GREEN SHIPS AND GREEN GROWTH ASSESSMENT OF SELECTED POLICIES PROMOTING THE CONSTRUCTION AND OPERATION OF GREENER VESSELS

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OCDE
DES POLITIQUES MEILLEURES POUR UNE VIE MEILLEURE

Agenda

- Green house gases (GHG)
- Air pollutants (SOx, NOx)
- Innovation

Policies and measures promoting the construction and operation of green ships

Targets	Level of implementation	Authorities responsible	Form of policy	Start year
GHG	International	IMO	Regulation	2013
	National	Japan	R&D support for maritime sector	2008
Air pollution	International	IMO	Regulation	2005
	Regional	IMO	Regulation	2006
	National	Finland	Grant for shipowners	2010
	National	Norway	Policy mix of fee and funding	2007
	National	Singapore	Port fee discount and tax deduction	2011
Biodiversity	International	IMO	Regulation	2017
	National	US	Regulation	2014
Cross-cutting	Regional	EIB	Loan guarantees to shipowners	2016
	National	Denmark	R&D support for maritime sector	2015
	National	Finland	R&D support for shipbuilding	2008
	National	Norway	Regulation in ferry tenders	2016
	National	Turkey	Subsidies for scrapping	2015
	National	Norway	Subsidies for scrapping and building	2016
	National	China	Subsidies for scrapping and building	2009
	National	Romania	Policy mix	2018

Contents

- Green house gases (GHG)
- Air pollutants (Sox, NOx)
- Innovations

CO2 emissions from ships

- International maritime shipping currently accounts for about 800 million tonnes of carbon dioxide equivalent (CO2e) emissions per year
- A figure that could almost double by 2060 under current energy and climate commitments made by the International Maritime Organization.

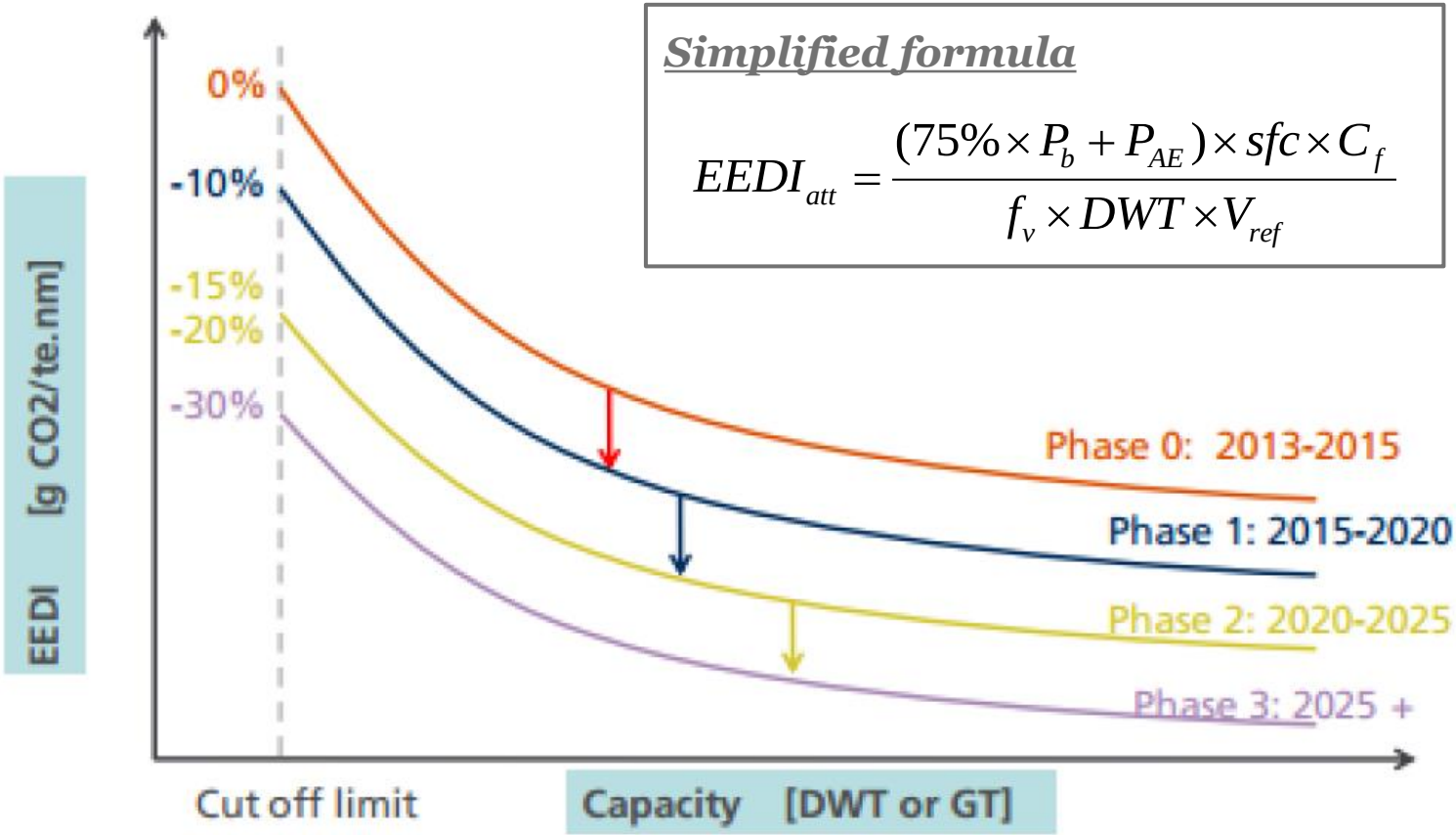
Source : IEA

Green house gases (GHG)

- Paris Agreement (December 2015)
  - International shipping is not included
- Kyoto Protocol
  - “Parties in Annex I should work through the International Maritime Organisation (IMO) on the limitation or reduction of GHGs emissions from ships”
- International Maritime Organisation (IMO)
  - Mandatory energy-efficiency regulation based on the Energy Efficiency Design Index (EEDI)

Energy Efficiency Design Index (EEDI)

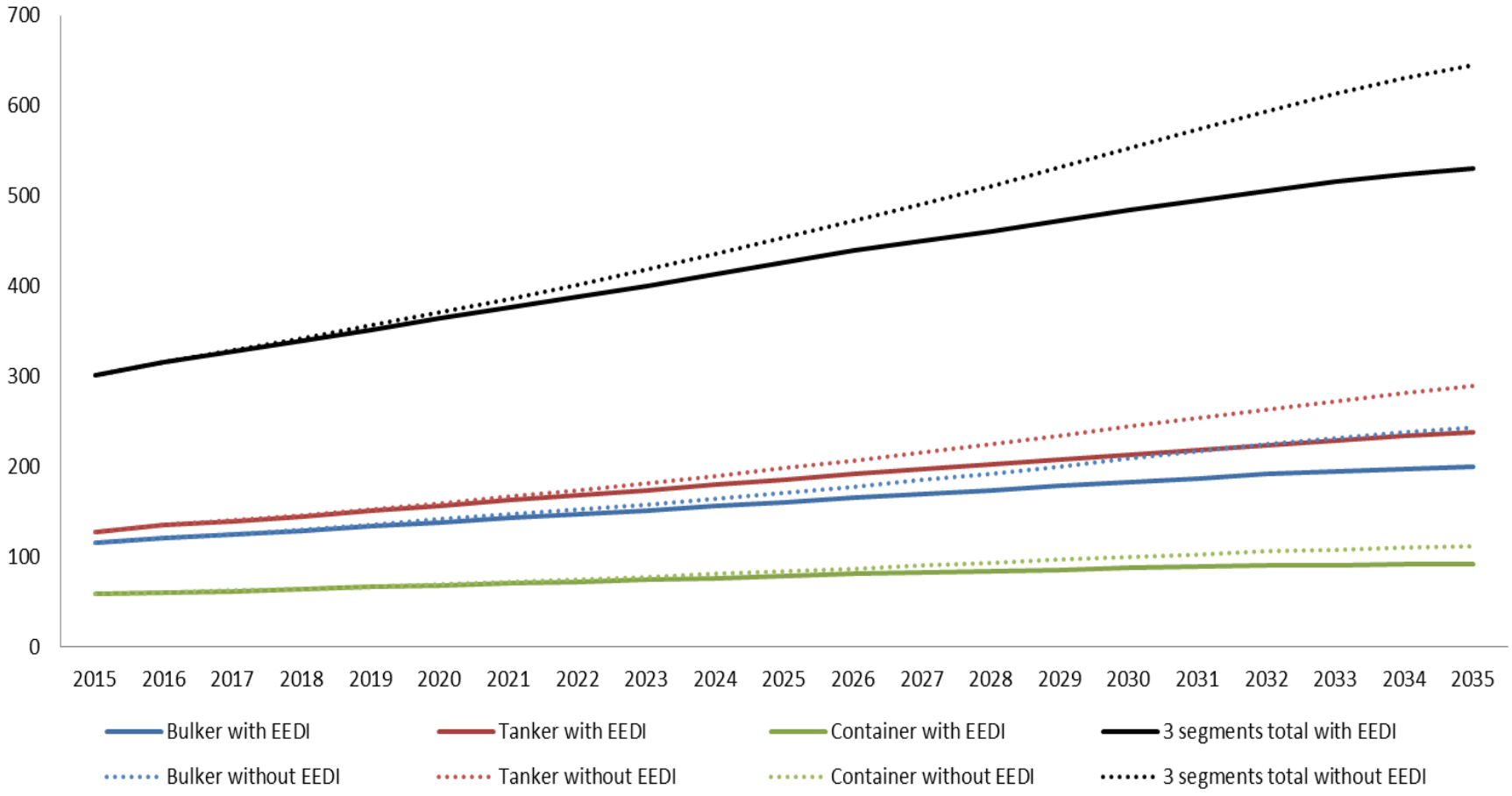
- Minimum energy efficiency level for different ship types



Simplified formula

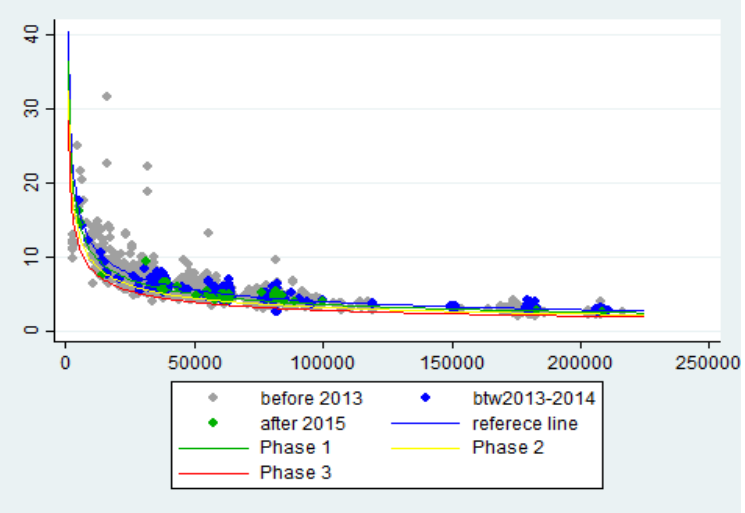
$$EEDI_{att} = \frac{(75\% \times P_b + P_{AE}) \times sfc \times C_f}{f_v \times DWT \times V_{ref}}$$

CO_2 emissions with and without EEDI, million CO_2-ton

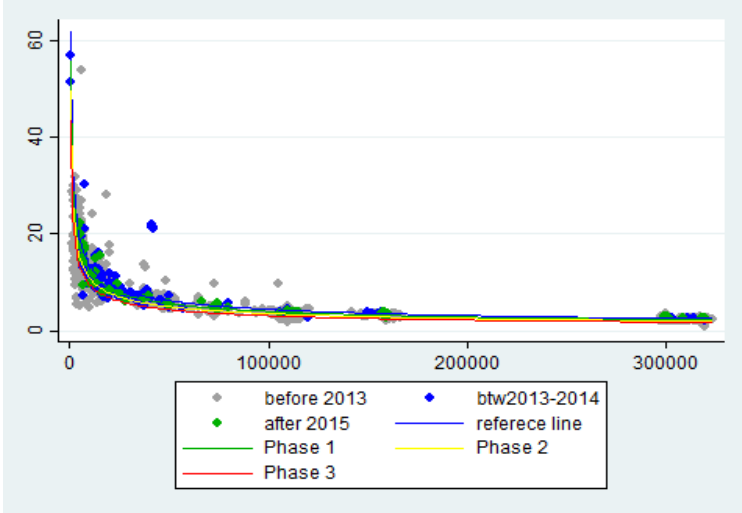


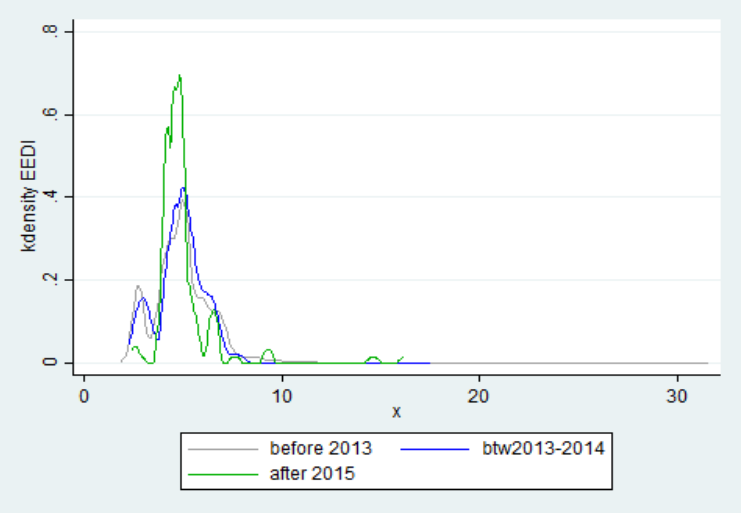
Estimation of EEDI values of individual vessels

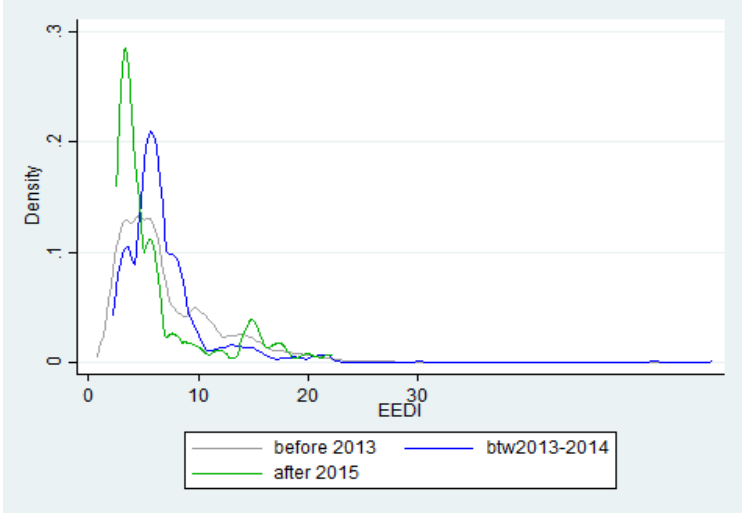
(a) Bulker



(b) Tanker

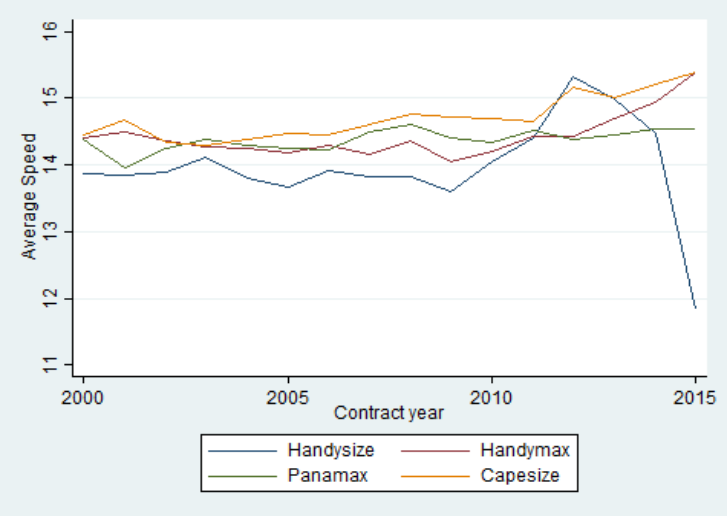




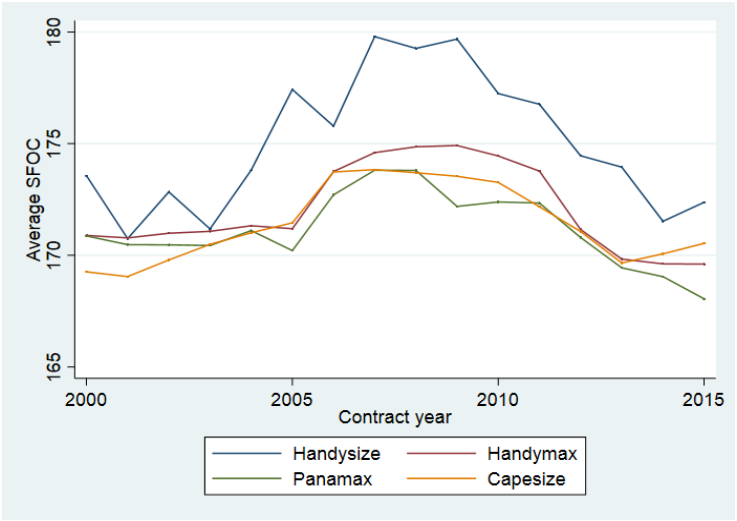


Evolution of ship design affecting EEDI, bulk carriers

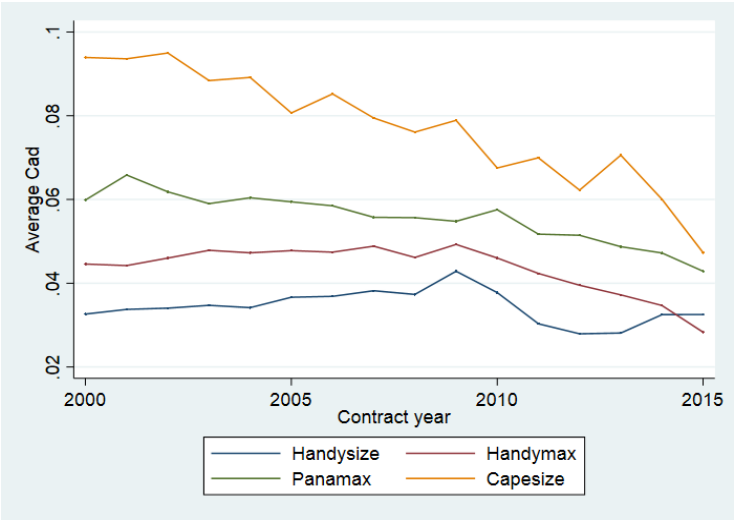
Speed of vessels by fleet size category, knots



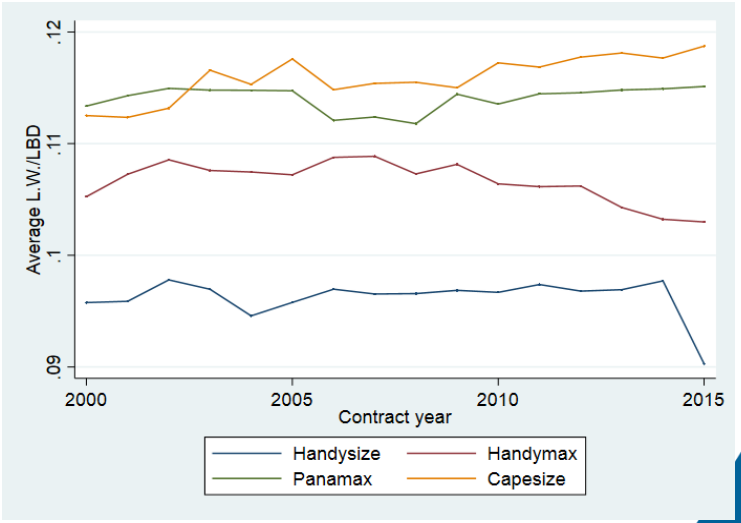
SFC of vessels by fleet size category



Admiralty coefficient of vessels by fleet size category



L.W. / LBD of vessels by fleet size category, ton per m3



Summary of EEDI assessment

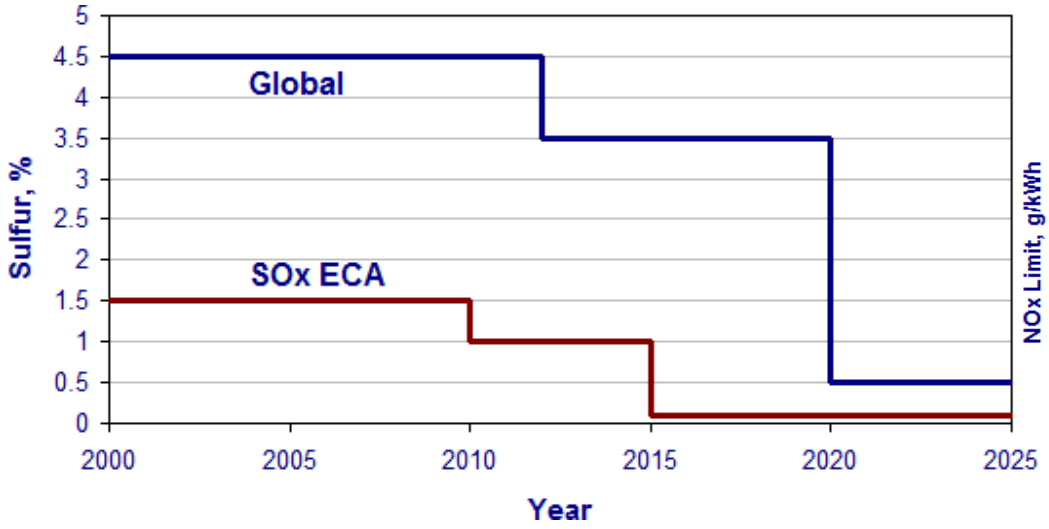
- EEDI : significant impact on shipping emissions
  - It contributes to a reduction by 115 million CO_2 ton by 2035, or 38% of emission from bulkers, tankers, containers in 2015.
- EEDI leads to improve vessel design rather than to reduce design speed.
- EEDI more effective to restrict low energy efficient vessels rather than promote energy efficient ones
  - Encouraging over compliant vessels in terms of fuel efficiency necessary in order to seek further reduction in CO_2 emissions from shipping

Contents

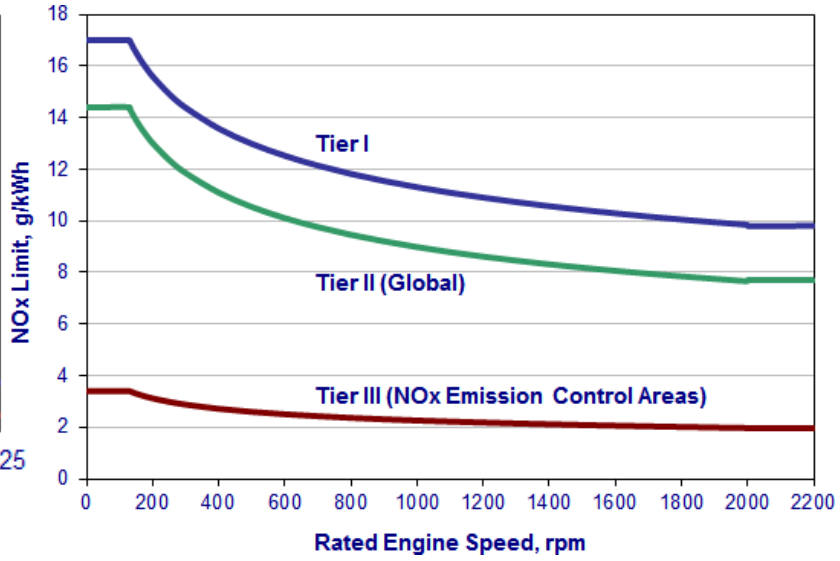
- Green house gases (GHG)
- Air pollutants (SOx, NOx)
- Innovations

IMO regulation on SOx and NOx

MARPOL Annex VI fuel sulfur limits



MARPOL Annex VI NOx emission limits



Source; Diesel net

MARPOL Annex VI: Emission Control Areas

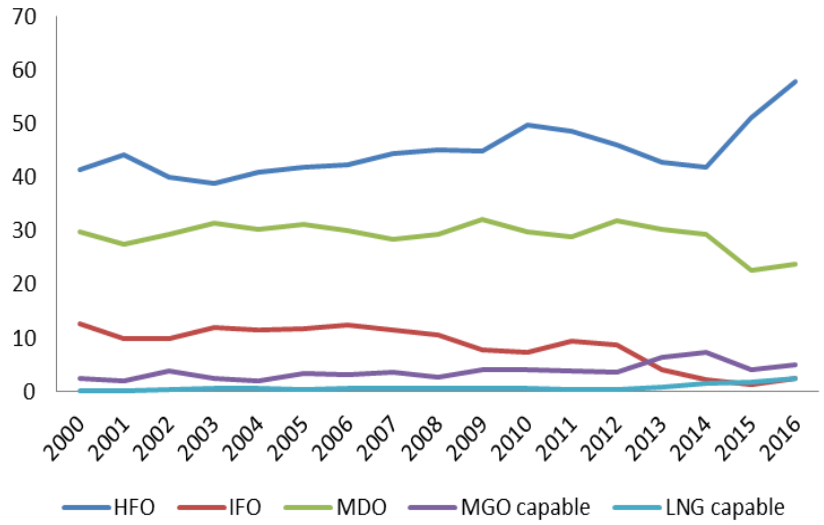
	Emissions	In effect from
Baltic Sea	SOx	19 May 2006
North Sea	SOx	22 November 2007
North American	SOx, NOx	1 August 2012
United States Caribbean Sea ECA	SOx, NOx	1 January 2014

Source; http://www.imo.org/en/OurWork/Environment/SpecialAreasUnderMARPOL/Pages/Default.aspx

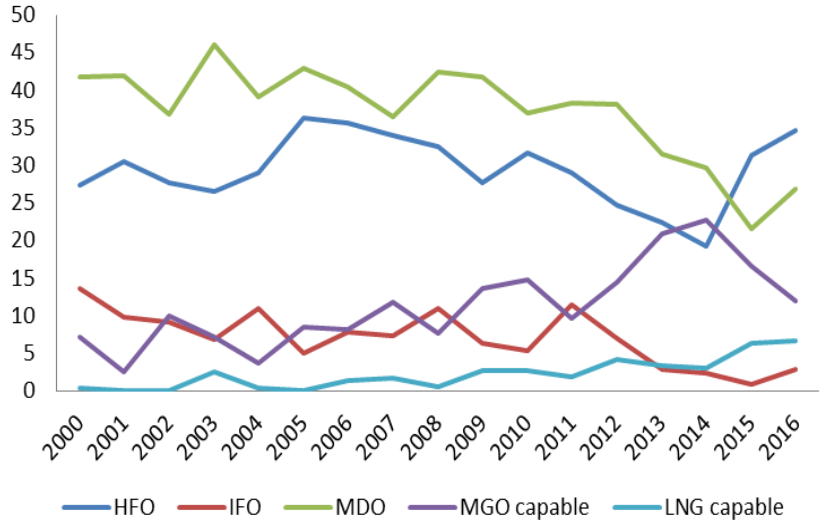
Shares of MGO or LNG capable vessels are increasing notably in SECA

Share of number of new built vessels by fuel type, % in total counts

(a) All vessels



(b) SECA flagged vessels



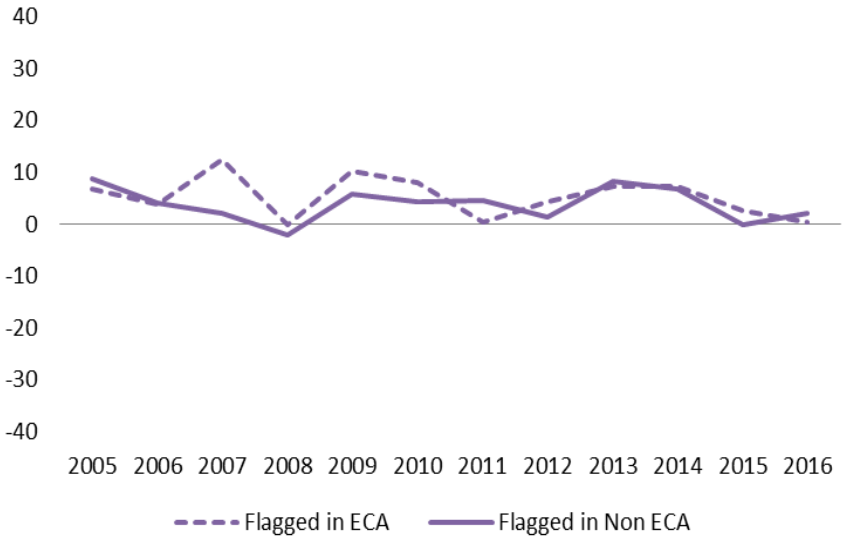
Source; OECD calculation based on Clarkson World Fleet Register

*MGO is Marine Gas Oil with Low-sulphur (<0.1%) contents

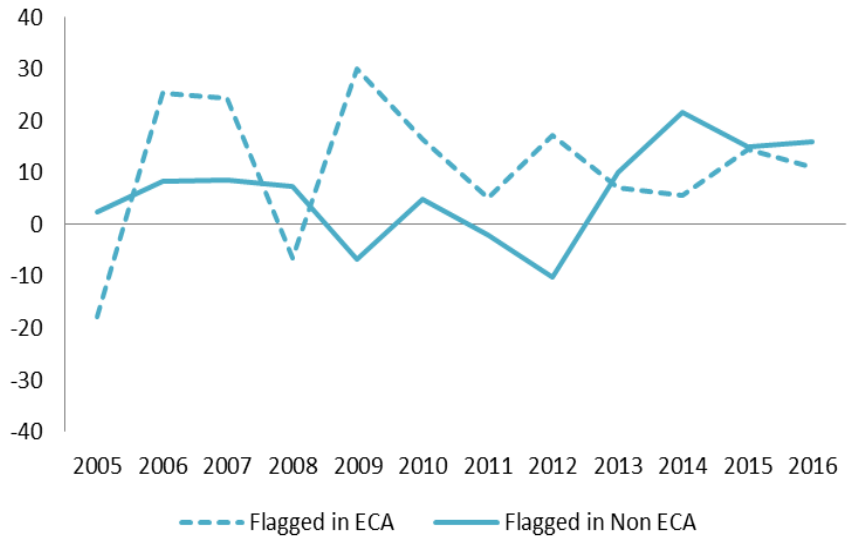
Growth rate in ship number of LNG capable vessels is high in SECA

Growth rate of share of MGO/LNG capable vessels in fleet number, %

(a) MGO capable vessels



(b) LNG capable vessels

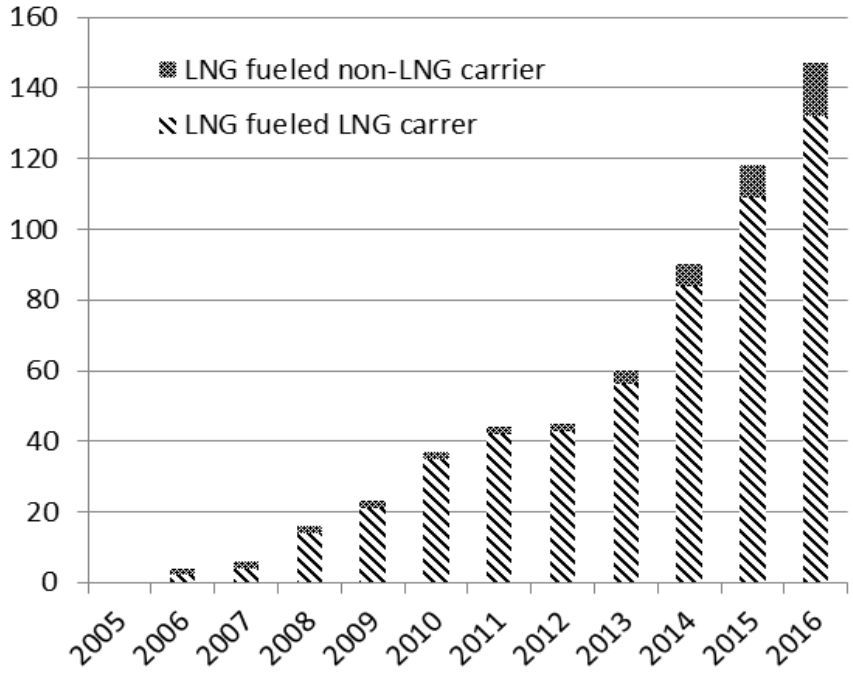


Source; OECD calculation based on Clarkson World Fleet Register

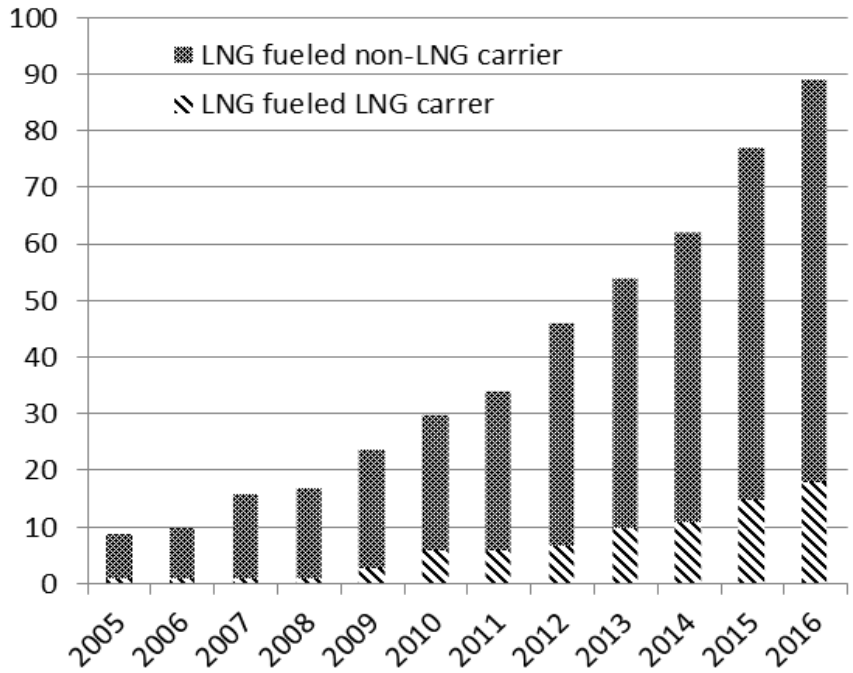
LNG fueled LNG carriers in non-SECA
LNG fueled non-LNG carriers in SECA

Fleet number of LNG-fueled vessels by vessel type, #

(a) Non-SECA flagged fleet number



(b) SECA flagged fleet number

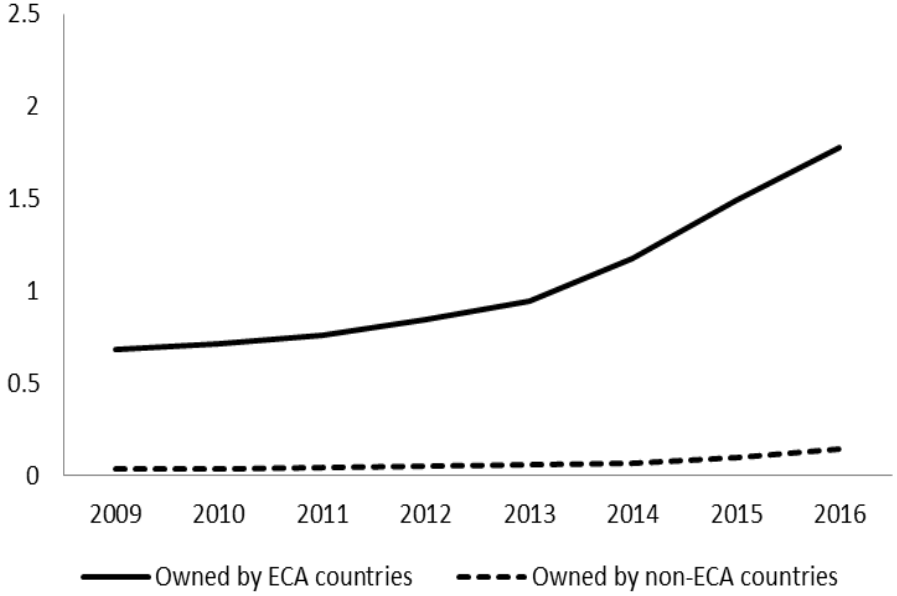


Source; OECD calculation based on Clarkson World Fleet Register

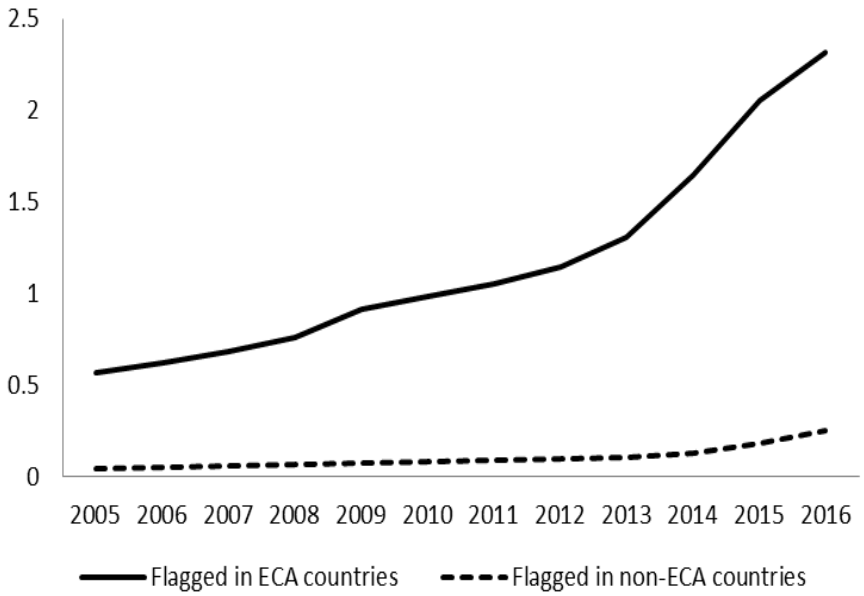
Scrubber equipped vessels are increasing in SECA, but growing similarly regardless of SECA/non-SECA

Scrubber equipped vessels share in total fleet, %

(a) Owner countries



(b) Flag countries



National policies in response to the regulation on emission of air pollutants

- **Finland**; **the Investment aid** scheme for purchasing greener ships or retrofitting green equipment.
- **Norway**; the **NOx tax** was introduced in 2007 to address NOx emissions from industry sectors. A substantial part (60 per cent) of the funding in the maritime sector was linked to LNG powered vessels.

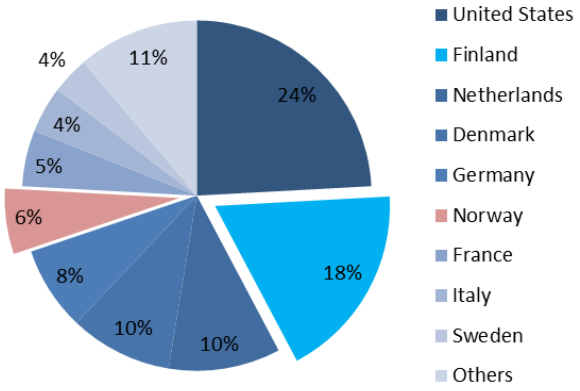
	Measures	Target pollutant	Start/End year	Budget
Finland	Investment aid	SOx	2010/2014	EUR 44 million per year
Norway	NOx tax and NOx fund	NOx	2007/On-going	NOK 700 million per year

Different reactions by countries to tighter restrictions on air pollutants emission

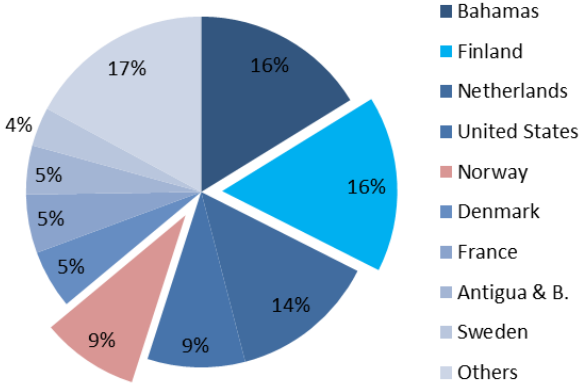
Share of scrubber retrofitting, LNG capable vessels and denitrification system equipped vessels

sulphur scrubber retrofitting

(a) Owner countries

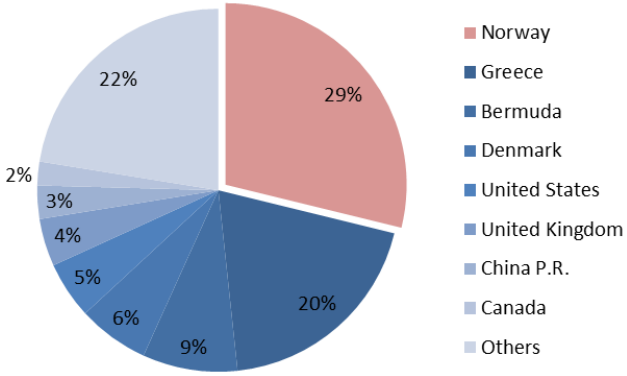


(b) Flag countries

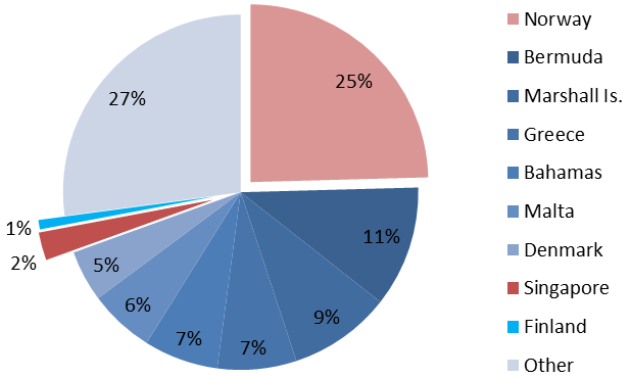


LNG capable vessels

(a) Owner countries

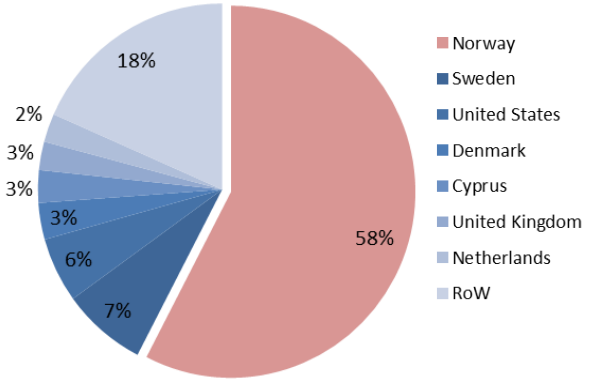


(b) Flag countries

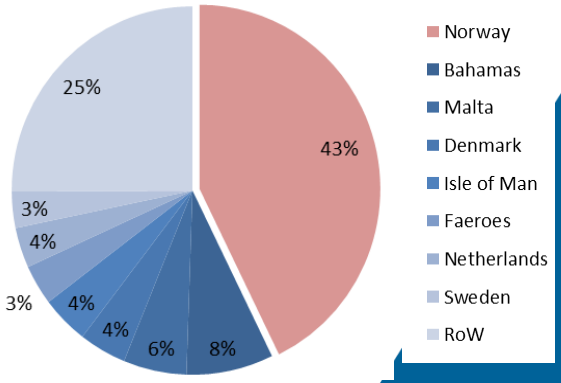


Denitrification system equipped

(a) Owner countries



(b) Flag countries



Summary of the assessment of stricter restriction on air pollutants in ECAs

- Stricter restriction on sulphur content in ECAs has an impact on developments of LNG capable vessels.
- National policies and measures appeared to significantly affect the owners' decisions on how they comply with regulations.

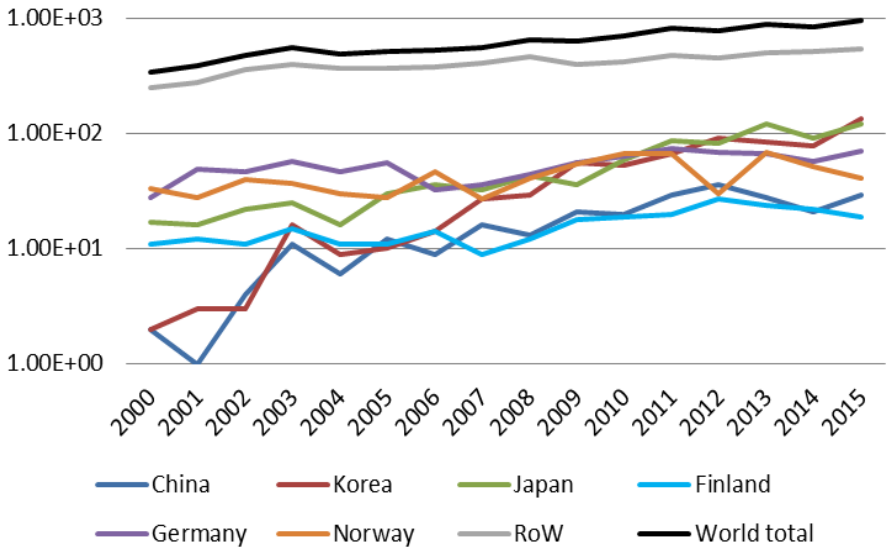
Contents

- Green house gases (GHG)
- Air pollutants (Sox, NOx)
- Innovation

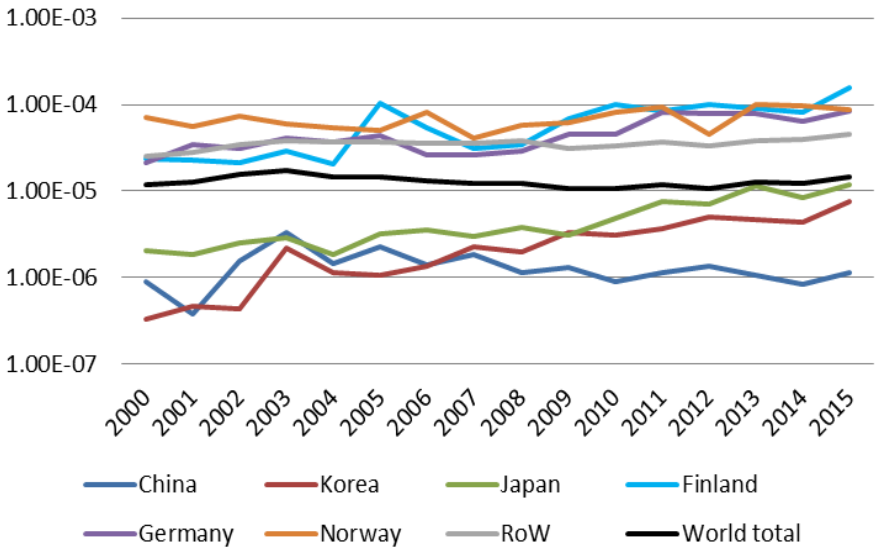
Significant increase in ship sector patent applications

Patent application counts in ship sector by country

(a) Patent application counts by selected country, #



(b) Patent application per SB capacity, # per cgt



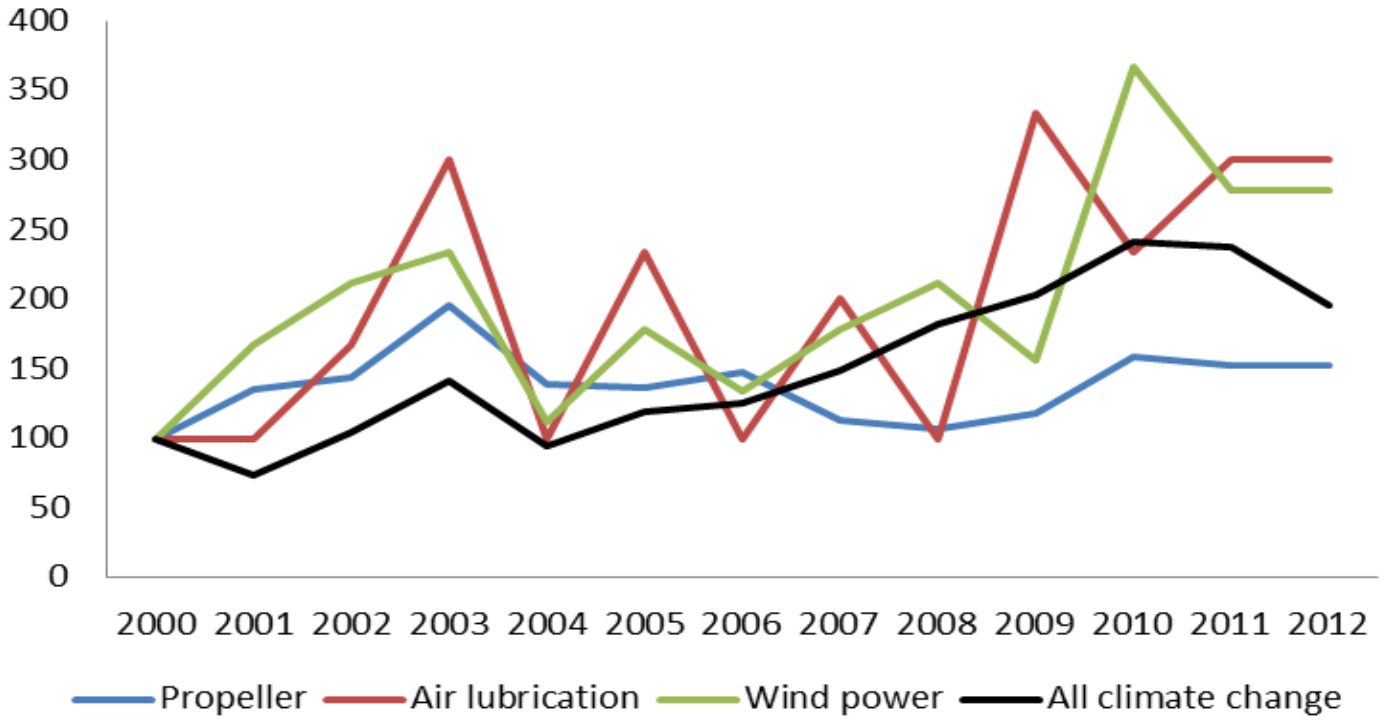
Source: OECD calculation based on IHS Seaweb and OECD Stat

Patent activities are more intense for technologies which are less likely to be introduced into the market

- Increase in patent activities (Propeller < Air lubrication ≈ Wind power)

*Marginal CO_2 abatement costs (Propeller < Air lubrication < Wind power)

Indexed patent trends (2000 = 100) for ship technologies related to climate change



Source: OECD St

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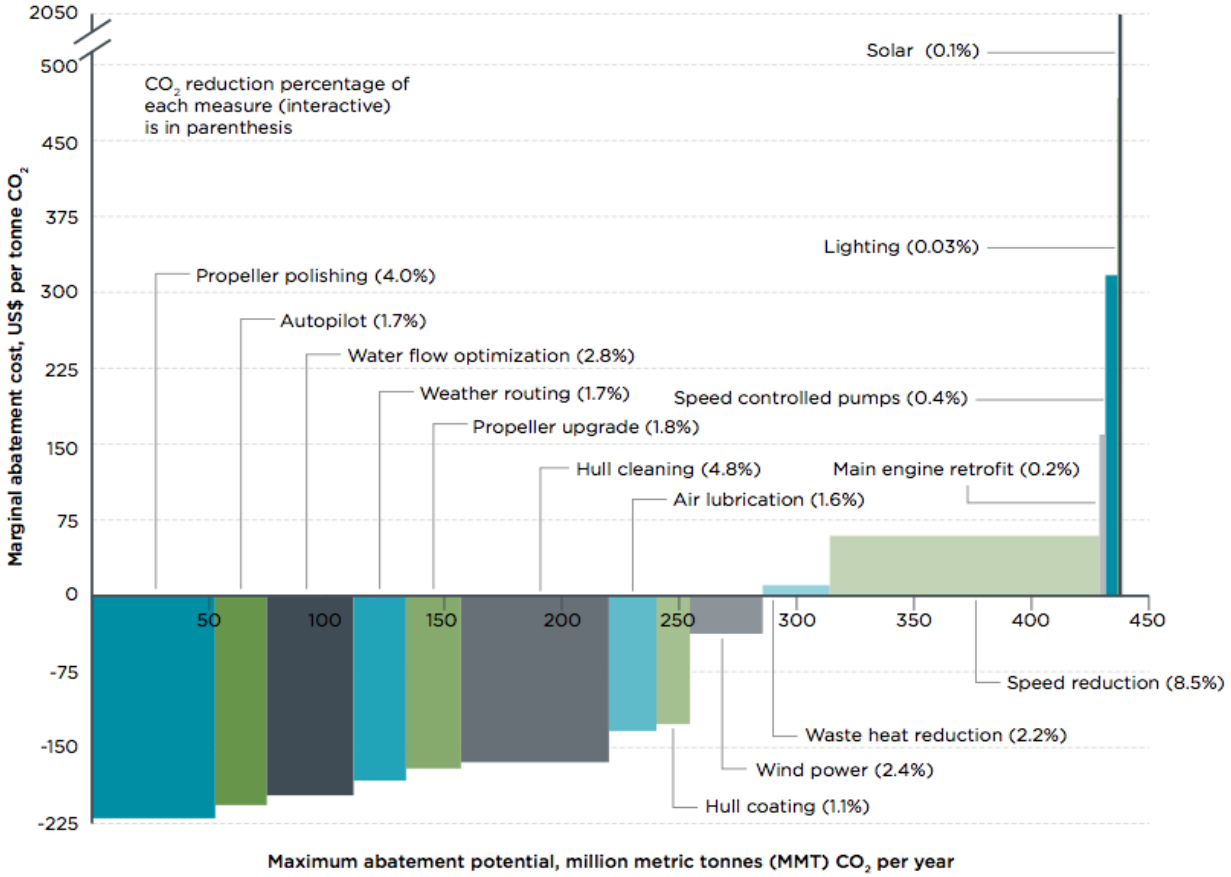


Source: International Council on Clean Transportation (ICCT), 2011

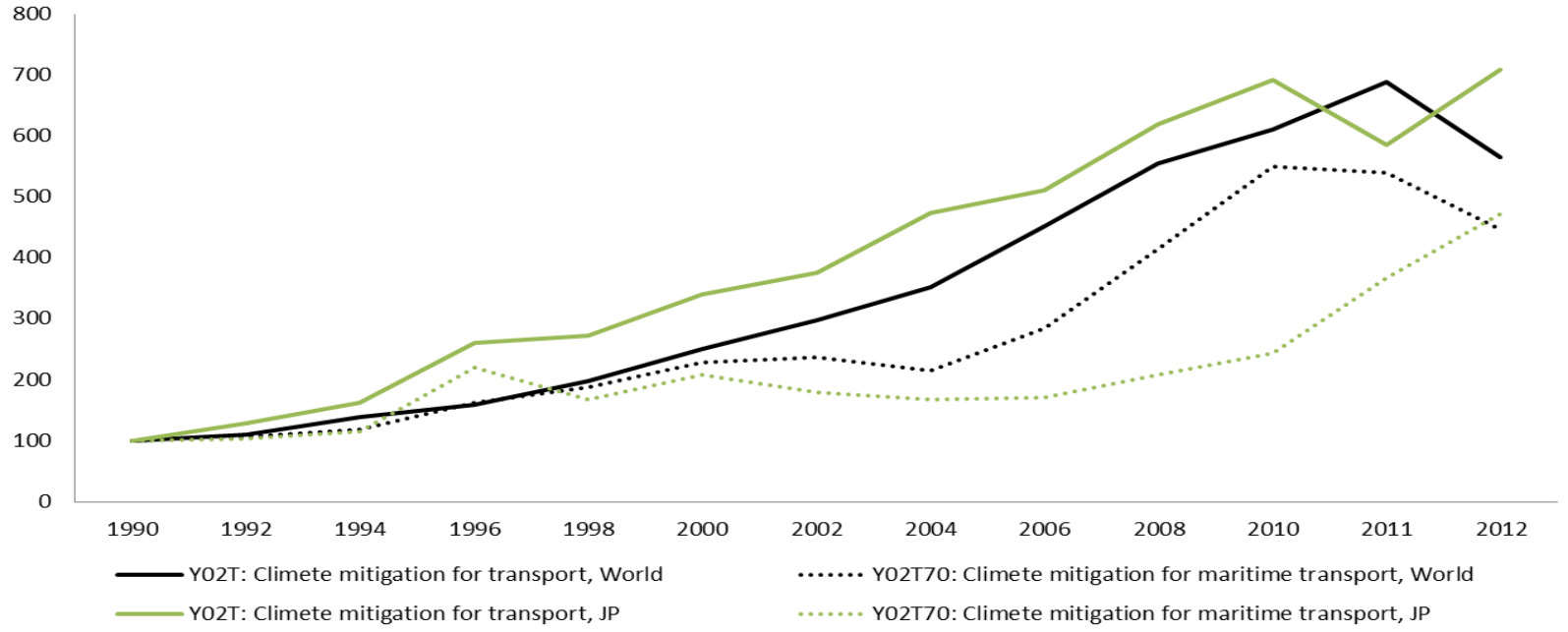
Case study on R&D support for green innovation in Japan

- R&D support for ship sector since 2009 in a form of grant, aiming to develop technologies which contribute reduction of CO_2 emissions from shipping

Volume of R&D support, in million JPY

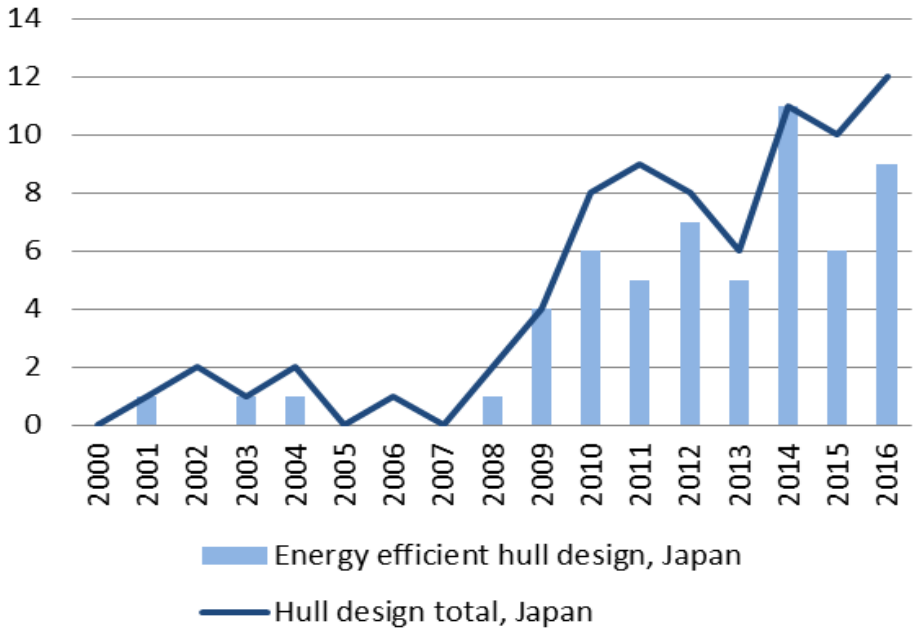
	2010	2011	2012	2013	2014	2015
Million JPY	783.17	684.87	428.31	333.19	354.61	301.19

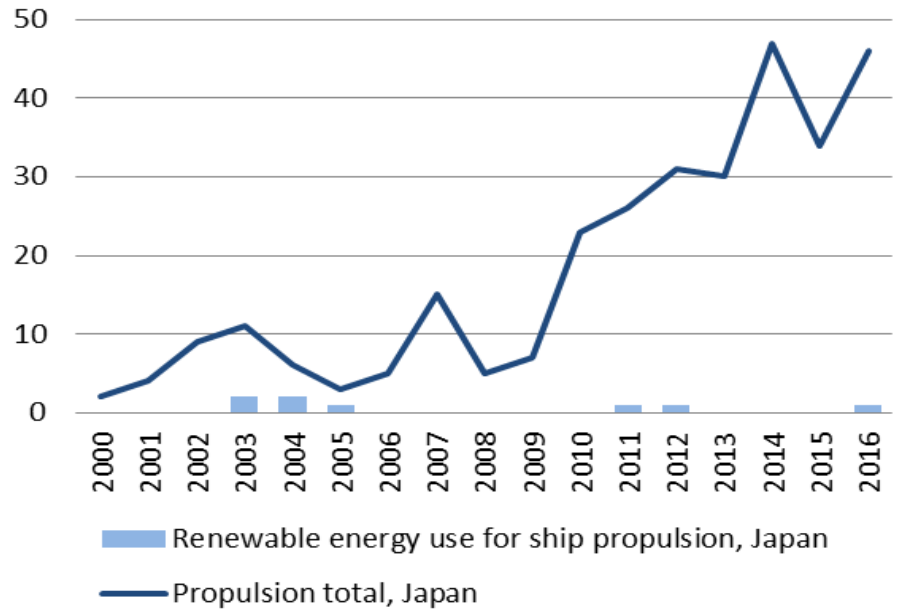
Indexed patent trends (1990 = 100) for various ship and waterborne technologies



Increase in patent applications in Japan since 2008 is driven by energy efficient hull design (i.e. air lubrication) and innovation in traditional propulsion system

PCT counts for hull design and propulsion system, #, **Japan**





Summary of analysis on patent activity in ship sector

- Patent activities are more intense for technologies which are less likely to be introduced into the market, but type of invented technology may depend on country and its policy.

Concluding remarks

- International regulation has an impact on
  - the environmental performance of ships
  - patent activities in the ship sector
  - business opportunities for shipbuilding and repair industries
- Regional and national measures impact stakeholders' decisions on how they
  - comply with regulations
  - undertake patent activities

Thank you.