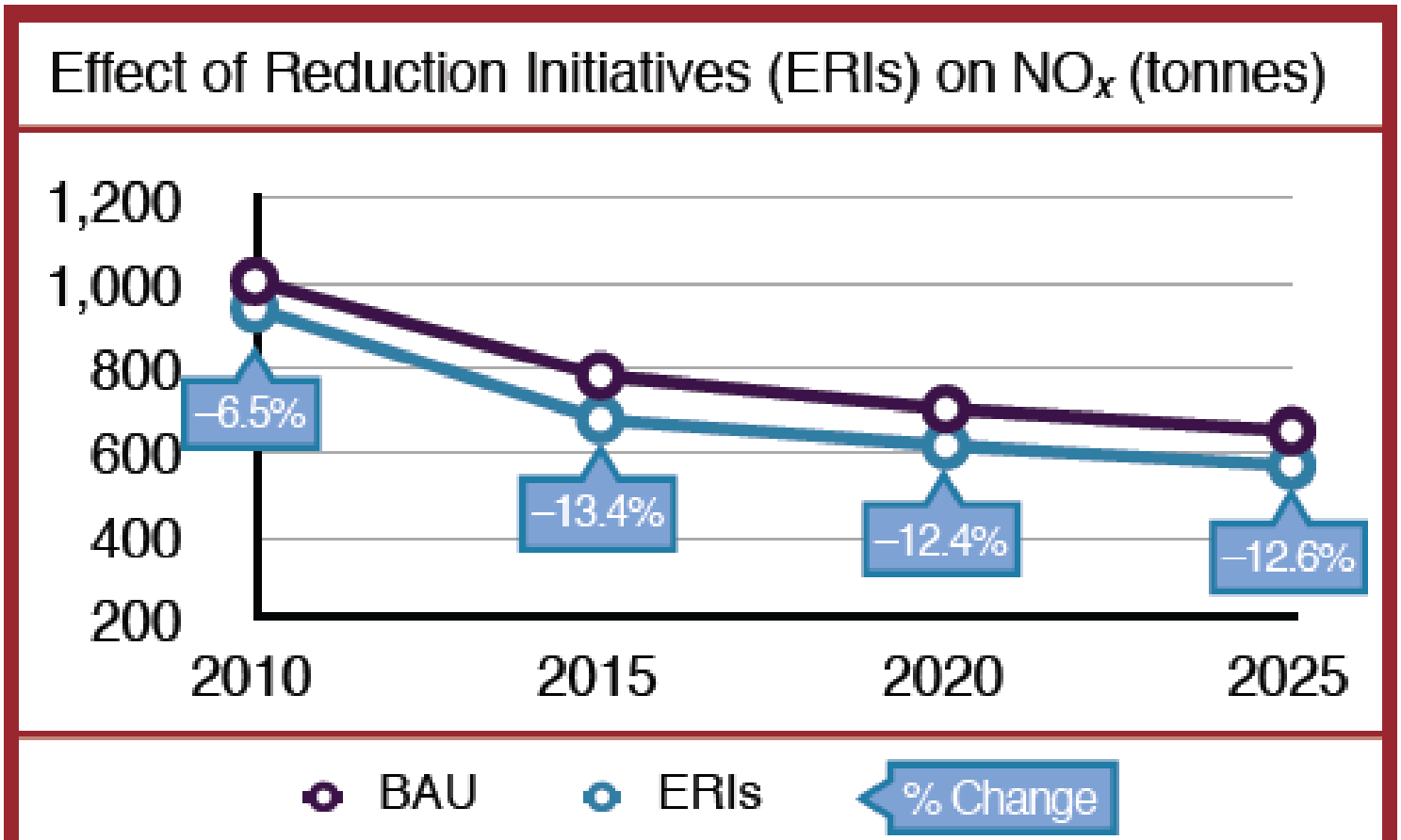
# PMV 2010 LEI – Regional Rail Activity Model



# PMV 2010 LEI – Gridded Emissions



# PMV 2010 LEI – Emission Reduction Initiatives



# 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

## hore Power Technology for Ports (2012 – 2015):

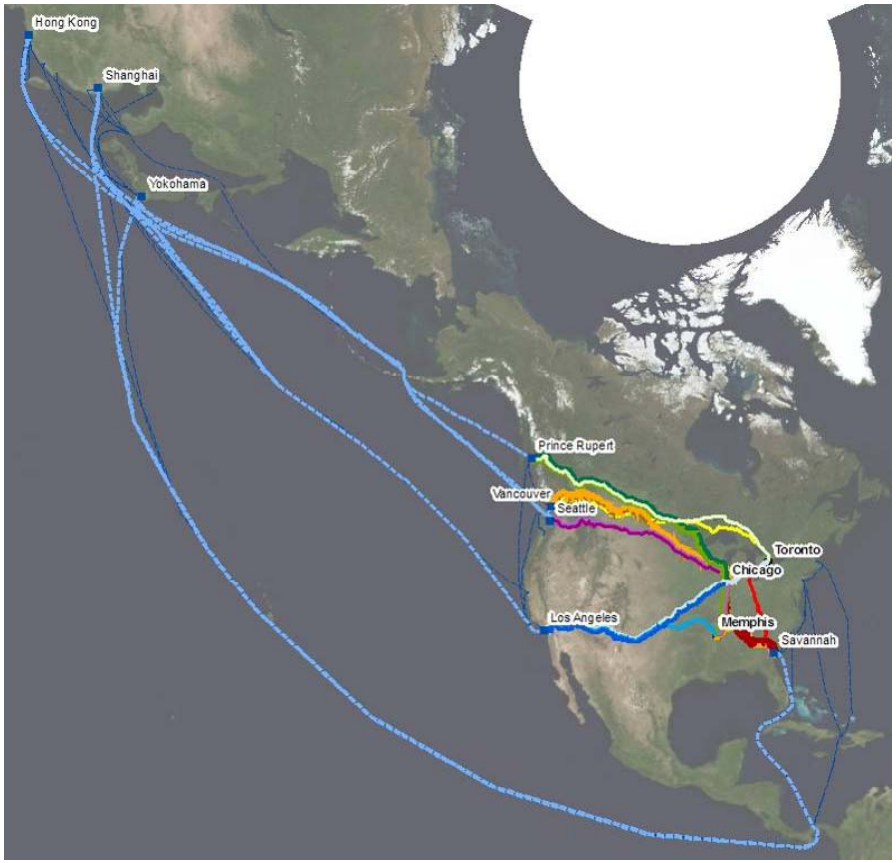
- $27 million funding program to install shoreside power for large ocean-going vessels and cruise ships
- Recently completed PMV cruise ship installation reduced $CO_2e$ emissions by 1,500 tonnes per year

# Future Work – TC National Ports EI project

# Future Work – Modelling Supply Chains

omparison study of
est coast gateway
orts:

- 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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