GREEN MARINE

**A VOLUNTARY ENVIRONMENTAL CERTIFICATION PROGRAM
FOR THE NORTH AMERICAN MARITIME INDUSTRY**

Measuring and Reducing GHG Emissions at Ports

AAPA Energy & Environment Seminar – Sept 11, 2018 – Jersey City, NJ

www.green-marine.org

OUTLINE

- ➤ Green Marine Overview
  - o Port Membership
  - o Certification Process
  - o Environmental Issues
- ➤ Reducing GHG
  - o Performance Indicator
- ➤ Measuring GHG
  - o Port Emission Inventory Tool (PEIT)

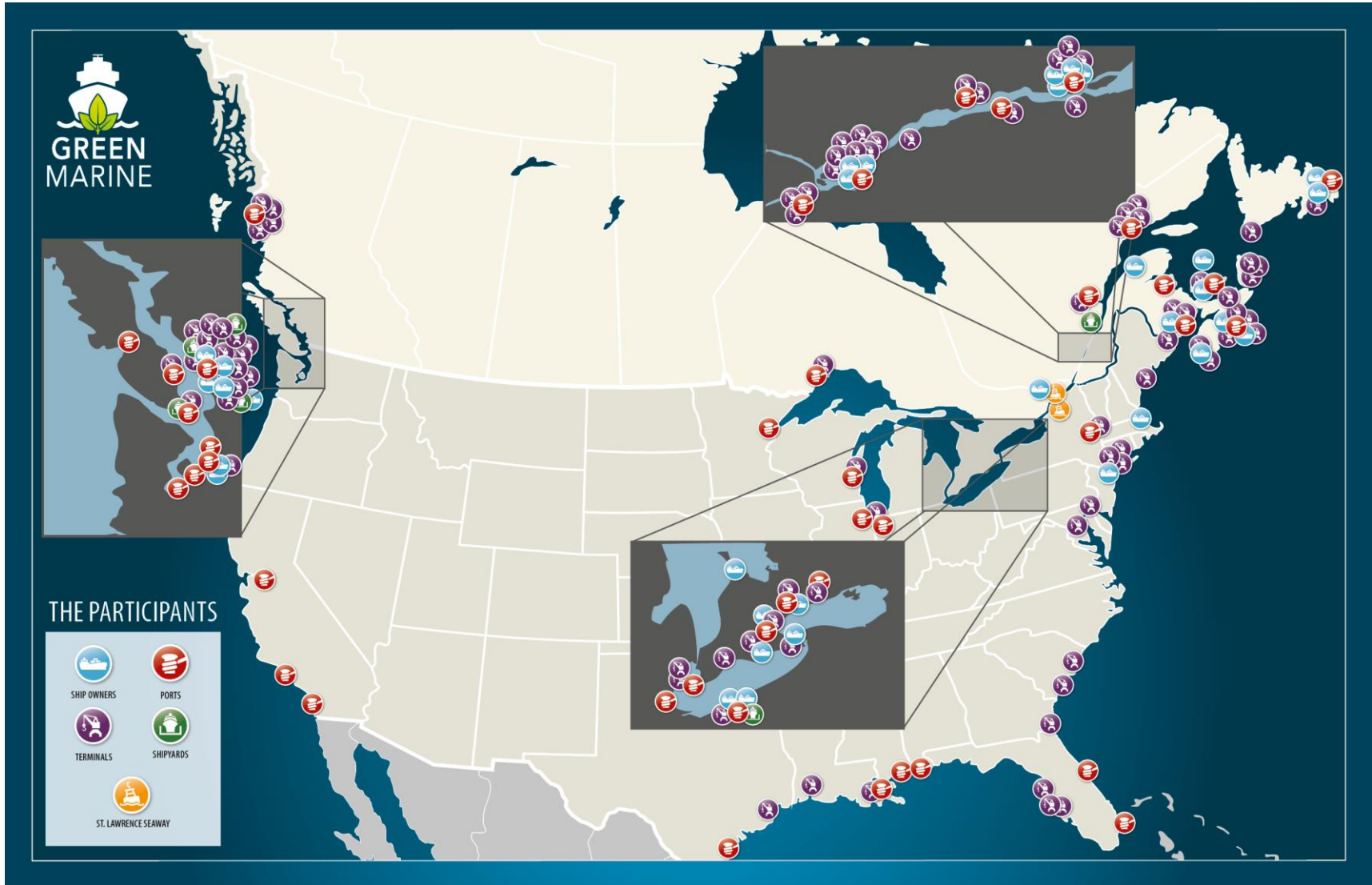GREEN MARINE

GREEN MARINE IS…

A **voluntary certification program** to reduce environmental footprint of marine operations by

- exceeding regulatory compliance
- promoting a culture of continual improvement

A **benchmarking tool** to measure performance
A **partnership** initiative involving stakeholders
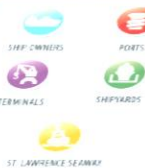
127 PARTICIPANTS IN U.S. AND CANADA

MEMBERSHIP GROWTH 2007 – 2018

	2007	2018
PARTICIPANTS	34	127
PARTNERS	23	82
SUPPORTERS	19	69
ASSOCIATIONS	7	23
TOTAL	83	301

PORTS

- Alabama State Port Authority
- Albany Port District Commission
- Bécancour Waterfront Industrial Park
- Belledune Port Authority
- Canaveral Port Authority
- Duluth Seaway Port Authority
- Greater Victoria Harbour Authority
- **Halifax Port Authority**
- Hamilton Port Authority
- Illinois International Port District
- Montréal Port Authority
- Nanaimo Port Authority
- Northwest Seaport Alliance

- Oshawa Port Authority
- Port Alberni Port Authority
- Port Charlottetown
- Port Everglades
- Port Milwaukee
- Port of Cleveland
- Port of Corpus Christi
- Port of Everett
- Port of Gulfport (MSPA)
- **Port of Hueneme**
- Port of Indiana - Burns Harbor
- Port of Monroe
- Port of New Orleans
- Port of Olympia
- **Port of San Diego**
- Port of Stockton
- Port of Seattle
- Port of Valleyfield

- Prince Rupert Port Authority
- Québec Port Authority
- Saguenay Port Authority
- Saint John Port Authority, NB
- Sept-Îles Port Authority
- St. John's Port Authority, NL
- Thunder Bay Port Authority
- Toronto Port Authority
- Trois-Rivières Port Authority
- Vancouver Fraser Port Authority
- Windsor Port Authority

ANNUAL CERTIFICATION PROCESS & CONFERENCE

Evaluation Process

- Annual self-evaluation requiring CEO sign-off

External Verification

- Third party verification every two years

Results Publication

- Annual Report
- Website

Certification

- Exceeding regulatory compliance
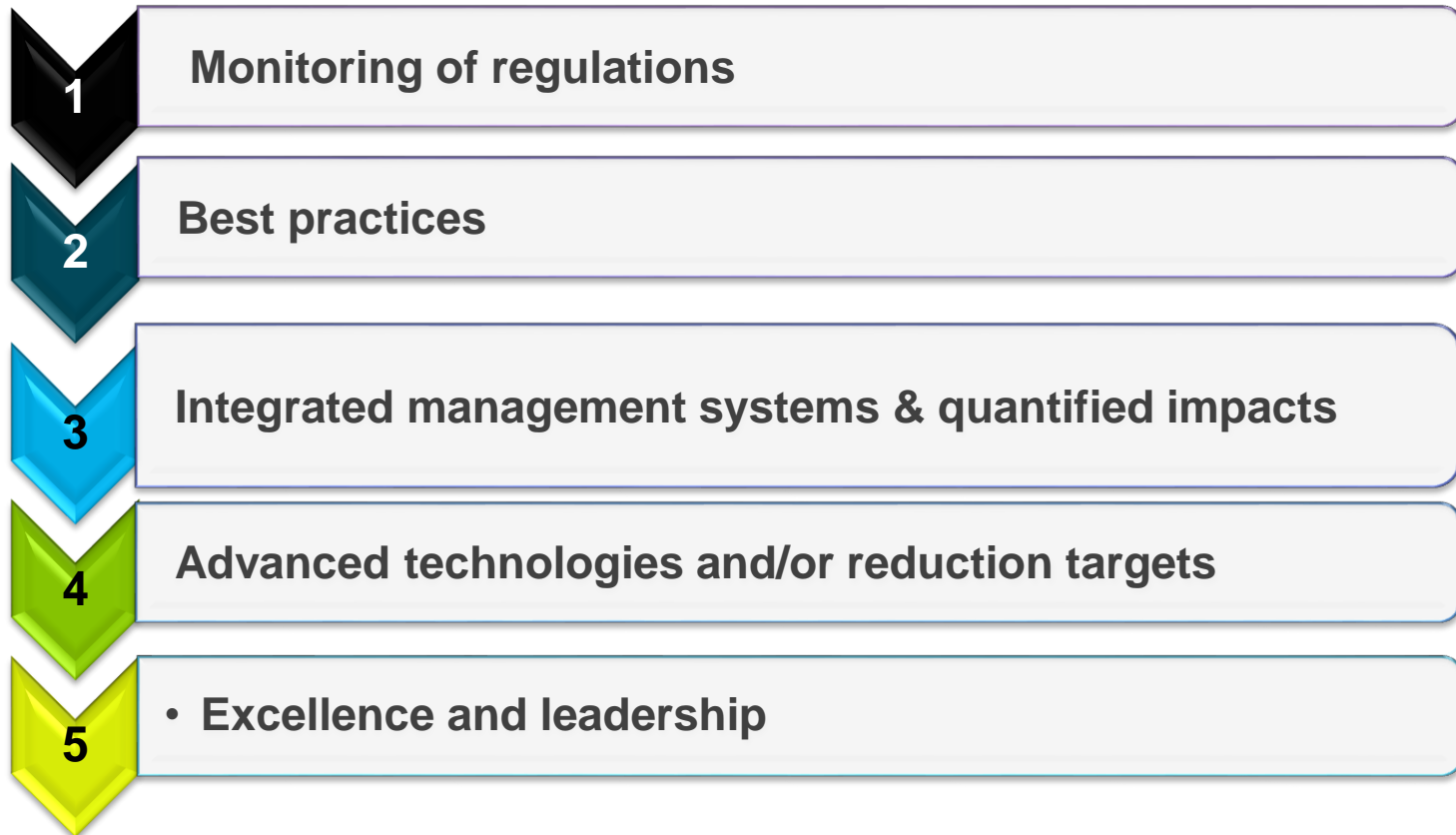- Demonstrating continuous improvement

SCOPE

ENVIRONMENTAL PERFORMANCE INDICATORS

PERFORMANCE INDICATORS	SHIP OWNERS	PORTS & SEAWAY	TERMINALS & SHIPYARDS
Aquatic invasive species	■		
Community impacts		■	■
Dry bulk handling and storage		■	■
Environmental leadership		■	
Garbage management	■		
Greenhouse gas emissions	■	■	■
Oily water	■		
Pollutant air emissions NOx	■		
Pollutant air emissions SOx & PM	■		
Prevention of spills and leakages		■	■
Underwater noise	■	■	
Waste management		■	■

PERFORMANCE INDICATOR (PI)

1 Monitoring of regulations

2 Best practices

3 Integrated management systems & quantified impacts

4 Advanced technologies and/or reduction targets

5 • Excellence and leadership

PROGRAM SUMMARY

Posted online: https://www.green-marine.org/program/

GHG & AIR POLLUTANTS PI 2018

Level 1 – Monitoring of Regulations

Level 2 – Best Practices

- Reduce idling of all ICE vehicles
- Promote sustainable transportation practices by employees
- Reduce truck congestion and idling

PEIT

Level 3 – Management and Assessment

- Scope 1 emissions inventory from port's owned sources (Annex 1-A)
- Port-wide equipment inventory within last 5 years <u>OR</u> voluntary emissions reduction program, ex. cleaner fuel, engine repower, or equipment replacement (optional for 2018)

Level 4 – Advancement

- Port-wide emissions inventory within last 5 years
- Internal plan w/ BMPs and quantitative reduction targets (Annex 1-B)

Level 5 – Excellence and Leadership

- Publically disclose targets and timeframe
- Demonstrate continual reduction

GHG & AIR POLLUTANTS PI 2017

GREEN MARINE

Ports and Seaway 2017 Results
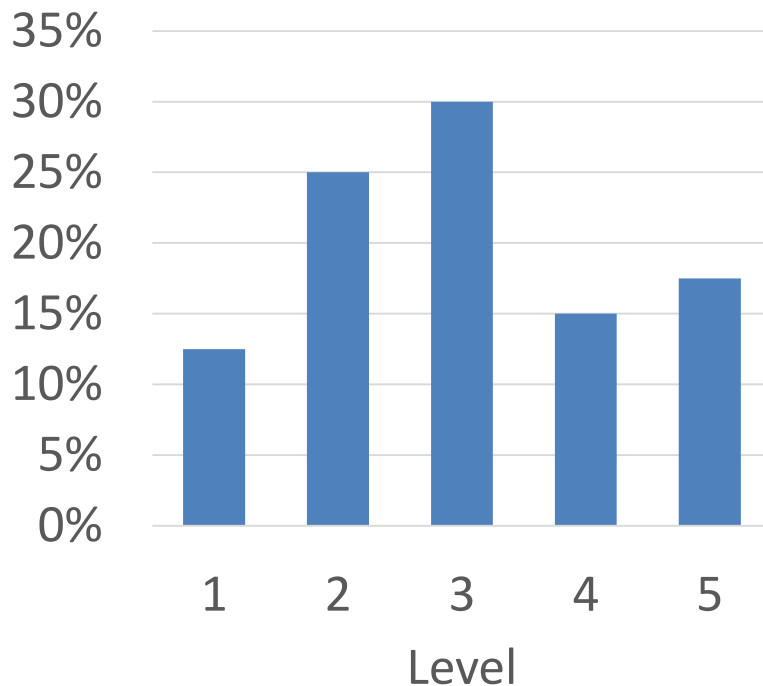
PORT AUTHORITIES	GHG & AIR POLLUTANTS	SPILL PREVENTION	DRY BULK HANDLING AND STORAGE	COMMUNITY IMPACTS	ENVIRONMENTAL LEADERSHIP	WASTE MANAGEMENT
Alabama State Port Authority	1	2	2	2	2	2
Bécancour Waterfront Industrial Park	4	2	n.a.	2	4	2
Belledune Port Authority*	1	2	1	1	1	1
Canaveral Port Authority	2	5	n.a.	2	2	2
Cleveland-Cuyahoga County Port Authority	3	4	3	2	4	2
Duluth Seaway Port Authority	5	5	5	5	5	2
Greater Victoria Harbour Authority	3	5	n.a.	5	3	3
Halifax Port Authority	4	5	n.a.	4	5	4
Hamilton Port Authority	3	3	n.a.	4	2	3
Montreal Port Authority	5	5	n.a.	5	5	4
Nanaimo Port Authority	2					
Northwest Seaport Alliance	3					
Oshawa Port Authority	2					
Port Alberni Port Authority	2					
Port Everglades	5					
Port of Albany	2					
Port of Corpus Christi	1					
Port of Everett	1					
Port of Gulfport	2					
Port of Hueneme	3					
Port of Indiana – Burns Harbor	2					
Port Milwaukee	3					
Port of Monroe	2					

GREEN MARINE 2017 PERFORMANCE REPORT

Net improvement of 5 levels from 40 reports in 2017 versus 2016
www.green-marine.org/certification/results/

Measuring GHG
Port Emission Inventory Tool (PEIT)

Desktop application on Microsoft Office platform: Excel and Access

A *fuel* and *activity-based* accounting of emissions

- Marine – HC and OGV
- Rail
- Cargo Handling Equipment
- Trucking
- Administration

Port-defined boundaries

Assessment by terminal, rolled up to the port level

Common Air Contaminants (CACs), GHGs, air toxics (optional)
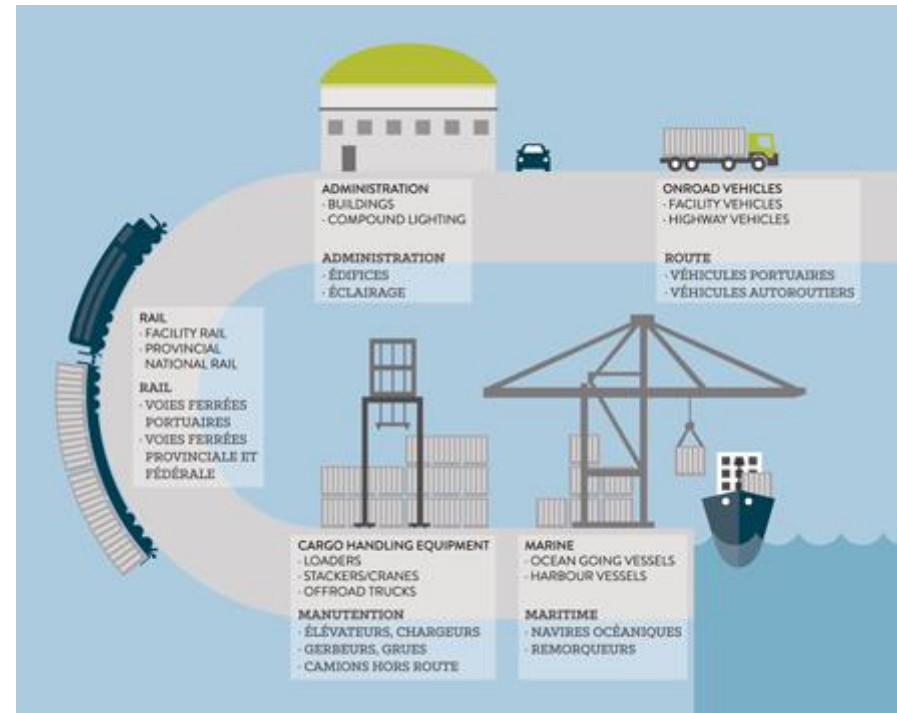
PEIT User Interface (MS Access)

Based on the latest available EPA emission factors

Technically sound for voluntary purposes – Informal Technical Review by OTAQ

Tenant Questionnaire
(MS Excel)

Identify folder with one or more completed PEIT questionnaires

Perform calculations to populate inventory tables

MS Access emissions data pivot table

Adjustments to fuel parameters and emission rates
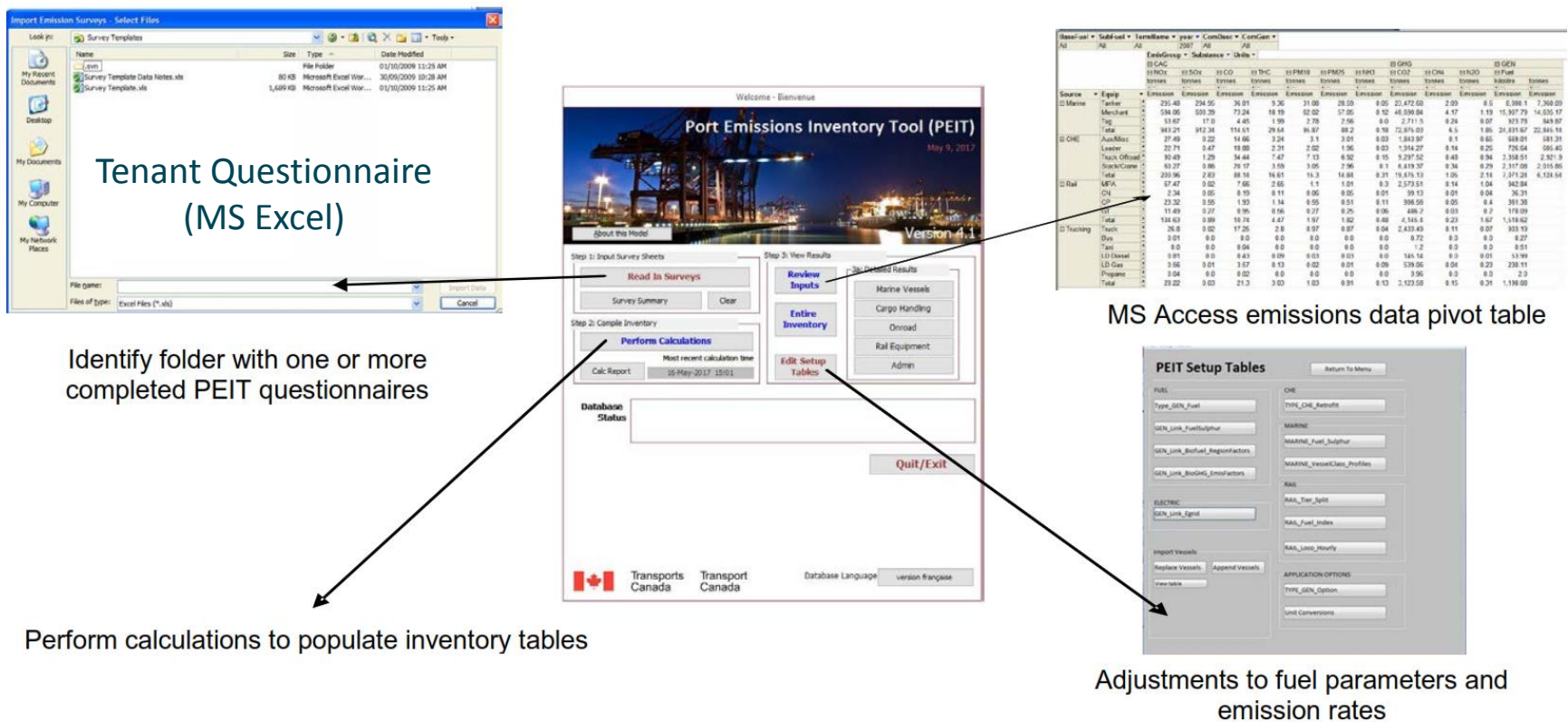
Figure 1-2: Schematic of Port Emission Inventory Tool

PEIT Input

Questionnaire designed for tenants to fill in

MS Excel Workbook

Worksheet tabs:
- Introduction
- Glossary
- Terminal
- 5 source sectors

Drop-down menus to choose responses, instructions, hints, notes / comment boxes

PEIT Output

Export to Excel

Sort by terminal or tenant, commodity, and source sector

Feedback to tenants

Track emissions and energy use over time

Report for port, community, region (ex. NWPCAS), funding application

Support planning and decision making (ex. electrification, alternative fuels, development, logistics)

GHG (Inventory Boundary)
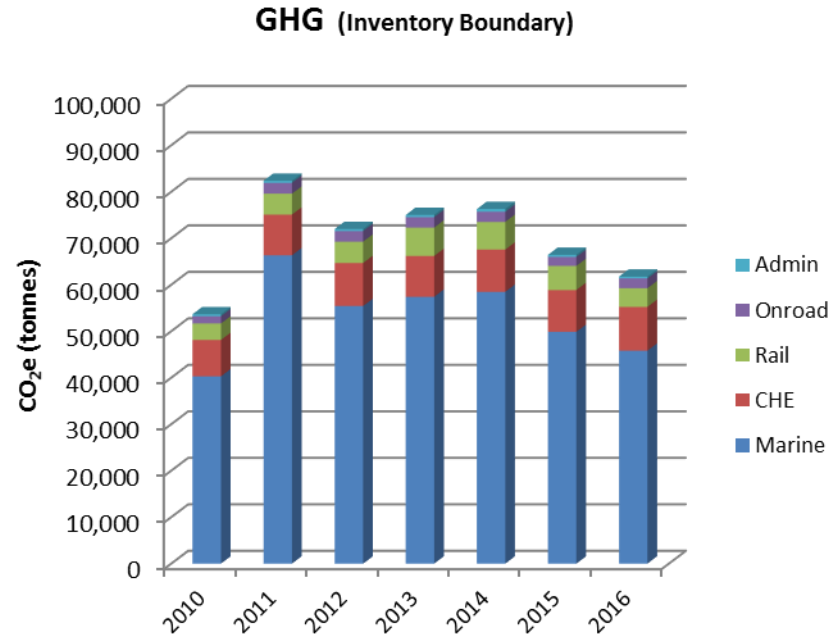
PRINCE RUPERT PORT AUTHORITY

PEIT Contracting

- Transport Canada (TC) contracted the original development of the PEIT in 2009 with SNC-Lavalin

- Memorandum of Cooperation between Green Marine (GM) and TC in 2012

- PEIT license agreement between GM and TC in 2016 and extended in 2018

- PEIT available to all GM Participants **cost-free** with signed sublicense

- Ongoing participant user support from SNC and GM

Reducing GHG – what else?

- Shore Power

- Congestion / throughput efficiencies

- Incentive programs for users
  - Ex. PRPA Green Wave, VFPA EcoAction
  - Ex. Clean Truck programs, like at New Orleans, Seattle

- Green Marine GHG&AP Workgroup Survey

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EXTRA

Inventory Boundary

Operational basis – no dependence on land ownership or corporate relationships

- All facilities engaged in marine trade
- Port decides on list of included tenants

Distinct geographical boundaries

- Terminal/Facility boundary
- Port Boundary (chosen by port)

Assessment by terminal, rolled up to the port level

Prince Rupert Inventory Boundary

- Landside Boundary includes all landside activities plus vessels at berth.

- Port Boundary includes all port anchorages and extends to pilot station at Triple Island. Also includes rail and road off of immediate terminal boundaries.
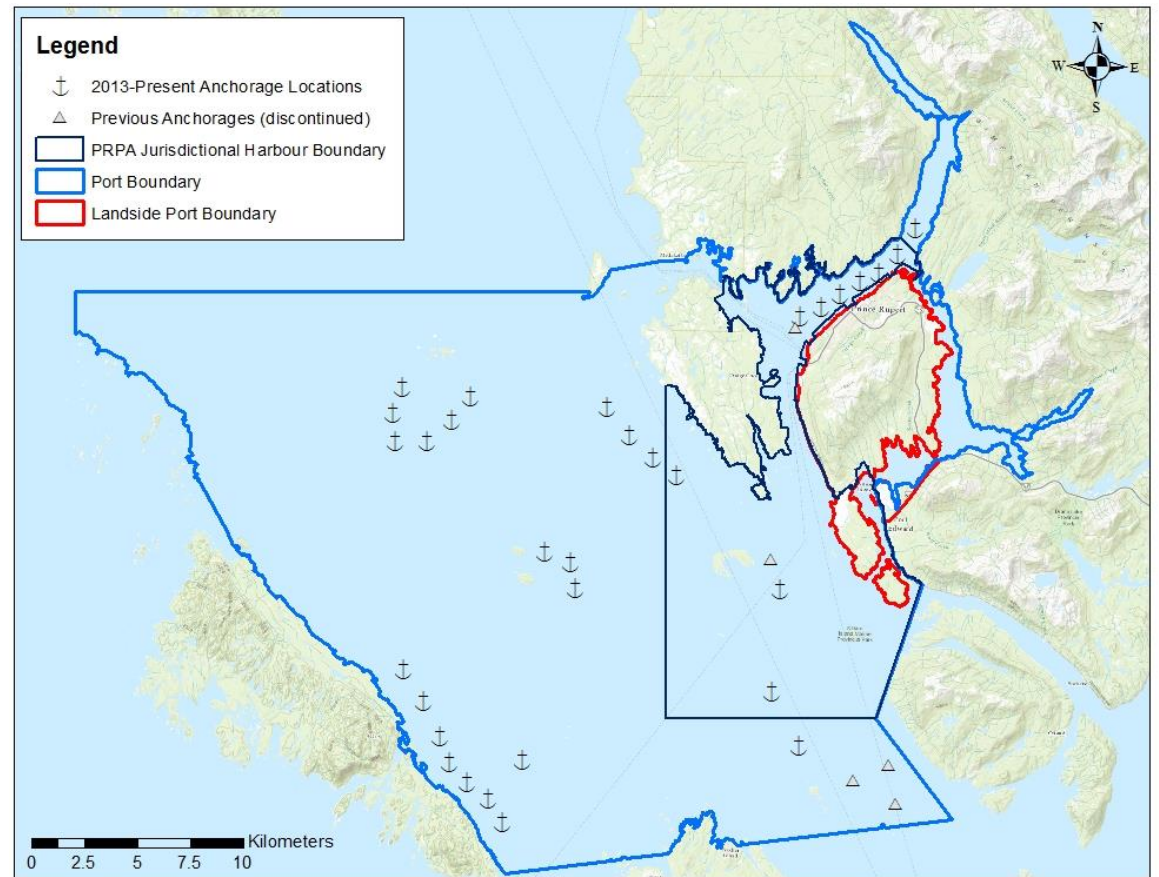
Courtesy of JS, PRPA as presented at GreenTech 2017

Legend

- 2013-Present Anchorage Locations
- Previous Anchorages (discontinued)
- PRPA Jurisdictional Harbour Boundary
- Port Boundary
- Landside Port Boundary

Prince Rupert 2018 Green Wave

		TIER 1 (-10%)	TIER 2 (-20%)	TIER 3 (-50%)
ENVIRONMENTAL PROGRAMS	Green Marine	Level 3 GHG and minimum Level 2 in all other indicators	Level 4 GHG and minimum Level 2 in all other indicators	Level 5 GHG and minimum Level 2 in all other indicators
	RightShip	Verified GHG B	Verified GHG B+	Verified GHG A
	Environmental Ship Index	Score 20 - 30	Score >30 - 50	Score >50
	Clean Cargo Working Group	CO_2 dry score <46 - 36	CO_2 dry score <36	
	Clean Shipping Index	CSI 3	CSI 4	CSI 5
	Energy Efficiency Design Index	Attained EEDI 15% better than required	Attained EEDI 25% better than required	
	Green Award	Award certificate		
UNDERWATER NOISE - CLASSIFICATION SOCIETIES	Det Norske Veritas – Germanischer Lloyd (DNV-GL)			SILENT notation or Certificate of Compliance
	Bureau Veritas (BV)			URN notation
	Registro Italiano Navale (RINA)			DOLPHIN notation
UNDERWATER NOISE - TECHNOLOGY	Becker Mewis Duct	BMD installed		
	Propeller Boss Cap Fins	PBCF installed		
	Schneekluth Wake Equalizing Duct	WED installed		

GREEN MARINE

PEIT MODEL
INTERNAL DATASETS – EQUIPMENT IDENTIFICATION, FUEL AND EMISSION CALCULATIONS

- # Marine Vessel
  - Vessel Identification: vessel engines, max cruise speed, engine usage patterns from lookup tables (vessel IMO # used)
  - Emissions Data (ship engine emission factors from US EPA (ICF - 2009), IMO)
- # Vehicle
  - U.S. EPA MOVES 2014a emission rates, fuel consumption rates, and future fuel consumption standards
- # Cargo Handling Equipment
  - U.S. EPA NONROAD 2008 emission rates by engine year and tier
- # Rail
  - U.S. EPA locomotive emission rates by tier, genset locomotive test data (2009)
- # Admin
  - Boiler emission rate
- # Global
  - CH4, N20, CO_2e intensity of electricity (g /kWhr) by region
  - Fuel-based GHG rates (g-GHG / fuel consumed), including bio content of fuels

PEIT V4.3 - US PORT CASE STUDY

- Select port location in either US or CAN

- Unit conversions for US (Imperial)

- Fuel definitions for state/regional electrical grid factors and biofuel content

- Rail – fuel and fleet info for BNSF and KCS
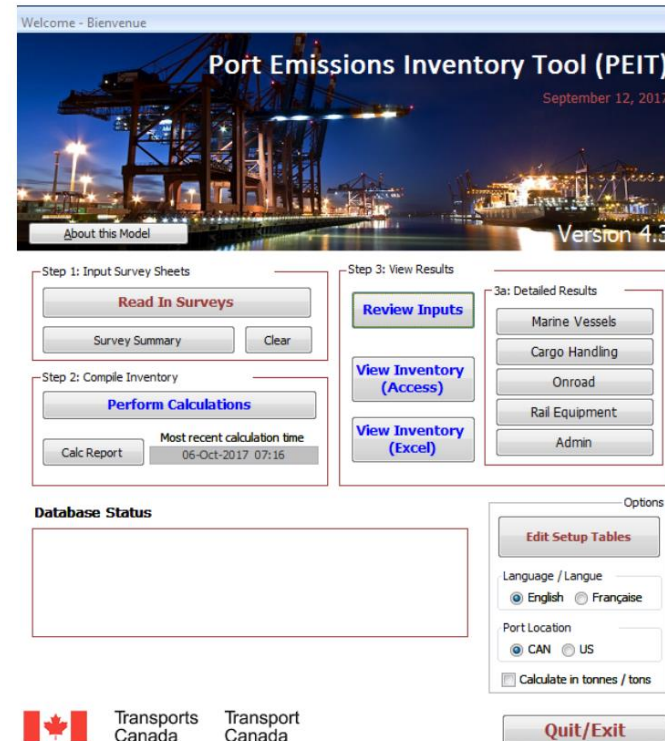
Figure B.1: PEIT Welcome Screen

PEIT OUTPUT REPORTS – Excel and Access

Output Filter Fields	Notes
Inventory Year	Should only be 1 choice if all tenants select the same year
PortAuthority	Defined in 'Introduction' worksheet
Activity	Defined in all activity worksheets
Terminal UKey	Defined in 'Introduction' worksheet
CommodityClass	Links with available general commodity classes in the 'Terminal' worksheet, ex. Breakbulk
Commodity	Links with available general commodity classes in the 'Terminal' worksheet, ex. Breakbulk - Logs
Boundary	EI boundary choice
EquipmentGroup	Specific equipment groups can be selected
Tech	Technology type of engine (e.g., Tier 1, Tier 2, etc.)
Retrofit	Engine and emission retrofits
Substance	Including CACs and GHGs
SubstanceGroup	Air contaminant groups can be selected
Units	Shows all units used in the EI data
SourceGroup	Marine, Rail, CHE, Vehicle, Admin
EquipmentType	Specific equipment pieces can be selected
Fuel	Emissions associated with specific fuels, ex. HFO, MDO, Electricity

PEIT FORECASTS / SCENARIO PLANNING

- Adjust questionnaire inputs

- Linear scaling
    By commodity scaling factors (e.g., 1.3 for containers, 1.15 for solid bulk, etc)

- Linear scaling
    By activity: hours of use or distance travelling

- Fleet renewal / equipment upgrades

- Regulatory changes

The published version of PEIT doesn't handle the back/forecasts directly. A modified version of PEIT has been used by SNC for this purpose. However, the adjustment to PEIT is relatively straightforward and can be implemented by other consulting groups (or the back/forecasts can be done external to PEIT).

PEIT INVENTORIES CONDUCTED

- Has been used to develop over 25 port inventories in Canada
- All 18 of Canada's official ports
- 2 inventories for Port Halifax (2008, 2010) and Montreal (2007, 2010)
- 5 inventories for Port of Prince Rupert (2010 – 2014)
- US Port Case Study for Port NOLA (2016 - 2017)

Equipment Type	Equipment Count				Energy Consumption (GJ)			
	2010	2011	2012	2013	2010	2011	2012	2013
Aux/ Misc								
Aerial Lifts	0	1	1	2	0	29.5	24.7	24.5
Boilers - Material Transfer	2	2	2	2	32,650.9	37,298.7	32,940.4	33,888.2
Crushers/grinders	3	0	0	1	4,866.3	0	0	42.1
Conveyors	22	22	22	27	82,948.7	94,804.1	89,141.0	92,450.5
Pumps - Transfer	15	17	17	17	17,164.4	14,981.5	18,959.5	21,794.7
Pumps - Water	0	1	1	1	0	128.4	167.3	204.1
Roller/compactors	0	1	1	1	0	204.5	171.4	152.5
Signal Boards/Light Plants	2	2	2	2	196.5	102.2	23.0	9.0
Sweepers/Scrubbers	1	1	1	1	6.5	4.2	4.8	4.4
TOTAL	45	47	47	54	137,833.2	147,553.0	141,432.0	148,570.2
Loaders								
Crawler Tractor/Dozers	3	3	4	4	2,969.3	11,319.6	16,681.2	14,839.5
Excavators	0	4	4	4	0	5,552.5	6,172.6	7,338.8
Forklifts	21	25	26	30	2,944.8	4,400.7	3,843.5	3,424.6
Rubber-Tire Loaders	4	5	4	5	10,198.2	10,159.6	6,613.5	9,001.3
Skid Steer Loaders	3	3	3	3	122.5	125.0	106.2	94.7
Tractors/Loaders/Backhoes	36	35	36	36	12,991.2	13,914.2	15,771.1	14,606.9
TOTAL	67	75	77	82	29,226.0	45,471.6	49,187.1	49,833.4
Stack/Crane								
Cranes (not RTG)	12	13	13	14	55,900.2	46,941.8	60,796.2	72,257.1
Reach Stackers	17	17	17	17	27,501.1	24,599.8	27,880.6	25,924.1
TOTAL	29	30	30	31	83,401.3	71,541.7	88,676.8	98,181.2
Truck Offroad								
Off-Highway Truck	2	3	3	3	2,926.0	2,963.1	2,483.3	2,209.2
Yard Truck	0	3	3	3	0	270.9	353.0	344.5
TOTAL	2	4	4	4	2,926.0	3,234.0	2,836.3	2,553.7
CARGO HANDLING EQUIPMENT TOTAL	143	158	160	173	253,386.5	267,800.2	282,132.2	299,138.5

PEIT SUMMARY

- Provides convenient, desktop tool based on MS Office Access and Excel
- Ensures consistency among ports and consistency with US EPA as well as recognized international methodologies (IMO)
- Tracks emissions and energy use over time
- Allows port authorities to assist their tenants with
    - emission reduction projects,
    - funding applications,
    - terminal development/expansion planning
- Facilitates planning decisions (ex. electrification, alternative fuels, logistics)
- Serves environmental reporting (ex. NWPCAS) and broader programs (ex. Green Marine)

PEIT v4.0 was released to Green Marine participants at GreenTech 2017. Available cost-free to Green Marine Participants, thanks to Transport Canada.

ANNUAL CONFERENCE

– Save the Date –
GREENTECH 2019

CLE

The Westin Cleveland Downtown
JUNE 5-7, 2019

CLEVELAND, OHIO

2008	➡	**Montreal**
2009	➡	**Toronto**
2010	➡	**Montreal**
2011	➡	**Chicago**
2012	➡	**Quebec City**
2013	➡	**Vancouver**
2014	➡	**Saint-John**
2015	➡	**Seattle**
2016	➡	**Quebec City**
2017	➡	**Fort Lauderdale**
2018	➡	**Vancouver, B.C.**

GreenTech 2019:

Cleveland, Ohio

June 5 – 7, 2019

GREEN MARINE

STAY IN TOUCH

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