

# **Investing/Living under a carbon cloud**

**How oil companies can motivate a reduction in fuel consumption /CO2 emission from the tankers they charter?**

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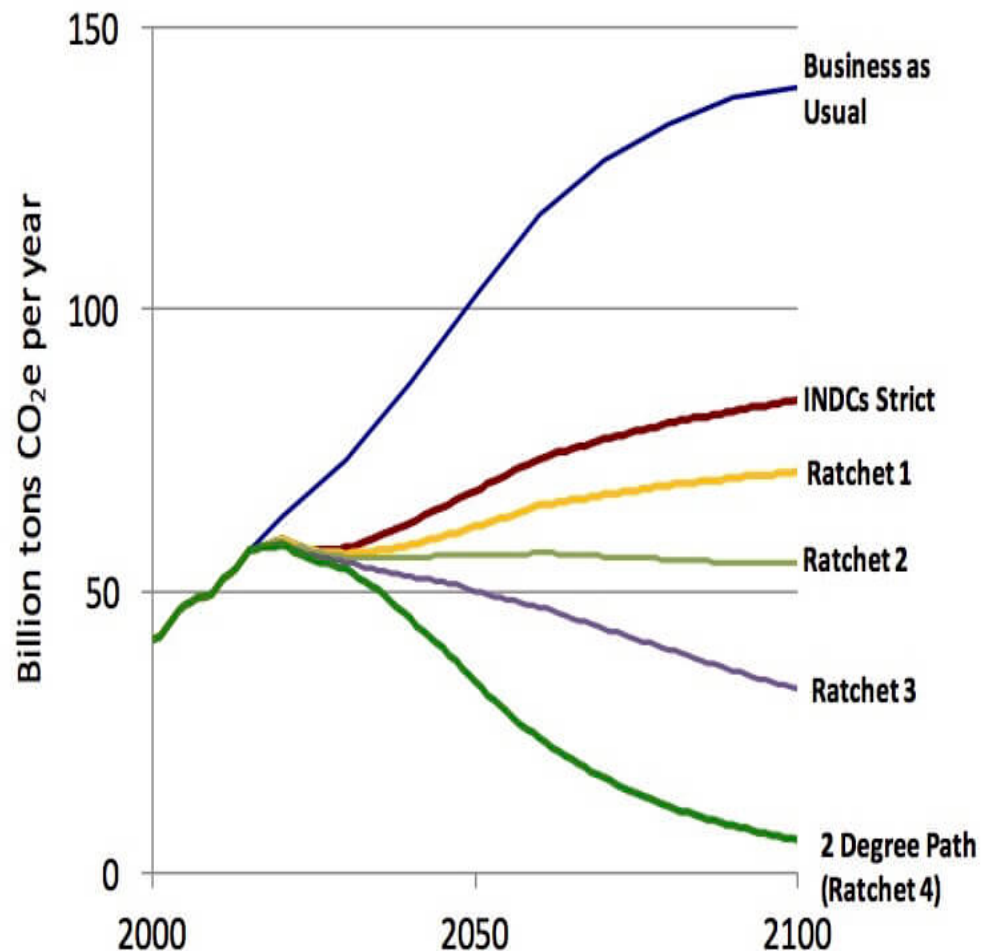
$$\text{Total CO}_2 \text{ emissions from shipping} = \text{tonne-miles} \times \text{CO}_2 \text{ emissions per tonne-mile}$$

↓





## Global Emissions



27 October 2015, ©2015 Climate Interactive - ClimateScoreboard.org

## 2100 Values

Temp. Increase Over Preindustrial (90% C.I.)	Atmospheric CO <sub>2</sub>	Atmospheric CO <sub>2</sub> e
4.5°C 8.1°F (2.6°C-5.9°C) (4.8°F-10.6°F)	910 ppm	1255 ppm
3.5°C 6.3°F (2°C-4.6°C) (3.6°F-8.2°F)	675 ppm	860 ppm
3.2°C 5.8°F (1.9°C-4.3°C) (3.4°F-7.7°F)	635 ppm	790 ppm
3°C 5.4°F (1.7°C-4°C) (3.1°F-7.1°F)	600 ppm	715 ppm
2.6°C 4.8°F (1.5°C-3.5°C) (2.7°F-6.4°F)	555 ppm	625 ppm
2°C 3.6°F (1.1°C-2.7°C) (1.9°F-4.9°F)	475 ppm	485 ppm



- Commence reduction in CO<sub>2</sub> emissions by 2017
- 25% reduction in CO<sub>2</sub> by 2035
- Gas still creates carbon
- World awash with oil now!
- Waves of Interest/Pools of anxiety

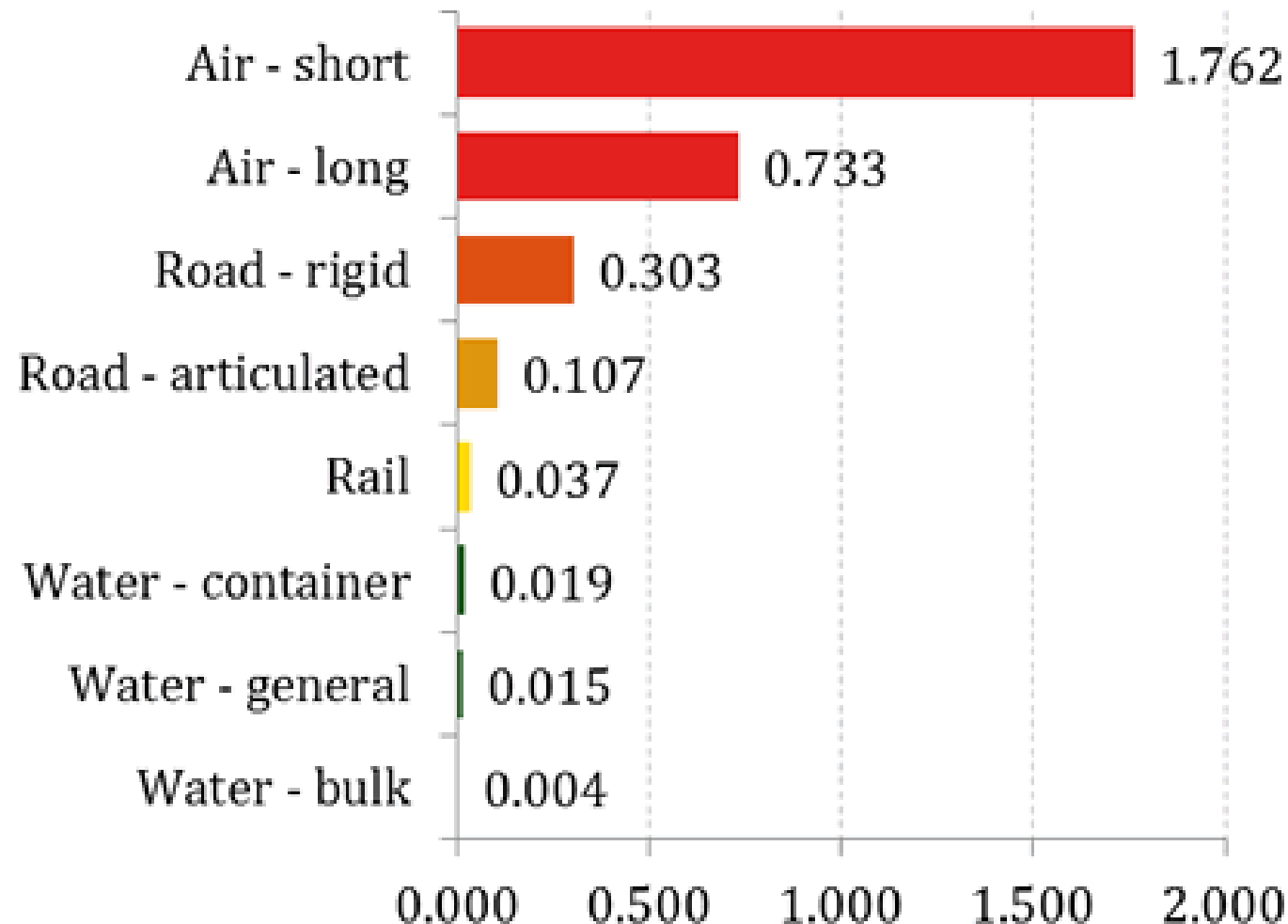


Year	Global CO <sub>2</sub>	Total shipping	% of global	International shipping	% of global
2007	31,409	1,100	3.50%	885	2.80%
2008	32,204	1,135	3.50%	921	2.90%
2009	32,047	978	3.10%	855	2.70%
2010	33,612	915	2.70%	771	2.30%
2011	34,723	1,022	2.90%	850	2.40%
2012	35,640	938	2.60%	796	2.20%
average	33,273	1,015	3.10%	846	2.60%

*Source IMO 2014 GHG Study*

# moams Efficient tortoises not hungry hares

## Freight Transport Emissions: kg CO<sub>2</sub>e/t.km



Note: All figures are kilograms carbon dioxide equivalents per tonne kilometre (kg CO<sub>2</sub>e/t.km). Figures based on a well-to-wheels analysis of fuel used and average loading per vehicle. For air freight long is greater than 3,700 km while short is less than it, no RFI multiplier is used. Road vehicles are based on UK diesel truck averages. Rail based on UK diesel and electric trains. All water vessels are ships, not ferries.

Sources: DEFRA Emissions Factors

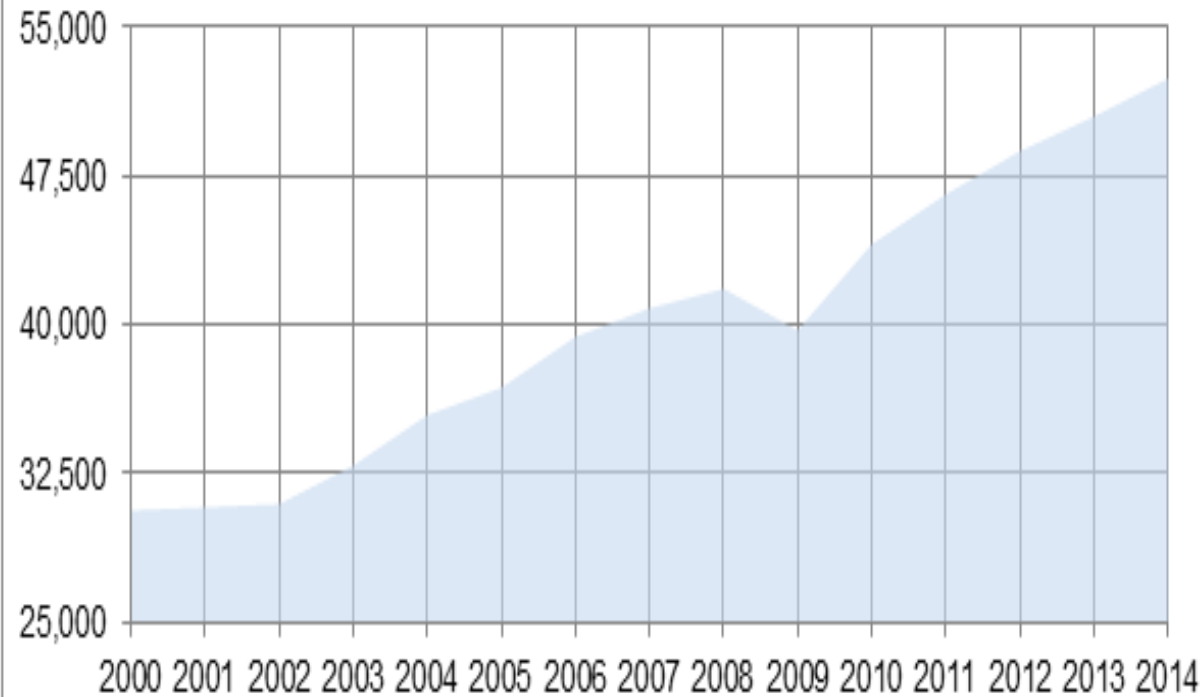




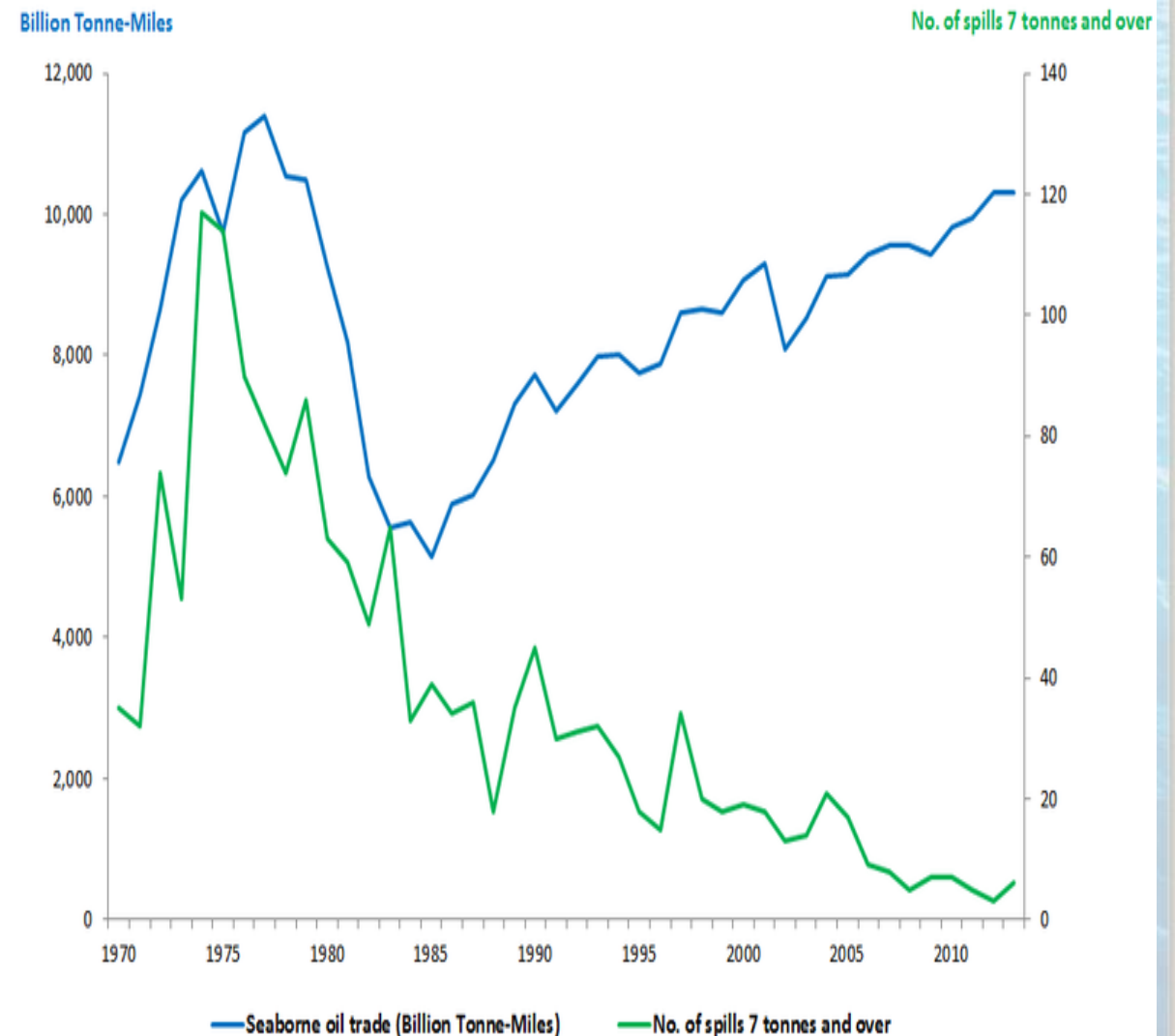
# **Demand drives Shipping Emissions**

# moams Demand-shipping moves the world

**World Seaborne Trade (billion tonne-miles)**



Source: UNCTAD Review of Maritime Transport, 2014



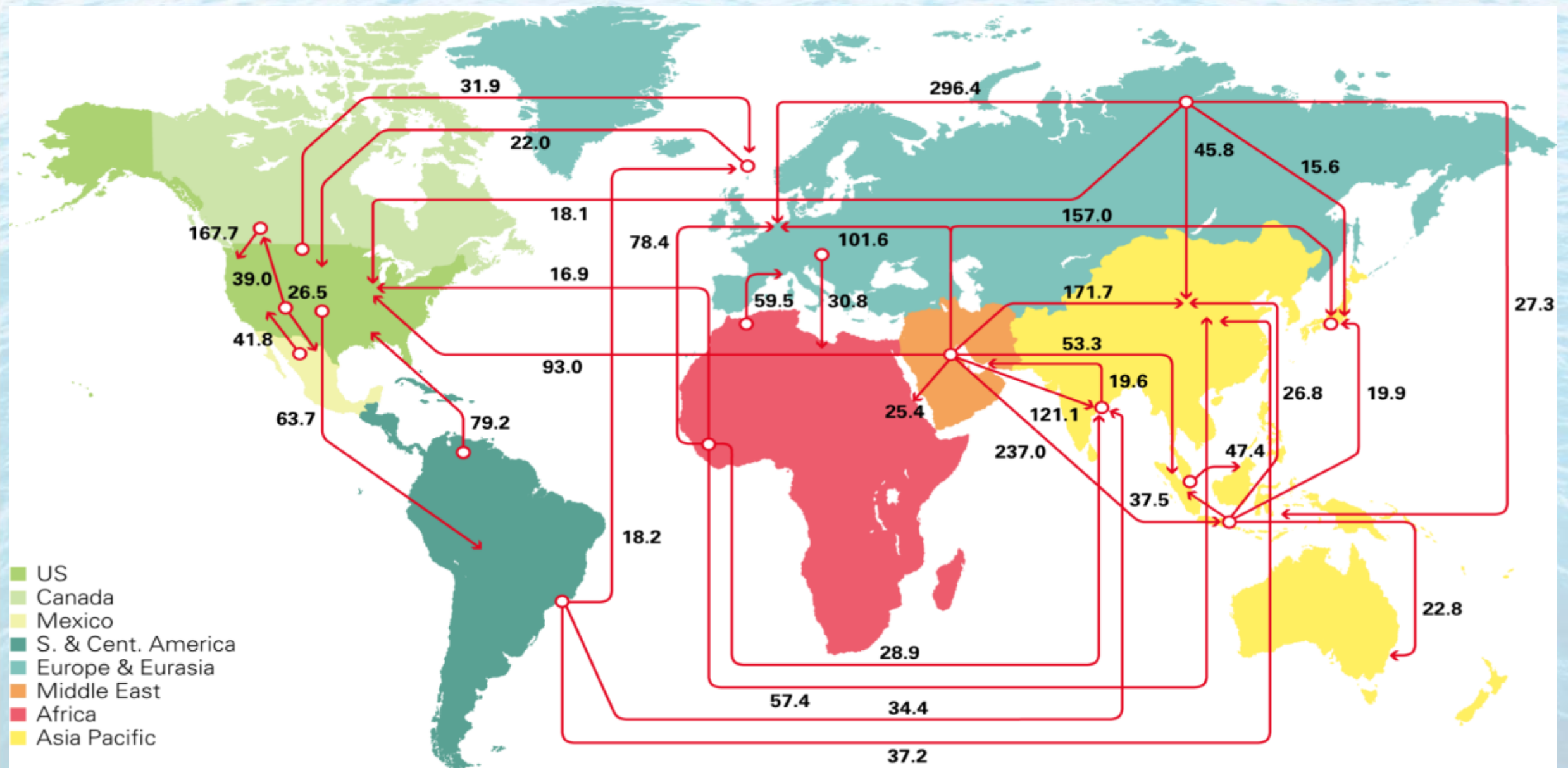
[Source: Fearnresearch 1970-1989, Lloyds List Intelligence 1990-2013]





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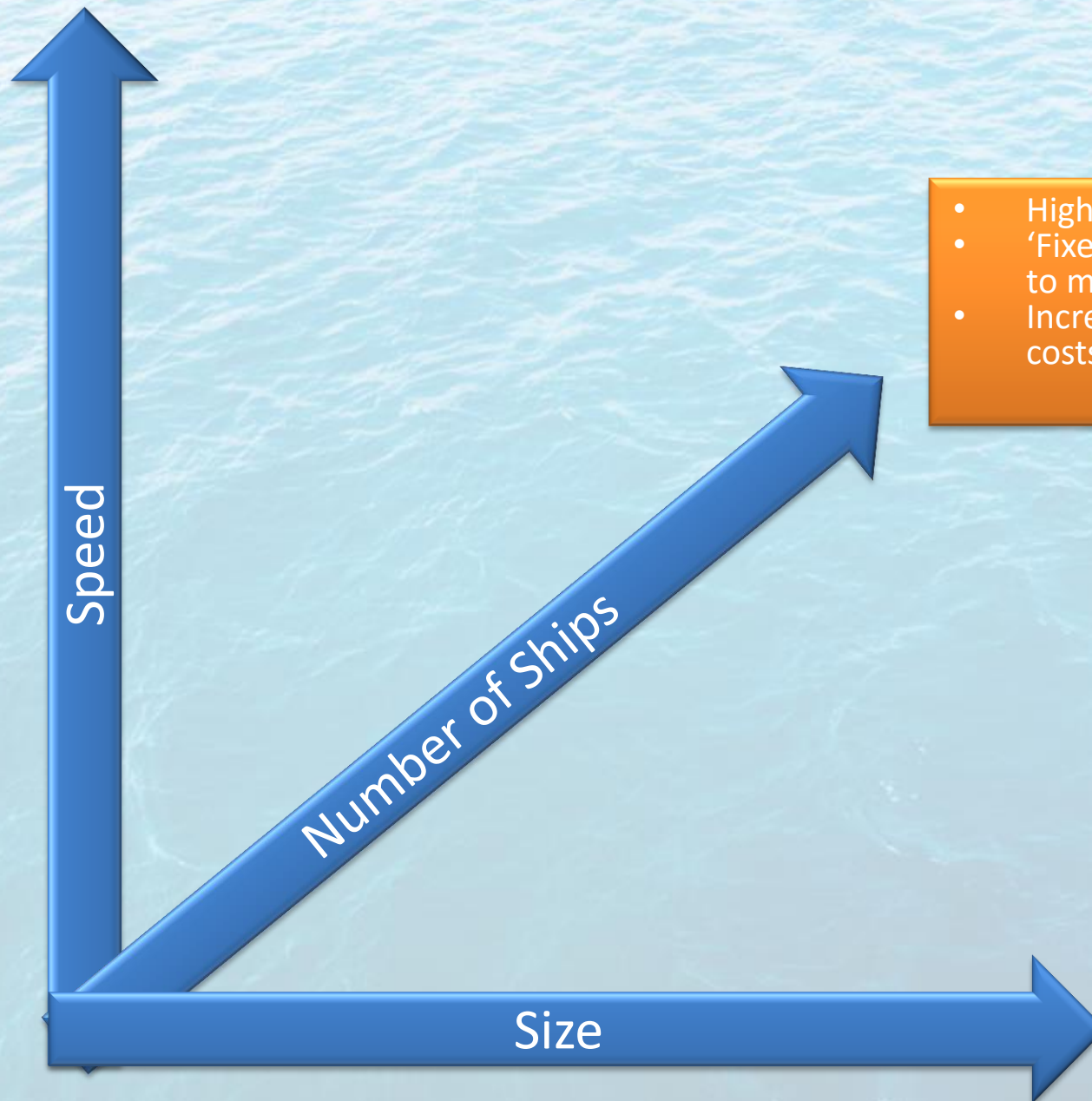
# Oil Movements



## Source bp review of world energy



- Square relationship
- Law of diminishing returns
- Higher Opex
- Low weight /high value such as passengers



- Higher Capex
- 'Fixed' energy costs to move empty ship
- Increased operating costs

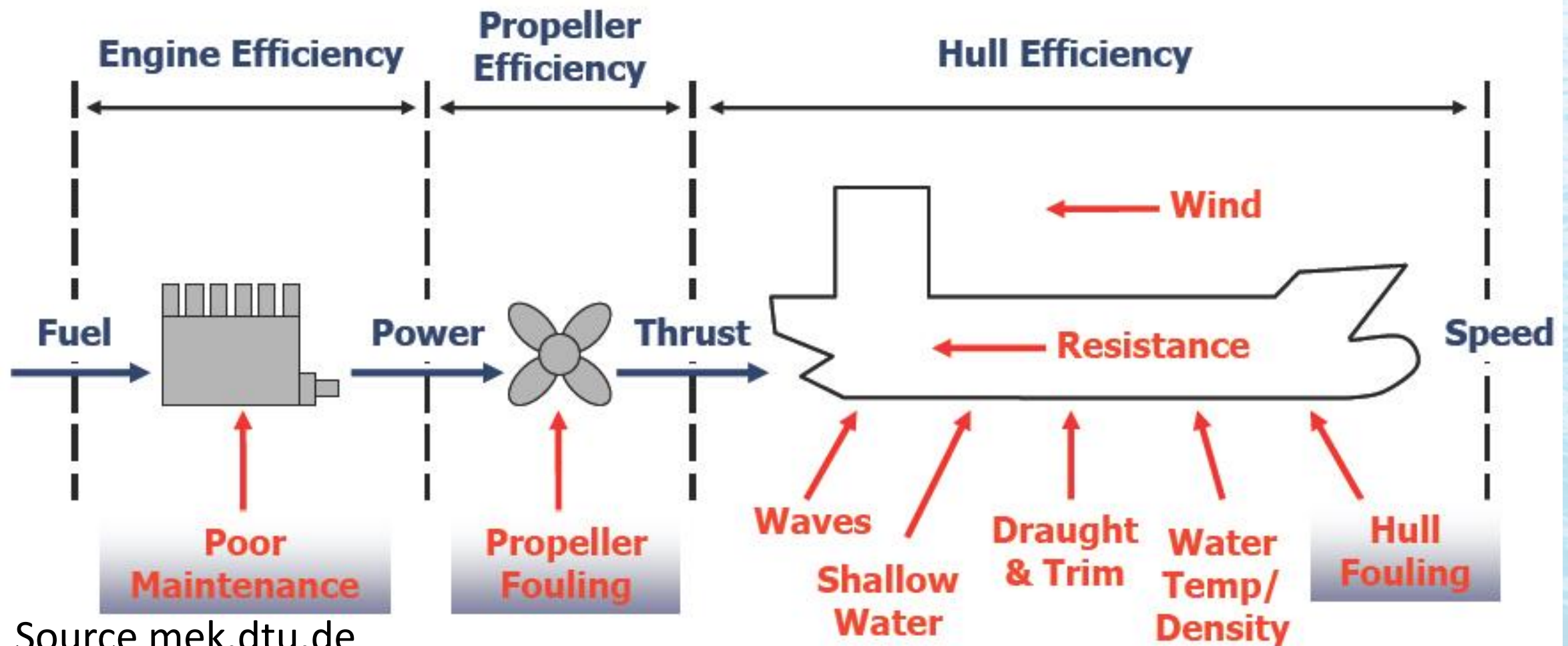
- Navigation restrictions
- Port restrictions
- Storage cost
- Working Capital
- Use for Crude not for products



# **Design...What Drives Ships?**



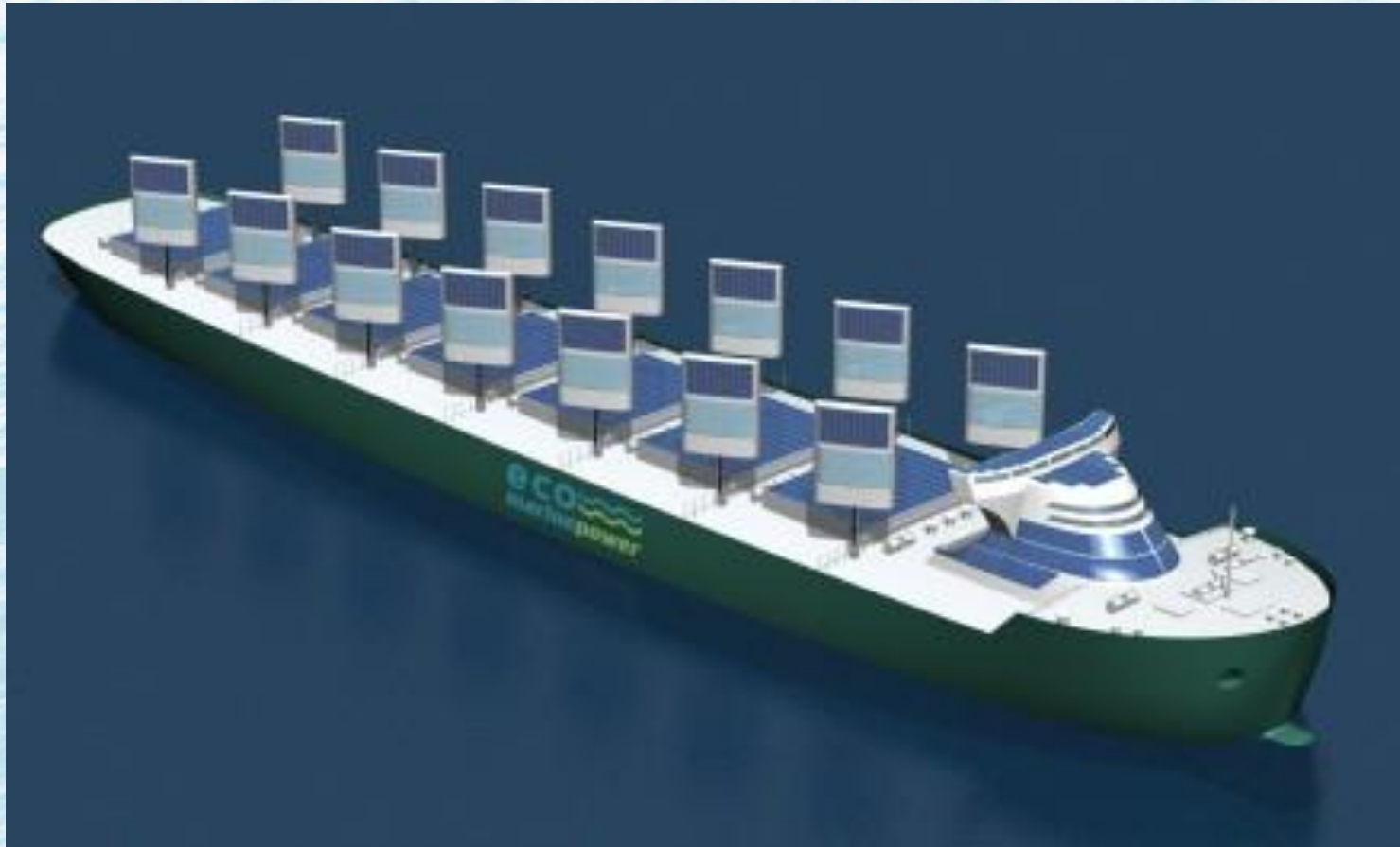
# moams Ship efficiency-its complex!!!



- No two days at sea are the same
  - Winds and waves
  - Speed over ground-tides
  - Exclude over Beaufort 5
  - Fuel/speed is a square relationship
  - How do you measure fouling?
- Subjective judgements
- Big Data

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## Back to the future



- Efficient Propellers
- Ducts
- Rudders
- Bulbs
- Hull shapes
- Sails
- Kites
- .....Fuels

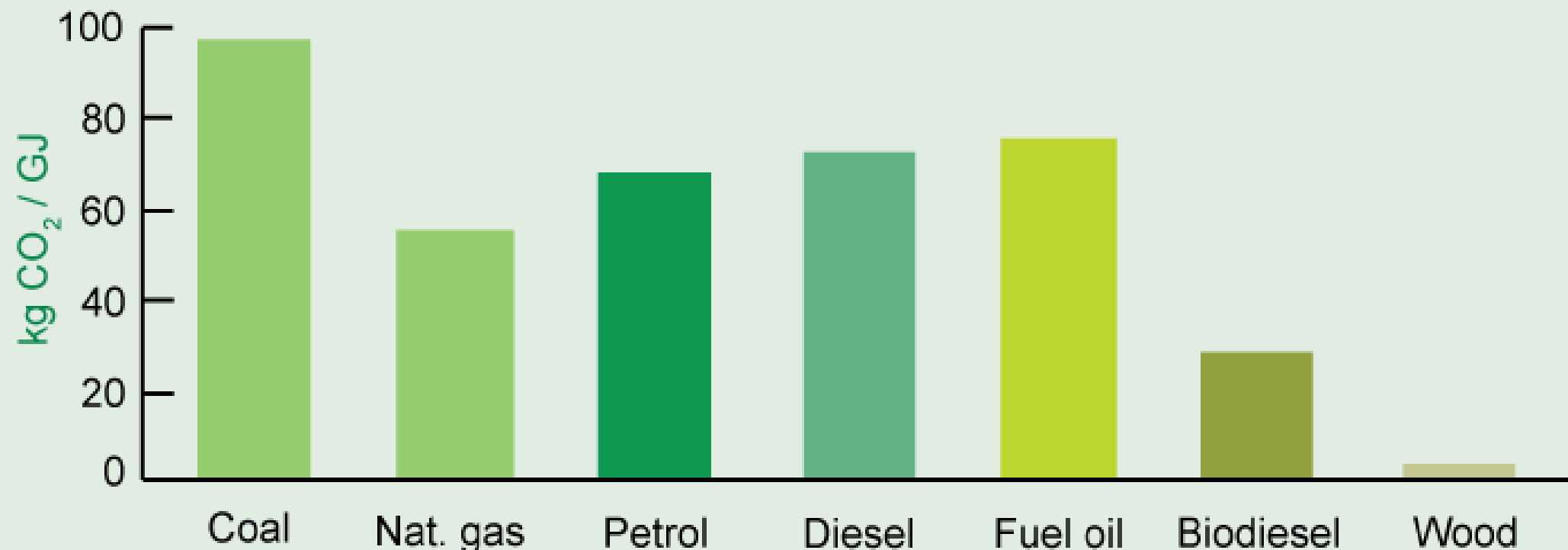


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# Fuels

## Carbon intensity of energy sources

Including CO<sub>2</sub> emissions during transport and production processes



Source: ECCM (Edinburgh Centre for Carbon Management), 2004



## Existing Fuel

- Heavy Fuel Oil
- Quality (or not)
  - Bottom of the barrel
  - Fuel or refinery waste disposal
  - Cat Fines
  - Disposal of Waste Oil
  - Requires substantial heating and onboard processing
- Available everywhere
- Sulphur caps

## Alternatives

- Self contained
  - Nuclear
  - Wind
  - Solar
- Networked Fuels
  - **Distillates**
  - **Methanol**
  - **LNG**
  - **Biofuels**





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# Chickens -lesson from history



Early Steam vessels had dual power, Steam and Sail, until a reliable global network of coaling stations was developed.

Then the sails disappeared .....after about 40 years

Chicken and Egg 19<sup>th</sup> century style



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# Operations

# The Operational Cycle





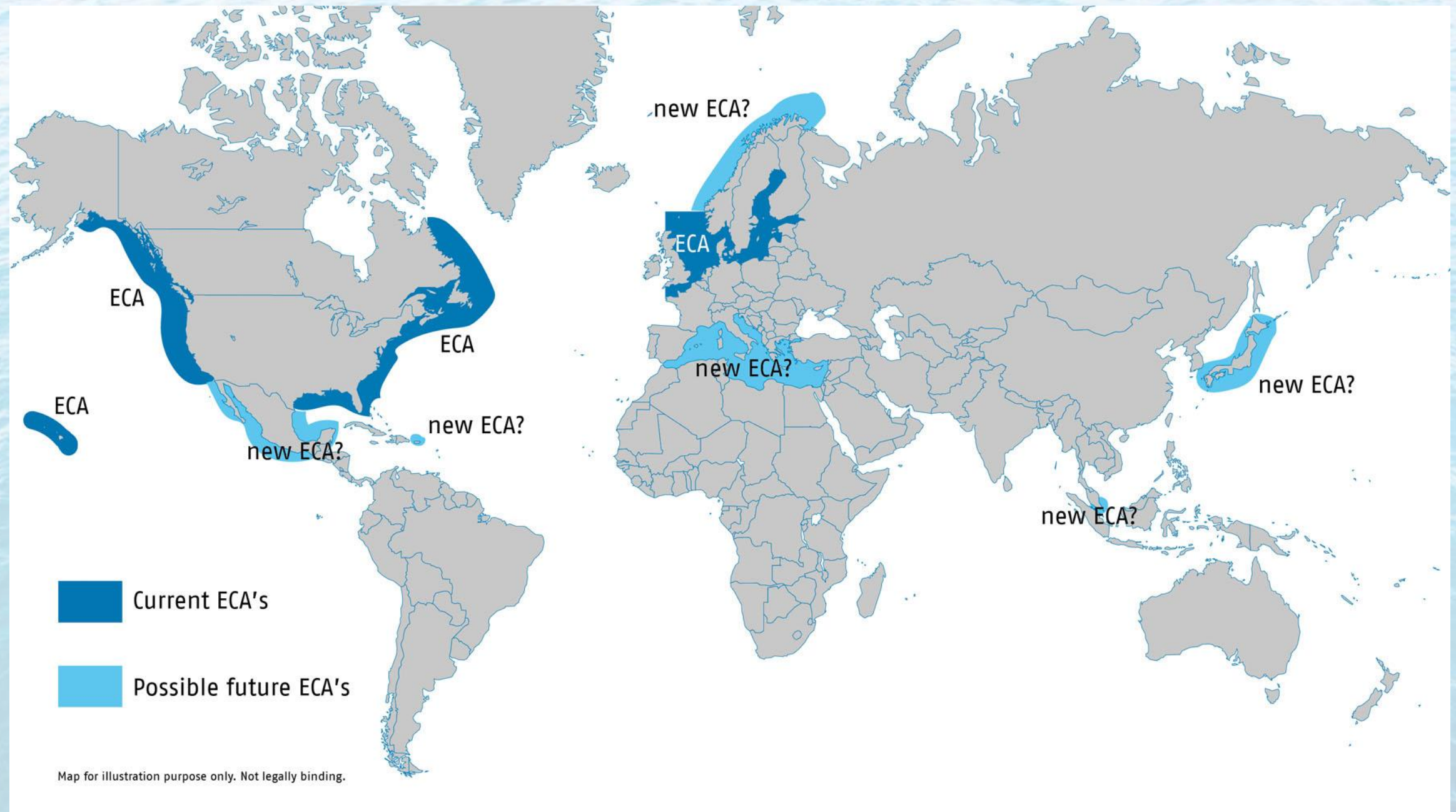
- Hurry up and wait
  - Contracts can encourage ships to go at full speed and then anchor potentially for long periods
- Just in time
  - Capital constraints can limit storage at loading and discharge locations
  - Stockholding costs in the new world with carbon pricing
- Ports
  - Sufficient storage for large parcels
  - Locating terminals to avoid draft restrictions
  - Sufficient jetties and tugs



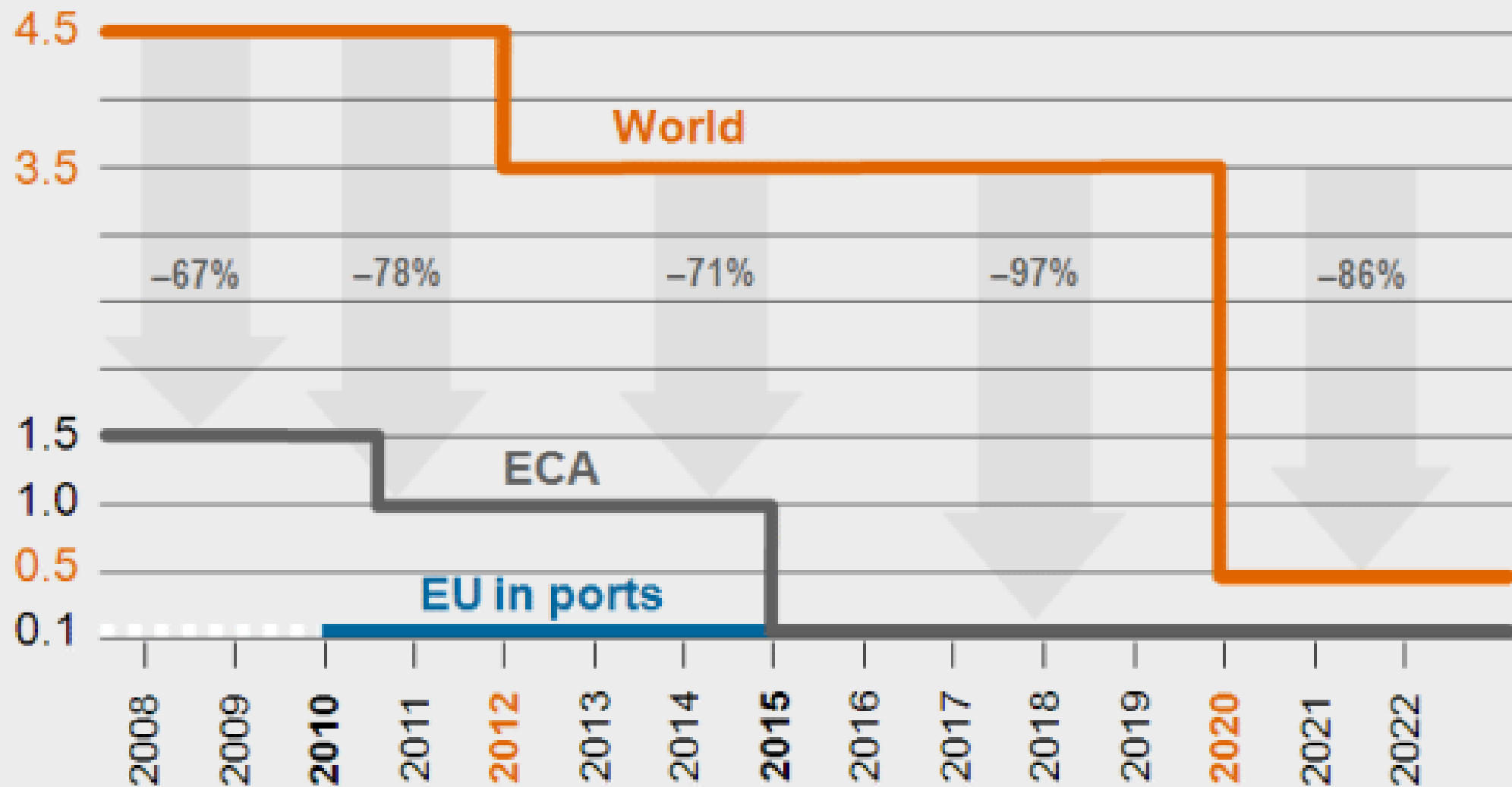
# **Clash of Environmental Aspects**



# moams Sulphur is driving fuel change today



Sulphur limit (%)

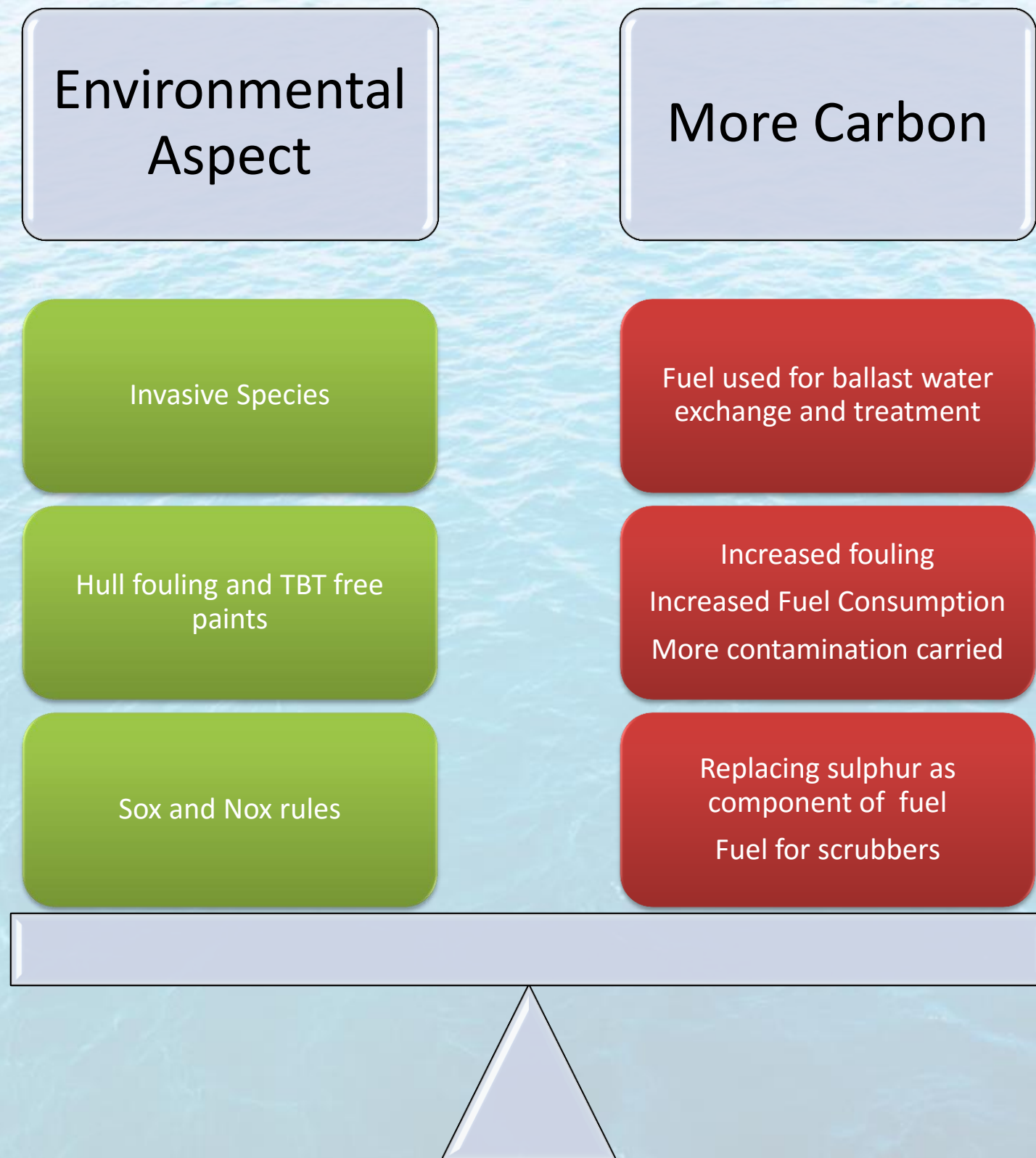


**Fuel type** Not regulated = both HFO and distillate are permitted.  
**Exhaustgas cleaning** Permitted alternative under Regulation 4 to achieve any regulated limit.  
**Particulate Matter (PM)** No limit values.

Figure 2. IMO sulphur limits for years 2008-2020 (% mass).



# moams Which Environmental Issue?





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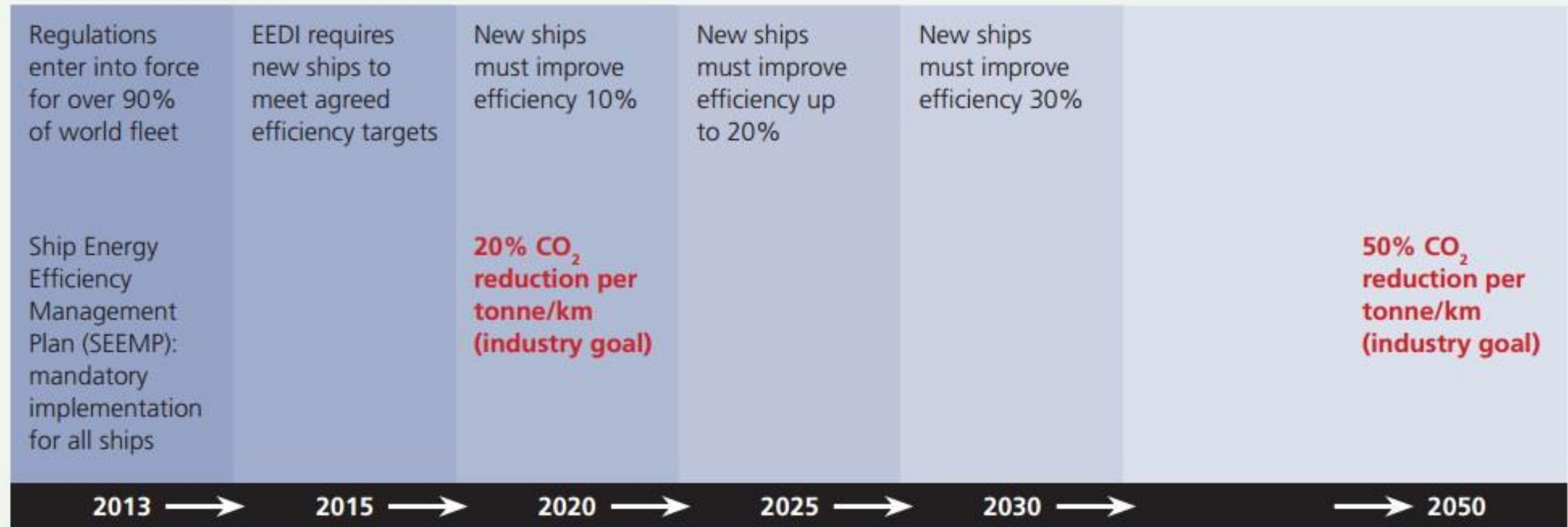
**What is the industry doing?**



# moams What the industry is doing

## IMO AGREEMENT ON TECHNICAL REGULATIONS WILL REDUCE SHIPS' CO<sub>2</sub>

MARPOL Annex VI, Chapter 4 adopted July 2011



### Issues

- Measurement
- Regional requirements EU/USCG
- Complex and opaque formulae

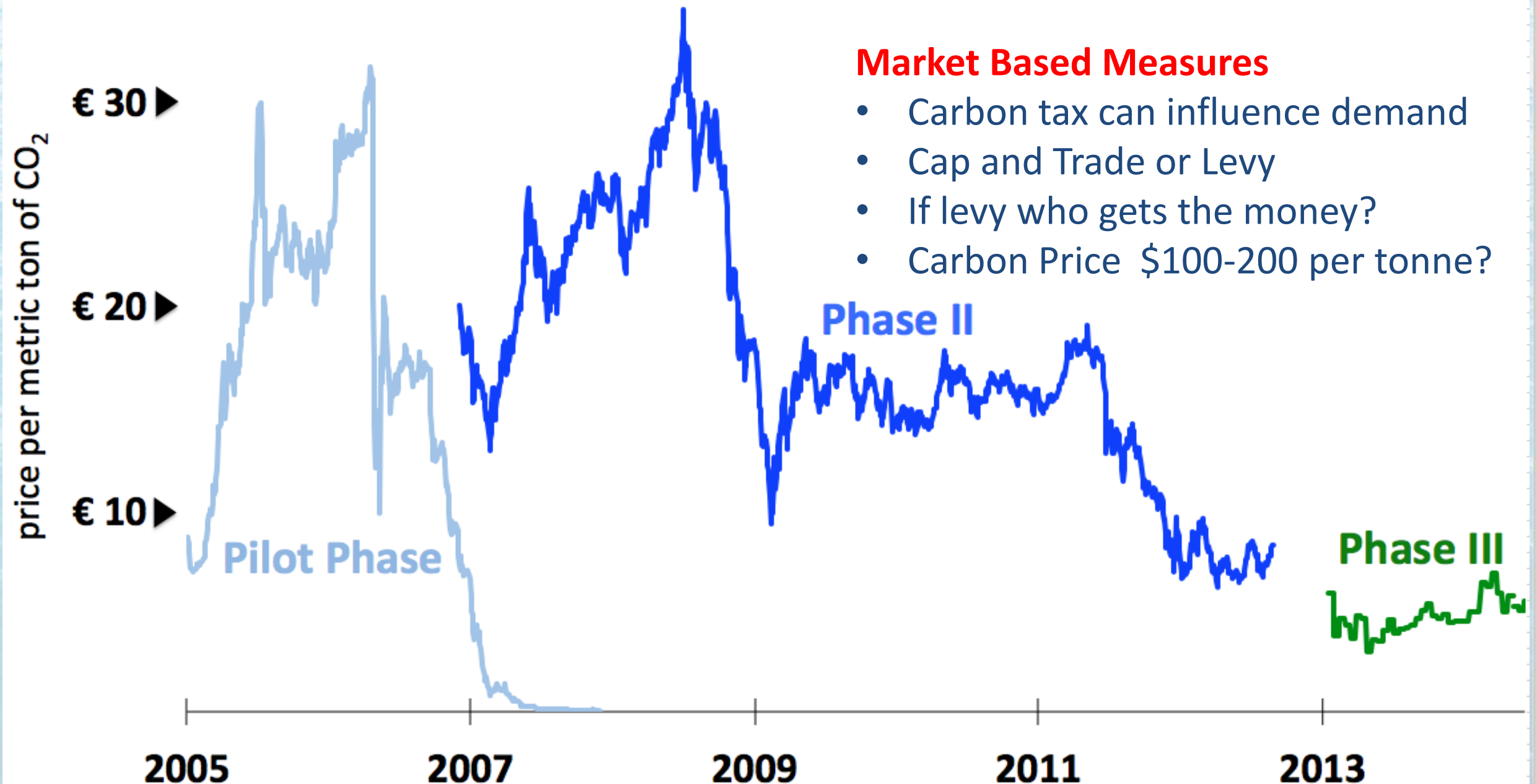
### Fuels

- Network fuels LNG distillate



# moams Carbon Pricing-how effective?

## EU carbon prices have been low since 2008

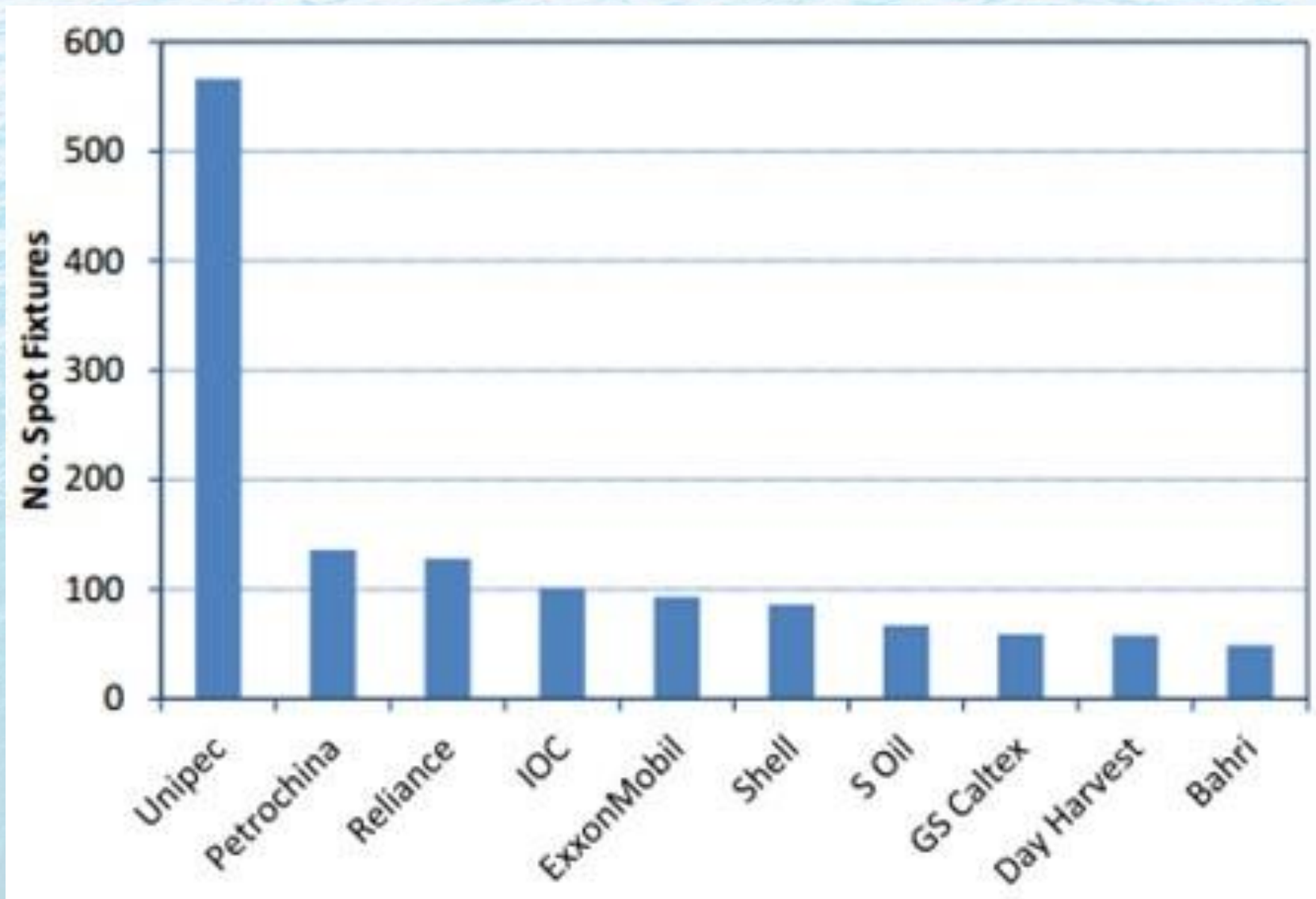


**What can the oil  
company/charterer do?**



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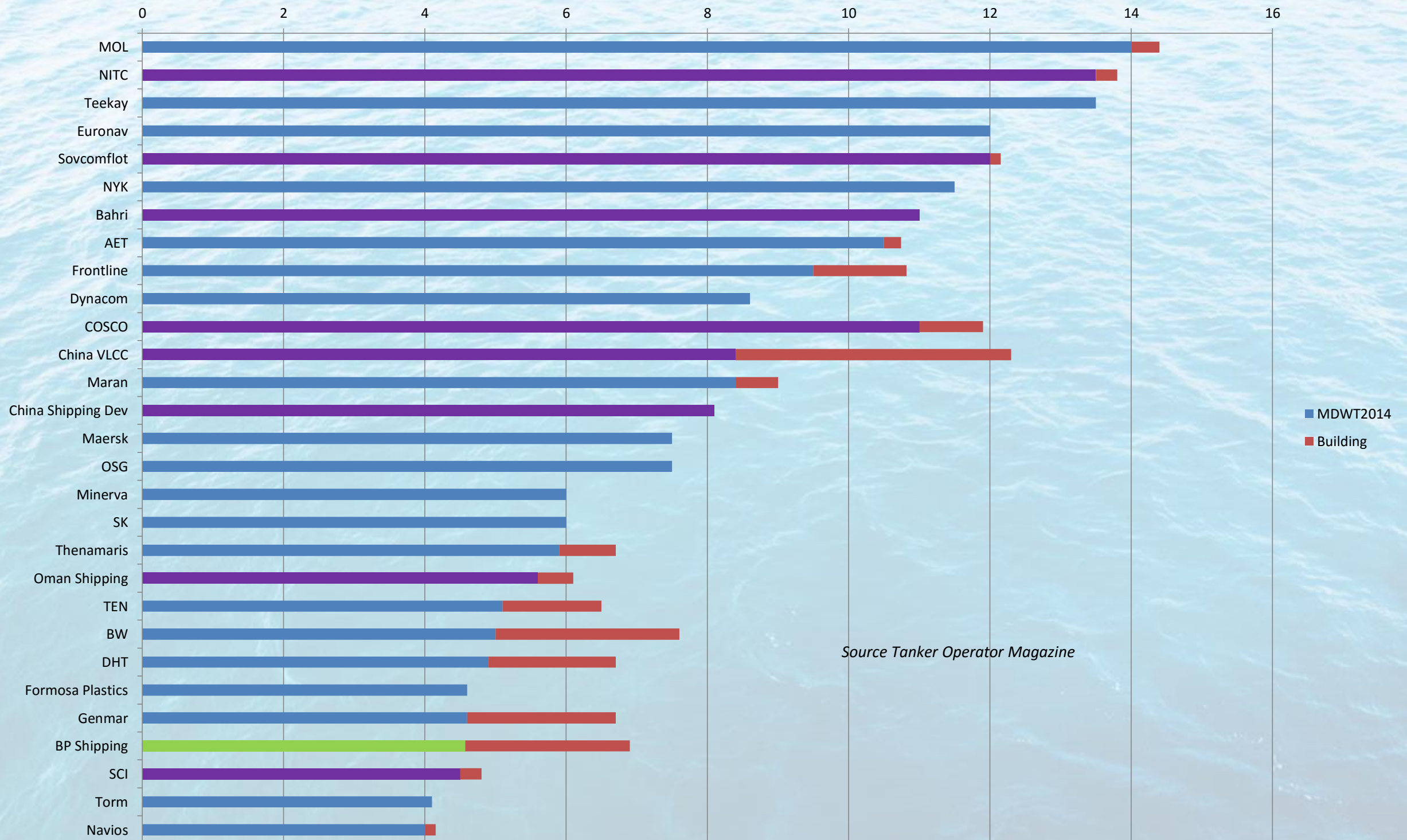
# What power does the IOC have?



Source Potens..2014 VLCC charters

# Who owns tankers?

## 2014 Top 30 Tanker Owners



Source Tanker Operator Magazine





$$\text{Total CO}_2 \text{ emissions from shipping} = \text{tonne-miles} \times \text{CO}_2 \text{ emissions per tonne-mile}$$

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1. World ( a naive view?)
  - a. Production near Consumers
  - b. Short Voyages and Big Ships
  - c. Priority to environmental goal
  - d. Re-examine JIT and stockholding costs through carbon lens
  - e. Needs carbon price to change behaviours
  
2. Oil companies
  - a. Use the power that reduced oil pollution to reduce CO<sub>2</sub>
  - b. More flexibility in design at load/discharge terminals berths, tanks etc.
  - c. Operational flexibility for most economic speed
  - d. Decent fuel that doesn't require an onboard refinery
  - e. Global fuelling networks for LNG and other fuels
  - f. MBM for the planet not for the bottom line
  - g. Oil trading, does it generate unnecessary emissions?