Welcome to the
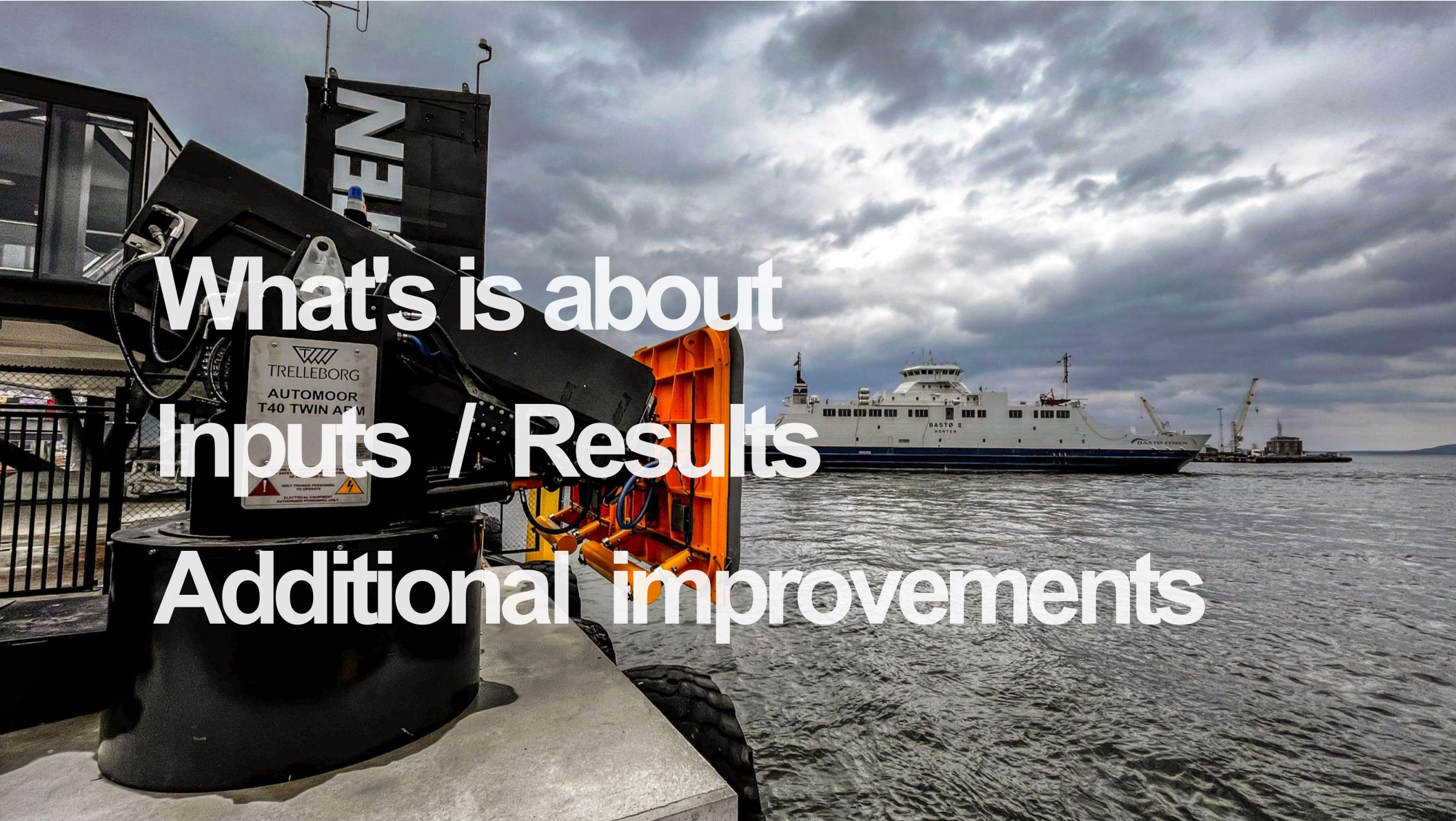# World of Trelleborg

Automation, Technology and digital advancements to drive Decarbonisation.

3RD PIANC APAC CONFERENCE

TRELLEBORG

What's is about
Inputs / Results
Additional improvements

What's the paper demonstrate

Remarkable reduction in CO2 and Tug fuel consumption through the application of AutoMoor

Using tugs less

	No Vacuum mooring	Vacuum mooring
Mooring time	35 mins	2 mins (Figure 1)
Sailing time	15 mins	1 mins (Figure 2)
Total	50 mins	3 mins
Per year @ 600 ships	500 Hours	30 Hours
Tug Fuel @ 600 ships	124,500ltrs	7,500ltrs
CO_2	333.66 tonnes	20.1 tonnes
CO_2 AND FUEL REDUCTIONS	94% less fuel Consumed 94% CO_2 reduction	

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Paper Key Inputs

Defining accurate Tug fuel consumption

Operations / timings

Vacuum mooring power consumption

11 Berths

600 ships per year

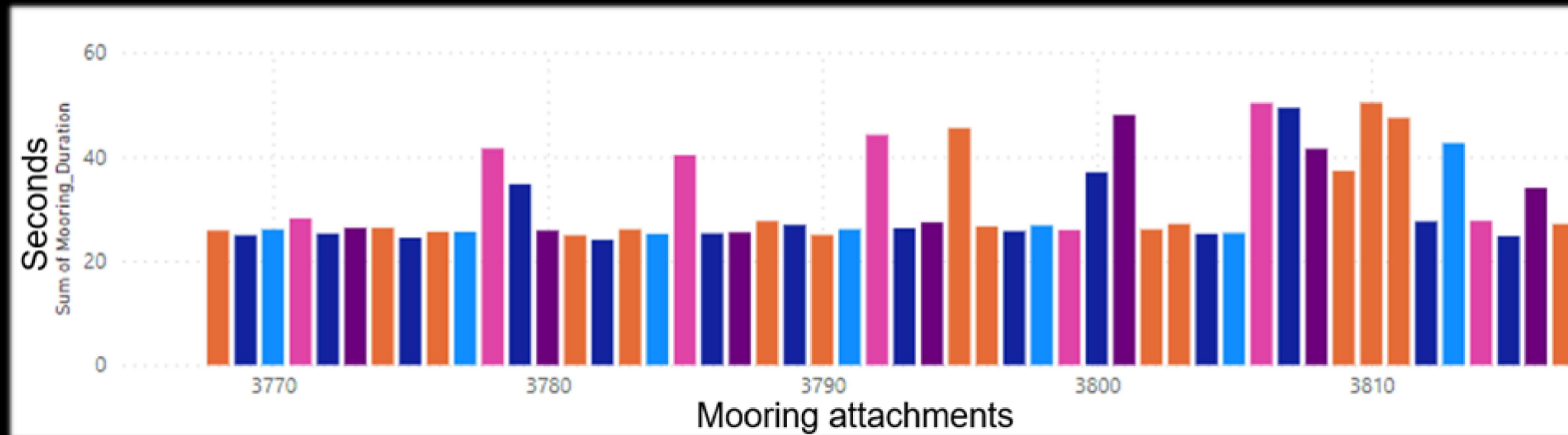2 Tugs per ship

8 Vacuum units per berth

Typical timings with lines (for this port)

- 35 mins for a tie up / arrival

- 15 mins for a let go / departure
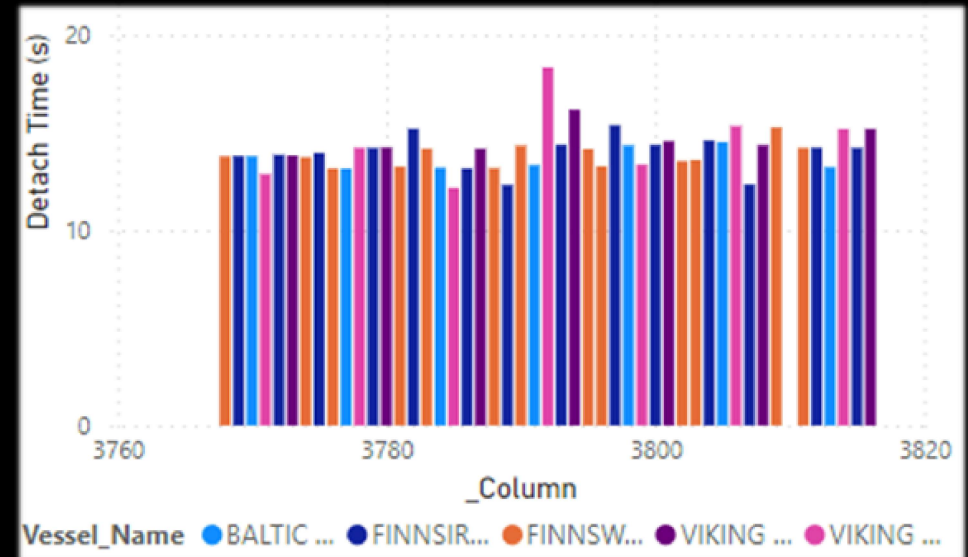
- These were averages observed by myself over 12 months

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AutoMoor mooring times

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AutoMoor detach times

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Fuel consumption based on a pair of Niigata 6L25HX engines

- Total fuel burn for a pair of Niigata 6L25HX at 130 shaft revolutions (¼ power) comes out at ~ 124.5LPH

- 2 Tugs @ 124.5LPH = 249LPH

- 500hours = 124,500Ltrs

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The adjustment of mooring times vs Tug fuel consumption

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AutoMoor energy consumption

CO2 produced from AutoMoor's energy consumption

AutoMoor CO_2 calculation

1 machine per vessel calculated at 400VAC.

Berthing	0.51	KWh
72 hours at berth	10.512	KWh
Departure	0.07	KWh
Total per vessel	11.092	KWh

DEVICE	Rating	Unit	Volts (V)
M61 Electric Drive (sway adjustment)	7.50	kW	400.00
M02 Vacuum Pump	4.00	kW	400.00
M60 HPU Motor (vertical adjustment)	4.00	kW	400.00
Control System	0.24	kW	230.00
Local Control Panel Heating Circuit	0.40	kW	230.00
External Heating Circuits	0.15	kW	230.00
Socket Outlet		kW	230.00
Total IFL (A)	16.3		

Machine Loads during operation states

| DEVICE	Rating	Unit	Volts (V)
Prep for berthing			
M61 Electric Drive (sway adjustment)	7.50	kW	400.00
M60 HPU Motor (vertical adjustment)	4.00	kW	400.00
M02 Vacuum Pump	4.00	kW	400.00
Control System	0.24	kW	230.00
Local Control Panel Heating Circuit	0.40	kW	230.00
External Heating Circuits	0.15	kW	230.00

11.092KWh x **8 units** = 88.736

600 Ships per year

AutoMoor uses 53,241KWh

- AutoMoor uses 53,241KWh

- CO_2 emissions are determined by multiplying energy consumed by carbon intensity of 503.18g CO_2 per kWh [1]

- (53,241 x 503.18g / 1000 = 26,789kg)

- CO2 per year = 26.789 Tonnes
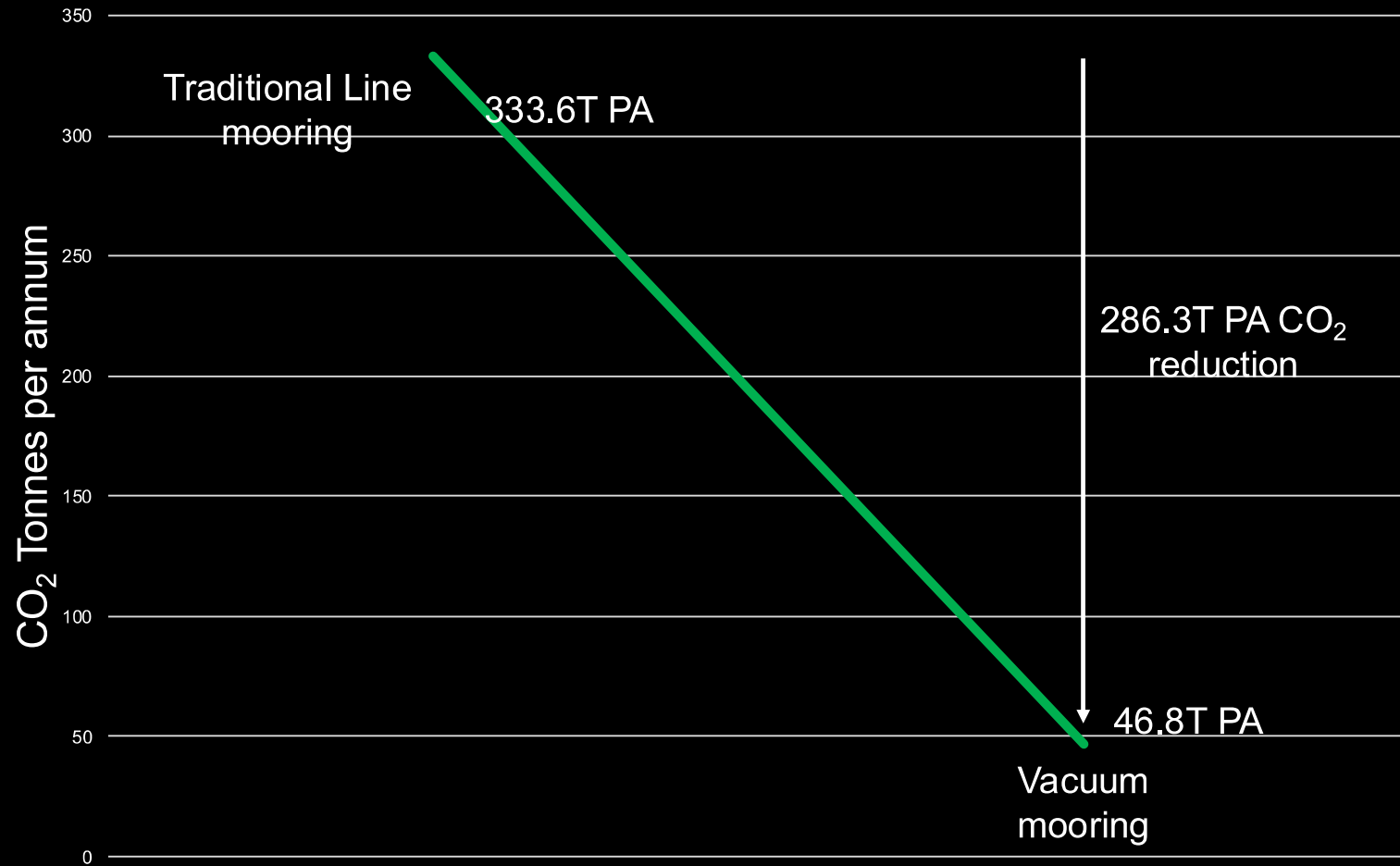
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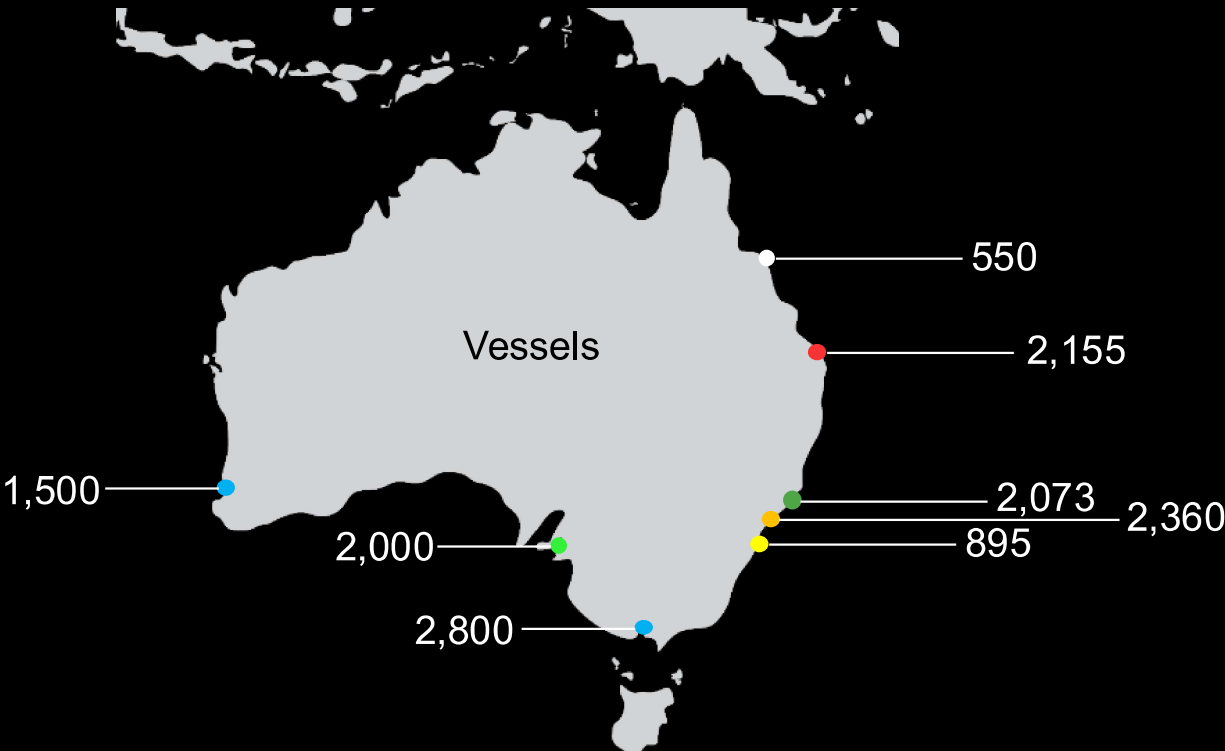117,000ltrs Diesel

313 Tonnes CO2
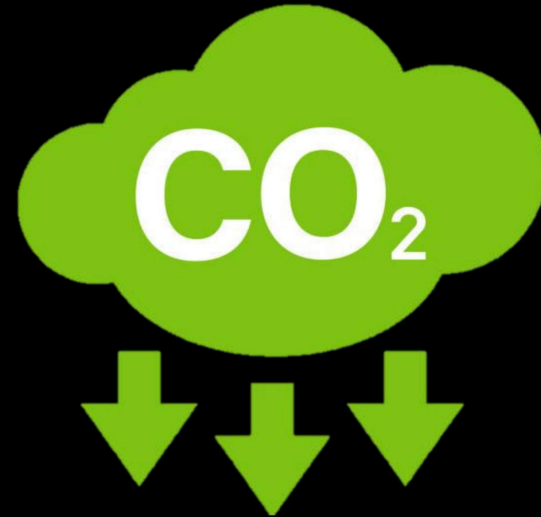
26.7 Tonnes CO2

CO$_2$

286.3T PA

CO$_2$ = 2.68 (Average) x Litre of MDO consumed

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CO_2 reduction as a result of reduced tug fuel consumption

CO₂ Tonnes per annum (y-axis: 0, 50, 100, 150, 200, 250, 300, 350)

Traditional Line mooring — 333.6T PA

286.3T PA CO_2 reduction

46.8T PA

Vacuum mooring

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If we scale it nationally, the reduction is impressive

Vessels

550

2,155

1,500

2,073

2,360

2,000

895

2,800

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How it looks scaled nationally

2,000 vessels   895 vessels   2,360 vessels   2,122 vessels

1,500 vessels   2,073 vessels

2,800 vessels   550 vessels
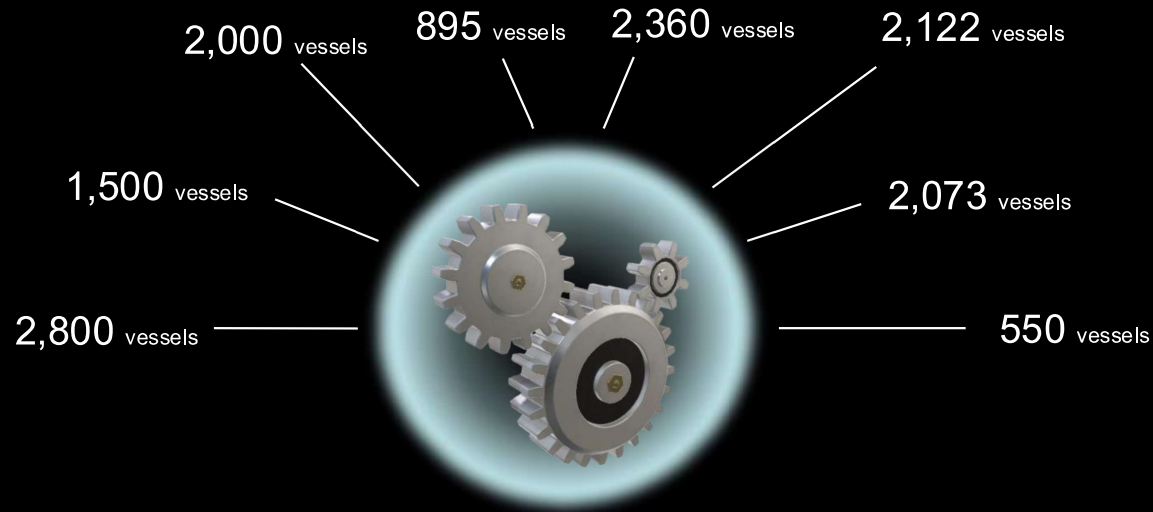
Reduction of **2,789,215** litres of Diesel

7,475 Tonnes of CO^2

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If we scale it globally, the reduction is staggering

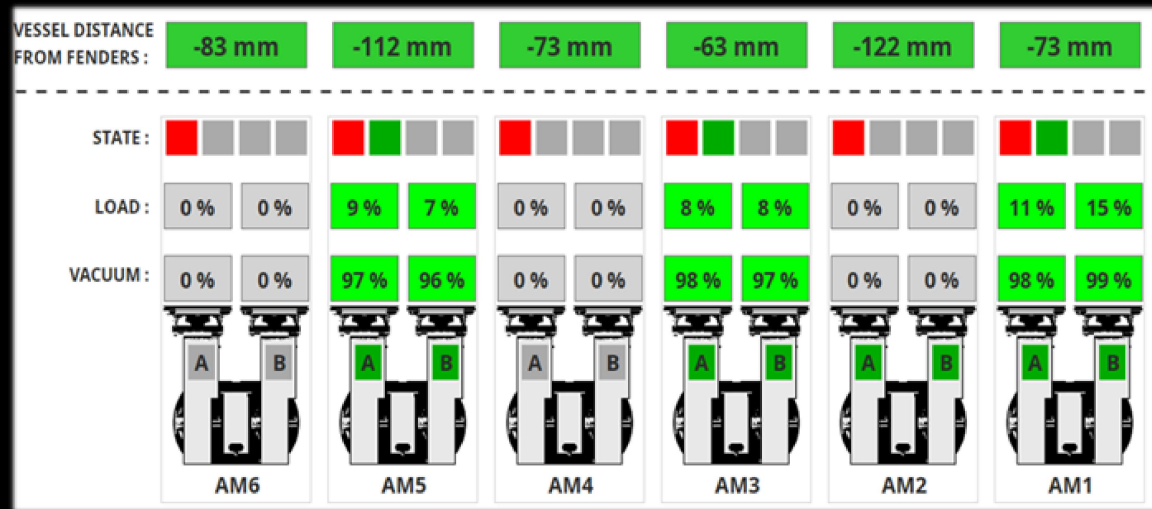**Autonomy, sail when permission to proceed is given**

TRELLEBORG

Offers newfound independence from shore-based mooring crews

Minimizing waiting times for tugs, reducing emissions generated by idling machinery

Aids in adhering to sailing schedules

Calibrated to the conditions

It operates at optimal levels without exerting undue pressure

References
[1] Carbon intensity
www.cencepower.com/calculators/kwh-to-co2-calculator

[2] CO_2 produced per litre of Diesel consumed in an ICE [2]
https://www.econology.info/Emissions-co2-liter-fuel-gasoline-or-diesel-gpl/

Relevant UN SDGs *https://sdgs.un.org/goals*)
9, 13, 14

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www.trelleborg.com