LNG w żegludze bałtyckiej

New international legislation on marine engine emissions 2011-2025

GDYNIA; 2011.09.30

MANAGING RISK DNV

Air emissions

Ships emit an array of pollutants to air

Pollutant	Shipping's share of global emissions
CO_2 - Carbon dioxide	2-3% - 1 bln ton/year
NO_X - Nitrogenous oxides	10-15%
SO_X - Sulphur Oxides	4-9%
VOC - Volatile Organic Compounds	
Particulates (PM)	
Other components	

Effects on:

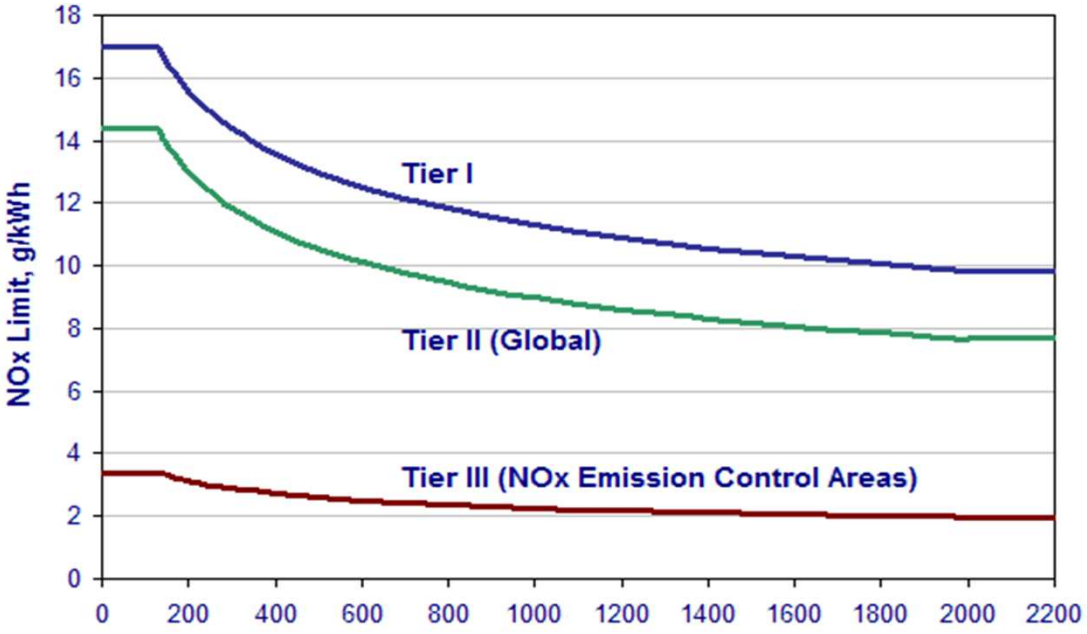
- Health
- Environment
- Climate

BUT shipping is transporting 85% of the world goods

MARPOL Annex VI - NO_X Emission Limits

Tier	Year	NO_X limit [g/kWh]		
		n < 130 rpm	130 ≤ n < 2000	n ≥ 2000 rpm
Tier I	2000	17.0	$45 \times n^{-0.2}$	9.8
Tier II	2011	14.4	$44 \times n^{-0.23}$	7.7
Tier III	2016[a]	3.4	$9 \times n^{-0.2}$	1.96

[a] In NO_X Emission Control Areas (Tier II standards apply outside ECAs).



Tier I (global):
become applicable to existing engines installed on ships built between1990.01.01 to 1999.12.31, with a displacement ≥ 90 litres per cylinder and rated output ≥ 5000 kW (subject to availability of approved engine upgrade kit, some makers non existing today …)

Tier II (global):
Could be met by engine modification packages (EMP) or low NO_X engines for new engines

Tier III (NOx ECAs):
Need additional post treatment (e.g. SCR-Selective Catalytic Reduction)

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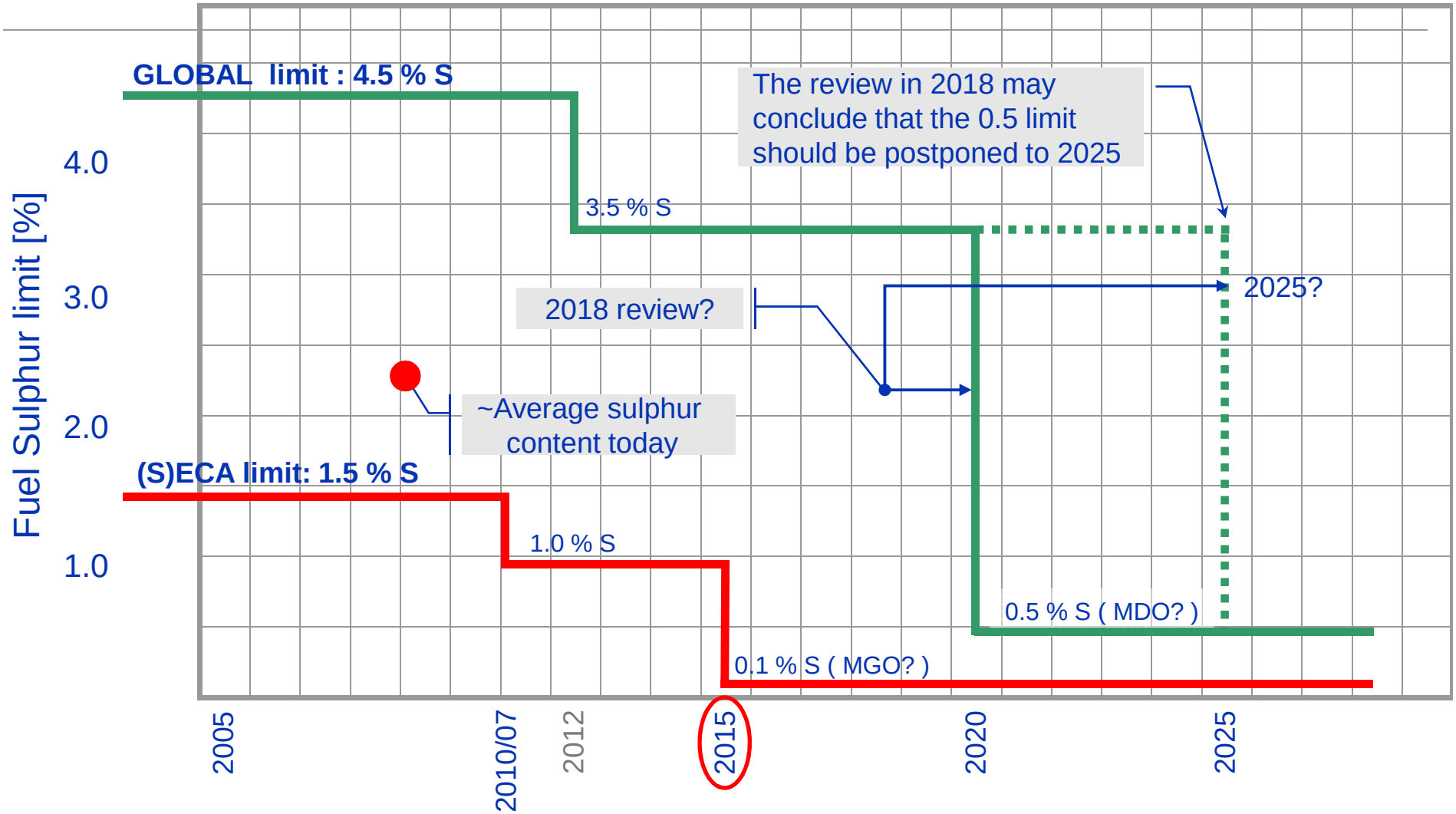
IMO/MARPOL Annex VI SOx Emission Limits



Note: No upper sulphur limit in fuel with use of abatement measure so far …**Abatement technology (eg Scrubbers) is regarded as "equivalent measure".** (some SECA/port states may fight this)

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What can ship owners do to comply?

Existing fleets	
Requirement 2010: SOx < 1,0% 2015: SOx < 0,1%	Compliance option • HFO + scrubber • Distillate fuels • LNG

Newbuilds (not legally approved for SECA)	
Requirement 2011: NOx Tier 2 2016: NOx Tier 3	Compliance option • Scrubber + SCR • LNG

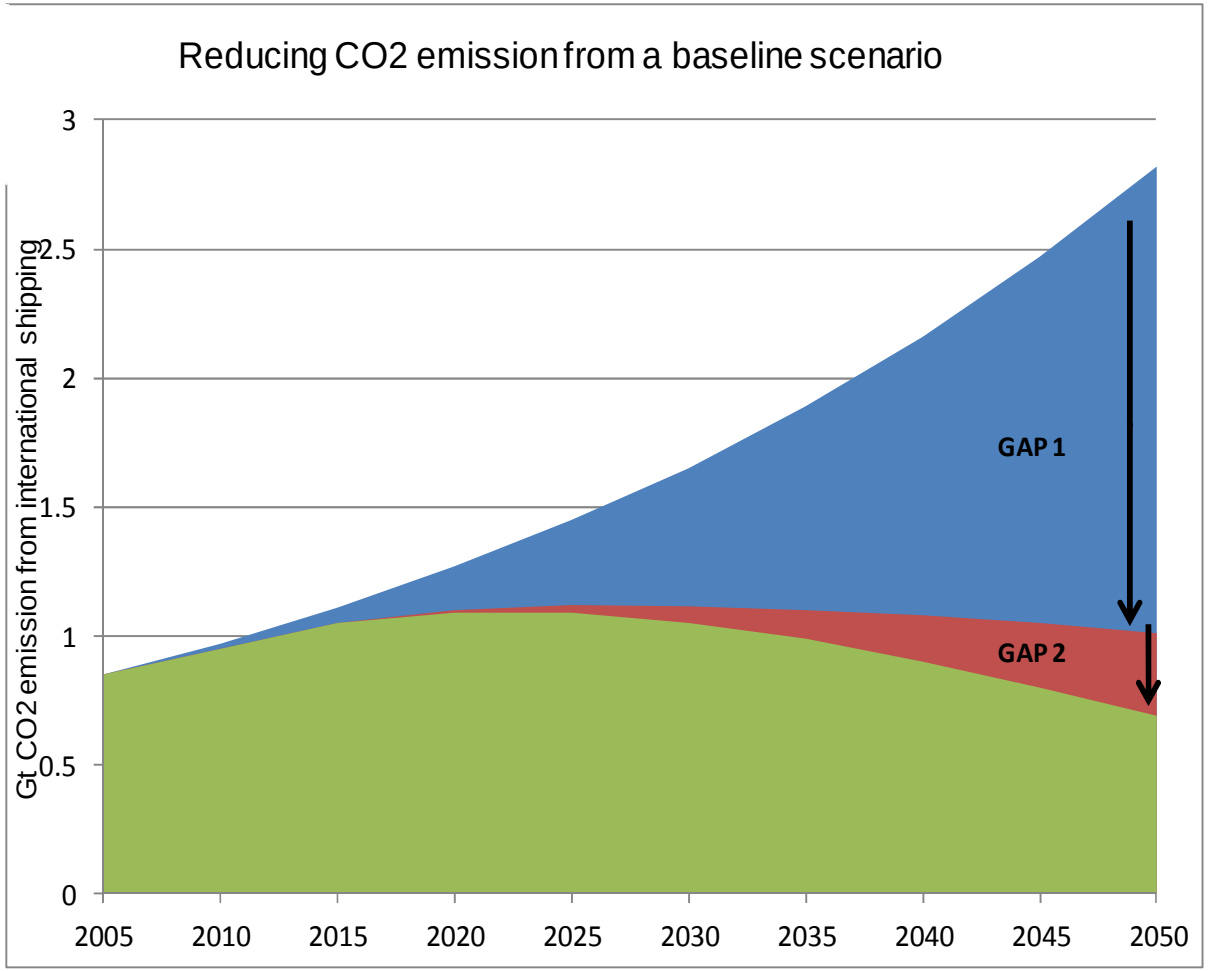
Political bodies shape global efforts to reduce shipping GHG

- **UNFCCC**. Arena for international climate negotiations. Considers shipping key source of climate change mitigation and adaptation **funding**

- **IMO**. Working to reach **industry wide, global agreements** reducing the amount of CO2 emissions from international shipping.

- **EU**. Proposes to cut shipping CO2 by **40% by 2050** when compared with 2005 levels. Working on regional regulations.

Long term global emission scenarios for shipping



GAP 1: Already known technical, operational and structural means

GAP 2: Break-through technologies needed beyond 2020

Emission **doubling or trebling by 2050** - likely consequence when business as usual scenario

The growth in trade will more than offset what all known measures can achieve, even with a doubling in efficiency.

How will this play out with policymakers requiring e.g. reductions to 40% of 2005 levels?

New requirements to energy efficiency from 2013 - MEPC

- The EEDI (Energy Efficiency Design Index) requirements will apply to **new ships above 400 GT**:
  - for which the **building contract** is placed on or after **1 January 2013**; or
  - **in the absence of a building contract**, the keel of which is laid or which is at a similar stage of construction on or after **1 July 2013**; or
  - the **delivery** of which is on or after **1 July 2015**
- **Attained EEDI** to be calculated for all ship types defined in regulation, compliance with **required EEDI** mandatory for a subset (reference curves)
- A **SEEMP** will have to be present onboard all vessels at the first IAPP certificate renewal or intermediate survey after **1 January 2013**, when an International Energy Efficiency Certificate will be issued.

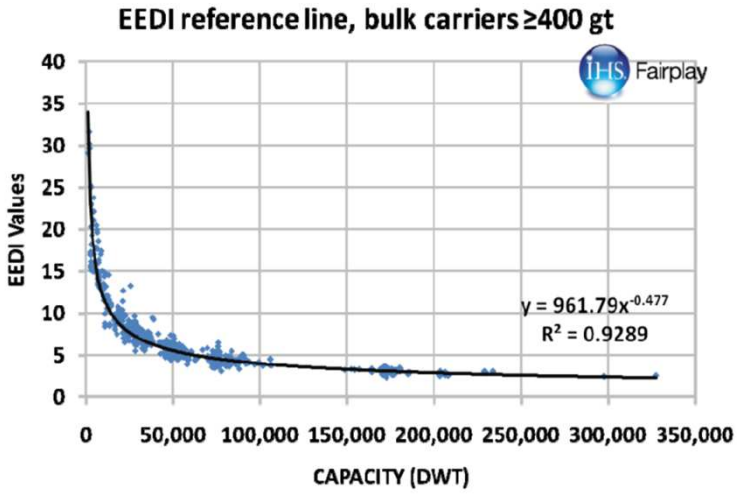
The EEDI - what is it?

- Clear parallel to the **mileage standard** in the automotive industry, but taking the **"benefit to society"** (i.e. transport capacity) into account;

$$\text{Attained design } CO_2 \text{ index} = \frac{\text{Environmental cost}}{\text{Benefit for society}}$$

- The index is defined as:
  grams CO_2 / capacity * nautical mile

- "Attained Index" for specific ships to be calculated per ship on design data, and to be less than "Required Index".



Ship types covered by EEDI requirements

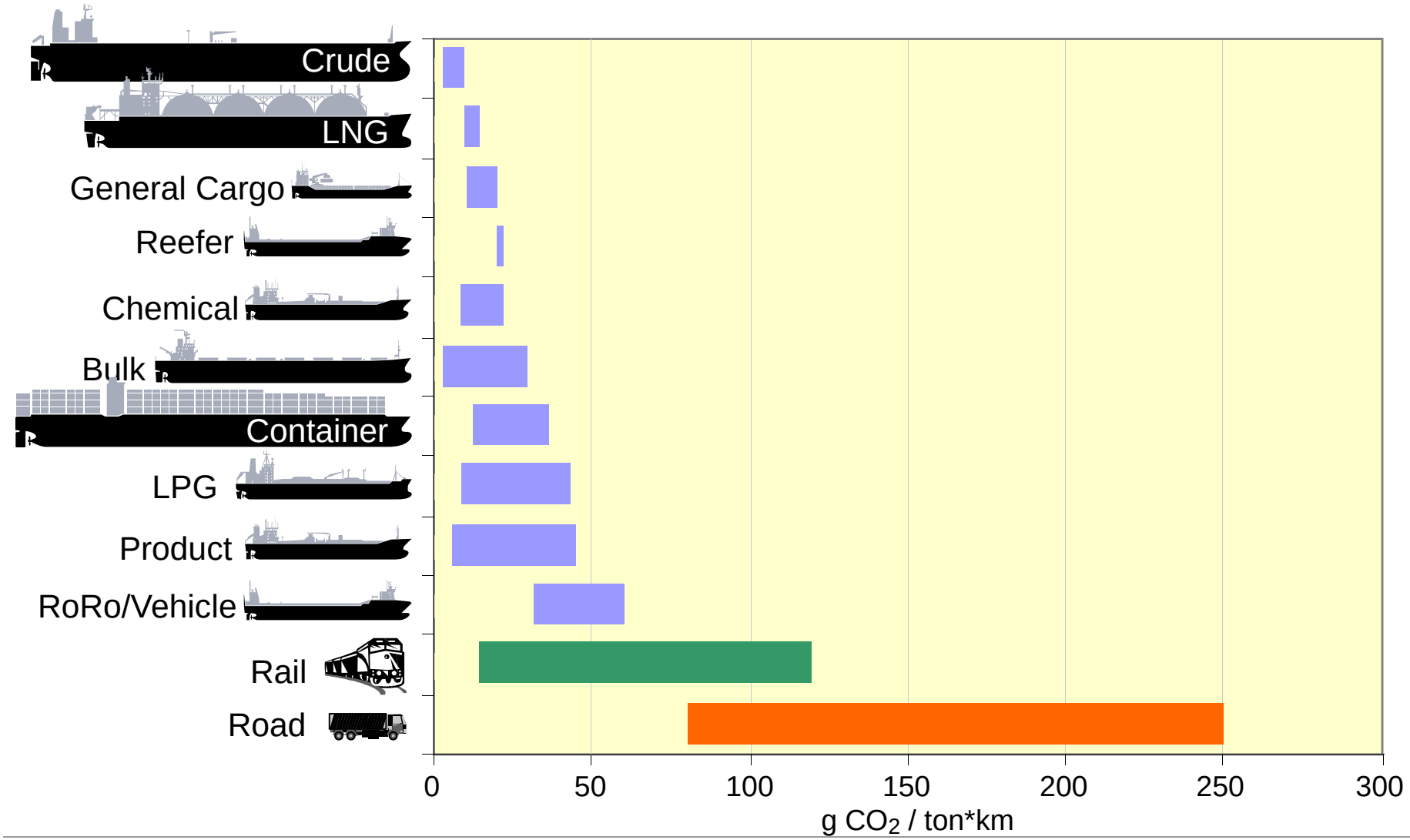
Reduction factors (in percentage) for the EEDI relative to the reference line for each ship type.

	Size	Phase 0 1 Jan 2013 – 31 Dec 2014	Phase 1 1 Jan 2015 – 31 Dec 2019	Phase 2 1 Jan 2020 – 31 Dec 2024	Phase 3 1 Jan 2025 onwards
Bulk Carriers	>20,000 Dwt	0%	10%	20%	30%
	10-20,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Gas tankers	>10,000 Dwt	0%	10%	20%	30%
	2-10,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Tanker and combination carriers	>20,000 Dwt	0%	10%	20%	30%
	4-20,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Container ships	>15,000 Dwt	0%	10%	20%	30%
	10-15,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
General Cargo ships	>15,000 Dwt	0%	10%	15%	30%
	3-15,000 Dwt	n/a	0-10%*	0-15%*	0-30%*
Refrigerated cargo carriers	>5,000 Dwt	0%	10%	15%	30%
	3-5,000 Dwt	n/a	0-10%*	0-15%*	0-30%*

* The reduction factor is to be linearly interpolated between the two values depending on the vessel size. The lower value of the reduction factor is to be applied to the smaller ship size.

- Roro and passenger vessels to be included once methods and reference lines are ready, indicated adoption in 2014
- Ships with diesel-electric, turbine or hybrid propulsion system will not be included before calculation methods are developed
- IMO review in 2015 based on technological developments; may adjust dates and rates
- The reduction factor for small ships will be reviewed in 2013

Typical CO2 efficiencies today

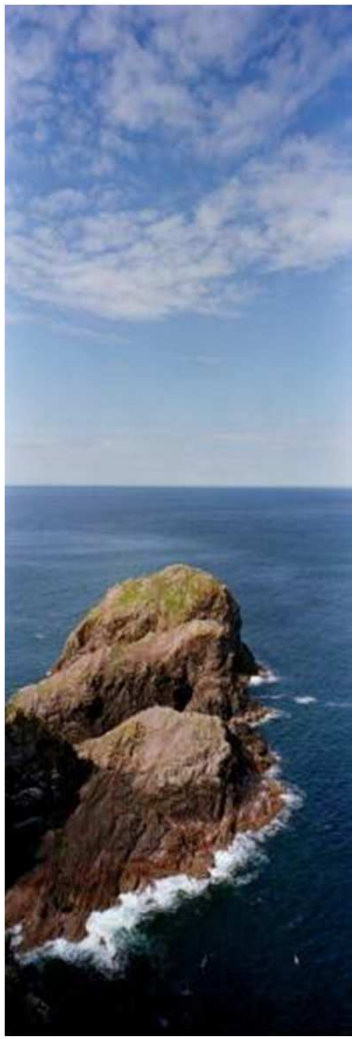


Source; IMO Study on Greenhouse Gas Emissions from Ships, Phase 2, 2009

Regulations aside, what can shipping actually do?

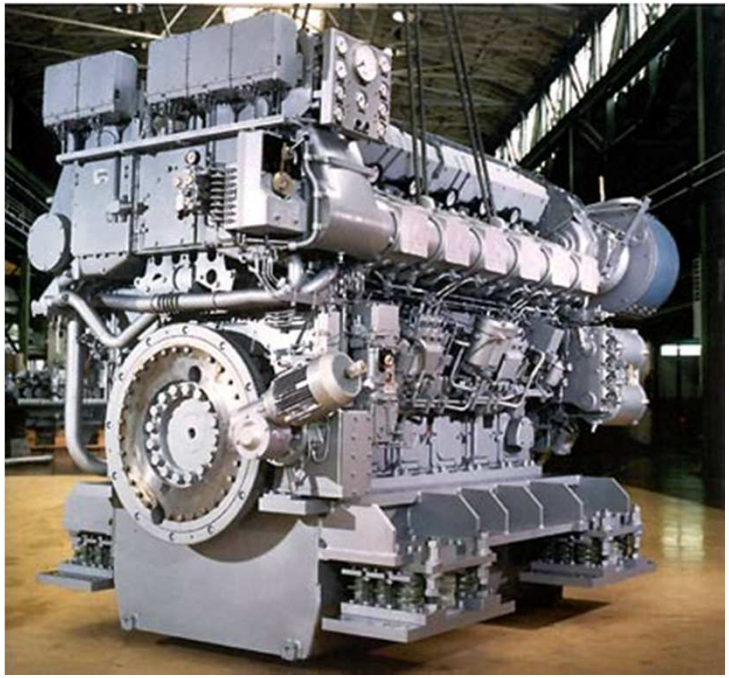
- **More efficient operations**, e.g. weather routing, control of energy consumers onboard, speed optimising and trim
- The introduction of **more efficient technology** – both for ships in operation and for newbuildings
- **Fuel shift** from residual fuel oils, marine gasoil and diesel oil to use of natural gas; possibly other green fuels. Change from oil fuels to LNG may result in 25% reduction of CO2 emission
- **Improved infrastructure**, including port turn-around times, port capacity / -logistics and size of ships
- **Improved cooperation** between players including

It's not just technology, it's also about people and their organisations



Technical – power plant and consumers examples

- More flexible use of main engines, plant optimisation
- Electronically controlled main engines
- Waste heat recovery plants
- Assisting sails and/or kites
- Miscellaneous technologies to improve minor energy consumers
  - Air conditioning
  - Lighting
  - Pumps
  - Boilers
  - Pipe insulation
  - Deck paint
- Alternative fuels, e.g. LNG



The shipping industry can't wait

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- Shipping has to act now on CO_2 emissions – no choice
- If we don't act, regulators outside shipping will set the shipping scene

But

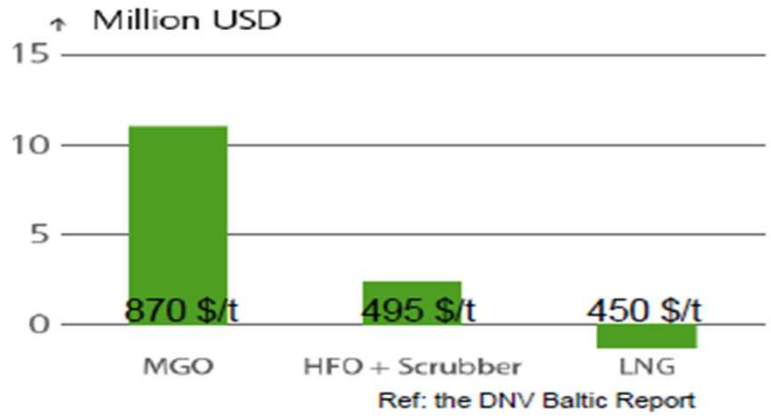
- The world fleet is growing fast. So are the CO_2 emission from shipping
- All industries have to reduce emissions in a post-Kyoto agreement
- However - shipping is more energy efficient than other forms of transport
- More cargo can be moved from air, trucks and rail to ships
- More shipping is part of the solution

LNG fuel – long term benefits

Small cargo ship: substantial savings over 20 years

- **Small cargo ship on LNG fuel:**
  - $12 million lower than MGO
  - $4 million lower than HFO with scrubber
- **An OSV compared to the cargo ship:**
  - 2-4 times higher fuel consumption
  - Only about 50 % higher LNG investment costs

Present value of costs over
20 years relative to conventional fuel



Ref: the DNV Baltic Report

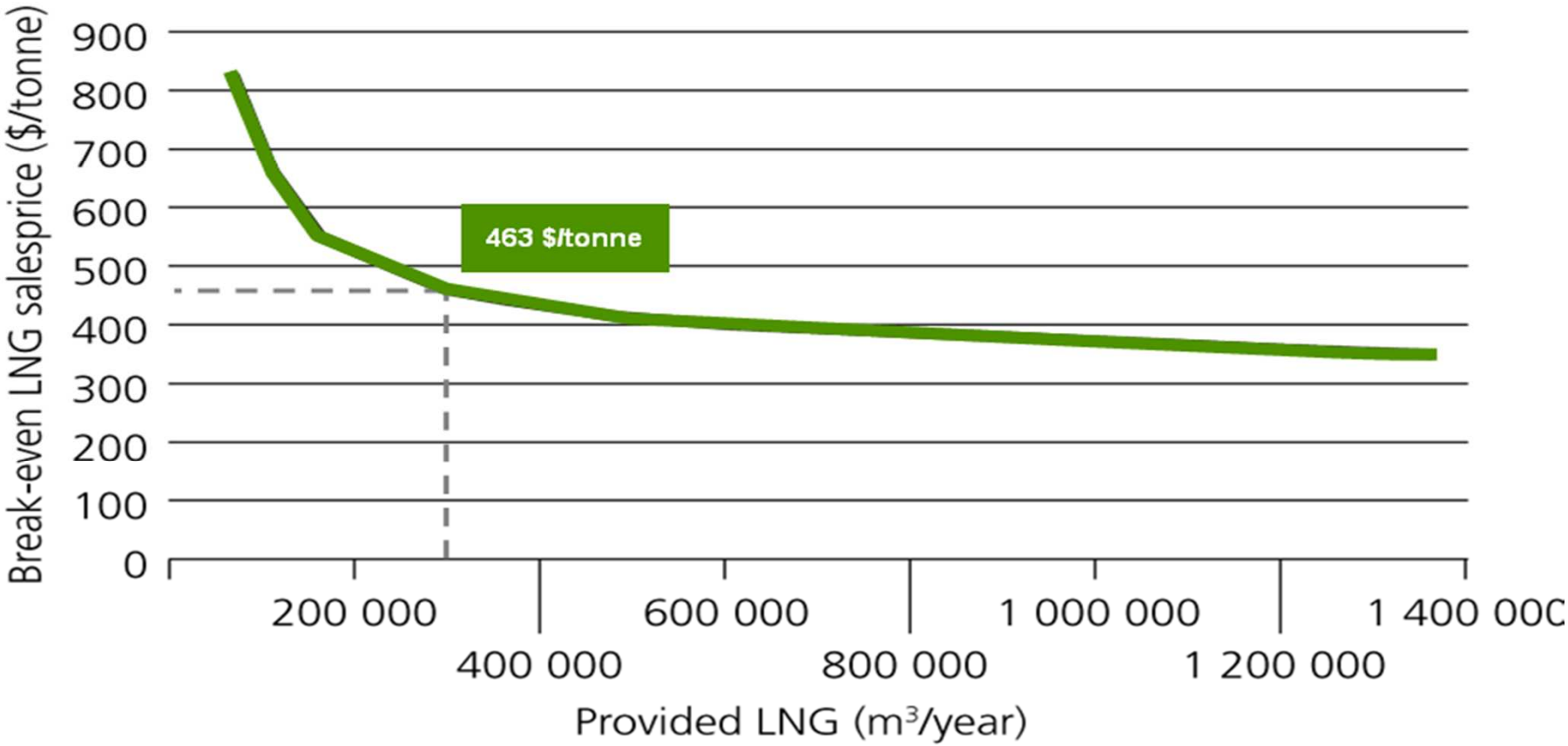
LNG price at $450 per tonne is realistic with large scale LNG distribution through the global LNG market

An OSV would have significantly higher benefits than the cargo ship by using LNG fuel

Among the three choices LNG has the lowest life cycle costs for ECA operation

LNG price

Volume is main driver behind low price



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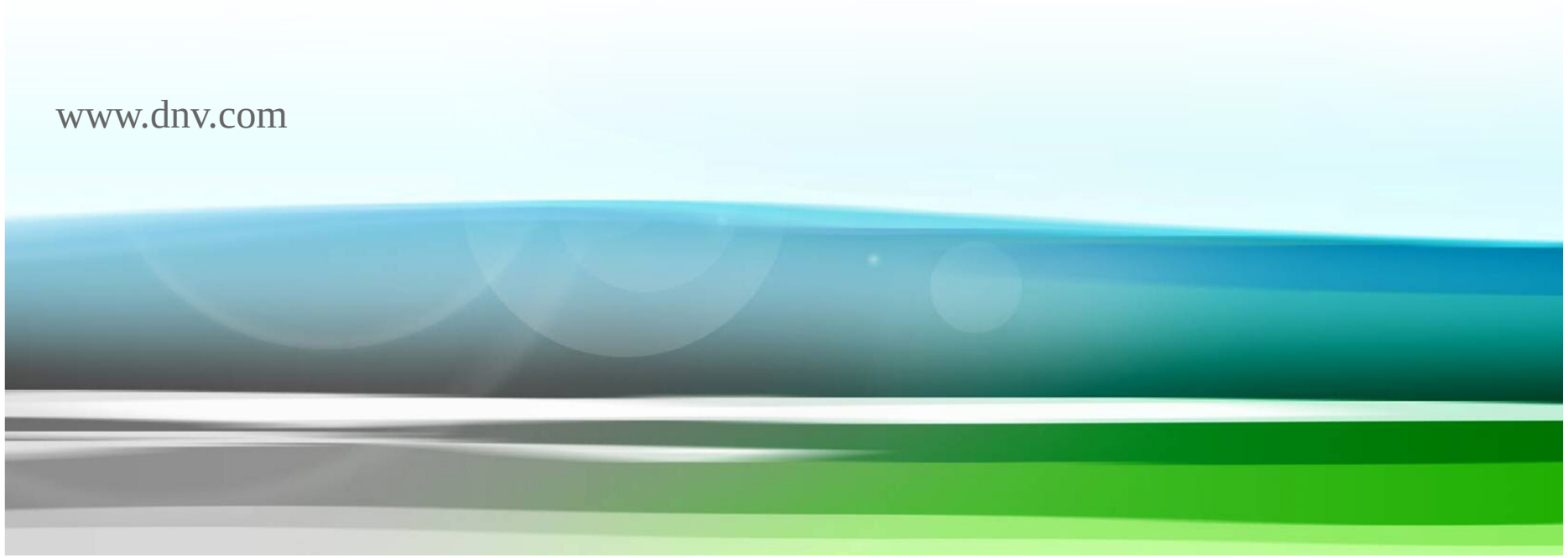

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