LE HAVRE, 25 MAY 2023

Session 1: impact of IMO sustainable policy and data management on maritime industry

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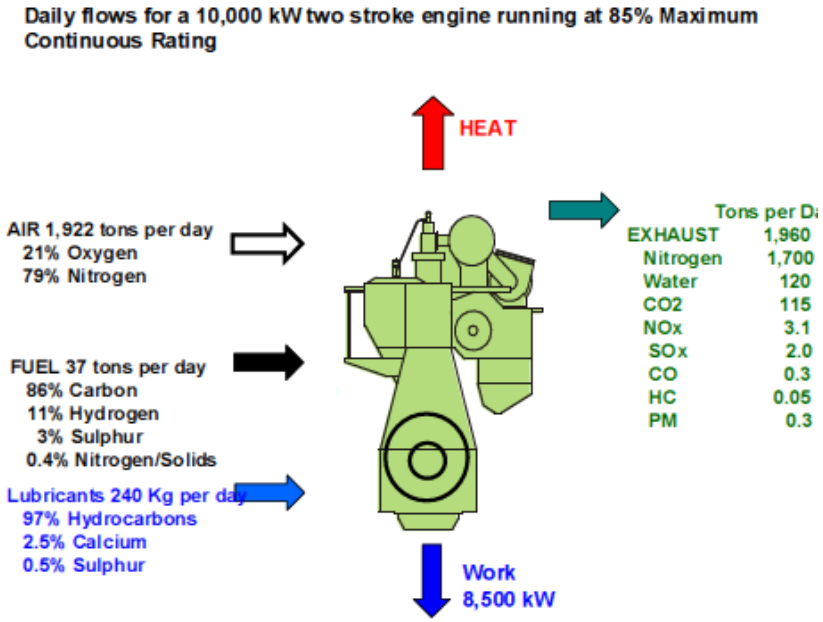
Agenda

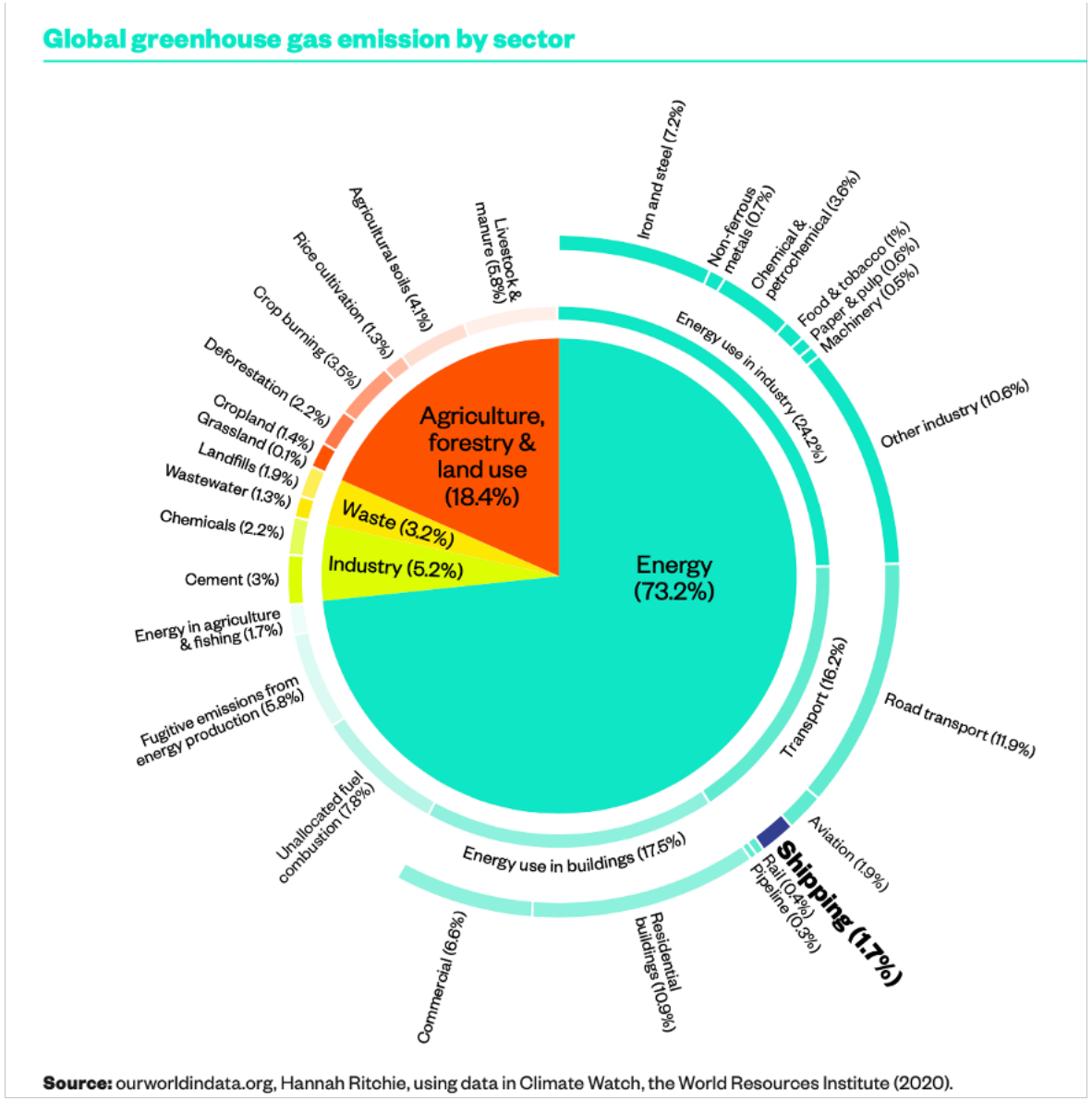
1. Setting the scene (contribution of shipping to carbon emissions)
2. Long-term projections
3. IMO policies and solutions
4. Technical and economic feasibility

Focus on carbon emissions from international shipping

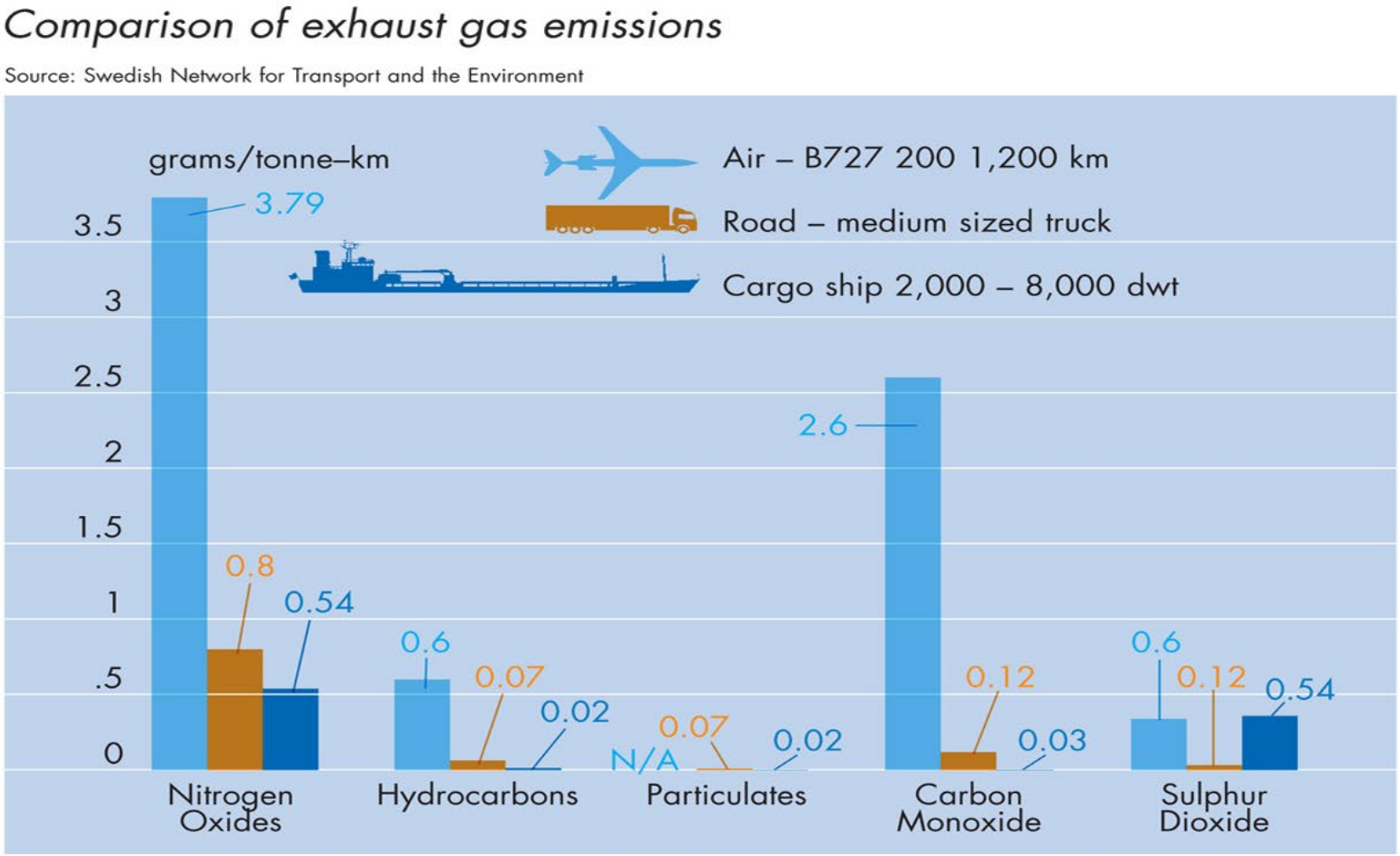


	Local	Regional	Global	Main impacts
Particulates Matters (PM)	■			Cardiopulmonary
Sulfur dioxide (Sox)	■	■		Cardiopulmonary Acid Rain
Oxides of nitrogen (Nox)	■	■	■	Cardiopulmonary Acid Rain
Carbon dioxide (CO2)			■	Global warming

Emissions from international studies



Focus on carbon emissions



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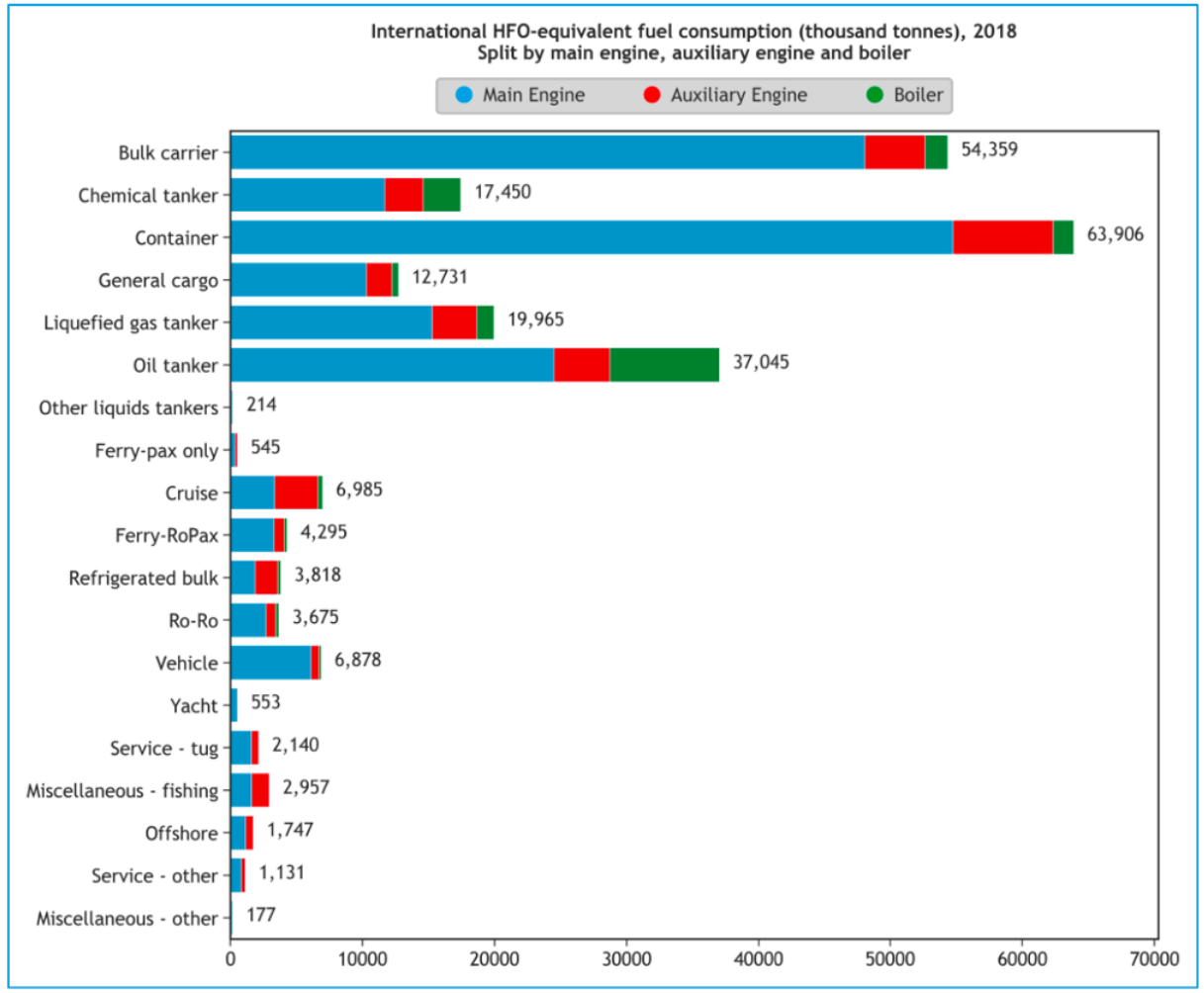
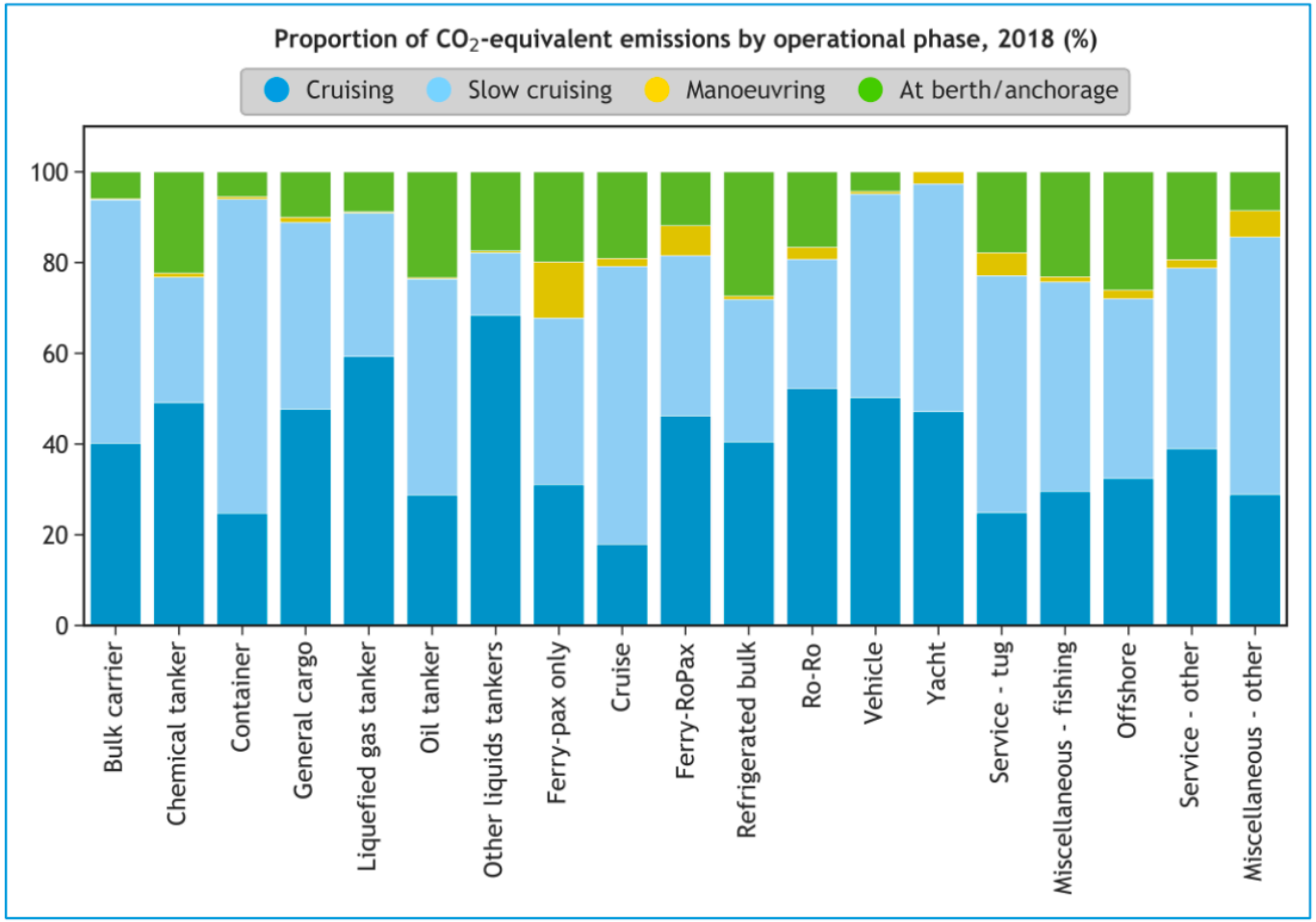
Sources of shipping emissions

Figure 5 - International HFO-equivalent fuel consumption, according to Option 2 (thousand tonnes), 2018, split by main engine, auxiliary engine and boiler



Sources of shipping emissions

Figure 6 - Proportion of international CO_2-equivalent emissions by operational phase in 2018



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2. Long-term projections 1/2 (OCDE 2018)

Figure 14. **Four different decarbonisation pathways for shipping**

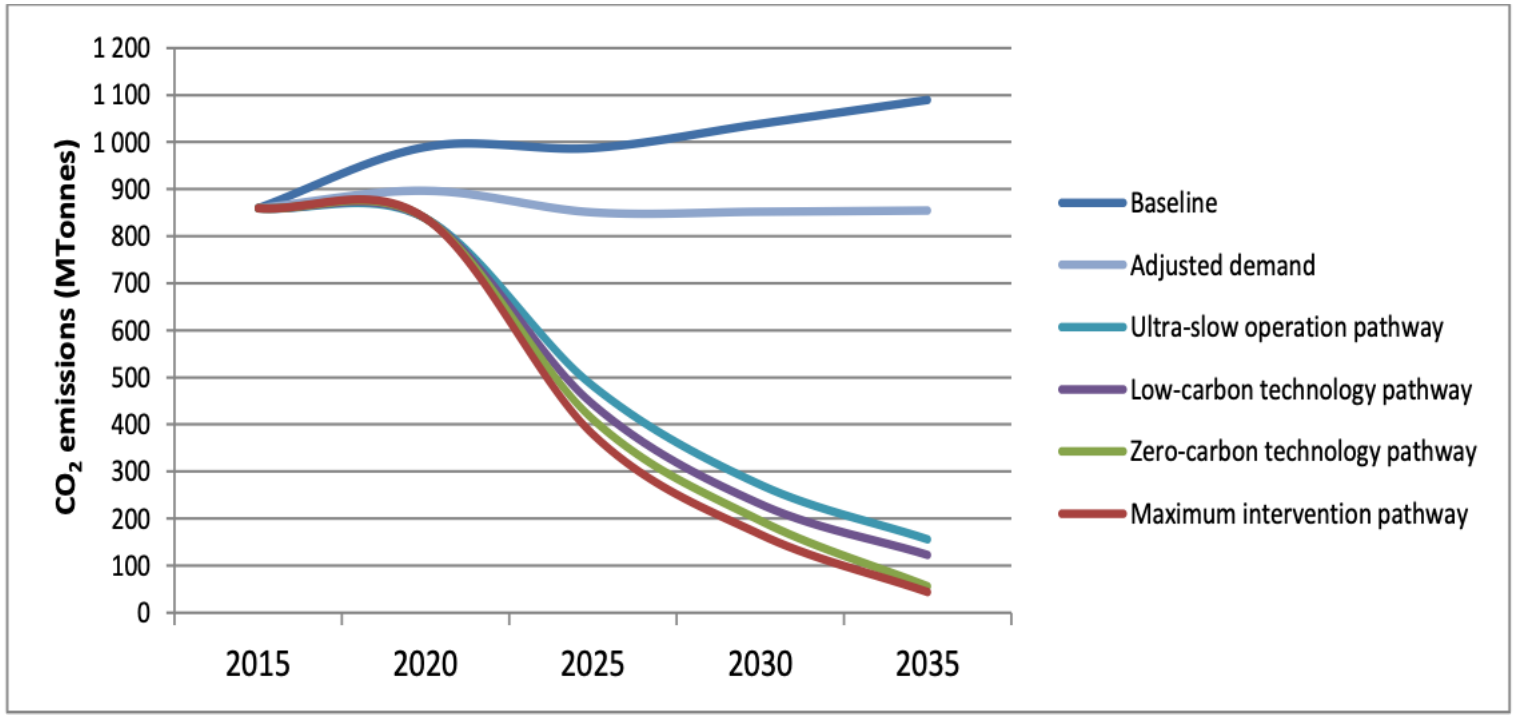
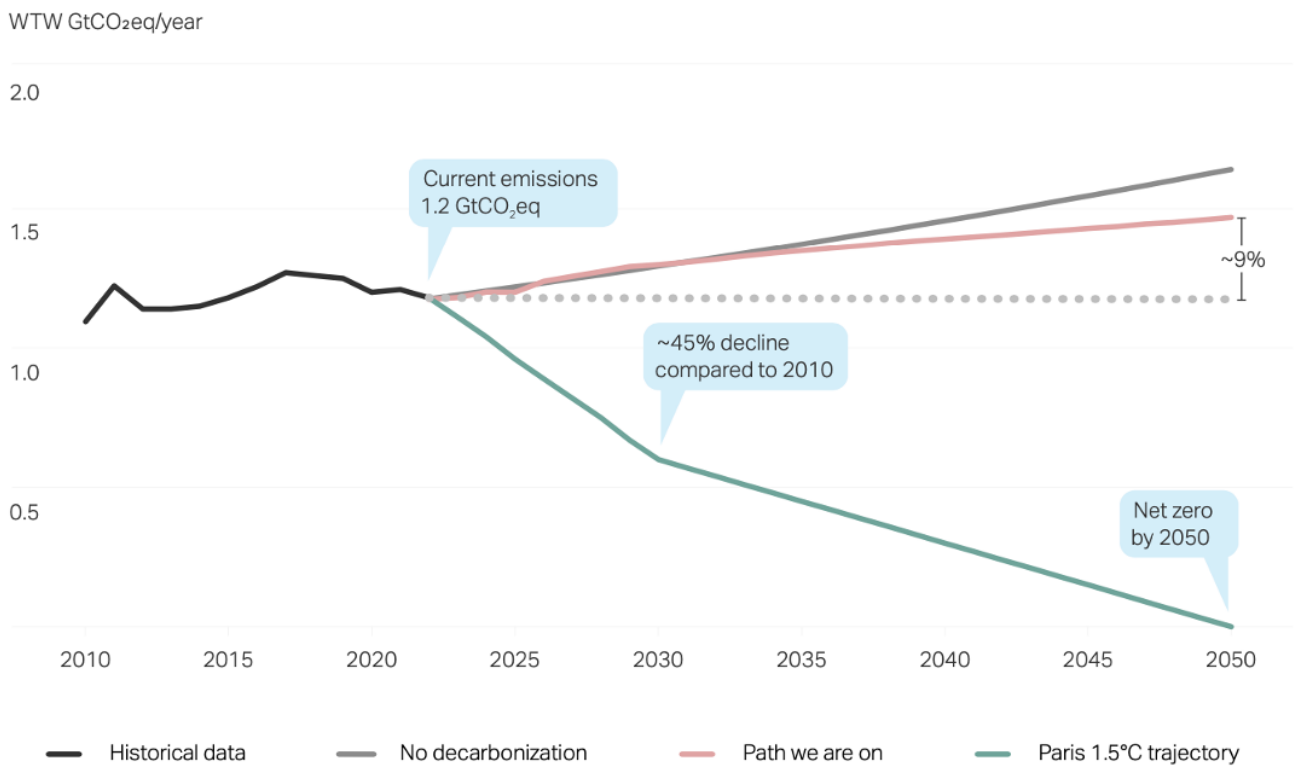


Table 6. **Four potential decarbonisation pathways and their components**

Pathway	Operational measures	Technical measures	Carbon factor reduction due to alternative fuels	Electric ship penetration
"Maximum intervention"	Maximum	Maximum	80%	10%
"Zero-carbon technology"	Moderate	Maximum	80%	10%
"Ultra-slow operation"	Maximum	Maximum	50%	-
"Low-carbon technology"	Moderate	Maximum	75%	-

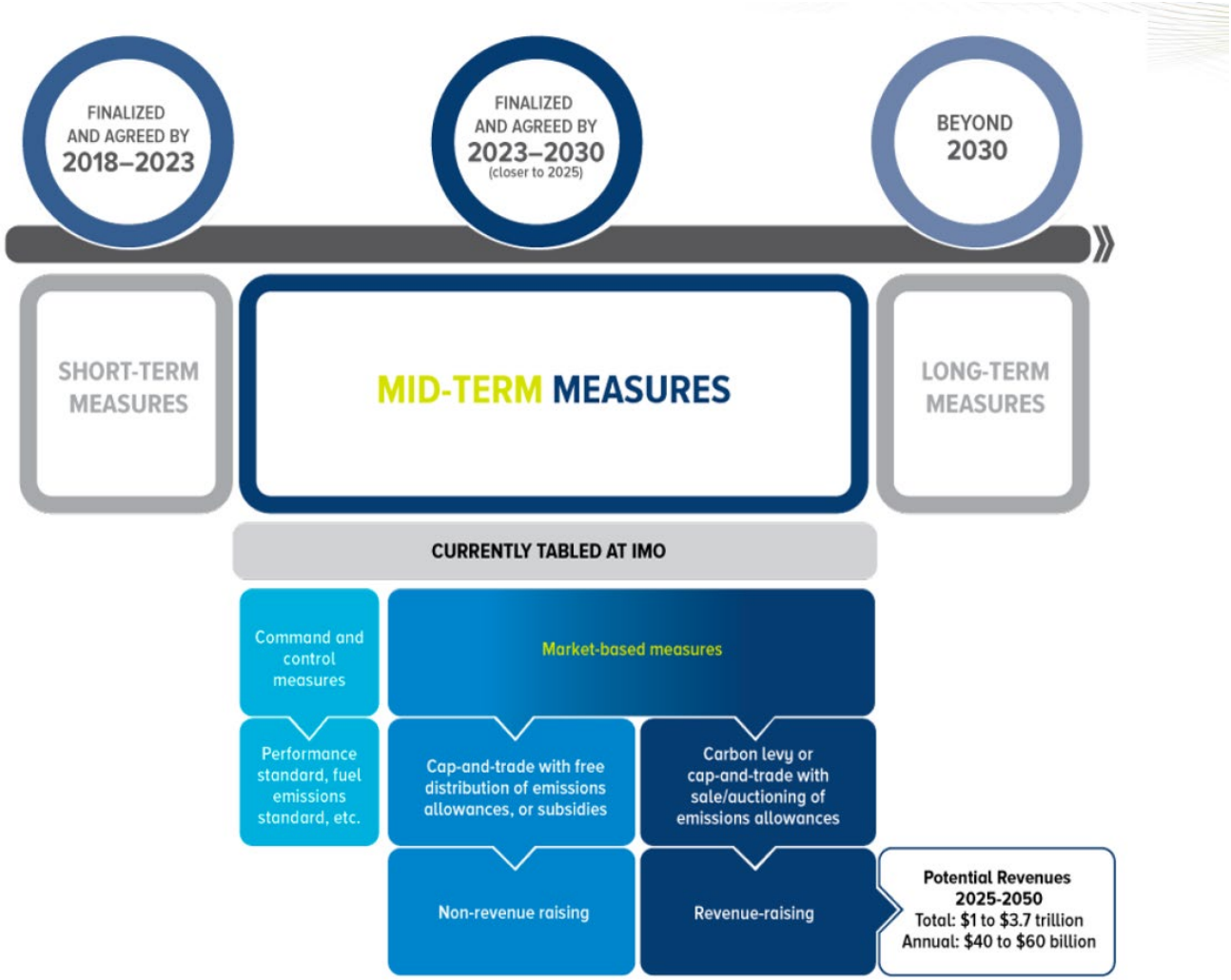
Long term projections 2/2 (2022)

Figure 1: Emissions between 2010 and 2050 based on historical data, 'the path we are on,' no decarbonization, and a 1.5°C trajectory based on shipping following the global trajectory presented by the IPCC.[6]



WTW = well-to-wake.
Historical data is based on the Third IMO GHG Study[7] and Fourth IMO GHG Study.[8] 'The path we are on' is based on MMMCZCS data and analysis as described in the ITS 2021.[9]

3. Regulations: OMI action plan (2018)



Short-term measures: EEDI + EEOI

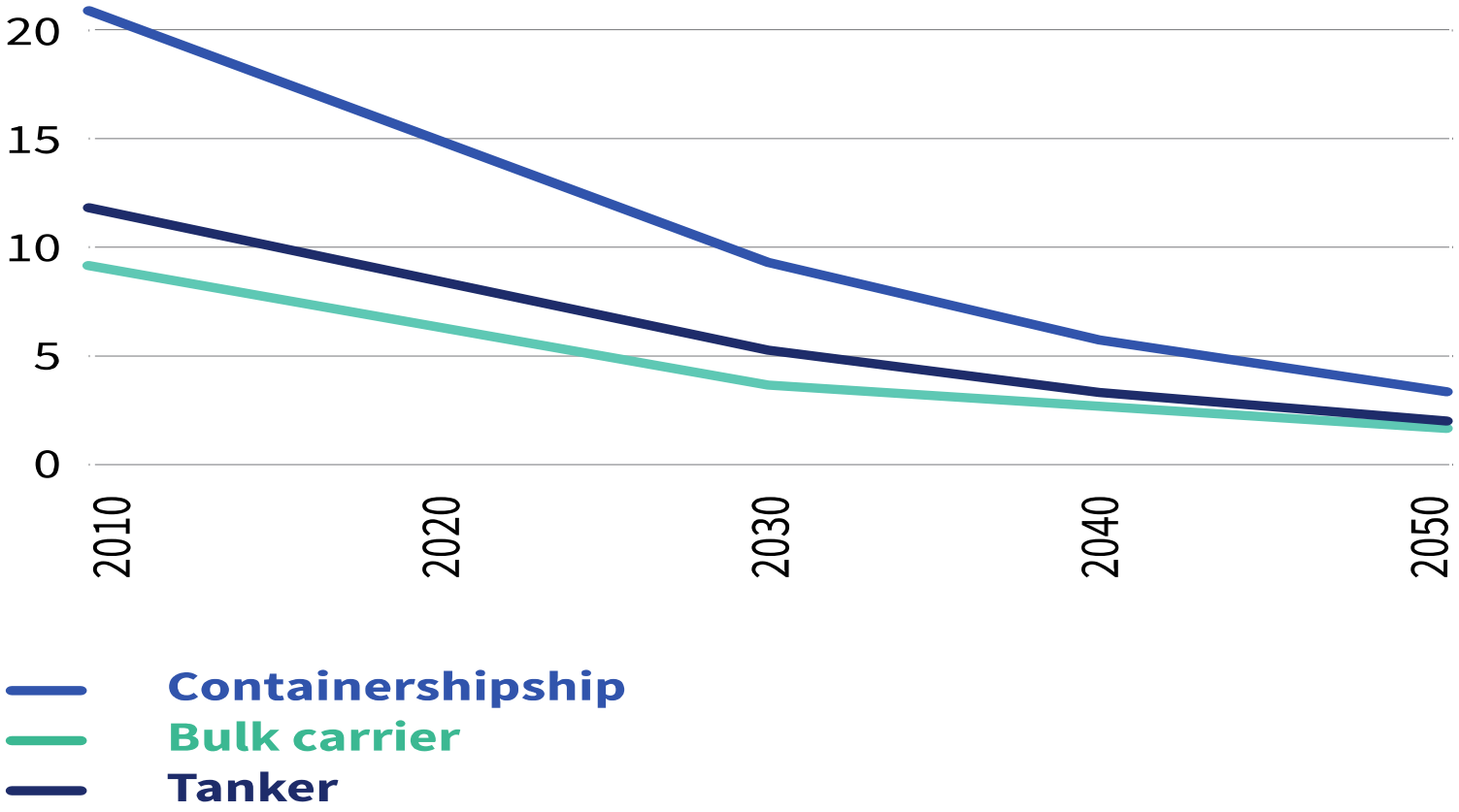
1. Reduce Energy efficiency design index (EEDI) of new vessels

2. Reduce operational emissions by 40% in « CO2 per ton-mile « in 2030, and 70% in 2050, compared to 2008.

3. Reduce total emissions by 50% in 2050 compared to 2008.

Required EEOIs

units of gCO_2/tnm



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Solutions

Table 1. **Overview of measures to reduce shipping's carbon emissions**

Type of measures	Main measures
Technological	Light materials, slender design, less friction, waste heat recovery
Operational	Lower speeds, ship size, ship-port interface
Alternative fuels/energy	Sustainable biofuels, hydrogen, ammonia, electric ships, wind assistance

Table 2. **Main technological measures**

Measures	Potential fuel savings
Light materials	0-10%
Slender design	10-15%
Propulsion improvement devices	1-25%
Bulbous bow	2-7%
Air lubrication and hull surface	2-9%
Heat recovery	0-4%

Note: Emission reduction potentials are assessed individually. Ranges roughly indicate possible fuel savings depending on varying conditions such as vessel size, segment, operational profile, route, etc., hence limiting the possibilities for comparison. Numbers cannot be cumulated without considering potential interactions between the measures.
Sources: Bouman et al. (2017); Gilbert et al. (2014); IMarEST (2011); Lindstad (2015b); Rehmatulla et al. (2017b); Royal Academy of Engineering (2013); Smith et al. (2016); Tillig et al. (2015); Van Kluijven et al. (2013).

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Table 3. **Main operational measures**

Measures	CO_2 emissions reduction potential
Speed	0-60%
Ship size	0-30%
Ship-port interface	1%
Onshore power	0-3%

Note: Emission reduction potentials concern the entire ship fleet. Numbers cannot be cumulated without considering potential interactions between the measures.
Sources: Faber et al. (2012, 2017a); Gollas et al. (2009); Kiani et al. (2006) Lindstad et al. (2011, 2012, 2013); Psaraftis and Kontovas (2014); Smith et al. (2014).

Table 4. **Main measures related to alternative fuels and energy**

Measures	CO_2 emission reductions
Advanced biofuels	25-100%
LNG	0-20%
Hydrogen	0-100%
Ammonia	0-100%
Fuel cells	2-20%
Electricity	0-100%
Wind	1-32%
Solar	0-12%
Nuclear	0-100%

Note: Emission reduction potentials are assessed individually. Ranges roughly indicate possible fuel savings depending on varying conditions such as vessel size, segment, operational profile, route, etc., hence limiting the possibilities for comparison. Numbers cannot be cumulated without considering potential interactions between the measures. Considering upstream emissions of synthetic fuels and electricity, an almost 100% emission reduction can occur only if produced by renewable energy sources.
Sources: See sections below.

4. Technical and economic Feasibility

Table 1: Energy efficiency levers, their potential impact and current uptake.

Area	Category	Examples	Potential energy efficiency gains per ship	Current fleet uptake*			
				Bulk	Tanker	Container	Passenger
Operational measures	Voyage optimization	Voyage planning, and weather routing, trim and draft optimization, energy management, hull, and propeller fouling management	1-10%				
	Fleet strategies	Fleet portfolio optimization, vessel deployment and utilization, scheduling, and speed optimization	1-15%				
Technological solutions	Hull & propeller efficiency	Hull form optimization, propeller design, anti-fouling systems, propulsion-improving devices, and air lubrication	1-8%				
	Engines and systems	Engine technology, electrification and hybridization, waste heat recovery system, and shaft generator	1-5%				
	Alternative power systems	Wind assisted propulsion	1-8%	P	P		P

Not applied · P Pilot installations · Limited adaption · Growing adaption · Best practice

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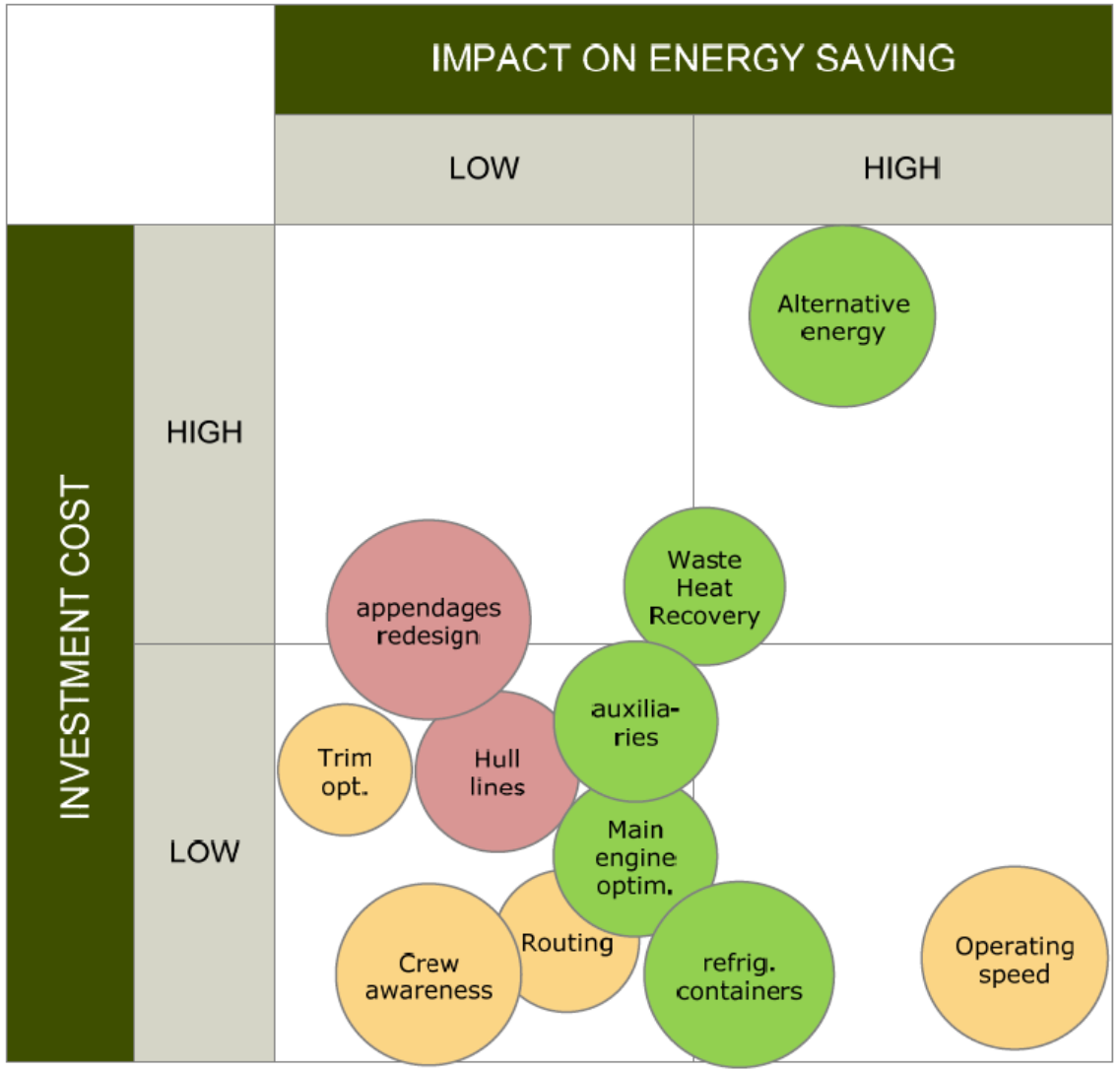
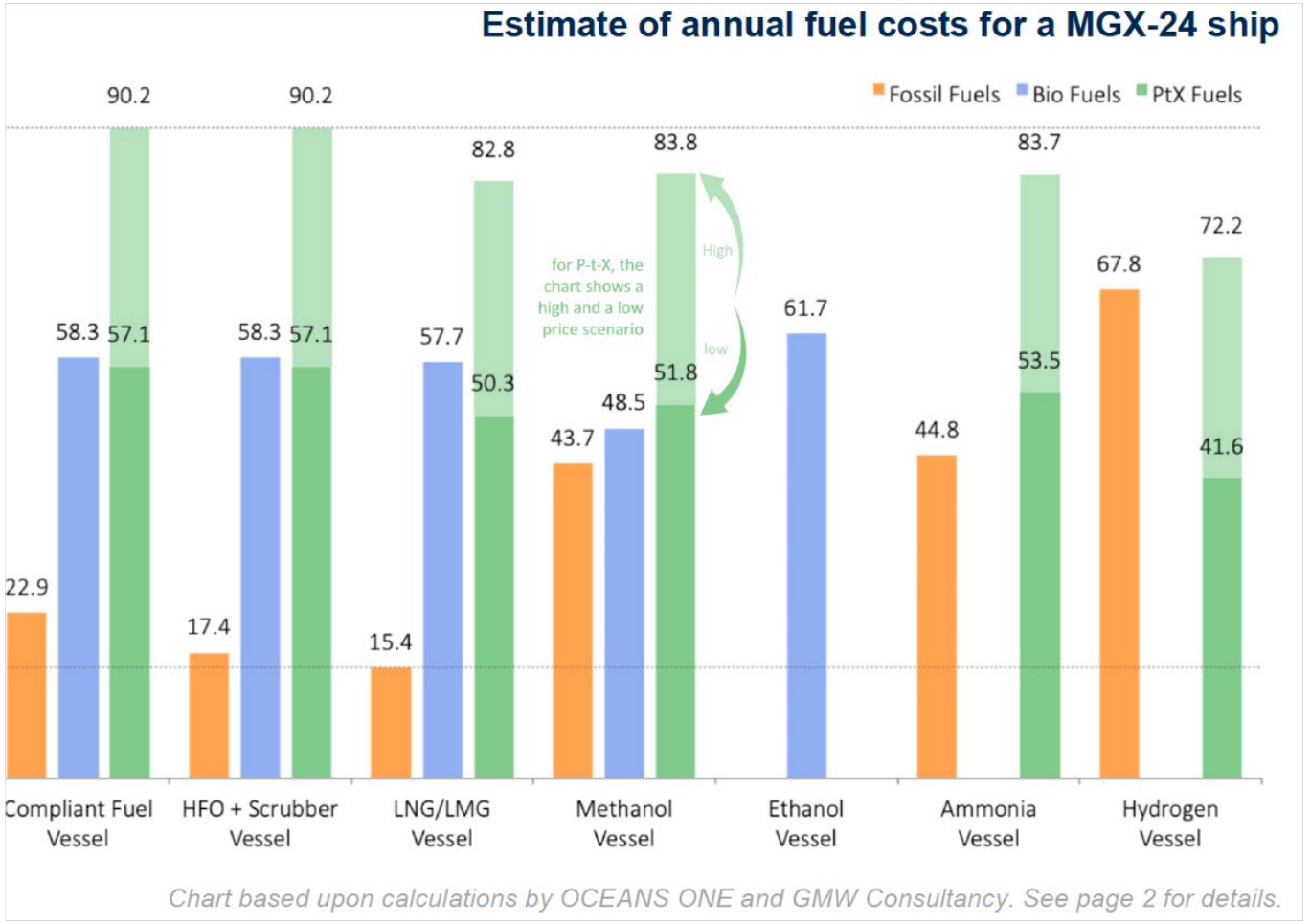
Economic Feasibility



Economic feasibility: impact on trade?



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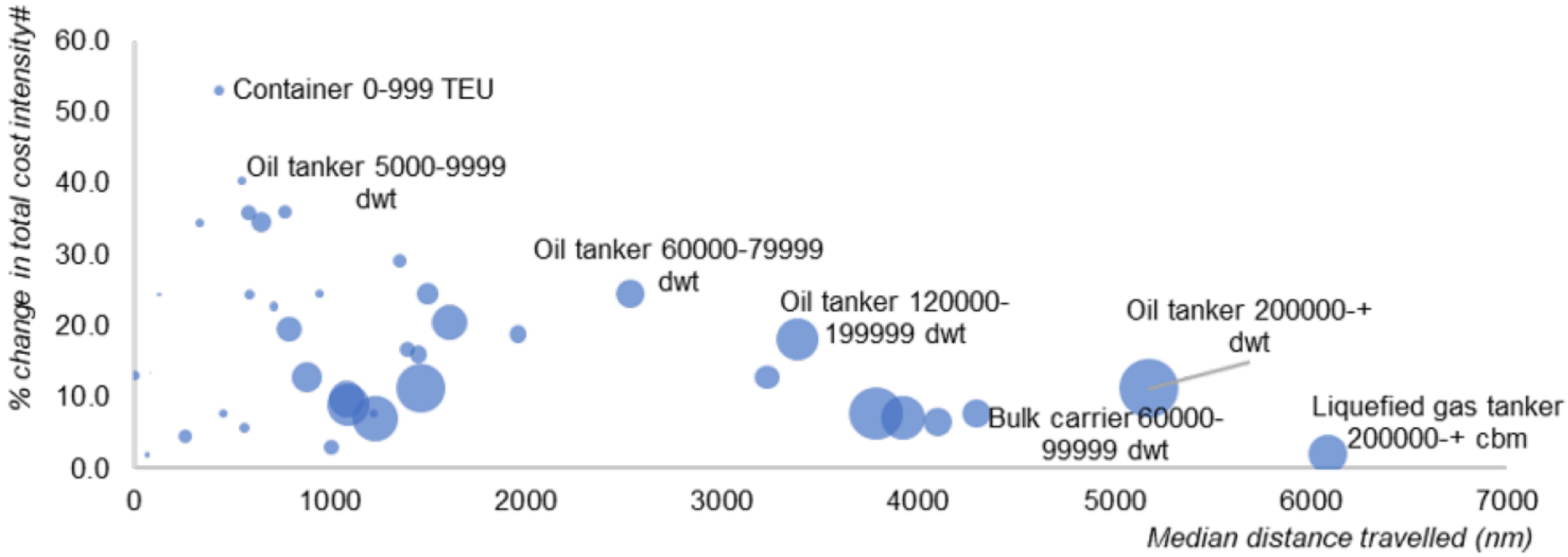

Figure 7: Percentage change in cost intensity by ship segment, average size* and median distance travelled.

Conclusion

1. Shipping remains amongst the best solution for international trade
2. Long-term projections are alarming
3. Policies (IMO, EU) and solutions exist
4. But technical and economic feasibility remains challenging.

Thank you

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