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The fleet of the future: Future outlook and fleet renewal

Shipping Forum

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Who are we?

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We have teamed up with Shell to generate commercial outcomes through a series of sectoral reports focused on decarbonisation

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Report Objectives

We set out to define decarbonisation pathways for harder-to-abate sectors to:

- Provide clarity around the **real challenges** creating bottlenecks around sectoral decarbonisation
- Create a **common language** which could be used to help discuss these challenges
- Outline a set of **practical solutions** which could be adopted today to begin making progress

All Hands on Deck centers around International shipping:

- The first report consisted of 74 one-on-one interviews with executives representing all segments in the sector.
- The most recent report consisted of 26 detailed interviews, with two auto manufacturers being included

Shipping
(2021)

Road Freight
(2022)

Aviation
(2022)

Fleet
(2022)

Construction
(2023)

Steel
(2023)

Shipping 2.0
(2023)

Today's focus:
Future outlook and fleet renewal

Existing IMO mandates such as EEDI and EEXI are already incentivising ship owners to invest in efficiency and design measures. EU ETS from January. IMO will present policy instruments in the upcoming years.

Selection of current and near-term policy

European Union (EU)

EU Emissions Trading System (EU ETS)

- Introduces the CO_2 "cap and trade" scheme to shipping as of 2024.

Renewable Energy Directive (RED II / III)

- Raises the overall EU target for renewable energy consumption by 2030 to 45% and supports the uptake of alternate fuels for transport e.g. biofuels or methanol

Fit for 55 - FuelEU Maritime

- Mandates shipping companies to reduce carbon intensity by 6% in 2030 and 75% by 2050, for any vessels above 5,000 GT travelling to, from or at berth in EU ports

International Maritime Organization (IMO)

GHG targets

- Overall ambition for global shipping is to reach net zero emissions around 2050.
- Check-points at 2030 (20-30%) and 2040 (70-80%).
- Measure(s) will entry into force in 2027, should comprise:
  - a **technical element**, namely a goal-based marine fuel standard
  - an **economic element**, on the basis of a maritime GHG emissions pricing mechanism.

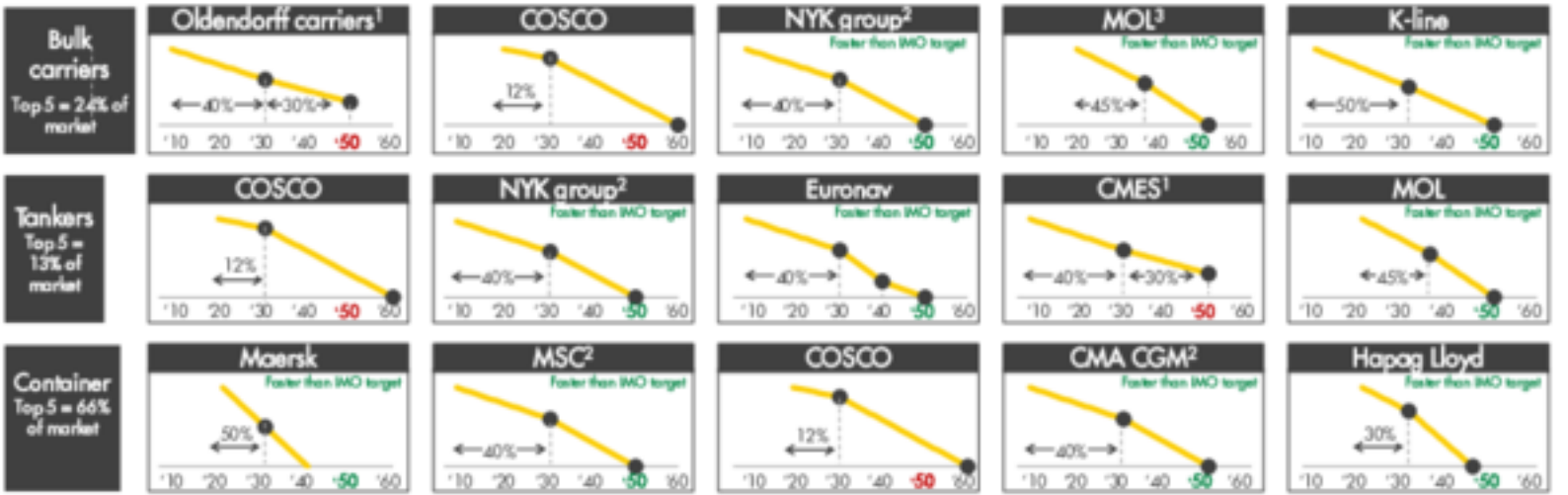
EEDI / EEXI

- Mandated energy efficiency minima for existing and new vessels

Source: IMO, EC, US Department of Energy, European Commission, Deloitte

Most large shipping companies have already committed to net-zero by 2050
The 2018 IMO initial GHG strategy targeted 50% absolute reduction

Top 5 shipping companies per shipping segment (Overall GHG emissions, indexed, reference year = 100)



Cargo owners are also increasingly **setting scope 3 targets**, including shipping, which can **increase the pressure** for shipping companies to decarbonise. Other **smaller shipping segments** with **higher margins** and / or **high demand pressure** could also **spearhead the transition**, e.g., cruise or off-shore contractors

Note: 1) Assumed to be in line with IMO's targets of CO2 emission intensity reduction of 40% in 2030 and 70% in 2050, as no company target was set; 2) 2030 target assumed to be in line with IMO's targets of CO_2 emission intensity reduction of 40% in 2030, as no 2030 company target was set; 3) GHG emission targets;
Source: Company announcements and annual/ESG reports; Deloitte

We use a framework of six factors to understand the sector's readiness to decarbonise

What makes an industry ready to decarbonise

Change dimensions	Change factors	
Why should we change?	**1. Market & customer demand** Pressure (or upside) from customers/consumers[1], financiers,...	**2. Regulatory incentives** Pressure from regulators (e.g. carbon tax)
Can we change?	**3. Technology alignment** Clarity on required fuel and other technology	**4. Clarity on roles and decision-making** Clarity on who needs to do what
How fast can we change?	**5. Ease of asset replacement** Capital and time required to replace assets	**6. Ease of infrastructure replacement** Size and concentration of bunkering and other infrastructure

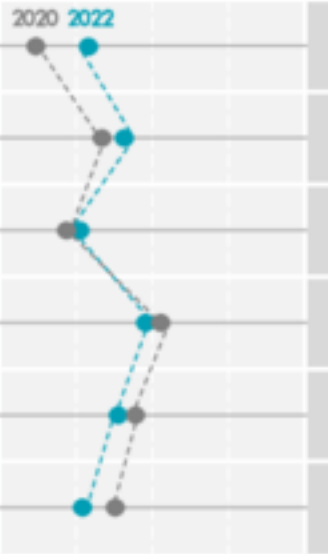
Notes: 1) Customers refer to all parties buying shipping services (e.g. freight forwarders, manufacturers, mining companies). Consumers refer to general public that buys goods, directly or indirectly from these companies

The barriers identified in 'All Hands on Deck 1.0' remain, with the largest signs of improvement around market and customer demand, regulation and technology

Decarbonisation readiness framework - Progress

Progress: Higher Lower

	Readiness factor	Progress	Supporting evidence	Barrier going forward
Why should the sector change?	1. Market and customer demand		• More requests on emission transparency and some green premiums in Containership segment	Major barrier 100% … Minor barrier 0%
	2. Regulatory incentives		• CII/EEXI • Shipping under EU ETS, RED II (EU) Methanol, RED III • IRA (USA)	Major barrier 100% … Minor barrier 0%
Can the sector change?	3. Technology alignment		• New alternate fuels vs. chapter 1 • Dual fuel and Fuel ready new builds, small quantities • Several pilots, questions on some fuels e.g. ammonia	Major barrier 100% … Minor barrier 0%
	4. Clarity on roles and decision-making		• Still too many initiatives, with limited alignment	Major barrier 100% … Minor barrier 0%
How fast can the sector change?	5. Ease of asset replacement		• Recognition of existing fleet measures and new fleet • Role of retrofits and scrapping to date not widely discussed	Major barrier 100% … Minor barrier 0%
	6. Ease of infrastructure replacement		• Held back by lack of certainty on fuel mosaic and capacity for zero emission fuels • Some progress on green corridor thinking	Major barrier 100% … Minor barrier 0%

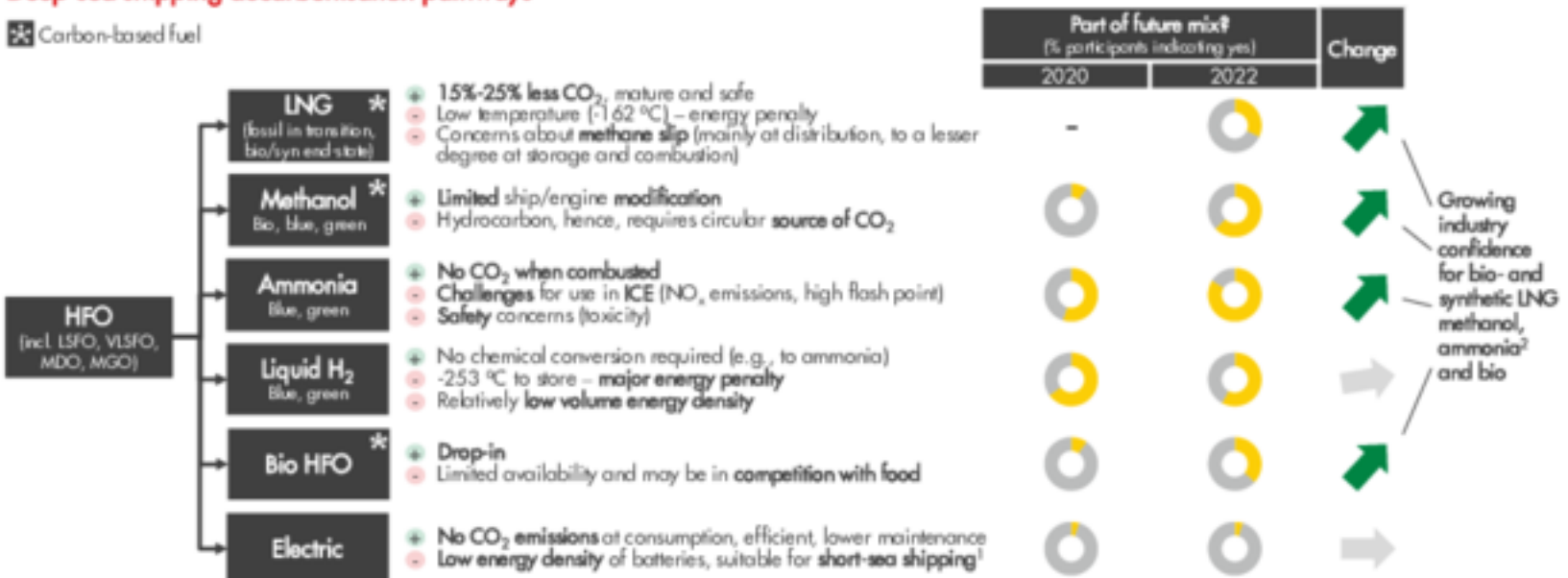


Source: Industry interviews

Stakeholders view the role of LNG and methanol as transition pathways, with additional hydrogen derivatives playing an expanding role beyond 2035

Deep-sea shipping decarbonisation pathways

Carbon-based fuel

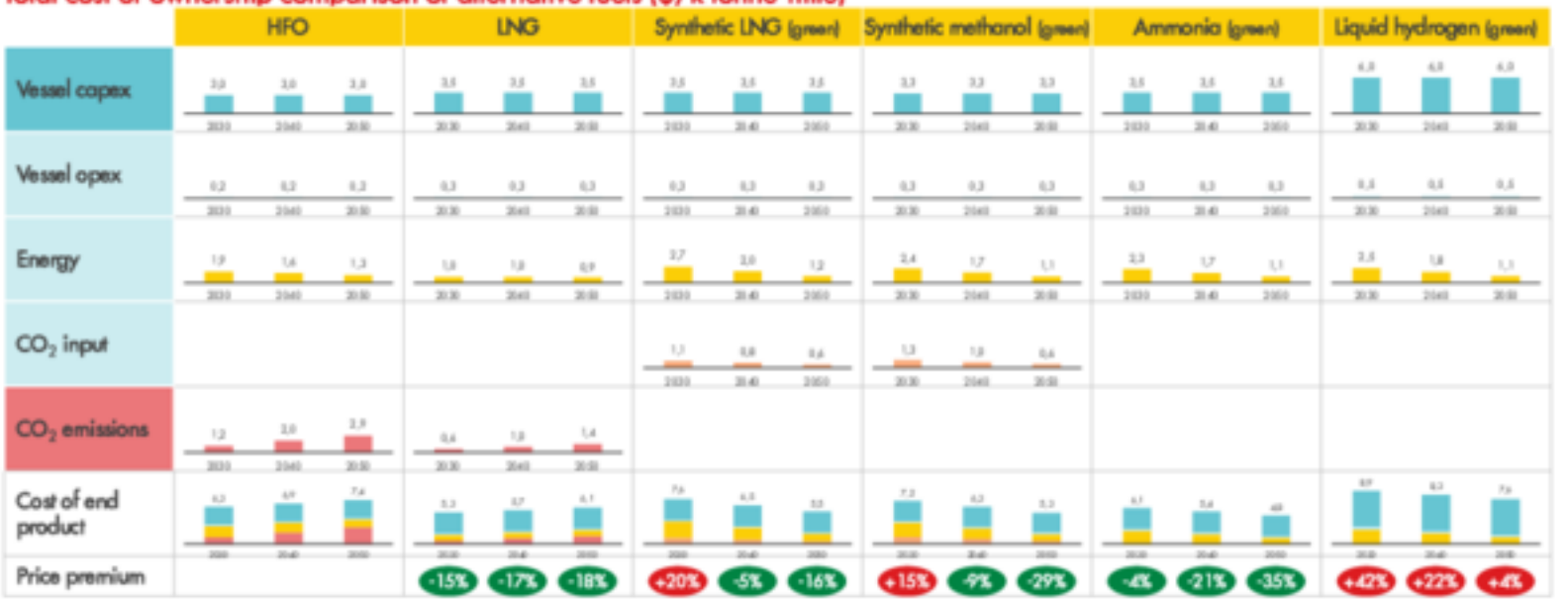


Note: 1) Opportunities for electrifying the short-sea shipping fleet are discussed in the Shell-Deloitte Marine Electrification Report (forthcoming March 2023); 2) Results for ammonia are conditional on if a solution is found for the significant toxicity challenge

Source: American Bureau of Shipping 'Pathways to Sustainable Shipping – 2020', Recharge; Shell-Deloitte "All Hands on Deck" (2020); IEA "Net zero by 2050 – A roadmap for the global energy sector" (2021), Expert interviews

Taking the total cost of ownership view supports the case for creating a level playing field between conventional and alternative fuels through a carbon price

Total cost of ownership comparison of alternative fuels ($/k tonne-mile)



Notes: Based on set lifetime of 500 tonne-miles and capex of $150M for HFO, $174M for LNG, $167M for methanol, $174M for ammonia and $300M for hydrogen; opex of 0.15% of capex; GJ / k tonne-miles of 0.148 oil for HFO, 0.102 for LNG, 0.12 hydrogen + 0.002 electricity for synthetic LNG (incl liquefaction), 0.099 hydrogen + 0.02 electricity for methanol, 0.94 hydrogen + 0.03 electricity for ammonia and 0.10 hydrogen + 0.03 electricity for hydrogen (incl liquefaction); tank-to-wake CO_2 emissions in kg CO_2 / GJ of 0.0774 for HFO and 0.0562 for LNG; CO_2 feedstock need in kg CO_2 / k tonne-miles of 5.6 for synthetic LNG and 6.3 for methanol; CO_2 feedstock assumed from Direct Air Capture at $200/t by 2030, moving down to $100/t by 2050

Sources: MMMC, Dacherra, PBL, Netherlands Enterprise Agency, Ali et al. - Liquefied synthetic methane from ambient CO_2 and renewable H2 - A techno-economic study, Deloitte analysis

~60% of shipping decarbonization initiatives globally (excluding LNG) are focused on methanol and ammonia, most in an early stage

Shipping decarbonization initiatives by type and maturity (# of initiatives, Jul '22)

	Vessel design			Bunkering			Fuel production / supply			Σ
	Potential[2]	Planned	Operational	Potential[2]	Planned	Operational	Potential[2]	Planned	Operational	
Methanol	2	7	3	1			4	11	1	**29** (30%)
Ammonia	16	4	1	1	1		2		3	**28** (29%)
Liquid H_2	6	1	1				2			**10** (10%)
Bio						1	6	1	1	**9** (9%)
Electric		1	1							**2** (2%)
Other[1]	1						1	1		**3** (3%)
Multiple	2			6			4	2	3	**17** (17%)
Σ	**27**	**13**	**6**	**8**	**1**	**1**	**19**	**15**	**8**	**98** (100%)

E.g., Maersk ordering dual fuel methanol-HFO container vessels

E.g., Yara pre-ordering 15 floating ammonia bunkering terminals for operation in Scandinavian ports in 2024

E.g., Maersk entering in six partnerships with fuel producers for offtake of ~0.8 Mt bio- and e-methanol

Notes: 1) Nuclear, CCS, LPG; 2) Potential includes very early stage announced initiatives without specific plans / timelines; Source: Company announcements, Deloitte analysis

To unlock the next steps, leading & enabling roles have been identified for each solution theme

Stakeholder responsibility matrix

Responsibility: Lead role | Enabling role

Barriers	Chapter 2 solution themes		Owners/ operators	Charterers	Cargo owners	Regulators	Financiers	Ports	Fuel providers	Shipyards	Crew
Market & customer demand	1	Demand aggregation	■	■	■	▫					
	2	Segment-based approach	▫	▫	■	■					
	3	Financing				■	■				
	4	Transparency	▫	▫	■						▫
Regulatory incentives	5	Regulation				■	▫	▫			
Technology alignment	6	Fuel landscape				▫			■		
Asset replacement	7	Efficiency measures	■	▫	■					■	▫
	8	Timely fleet replacement	■	▫						■	
	9	Yard capacity								■	
Infrastructure replacement	10	Hubs				■			■		
	11	Green corridors	■	▫	■	▫	▫	■	■		
Roles & decision making	12	Health, safety & environment	■	■		■					■
	13	Platform strategy	■			■		▫	▫	▫	▫

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Takk for oss!

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