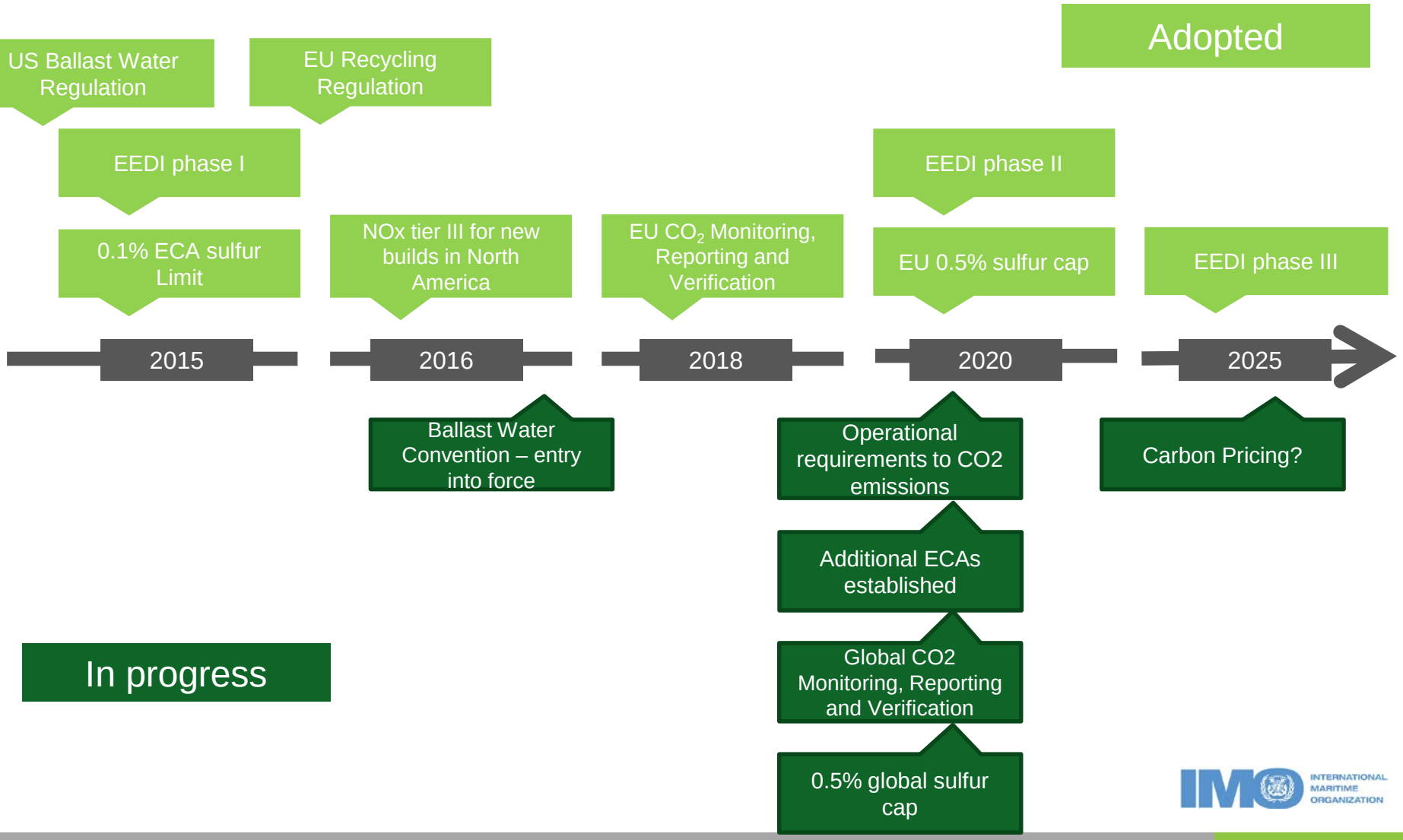
Polarcus Limited

Monitoring and Reporting Airborne Emissions

17 February 2017

Drew St. Peter, Arctic & Sustainability Manager

Current and future maritime regulation

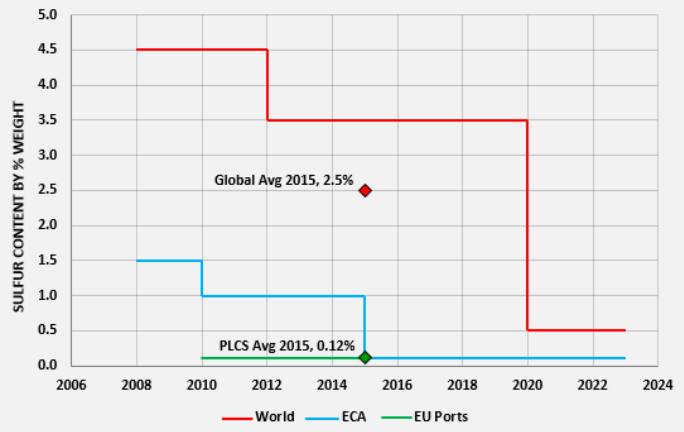


Sulfur emissions requirements are tightening

IMO: Global Sulfur	IMO: ECA Sulfur	EU: Sulfur Directive
2020 / 2025*; Sulfur < 0.5%	2010; Sulfur < 1.0%	2020*; Sulfur < 0.5%
* Date TBC pending review. Discussion commences in Oct 2016	2015; Sulfur < 0.1%	* All EU waters; EEZ

Emission Control Areas

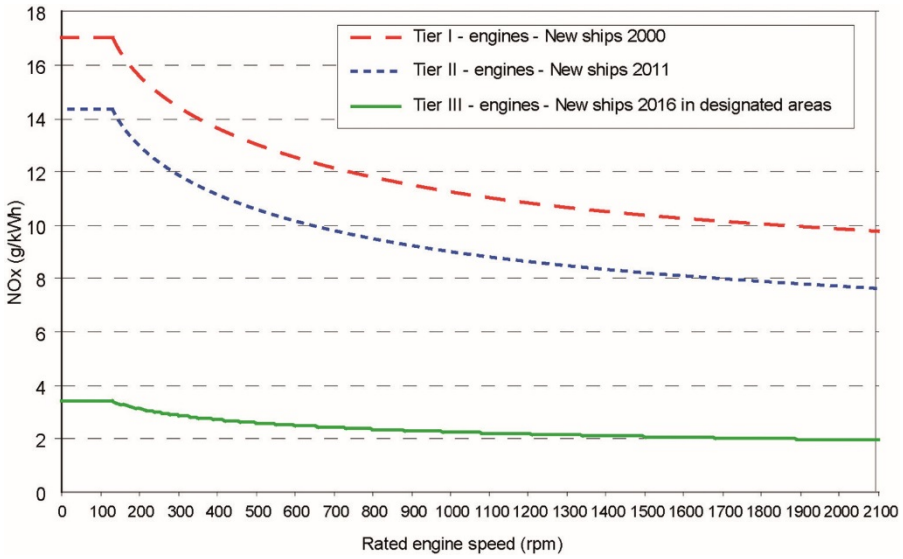
IMO Sulfur Content 2008 - 2020



NOx Emission Control Areas (NECA)

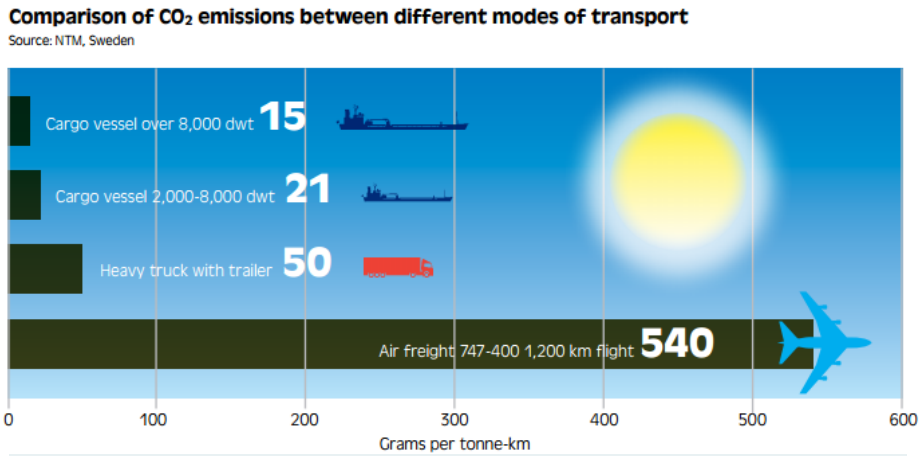
NOx	NECA Baltic	NECA North Sea
2011; NOx Tier 2, -20%	Unofficial EU consensus on application has been reached	Consultations ongoing. Likely joint application with Baltic NECA
2016; NOx Tier 3, -80%*	Application date TBC but likely same time as North Sea	Application date TBC but possible in 2016 / 2017
* New builds only in existing N American / U.S. Caribbean NECA.		

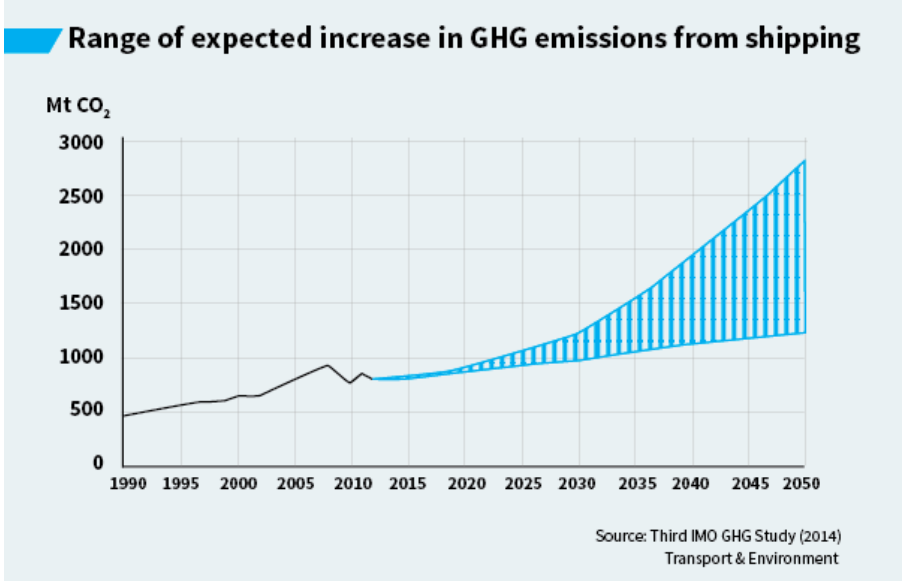
IMO NOX Emissions Limits



North American NECA

Marine shipping and carbon dioxide





Carbon dioxide emissions from shipping account for ~3% of the global total.

Current projections call for up to 250% increase in marine shipping CO_2 emissions by 2050.

This represents >14% of global CO_2 emissions. The shipping industry will be among the top 5 largest emitters if compared to world nations.

CO^2 emissions

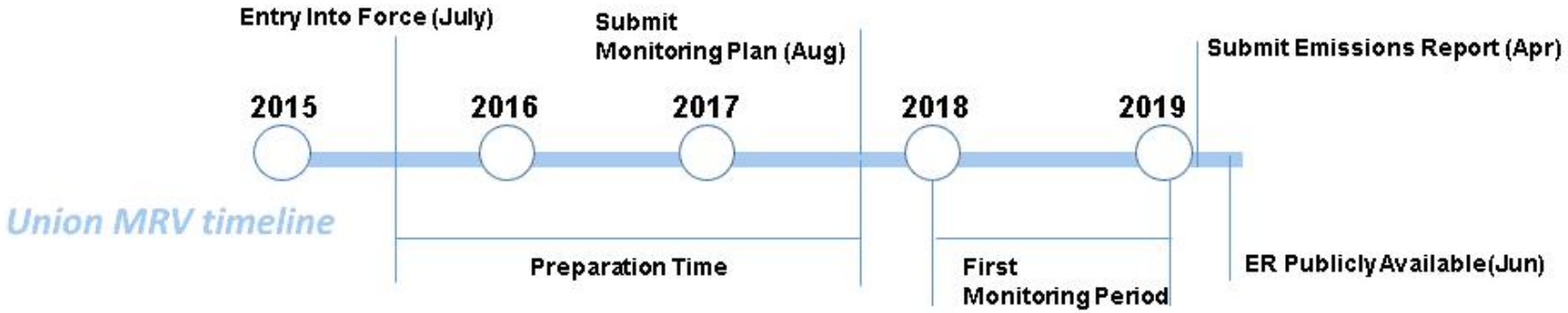
European Union CO^2 Monitoring, Reporting and Verification (MRV)

- Applicable to all vessels > 5,000 GT (all flags)
- Annual report of CO^2 emission on voyages to, from and between EU ports

- Timeline:
  - Entered into force July 2015
  - Monitoring plans to be submitted by August 2017
  - Monitoring effective from 01 January 2018

- Efficiency data, e.g. CO^2 emissions per unit work (EEOI) also to be reported

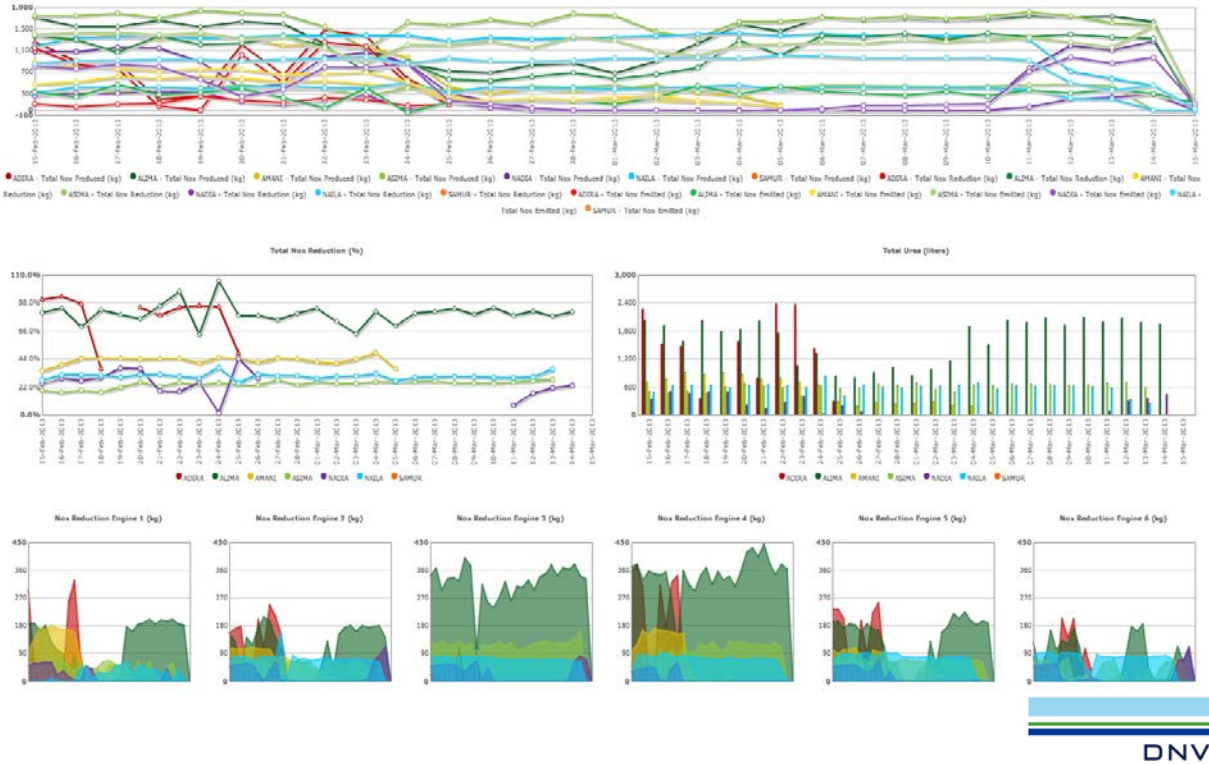
- Viewed as a step towards global CO2 monitoring, reporting, verification (MRV) and real emissions reductions for shipping



Polarcus DNV GL certified emissions tool

- **Engine Data**
  - Engine Data Summary
  - Energy Production
  - Engine Utilization
  - Power Plant Efficiency
  - Nox and Urea
- **Fuel Data**
  - Fuel Consumption
  - Fuel Log
  - Urea Log
- **Compressor Data**
  - Compressor Load
  - Compressor Load per sail Km
  - Compressor Load per Production Sequence
- **Propulsion Data**
  - Propulsion Load
  - Propulsion Load per Production Sequence

- **Emissions Sales Model**
- **Emissions Operations**
- **Support Vessel Data**
- **EEOI**
- **Dashboard**



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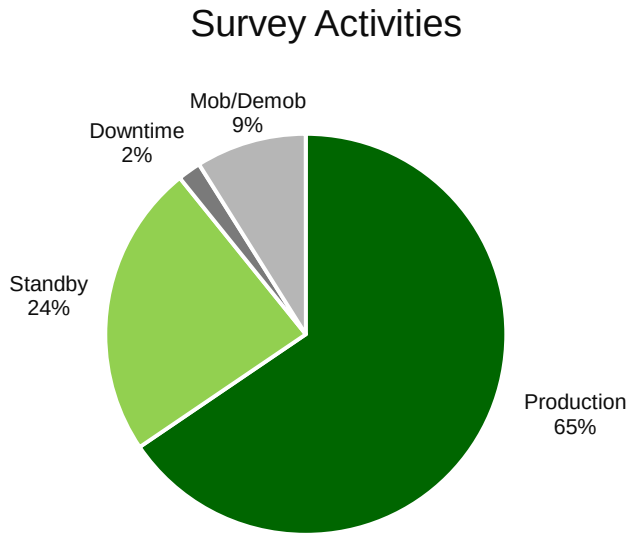
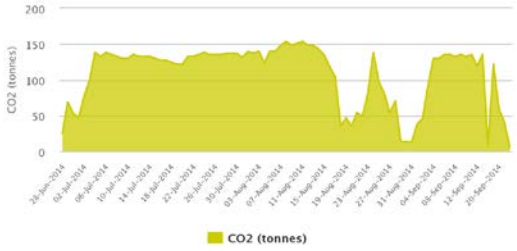
Certified emissions reporting



CO2 Emissions



SOx Emissions

EMISSIONS CERTIFICATE

POLARCUS AMANI

Client:	Polarcus	Start Date:	28-Jun-2014
Country:	Ireland	End Date:	22-Sep-2014
Region:	Europe, Africa, Middle East	Survey Size:	4,929
Streamer Config:	10 x 150 x 8100	Survey Duration:	81.1

Emissions Totals		Emissions per sq.km	
Raw NOx Emitted (t)	97.65	NOx Emitted (kg/sq.km)	11.82
NOx Reduction (t)	39.40	SOx Emitted (kg/sq.km)	0.68
Actual NOx Emitted (t)	58.25	CO2 Emitted (t/sq.km)	1.82
Actual NOx Emitted (g/kWh)	4.45		
SOx Emitted (t)	3.35	Vessel Consumption	
SOx % Reduction vs. IMO ECA	94	Fuel (MT)	2,815
SOx % Reduction vs. Non IMO ECA	98	Urea (t)	58
CO2 Emitted (t)	8,966		
		EEOI Seismic Acquisition	
		EEOI Target	6.43
		EEOI Value	2.04

Vessel manager

DNV·GL

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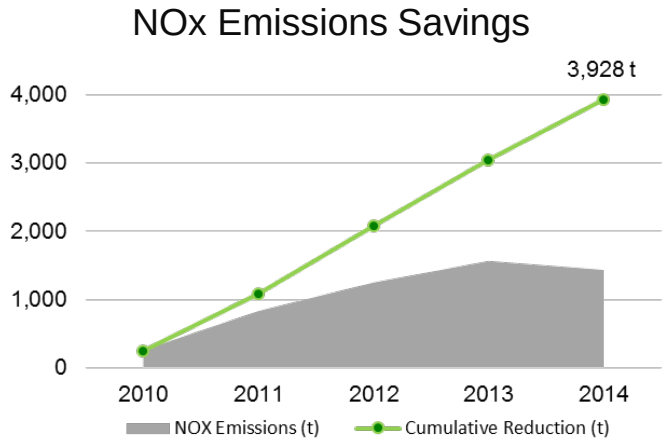
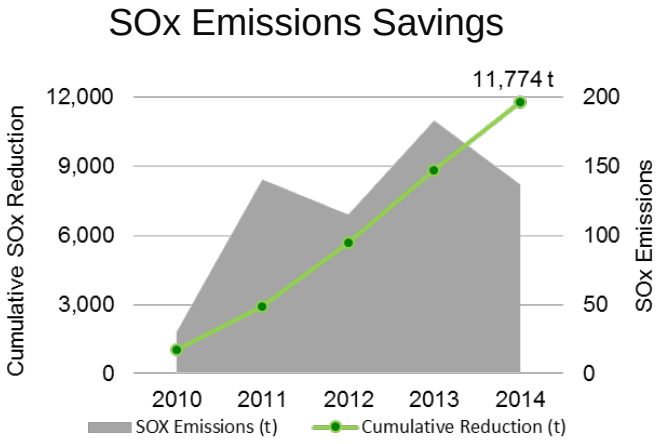
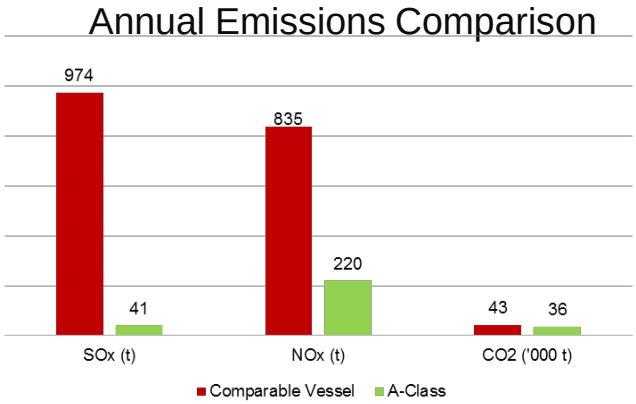
Verified emissions reductions







Fleet Annual Emissions

Emission	2013	2014	% Change
CO_2 (‘000t)	214	193	- 10%
NOx (t)	1,552	1,393	- 10%
SOx (t)	182	135	- 26%

Mitigating emissions begins with accurate measuring and reporting

Being Polarcus

Responsibility - Innovation - Excellence