

CLIMATE ACTION IN SHIPPING

Progress towards Shipping's
2030 Breakthrough



UMAS

RACE TO ZERO

2030
BREAKTHROUGHS

CLIMATE ACTION IN SHIPPING

Progress towards Shipping's 2030 Breakthrough

This report is a joint effort between UMAS and UN Climate Change High Level Champions.

LEAD AUTHORS

Dr Domagoj Baresic (Consultant - UMAS)
Katharine Palmer (Shipping Lead - Climate Champions Team)

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Tristan Smith
Nishatabbas Rehmatulla
Joseph Taylor
Aidé Saucedo Dávila
Akash Kapur
Jean-Marc Bonello
Alison Shaw
Camilo Perico

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UMAS delivers consultancy services and undertakes research for a wide range of clients in the public and private sectors using models of the shipping system, shipping big data, and qualitative and social science analysis of the policy and commercial structure of the shipping system. UMAS's work is underpinned by state-of-the-art data supported by rigorous models and research practices, which makes UMAS world-leading on three key areas; using big data to understand drivers of shipping emissions, using models to explore shipping's transition to a zero emissions future and providing interpretation to key decision makers.

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The Getting to Zero (GtZ) Coalition, a partnership between the Global Maritime Forum and World Economic Forum, is a community of ambitious stakeholders from across the maritime, energy, infrastructure and financial sectors, and supported by key governments, IGOs and other stakeholders, who are committed to the decarbonization of shipping. Core funding is received from Mission Possible Partnership.



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The 2030 5% goal is within reach!

The time is now to convert commitments to action. This report assesses progress to a goal of having **scalable zero emission fuels (SZEf) make up 5% of international shipping fuels by 2030**. The findings show significant progress, especially in terms of commitments by industry, national governments, and positive developments at the International Maritime Organization (IMO). The 5% goal can be viewed as a breakthrough needed to rapidly scale uptake of SZEf and achieve zero emission shipping by at least 2050. **Currently, actions towards this 5% goal can be considered as being partially on track**. This is because, **even though progress has been significant, more is needed to bring us to 5% and beyond**, not just in terms of commitments, but also in terms of converting those commitments into concrete developments.

In terms of technology and supply for SZEf progress is partially on track. Currently there are at least 203 shipping decarbonization pilot and demonstration projects in the pipeline. Internationally, progress has been observed regarding bunkering and safety guideline developments. However, **moving from pilots to SZEf production commitments, investments, and infrastructure development is now a key requirement**. Current estimates in line with IMO Initial Strategy ambitions put the total additional capital needed for shipping's decarbonization at US\$ 1-1.4 trillion, with over 80% of this figure upstream (e.g., associated with infrastructure investment).

In terms of finance for SZEf current developments are partially on track. There are growing commitments in ship finance such as the 'Poseidon Principles,' **with 28 current signatories accounting for over 50% of shipping debt finance**. Other commitments such as the 'Clydebank Declaration' raise the potential for future private funding, especially in terms of green corridors. **However, limited progress has been observed in terms of SZEf infrastructure funding commitments and creation of financial mechanisms desirable for SZEf adoption such as contracts for difference (CFD)**.

In terms of **policy to facilitate SZEf uptake** developments are also **partially on track**. Several industry announcements regarding SZEf safety rules have been made. There have been growing calls

for shipping to align with a 1.5°C trajectory, such as the 'Climate Vulnerable Forum Dhaka-Glasgow Declaration' signed by 55 nations and signatories to the 'Declaration on Zero Emission Shipping by 2050' have almost doubled since its launch at COP26. **From an IMO perspective, progress has been made regarding shorter term measures, as well as a consensus on pricing GHG emissions**. However, agreement regarding the type and scale of market-based mechanisms (MBMs) in shipping will require additional progress at the IMO.

In terms of demand for SZEf progress is partially on track. In several areas such as freight purchaser commitment to zero emission freight significant progress has been made which are now starting to be converted into actions. **Through the cross-sector initiative 'First Movers Coalition' several companies have committed to shift to zero emission fuels**. Similarly, cargo owners have committed a percentage of volume shipped zero emission vessels. Other commitments through coZEV and the Sea Cargo Charter has supported increased industry commitment in bringing zero carbon freight to the market.

In terms of civil society progress is partially on track. In 2021 the International Transport Workers Federation (ITF) set out principles for a just transition to sustainable shipping, and subsequently a Just Transition Maritime Taskforce was launched at COP26. Initiatives such as 'Ports for People' and 'Ship it Zero' facilitated by 'Pacific Environment' have increased visibility of the need for shipping to reduce its climate footprint. **However, this action is limited to Global North and would need to grow geographically representing action in the Global South**.

Overall, there has been significant progress in commitments which are starting to be converted into action through creation of standards, improvements in transparency and cross value chain collaborations coming together to test and pilot demonstrations. There is hope that this puts us on track to meet enabling actions by middle of this decade setting the course towards the 5% breakthrough goal by 2030.

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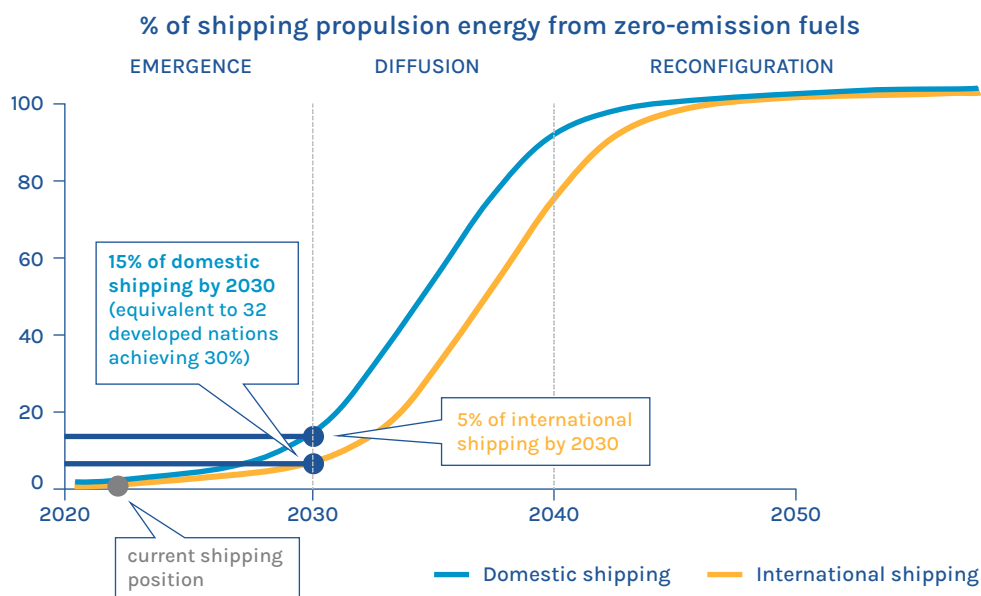
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Introduction

Shipping transports around 90% of global trade and accounts for 3% of global Greenhouse Gas (GHG) emissions, from the combustion of fossil fuels (Faber et al., 2020). Under business-as-usual (BAU), emissions may increase by 130% by 2050 compared to 2008 levels (Ibid.). To set international shipping on an ambitious, zero emission trajectory aligned to 1.5°C, the sector must transition away from using fossil fuels, supported by the necessary technology and infrastructure to produce safe and scalable zero-emission fuels (SZE¹) including, distribution, storage, and bunkering. Significant take up of SZE¹ will be necessary for shipping to be on this trajectory. A general fuel transition can be considered to go through three distinct phases, ‘emergence’, ‘diffusion’ and ‘reconfiguration’, in the first phase research through pilots and innovation begins to increase adoption of a novel fuel, which then rapidly increases in competitiveness through the ‘diffusion’ phase, to become the new dominant fuel in the ‘reconfiguration’ phase, the shape of this transition is often referred to as the S-Curve (Figure 1). Currently shipping is still in the emergence phase of the transition, and at least 5% of SZE¹ is required by 2030 (Osterkamp et al., 2021) to enable rapid scaling and mass adoption in the diffusion phase. This would equate to just over 0.6 EJ of energy demand which depending on the green hydrogen derived SZE¹ used this equates to either 29.8 million tonnes of ammonia or 28.1 million tonnes of methanol as examples.²

Figure 1: S-Curve relation to decarbonization of maritime shipping³.



Note: Based on a smoothed sigmoid curve forced to 100% at the end given the starting point.
Source: High Level Champions, 2020.

- 1 Fuels which have net zero well-to-wake GHG emissions and have the potential to be produced at a competitive price compared to fossil fuels over a long period of time, whilst also having the potential to be produced at the volumes necessary to meet a significant amount of global maritime demand (i.e., in EJ of energy by the 2030s) (Smith et al., 2021).
- 2 Based on internal UMAS calculations. Fuels such as methanol would have to be sustainably sourced and produced as e-fuel options in a similar way to other synthetic fuels.
- 3 S-Curve includes adjustments from Smith et al. (2021).

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This 2030 breakthrough goal of 5% helps affirm and mobilize commitment and action across all stakeholders for example:

- Energy companies have greater confidence in expected demand when planning green energy development projects
- Cargo owners can be mobilized to take part in cross supply chain collaboration and investment, including through paying a premium for zero emission fuels on a corresponding percent of their freight
- Investors can quantify the amount of investment needed across the value chain
- Shipping companies can be confident to plan and invest in new builds and retrofits
- Regulators can be called on to ensure a level playing field is in place to enable the transition

Shipping is currently only in the very early stages of a fuel transition – the ‘emergence’ phase. Multiple actions are necessary for 5% uptake of SZEf across different change levers and different actors

Initial efforts are already taking place to decarbonize shipping, but must be accelerated if the shipping sector is to achieve its 2030 breakthrough goal of 5% SZEf in international shipping as outlined by UN Climate Change High Level Champions 2030 Breakthroughs campaign (UNFCCC, 2021). This will not be possible without further alignment and collaboration across the entire maritime value chain.

Individual efforts taking place from maritime actors need to be coordinated to fully deliver the step change. In October 2021 the UN Climate Change High Level Champions, UMAS and the Global Maritime Forum (GMF) published an action plan (Palmer et al., 2021) to achieve the 2030 Breakthrough goal of 5% which sets out the specific near-term actions and milestones, around which businesses and governments can unite. It details what key actors must do and by when to deliver the needed transformation of shipping, creating a shared vision for all players in the maritime value chain and clarifying how efforts of each actor contribute to the whole, therefore increasing confidence and generating greater impact. Uniting around this master plan to achieve at least 5% SZEf by 2030 helps guide decisions, actions, and allows us to monitor the progress of the sector’s transition to zero, demonstrating that the shipping industry is taking a leading role in the just, equitable, healthy, and resilient transition to a zero-carbon world.

This report tracks progress against this 2030 breakthrough with the associated master plan to see what actions are necessary to reach 5% SZEf adoption and what progress has been made by taking the following approach:

- Ascertain progress towards the 5% goal and see which actions are on track and which are not**
- Where appropriate make suggestion for actions with up-to-date information**

The principal objective of this report is to assess whether sufficient progress has been made within the outlined actions to reach 5% by 2030 and ensure continued momentum around the actions needing more support and attention. The justifications of outcomes for each action in terms of progress tracking are provided in the report Annex. The report reviews 5 system change levers; technology/supply, finance, policy, demand, and civil society, across 3 different types of actors; industry actors, national actors, and international actors, and ascertains whether the actions currently undertaken

Introduction

are in alignment with the breakthrough goal and if any should be modified⁴ and tracks progress between different unique actor groups regarding developments towards the 5% goal. This process also includes assessment of current targets, including addition of specific intermediate 2025 enabling goals.

4 Further information on these levers can be found in the Transitions Strategy report (Smith et al., 2021).



Overview of progress towards the 2030 Breakthrough Goal – 5% Scalable Zero Emission Fuel

The actions necessary to reach the breakthrough goal of 5% SZEf by 2030 are as important as ever and show the scope of the challenge facing the shipping industry, whilst providing valuable insights on how to move forward. With clear, timely and urgent action there is a road along which meaningful progress to 5% can be made and shipping can do its fair share to contribute to tackling the on-going climate emergency.

Overall, the actions to reach 5% SZEf by 2030 can be considered to be partially on track as highlighted in Table 1. Progress has been observed in all three identified categories: industry, national and international developments and there has been significant progress on R&D and high-level commitments for maritime shipping decarbonization in the last 24 months; for example, commitments to the Zero Emission Shipping Declaration (Government of Denmark, 2021), the Clydebank Declaration (UK Government, 2021) and the growth of members in the Getting to Zero Coalition (GMF, 2022c).

Significant progress has been made toward the 5% ambition, but now it the time to convert commitments to action

This marked increase in signing of a range of declarations, ambition statements and positions by a range of industry and national stakeholders covering finance, freight and shipowners demonstrates commitment. However, on a more concrete level when it comes to actions which would take shipping from the current 'emergence' to the 'diffusion' phase and thus support reaching the 5% goal further progress is required. And now is the time to convert these pledges & commitment into action and solutions.






In order for the 2030 Breakthrough goal to be to be achieved actions and development will need to include:

- International action at the IMO is required, as without this the 5% goal becomes harder, even though still achievable, but beyond 2030, which is the next step along the S-Curve and achieving full sector transformation mass policy adoption is key.
- International policy developments at the IMO and on a plurilateral level to accelerate global decarbonization trends. These should include timely adoption of short and mid-term measures at the IMO which are in line with 5% SZEf adoption and full decarbonization by 2050.
- A move towards a SZEf which reduces dependency on imports of oil and gas which can increase energy security by providing energy independence. This is done by decreasing demand for fossil fuels and creating new, more widespread, and more diverse energy production pathways focused on renewable electricity which is readily available in many countries.
- The development of the 5% SZEf goal to promote increased domestic renewable electricity production and as such closely align with any national energy security development plans as it has the potential to greatly complement such concerns.

Overview of progress towards the 2030 Breakthrough Goal – 5% Scalable Zero Emission Fuel

- Domestic policy in terms of establishing Market based mechanisms (MBMs) / fuel standards to achieve 30% emission reduction in 32 developed nations for example United States, Japan, United Kingdom, Indonesia, Norway, Italy, Netherlands, and others. In addition, financial mechanisms which can support funding of necessary SZEf production and bunkering infrastructure will also be required.
- Coordinated, global and internationally aligned cooperation supporting progress along the S-Curve in the long term, even though significant progress can be made by industry and national commitments in the short term.
- A multitude of wide-ranging industry actions across the entire maritime shipping value chain. Including investment and development of SZEf production pathways with over 210 production facilities, and SZEf availability in at least 20 key ports alongside investment and development into the technologies for use onboard with commercially available fuel cell technology of large-scale usage. Commitments by freight purchasers for purchase of at least 5 million TEUs of zero emission TEU by 2030 and a range of shipowner commitments to order only zero emissions-ready ships will be required.
- Industry participation in demonstration projects, pilots, and R&D in the short term to learn and increase engagement.

Table 1: Summary of progression and key goals by 2030.

CHANGE LEVER	PROGRESSION	GOALS BY 2030
 TECHNOLOGY/SUPPLY		<ul style="list-style-type: none"> • 20 large ports offer SZEf bunkering • At least 210 SZEf production facilities • All new vessels are either dual fuel or SZEf-ready
 FINANCE		<ul style="list-style-type: none"> • Green corridor bonds in place • US\$40bn bunkering/production SZEf investment • At least 20 G20 Countries and 10 developing countries have public finance mechanisms in place to support R, D&D
 POLICY		<ul style="list-style-type: none"> • Adoption of ambitious shipping MBM/fuel standard at IMO • Majority of G20 Countries have stringent domestic shipping decarbonization targets • International agreements on zero carbon shipping route creation
 DEMAND		<ul style="list-style-type: none"> • 30 zero carbon routes by 2030 • 200 zero carbon deep sea vessels in operation • 5 million TEU of zero emission freight commitment across all shipping segments
 CIVIL SOCIETY		<ul style="list-style-type: none"> • Growing SIDS/LDC participation • Increased NGO pressure • Workforce upskilling / retraining programmes in place

KEY:

On track: Progression in line with requirement across all actors

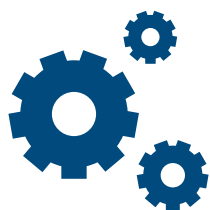
Partially on track: close to being met but insufficient evidence

Not on track: Not progressing in line with requirements

System Change Levers

Actions necessary to reach 5% SZEf adoption by 2030 can be grouped in 5 distinct change levers, which includes Technology & supply, Finance, Policy, Demand and Civil society.

In this section we track progress against each action within the system change lever and present the key findings which are briefly discussed, accompanied by with a more detailed breakdown of each action and its respective timeline in the accompanying table. A more detailed explanation for each action is available in the Annex.



Technology and Supply

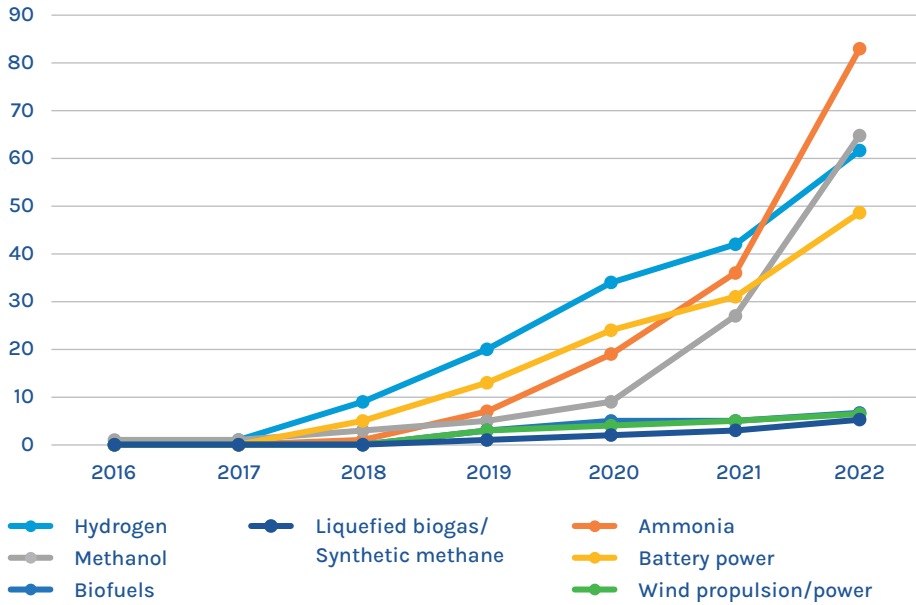
Overview

The technology and supply actions focus on development of the relevant technological R&D, as well as meeting the planned demand for SZEf. In terms of R&D it is expected that significant investment will be necessary in small and large scale SZEf production facilities to meet the demand for fuels by domestic and international shipping. Analysis⁵ suggests that by 2030 at least 170 small (100 MW) and 40 large (1 GW) production facilities for SZEf will be required. These are intended to be spread globally within at least 3 continents and in dozens of countries. It is expected that their concentration will be higher within more developed countries and large economies (i.e., G20 countries), as well as countries with large shipping requirements. Smaller facilities are generally associated more with domestic shipping and larger ones with deep sea ‘green corridors’ and large international ports. In addition, large scale maritime demonstration projects which include pilot fuel production facilities and SZEf-fuelled ships will also be necessary to demonstrate SZEf viability. Figures 2 and 3 show that significant progress in pilot project development over the past few years, both in terms of a rapid increase in numbers, but also in terms of the diversity in range and type in relation to ship and fuel type.

⁵ UMAS analysis based on GloTraM outputs of global energy demand and several sources for production facility capacities based on literature review.

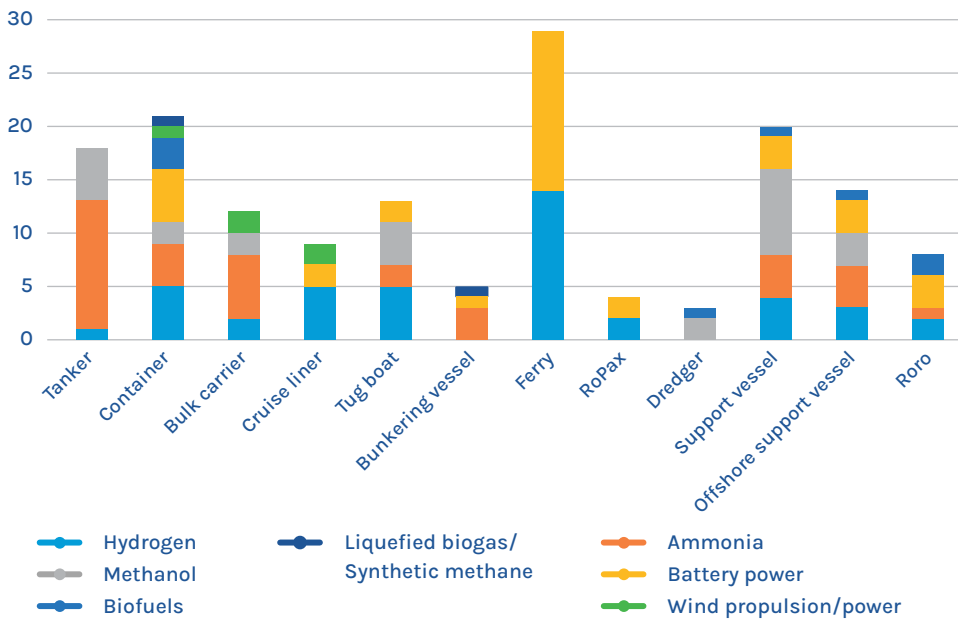
System Change Levers

Figure 2: Total number of ship technology projects by fuel focus 2016 to 2022⁶ (GMF, 2022b).



As was shown in the case of LNG as a marine fuel, flagship projects often attract interest of other stakeholders and can play an important role in convincing investors, politicians, a range of relevant industry stakeholders and the public of the long-term viability of the proposed fuel (Baresic, 2020). However, the relatively slow historic uptake of LNG also provides a valuable lesson of the need to overcome multiple adoption challenges simultaneously for fuel diffusion to be successful. Such projects also play an important role in developing technical procedures and technological improvements to cut down future costs of SZEF options and thus close the ‘competitiveness gap’ between them and fossil fuels (GMF, 2022a).

Figure 3: Total number of ship technology projects by ship type fuel focus 2016 to Q1 2022 (GMF, 2022b).



⁶ The data for 2022 was extrapolated from Q1 2022 data, and growth rates from 2020, as available from the GMF (2022b) report.

 **Tracking progress**

KEY:

Industry actors: actions led mostly by industry

National actors: actions led mostly by public national actors

International actors: actions led mostly by public international actors (i.e., IGO¹⁴s)

On track: Progression in line with requirement across all actors

Partially on track: close to being met but insufficient evidence

Not on track: Not progressing in line with requirements

KEY ACTIONS	TIMELINE:				PROGRESSION	TARGET BY:			
	22	25	30	40		2022	2025	2030	2040
Key shipping industry actors ⁷ commit to zero by 2050 and adopt SBTi ⁸					NOT ON TRACK			All new orders only DF or SZEf-ready 20 ship owners join Race to Zero	Ban on fossil fuels for all newbuilds and in majority of industry segments ⁹
Cross-industry collaboration to develop smaller zero-emission ships					ON TRACK		20 collaborations ¹⁰		
Develop small scale green zero emission fuel production facilities for maritime SZEf demand					NOT ON TRACK		50 small scale zero emission fuel facilities	At least 170 small production facilities totalling 17GW ¹² solely for shipping	
Develop large scale zero-emission fuel production facilities for maritime SZEf demand					NOT ON TRACK		10 large-scale production facilities	At least 40 large production facilities totalling 40 GW ¹² principally for shipping ¹³	
Large-scale maritime demonstration projects to demonstrate zero viability					PARTIALLY ON TRACK	2 Projects (Under development)	10 projects (In operation)		
Majority of international shipping is zero carbon					NOT ON TRACK				Over 50% of all fuels are SZEf.

7 Including large scale freight purchasers, shipowners, operators, and charterers.

8 Science Based Targets Initiative.

9 SIDS and LDC exemptions, as well as exemptions for some legacy assets in hard to abate segments.

10 Based on the assumption that these ships would be used mostly for domestic shipping and taking into consideration that at least several small-scale production facilities, including at least two value chain actors over all 20 projects from most nations which are set to decarbonize shortsea shipping at 30% by 2030 (i.e., 32), with the assumption that roughly 3 different value chain actors (i.e. higher level estimate based on information from GMF (2022b)) participate in each project (i.e. 60 overall).

11 Small scale facilities are characterised as <100MW.

12 Large scale facilities are characterised as >1GW.

13 Globally, planned hydrogen production capacity will likely supply 1/3 of demand by 2030 across all sectors, based on UMAS analysis.

14 Intergovernmental organizations.

System Change Levers

KEY ACTIONS	TIMELINE:				PROGRESSION	TARGET BY:			
	22	25	30	40		2022	2025	2030	2040
Key technological developments in maritime fuel cell technologies take place	█	█	█		ON TRACK		10 fuel cell pilots (above 400 GT) in operation	ICE alternatives become readily available	
Government-energy industry collaboration to scale up SZEF production	█	█	█		PARTIALLY ON TRACK		Hydrogen production at \$2/kg ¹⁴	0.60 EJ ¹⁵ , or 5% by 2030	40% by 2040 and 100% by 2050
Ports on at least 3 continents set out decarbonization strategies and pathways to zero carbon bunkering	█	█	█		ON TRACK	10 key ports - strategies	10 key ports - SZEF availability	20 key ports - SZEF availability	
Develop bunkering guidelines for SZEF	█	█			ON TRACK				

These actions are partially on track. Most industry actions are ascertained as not being on track, with the international and national public policy/NGOs actions being either fully on track or at least partially. As can be seen from the action table the main challenges remain regarding SZEF production. Previous research has shown that the level of investment for shipping to be

To decarbonize shipping, by 2050 between US\$ 1-1.4 trillion investment into the industry will be required.

in line with the IMO ‘Initial Strategy’ by 2050 would be between US\$ 1-1.4 trillion, and that the great majority of this investment would be required upstream (i.e., 87%) (GMF, 2020). Development of the required production capacities for SZEF is not on the trajectory compared with what is required to meet demand in 2025 and then in 2030. All the announced hydrogen production plants¹⁷ are generally developed to provide hydrogen for either specific land-based purposes or are intended to meet a range of demand requirements.

Industry actions which are on track relate to the development of R&D for onboard technology (i.e., machinery and onboard storage, etc.) and development of demonstration projects. There is significant interest in this phase of development with over 200 projects, out of which almost 140 are ship technology projects currently in the pipeline, with as many having private funding committed and a majority including industry actors (GMF, 2022b). This is somewhat expected due to the industry being interested in trying and testing different potential SZEF solutions for shipping. However, a rapid progression from this step to commit to a particular SZEF and their scaling up is necessary by 2025 in order for shipping to be on track to reach 5% by 2030. From a public policy/NGO/research perspective, there has been significant progress in support and commitments to develop bunkering and safety guidelines for ships and some progress has also been made in increased

15 The assumption is that most hydrogen in the early years would be produced close to the demand centres in small scale production facilities for shortsea shipping or large-scale production facilities for green corridor demand. Over time, if production were aggregated, transportation costs would also have to be considered and these would have to be outweighed by economies of scale and lower production costs.
 16 Equivalent to 32 MtHFOe of NH₃, or 30 MtHFOe of Methanol.
 17 Hydrogen as being the main feedstock for most of the usually discussed SZEF options, such as synthetic methanol and green ammonia or used directly as a fuel as green hydrogen.

System Change Levers

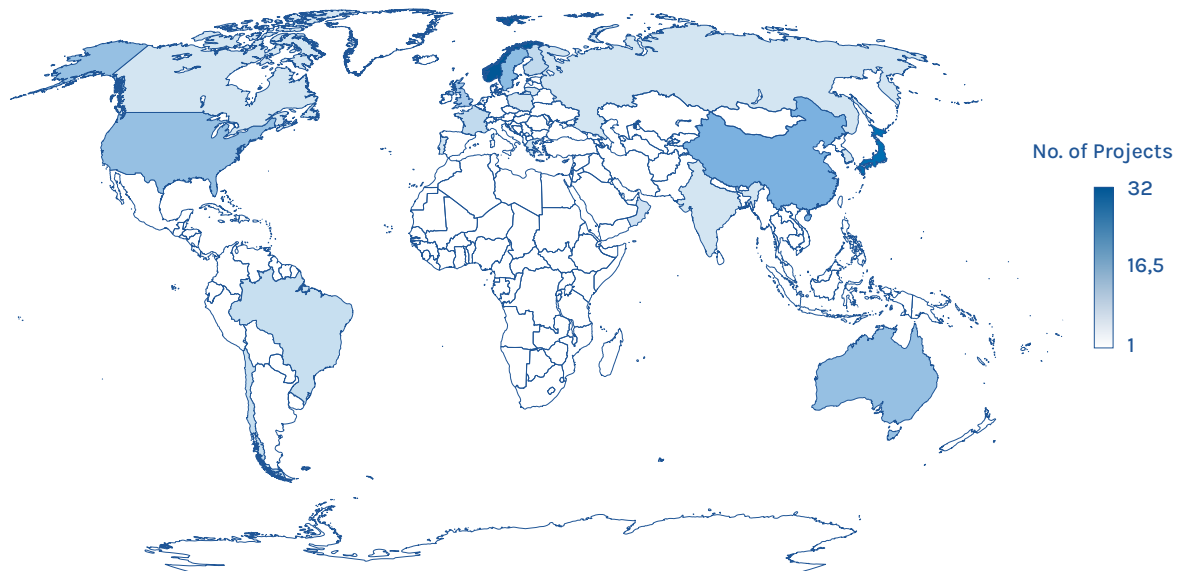
collaboration and government support for SZEf projects. However, government commitments must increase and be specifically tailored to shipping fuels in order to support reaching the required 5% goal.

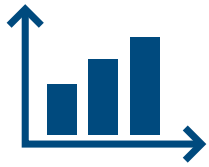
Over 200 zero emission pilot and demonstration projects are currently in the pipeline, an increase of almost 100% since 2021.

On the other hand, the 140 announced maritime developments are mostly pilots or R&D projects which cannot on their own meet any significant amount of hydrogen demand necessary to put shipping in line with the 5% goal by 2030 (Ibid.). The outlined S-Curve (Figure 1) SZEf adoption assumes that there will be a rapid significant increase in commitments later in the decade, so current focus on R&D is somewhat to be expected. It is estimated that 210 SZEf production facilities will be necessary by 2030, assuming that their principal source of demand is shipping. This number could be greater

if demand were aggregated with other sectors. Such aggregation would offer benefits from an investment perspective. In addition, currently announced government hydrogen commitments will need to be adjusted over time to take into consideration from shipping and synergies with other sectors. As can be seen from Figure 4, there is significant geographic heterogeneity in currently announced projects, but there are still limited developments observed in LDCs which would also need to change in the future in order for these countries to participate in the global maritime decarbonization trajectory. Depending on how quickly new projects for hydrogen production start coming online and assuming a quick transition from R&D to production this segment could be on track, but due to remaining uncertainty, for the moment it is put as being partially on track.

Figure 4: Number of projects in each country (GMF, 2022b)





Finance

Overview

Financial actions include a range of mechanisms which can support shipping decarbonization by increasing access to capital. These include development of better transparency through creation and adoption of relevant financial standards and ambitions such as the Net-Zero Banking Alliance (UNEP, 2022); Taskforce on Climate-Related Financial Disclosures (TCFD) (TCFD, 2022) and ‘Poseidon Principles’ (Poseidon Principles, 2022a). In addition, many of the actions are intended to ascertain how much potential financial support from industry/private capital as well and from public sources of capital would be necessary to reach the 2030 ambition. The capital is intended to support development of land based bunkering infrastructure for SZEf, support the construction of SZEf-ready newbuilds and support investment into R&D. Based on UMAS analysis it is expected that the industry would have to commit to investing around US\$40 billion annually by 2030 for SZEf bunkering and production¹⁸. This investment is somewhat smaller than the larger figures of overall scale of bunkering investment necessary¹⁹, the reason for this is that it is also projected that part of the planned support from industry and the public sector for large scale demonstration projects (i.e., US\$10bn each) will also support development of bunkering infrastructure, whilst these early commitments should also have a cascading effect on other associated developments. In addition, it is expected that some of the developments will utilise market synergies with other sectors and thus mitigate some of the shipping costs.

From a regulatory perspective, at the GtZ workshop multiple stakeholders have mentioned the relevance of creating a global shipping revenue generating MBM, with the aim of narrowing the price gap between SZEf and fossil fuels, reinvesting revenue into the industry. In addition, a general appreciation for contract for difference in shipping was also expressed, an area which has shown significant promise (GMF, 2022b). Such development, if undertaken in a dozen large economies such as G20 nations by 2030 could significantly support the decarbonization of the domestic shipping industry in those countries and create niche markets from which deep sea shipping corridors could benefit. However, for deep-sea corridors creation of specific ‘zero emission green corridor bonds’ with at least US\$10 bn available by 2030²⁰ would play an important role in supporting their development, and through them development of bunkering infrastructure, newbuild ships and associated SZEf project experience.

¹⁸ Based on UMAS analysis.

¹⁹ Previous analysis has shown that the scale of cumulative investment needed between 2030 and 2050 is USD 50- 70 billion annually for 20 years (GMF, 2020), this analysis assumes that around 87% of this investment is into land-based infrastructure (Ibid.).

²⁰ Based on UMAS analysis.

 **Tracking progress**

KEY ACTIONS	TIMELINE:				PROGRESSION	TARGET BY:			
	22	25	30	40		2022	2025	2030	2040
Increase transparency in ship finance, improve usage of existing standards ²¹ , and adopt stringent ESG standards and sign up to Poseidon Principles					PARTIALLY ON TRACK	Development/initial adoption	Widespread adoption		
Develop risk-sharing framework (e.g., for first movers), such as Sustainability Linked Loans (SLLP), longer maturities for ship finance and green bonds (i.e., Climate Bonds Initiative)					PARTIALLY ON TRACK		Widespread adoption		
Mobilize industry and finance support for large scale demonstration projects					PARTIALLY ON TRACK		\$3-6bn by 2025	\$6-10bn by 2030	
Rapid deployment of investments on international routes and domestic shipping in key countries (i.e., national funds)					NOT ON TRACK			In place	
Mobilize industry funding for large scale SZEf bunkering and production investment					NOT ON TRACK		\$1bn by 2025	\$40bn by 2030	
Mobilize government support for large scale demonstration projects and to offset first loss risk					PARTIALLY ON TRACK		\$2-4bn by 2025	\$6-10bn by 2030	
Middle/low-income countries ramp up financing for large scale demonstration projects					NOT ON TRACK		In place		
Spread of finance schemes and market-based mechanism for shipping globally (i.e., reinvest scheme revenues into the industry)					PARTIALLY ON TRACK			In place	
Development of key contracts for difference promoting SZEf in G20 countries and on green corridors					NOT ON TRACK		5 G20 Implement CFD	10 G20 Implement CFD	
Development of zero emission green corridor bonds					PARTIALLY ON TRACK		In place-\$1bn issued	In place-\$10bn issued	
Phase out ship and fuel production/bunkering finance (i.e., banks and credit agencies) for fossil fuelled ships					PARTIALLY ON TRACK		ESG performance tied for main ship finance	All newbuilds required to be DF ²²	Fossil fuelled ship finance banned

21 i.e., GFANZ, net zero banking, UNEP FI principles.
 22 Dual fuelled.

28 current signatories of the Poseidon Principles account for over 50% of shipping debt finance.

Currently the financial actions are partially on track due to the significant number of R&D pilot projects under development growing significantly and the commitments on several green shipping corridors showing a promise of increased investment into shipping decarbonization being unlocked. In terms of 'green corridors' commitment such as the 'Clydebank Declaration' and announcements of various 'green corridors' such as the proposal by C40 (i.e., the Port of Los Angeles and Port of Shanghai corridor) (C40, 2022) are pointing in the right direction. Such developments put related financial ambitions at least partially on track, and if over time monetary commitments relating to their adoption also get announced, they will be considered as being fully on track. On the industry side some progress has been made in developing and adjusting financial mechanisms for zero carbon shipping. There has been significant progress in ship finance, especially through the development of the 'Poseidon Principles', which have 28 signatories and account of over 50% (US\$185 bn) of shipping debt finance (Poseidon Principles, 2022b; Poseidon Principles, 2022c). Further progress could be made if the 'Poseidon Principles' target, which is currently aligned with the IMO 'Initial Strategy' level of ambition²³ is strengthened to better align with a 1.5°C trajectory. This alignment would increase its potential to contribute to driving the 5%.



Policy

Overview

Policy actions cover a range of industry, national/international commitments and regulatory developments which can support the decarbonization of both domestic and international shipping. Industry commitments are within this set of actions limited to only two, dealing with classification society guidelines and standards for SZEK vessels. These are within the policy space due to their close alignment with development of policy regimes for SZEK fuels. From a domestic perspective, the main aim of the actions is to directly support decarbonization of domestic fleets²⁴. In addition, the secondary aim is to use the developed infrastructure, expertise, and mechanism as a spill-over which can support development of deep sea zero emission corridors. To achieve these SZEK production targets, higher ambitions, and implementation of MBMs/ fuel mandates/standards for domestic shipping are deemed necessary. From an international perspective the key ambition deals with decarbonization of international shipping and putting the sector on a full decarbonization pathway. A significant number of policy targets deal with the IMO and relevant mechanism which can support GHG reductions, such as guidelines, operational/energy efficiency measures and adoption of global MBM measures (i.e., more stringent mid- term measures).

23 At least 50% decarbonization by 2050 compared to 2008 levels, and Poseidon Principles are aligned with the minimum ambition.

24 In line with an average 30% decarbonization of the 32 developed nations in terms of domestic shipping size.

 **Tracking progress**

KEY ACTIONS	TIMELINE:				PROGRESSION	TARGET BY:			
	22	25	30	40		2022	2025	2030	2040
Classification societies adopt robust zero-emission ready guidelines					ON TRACK	In place - for key SZEF			
Classification societies research and set operational and safety standards					PARTIALLY ON TRACK		In place - at least 5 large class. soc.		
Governments publish 1.5°C aligned decarbonization plans for domestic shipping					PARTIALLY ON TRACK			In place	
Governments create tax incentives for usage of SZEF in shipping					PARTIALLY ON TRACK		In place - 10 countries ²⁵	In place - 20 countries	
Governments create MBMs for domestic shipping (i.e., carbon price)					PARTIALLY ON TRACK		In place - 5 countries	In place - 20 countries ²⁶	
Governments set production targets for zero carbon fuels (intermodal usage)					PARTIALLY ON TRACK	In place - especially for H ₂ production			
Most national governments completely phase out fossil bunkers in domestic shipping					NOT ON TRACK				In place
Submission to IMO of NAPs ²⁷ to address GHG emissions from international shipping					PARTIALLY ON TRACK	In place -10	In place - 20		
Multiple nations make high-level commitments to decarbonize shipping					ON TRACK	10 Nations			
International agreements on zero carbon shipping route creation (at least 3 global and 3 regional routes)					PARTIALLY ON TRACK		10 Nations		
IMO to agree mid- and long-term measures for shipping (e.g., MBMs and non-MBMs) which are aligned with 5% SZEF and decarbonization by 2050.					PARTIALLY ON TRACK		Mid-term measures agreed	Long-term measures agreed ²⁸	
IMO require new ships to be zero-emission ready, e.g., 'GHG Reduction Plan with zero emission propulsion capability'					NOT ON TRACK		In place		
IMO adopts measures in energy/ operational efficiency					ON TRACK		In place		
IMO adopt guidelines to estimate well-to-tank GHG emissions and regulation/ incentives for SZEF					PARTIALLY ON TRACK		In place		
IMO agrees on comprehensive decarbonization strategy and zero by 2050 target					PARTIALLY ON TRACK				
Global agreement on gradual phase out and ban of fossil bunkers					NOT ON TRACK				

²⁵ Out of which 5 are which the top 20 countries with respect to international seaborne trade.

²⁶ At least 3 are within top 10 with regards to energy demand of domestic fleet.

²⁷ National Allocation Plans.

²⁸ Long-term measures agreed by this date and not necessarily entered into force.

System Change Levers

This set of actions is considered partially on track. From the perspective of industry action there have been several announcements that research development of SZEf safety rules, including by LR (Lloyd's Register, 2021), DNV (DNV, 2022a), RINA (RINA, 2021) and others. This work is currently under development, due to some uncertainty remaining as to the speed of progress on this work, but based on current progress, there is optimism that the work is currently on track. Regarding national level developments, most ambitions are partially on track such as the development of MBMs for domestic shipping. Announcement of the inclusion of shipping into the EU ETS (European Commission, 2022) and discussions in the UK of bringing shipping into the national ETS (Reuters, 2022) show a growing prominence of the potential role MBMs can play in domestic shipping decarbonization. However, further action by many more countries, especially those with large domestic shipping fleets is necessary to have significant progress to 5%.

The IMO has reached historic consensus on pricing GHG emissions. Furthermore, over 20% of member states show support for zero GHG emissions by 2050. However, further progress is needed.

Other actions such as governments committing to 1.5°C aligned decarbonization plans for domestic shipping are only partially on track. Over 50 signatories of the 'Climate Vulnerable Forum Dhaka-Glasgow Declaration' support 1.5°C aligned GHG reduction targets for shipping (CVF, 2021) and several national governments have highlighted importance of the 1.5°C goal such as Norway (NSA, 2020), Sweden (Government of Sweden, 2021). At the IMO over 20% of member states have shown support at MEPC for 1.5°C aligned or zero emissions by 2050, this number grows to over 50% if only those member states who made interventions during the discussion at MEPC are considered²⁹. In addition, this ambition has also been highlighted by the highest levels at the UN (UN,

2021). However, concrete 1.5°C aligned national commitments for shipping are still sparse and limited further progress on this front is required. From an IMO perspective, most progress has been made regarding shorter term measures such as energy and operational efficiency developments³⁰, but many ambitions regarding retrofitting, zero-emission ready plans and outlines for fossil fuel phase out show limited evidence of any meaningful discussion. However, positive progress has been made regarding a consensus on pricing GHG emissions, which is a significant step forward (UMAS, 2022b) and offer promise on a positive future policy pathway. Other ambitions are partially on track with the work on mid-term measures progressing. However, current lack of agreement to the type and scale of MBMs in shipping imply that progress on these discussions and reaching the necessary level of ambition will require additional progress at the IMO. Regarding international agreements on 'green corridors,' several commitments exist, such as the Clydebank Declaration, further policy levers offering direct regulatory support would be necessary to fully put this ambition on track.

²⁹ Based on UMAS analysis of MEPC 78 and prior analysis of MEPC 77 (Shaw and Smith, 2021), the analysis looks at the total number of member states which have announced support for zero at MEPC divided by the total number of member states. If, however, only those states which made interventions are taken into account over 50% supported zero.

³⁰ It is appreciated that these measures will likely have to be reviewed and further strengthened in the future.



Demand

Overview

Demand actions are divided between national and industry actions which are necessary to increase demand for SZEf and thus create a viable market for such fuels by 2030. This is extremely important so that the fuel producers have a viable business model since a significant part of the investment costs for bunkering infrastructure will come from private industry funding³¹. Industry actions include creating significant commitments by large freight

Large freight purchasers in the container sector have committed to buying 5 million TEU of zero emission freight by 2030.

purchasers in the container sector for buying of 5 million TEU of zero emission freight by 2030³². Through this process shipping decarbonization visibility in the wider community will increase and such commitments could make several proposed 'green corridors' more viable³³. Many other commitments are based around commercialization of zero emission shipping and with development of 'green corridors' for shipping. Estimates for the number of green corridors necessary for the 5% goal vary widely depending on the type of corridor, its length and number of intermediate ports taken into

account. However, a value of 30 deep sea routes has been taken as target by 2030 for this ambition³⁴. The target is a significant scaling up from 6 deep sea corridors as stated by 2025 in the 'Clydebank Declaration', but due to the potential for synergies between overlapping corridors and the presumed acceleration of adoption of SZEf in the latter half of the decade based on the S-Curve shape, this is considered as being achievable. This target balances out between corridors size, number of vessels required and its decarbonization impact. National level actions are concerned with facilitating domestic shipping decarbonization through setting targets for zero carbon fuels and inter-modal fuel usage.

³¹ Based on UMAS analysis of the level of investment required and the assumption that over time as SZEf adoption progresses along the S-Curve public funding will become less prevalent with industry taking a leading role.

³² Based on UMAS analysis for the Shanghai-Los Angeles route as an example.

³³ UMAS analysis has identified the container shipping segment as one of the key potential first movers for SZEf adoption on deep sea 'green corridor' routes.

³⁴ Based on UMAS analysis of green corridors for SZEf, considering the potential size of corridor, number of vessels and number of ports the vessel would call at.

 **Tracking progress**

KEY ACTIONS	TIMELINE:				PROGRESSION	TARGET BY:			
	22	25	30	40		2022	2025	2030	2040
Freight purchasers ³⁵ commit to buying 5m TEUs of zero emission freight and commercialize zero-emission shipping to consumers (i.e., more freight purchasers participate in coZEV, First Movers Coalition Initiative, and similar mechanism)	█	█			PARTIALLY ON TRACK	20 commit to full decarb by 2040 and work towards	5 actively purchase zero carbon ocean freight services	Commit to 5 million TEUs ³⁶ on zero emission vessels	
Shipowners, charterers, and freight purchasers conduct feasibility studies for mid-term SZE demand with potential producers	█				PARTIALLY ON TRACK	In place			
Freight purchasers participate in system demonstrations	█	█			PARTIALLY ON TRACK		20 active		
Freight purchasers' market/commercialize zero-emission shipping to end customers ³⁷		█	█		NOT ON TRACK		50 active		
Functional market for zero emission cargo in existence - with rates, and robust value chain		█	█	█	PARTIALLY ON TRACK			In place	
Development ³⁸ of first "Green Corridors" for zero-emission shipping	█	█			PARTIALLY ON TRACK		Minimum 6 deep sea corridors	30 routes by 2030 ³⁹	
Shipping companies commit to buying zero-emission propulsion ready vessels (fuel tank, system, and engine)	█	█			ON TRACK		50 deep sea zero emission ships in operation	200 deep sea zero emission ships in operation ⁴⁰	
32 developed nations ⁴¹ decarbonize domestic shipping to 30% zero carbon fuels by 2030	█	█	█		NOT ON TRACK		10 nations have operational zero carbon ships	32 nations at 30% of zero carbon shipping	
Leading countries issue domestic shipping tenders with zero carbon clauses and set out plans for inter-modal zero fuel usage		█	█		NOT ON TRACK		In place - 2 G20 countries	In place - 10 G20 countries	

The demand actions are ascertained to be partially on track. Within the industry segment most actions are partially on track, in several areas such as freight purchaser commitment to zero emission freight certain progress has been made. Through the cross-sector initiative 'First Movers Coalition' several companies have committed to shift to zero emission fuels. Similarly, cargo owners have committed a percentage of volume shipped zero emission vessels (WEF, 2022).

35 If container responsible for at least 50,000 TEU of annual goods traffic, or bulk equivalent. Freight purchases are defined as industry actors who order and buy freight which is shipped by sea and uses the services of the container and bulk shipping industry.
 36 Based on UMAS assessment first mover are likely to be in the container sector, but as time progresses this will be kept in review with the possibility of adding bulk sector targets in the future as well.
 37 Based on the MarSTF framework used in this analysis, in order to reach the 5% goal, various types of engagement are necessary. In some cases, convincing consumers to pay a premium can be a way of creating a separate niche market.
 38 Development as such includes any projects currently announced, but in terms of numerical targets in the years when they are set as targets, the final stage of development is assumed to be met. This stage is a fully operational corridor.
 39 Based on UMAS analysis.
 40 Based on UMAS analysis.
 41 Including at least 5 out of the top 10 countries when comparing fuel demand of domestic shipping fleet.



Civil society

Overview

Civil society is an essential lever in the system transformation needed and these new actions have been added to the action plan. These were developed

Civil society plays an important role such a campaign led the Los Angeles City Council to adopt a resolution to call for zero emission shipping at Los Angeles and Long Beach by 2030.

based on the growing perception of the need to include a wider range of voices into the maritime decarbonization space. This is a debate that has been growing in strength over the past few years and has also been identified as an area of relevance by the GtZ Workshop participants. This section is still being developed with relevant actions but is considered as an important first step in creating a foundation for a just and equitable transition in shipping. The outlined actions focus on several types of communities and associated representative bodies. These are: local communities affected by port air pollutant emissions; indigenous communities, and their international representation regarding shipping decarbonization; and representatives from SIDS and LDCs at the IMO.



 **Tracking progress**

KEY ACTIONS	TIMELINE:				PROGRESSION	TARGET BY:			
	22	25	30	40		2022	2025	2030	2040
Indigenous groups, SIDS and LDCs become more prominent and increase participation in shipping decarbonization negotiations					PARTIALLY ON TRACK	Observer status and attending IMO meetings	Participate in submissions		
Climate change NGOs increase focus on shipping decarbonization with representatives from both global south and north.					ON TRACK	5 major ⁴² NGOs publish maritime decarbonization reports	Major NGOs push for accelerated pace on maritime decarbonization	Campaign to phase out fossil fuels in shipping	
Consumer labelling of goods that have come from sea becomes mainstream					PARTIALLY ON TRACK		Growing visibility	Fully established	
Key labour organizations voice support for decarbonisation					ON TRACK	Public statements issued			
Green Skills Gaps identified and recommendations in place to address for both jobs at sea and across the supply chain					PARTIALLY ON TRACK		Policy recommendations accepted and corporate actors mobilised		
Local NGOs surrounding top 50 global ports calling for air pollution mitigation					ON TRACK		NGOs at 10 of top 100 ports	NGOs at 25 of top 50 ports	

Although progress has commenced on all levels, for now the actions can be considered as being partially on track. However, more work remains to be done. In 2021 the international Transport Workers Federation (ITF) published their position on Sustainable Shipping, setting out fundamental principles for a just transition to sustainable shipping, this was the first time that the maritime workforce supported maritime decarbonization and subsequently a Just Transition Maritime Taskforce was launched at COP26 to assess the skills gap for seafarers and across the maritime supply chain. In 2021, the Regional Coordination Operations Center, both representing SIDS and LDCs from different perspectives have concluded ‘agreements of cooperation’ with the IMO. With regards to promoting sustainable shipping, initiatives such as ‘Ports for People’ (Pacific Environment, 2022) and ‘Ship it Zero’ (Pacific Environment, 2022) facilitated by ‘Pacific Environment’ have increased visibility of the need for shipping to reduce its climate footprint, however this action is limited to Global North countries in particular the United States of America, this action would need to grow geographically representing action in the Global South. In addition, in 2021 the ‘Inuit Circumpolar Council’ became an IMO observer, it is likely that this trend will continue and that more organizations representing civil society and communities will become engaged with the IMO in the future, other recent observer organizations representing environmental groups include Pacific Environment. However, it remains to be seen to what extent these organizations will influence development of IMO guidelines and rules. Civil society protests during IMO meetings are another likely sign of growing awareness and engagement.

⁴² NGOs with international presence and influence in large international for a such as IMO, UN bodies and regularly working with national government.

Methodology

The analysis used for the purposes of this report is based on the MarSTF⁴³ (Baresic, et al., 2020) conceptual framework. The framework applies a holistic approach to shipping decarbonization, which looks at the way different segments of the maritime zero-carbon transition are interconnected and assesses how these interact together. Using this approach and combining evidence from multiple scientific disciplines, a detailed picture of actions necessary to reach 5% emerges.

The framework is used to develop the data gathering exercise and applied in the analysis of collected data to assess the key actions which have to be in place in order for the 5% goal to be reached by 2030. The actions are divided into 5 distinct change levers, these being:

- i. **Technology and supply** – key actions relating to the development of necessary on-board and shore-based infrastructure and technology for SZEF fuelled ships, such as electrolysers, fuel cells, internal combustion engine modifications, bunkering infrastructure, and production facilities.
- ii. **Finance** – financial mechanisms necessary for the creation of a viable SZEF market such as transparent ship finance, climate bonds, blended financing products, subsidies and other associated financial mechanisms.
- iii. **Policy** – necessary policy developments both at a national and international levels (i.e., IMO) which would be necessary to facilitate adoption of SZEF such as Market Based Measures (MBMs)/ fuel & GHG standards, energy efficiency and operational measures, various guidelines, and agreements.
- iv. **Demand** – necessary developments in terms of demand for SZEF so that - alongside a supportive policy environment - a viable market for SZEF fuels can be developed over time in a gradual manner, avoiding supply issues and facilitating a possibility for rapid production scale up. These developments include mobilization of relevant actors, such as end users facilitating demand for zero carbon products, with relevant actors facilitating the creation necessary conditions. These actors being shipowners, freight purchasers (e.g., freight forwarders and cargo owners), charterers and the general public who facilitate creation of zero emission shipping corridors (i.e., ‘green corridors’) and scaling up of orders for SZEF-ready ships.
- v. **Civil society** – individual, workforce and community engagement and action including provision of future decent work, increasing participation of underrepresented groups in shipping climate change discussions such as SIDS/LDCs⁴⁴, indigenous communities and a range of other diverse communities. In addition, supporting change at a local level by increasing NGO participation in debates regarding addressing of port air emission concerns, and increasing visibility of shipping GHG impacts through media participation.

The actions are further grouped into three specific types of actors, these being industry actors, national actors, and international actors. In this way progress can also be tracked between these unique groups regarding developments towards the 5% goal.

43 Maritime Sustainability Transitions Framework – based on combining parameters from several conceptual approaches, including spatial and non-spatial proximity (Boschma, 2005), work on the dynamics of protective spaces (i.e., ‘shielding, ‘nurturing’ and ‘empowering’) (Smith and Raven, 2012) and the multilevel perspective (Geels, 2002).

44 Small Island Developing States and Least Developed Countries.

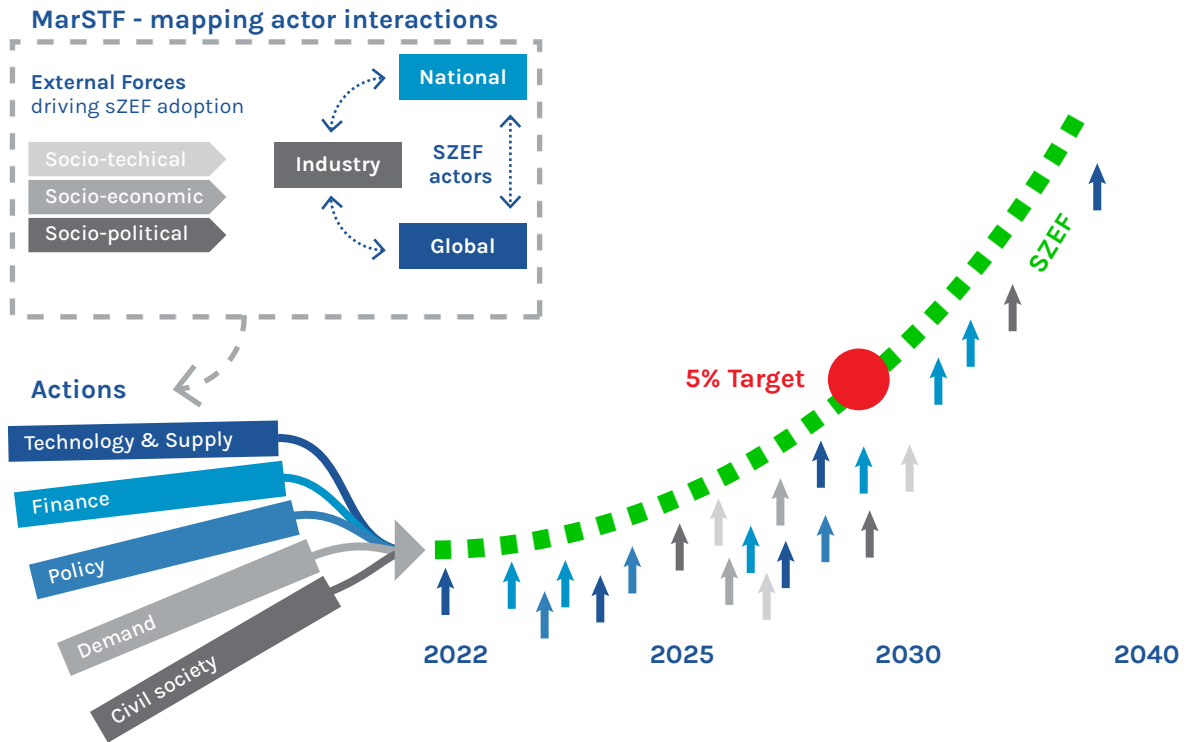
The actions are evaluated as being:

- a. **On-track** – the action and targets of the actions are progressing in line with requirements. All the actors involved are progressing with their respective developments in line with reaching the 5% goal.
- b. **Partially on-track** – the criteria related to these actions are progressing in a promising direction and are close to being met. However, there is either insufficient evidence to adequately ascertain target progress, there has been significant progress, but it still falls short of the set target, there is significant informal discussions/developments point to future progress, but no official announcements have yet been made.
- c. **Not on track** – the action and associated targets are not progressing in line with requirements necessary to reach the 5% goal.

It is worth noting that adoption of some measures in isolation, such as energy efficiency, without later adoption of more stringent midterm measures could potentially not have the desired outcome of increasing SZEf adoption but could potentially lead to increased shipping or adoption of fuels such as LNG. Other measures might be adopted which hinder progress altogether, such as increased energy security regulations which promote domestic oil and gas developments. In the first case, this report assumes that the measures discussed occur in progression, following an S-Curve and that the initial measures will be followed by later measures to provide the desired outcome. In the second case, as these measures are not considered as being beneficial to the adoption of SZEf, they are beyond the scope of the actions tracked in this report but might be reflected in ascertaining progress towards some specific actions.

The MarSTF framework follows a long tradition of research within economic geography which shows the importance of actors and different contexts such as location, geopolitics, and networks on the uptake of new technologies such as SZEf (Kohler et al., 2019). As can be seen in Figure 5, the framework conceptualizes the role those external developments such as market pressures, geopolitical developments and demographic changes can affect various actors at national and international levels responsible for shipping decarbonization. These actors in turn through a complex set of mutual interactions create actions which cumulatively support adoption of SZEf. This framework was used to determine the key actions necessary to meet 5% SZEf demand. The consequent targets were developed using a combination of back casting of necessary demand for various components necessary to meet the 5% goal whilst also being mindful of the S-Curve and possibility that smaller targets in certain areas can lead to a rapid take up of fuels in other segments or over a relatively short timeframe. Progress towards these targets was then determined based on comparing current available information on shipping developments with the assessment of necessary target progress.

Figure 5: Conceptual framework and development of key actions for the 5% goal.



The data used in the analysis was collected through a three-step approach:

1. **Update of quantitative information** – using up-to-date information from a range of different sources, including updated energy demand scenarios from UMAS analysis, using the GloTraM model (UMAS, 2022a), recent analysis of zero-carbon shipping corridors as well as a range and diverse internally collected data sources from UMAS and GMF.
2. **Stakeholder data gathering exercise** – a Getting to Zero Coalition (GtZ) workshop was organised in Copenhagen on the 23rd of June 2022, at which senior maritime stakeholders from across the maritime value chain were asked to ascertain for each change lever the level of progress, what changes/modifications to the actions should be taken and what their opinions on the current goals are. This information was collected and used to inform the updated set of actions.
3. **Desk based research** – a review of up-to-date academic literature, grey literature⁴⁵ and news reports was carried out to ascertain the most recent information relevant for the analysis. The information was collected for each of the actions in every action category.

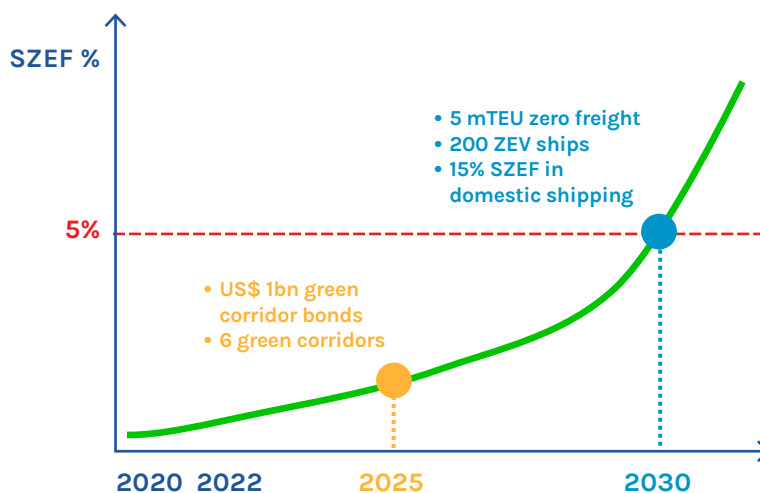
The information from all three areas was triangulated and used to ascertain progress towards the 5% goal.

⁴⁵ Information from various industry reports, policy, government documents and other relevant information.

Key conclusions

Overall, the actions to reach 5% SZEF by 2030 can be considered partially on track. Significant amount of this progress has been made in the past 24 months, showing the incredible achievements that are taking place within industry on both national and international levels. Progress has been observed in all three identified categories: industry, national and international developments. There has been significant progress on R&D and high-level commitments for maritime shipping decarbonization. The past few years have seen a marked increase in signing of a range of declarations, ambition statements and positions by a range of industry and national stakeholders covering finance, freight and ‘green corridors.’ Some national governments have committed more funds to decarbonization, and the IMO has made progress of short-term measures, but the scale of further actions necessary is significant. In addition, the importance of countries to step up in the IMO to increase ambitions at the forthcoming important meetings in MEPC is evident. Industry needs more clarity on funding commitments for SZEF production infrastructure and the current orders for SZEF-ready ships should increase further, whilst a genuine zero carbon freight market should start emerging. Finally, ambitious action at the IMO regarding mid-term measures is necessary for shipping to go from 5% SZEF to being fully decarbonized.

Figure 6: Key developments towards the 5% SZEF 2030 goal.



This report shows the importance of tracking progress towards the 5% goal. Understanding what actions are progressing well and which are falling behind can be instrumental in mobilizing effort where it is most impactful. This piece of work can be considered as a first step in a broader effort with several steps planned to follow:

Key conclusions

- This report is planned to become a blueprint for a long-term effort to regularly monitor progress towards the 5% goal by tracking progress along all the outlined actions and giving regular updates
- Additional analysis of specific actions where necessary to improve understanding and add more granularity to the understanding of SZEf adoption
- Regular improvements to target, actions, and granularity of the analysis in order to ensure that as SZEf adoption continues, progress monitoring provides the most relevant information.



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Acronyms

BAU	- business-as-usual
CFD	- Contracts for Difference
COP	- Conference of the Parties
CVF	- Climate Vulnerable Forum
COP	- Conference of the Parties
coZEV	- Cargo owners for Zero Emission vessels
DF	- dual fuel
DNV	- Det Norske Veritas
EEDI	- Energy Efficiency Design Index
EEXI	- Energy Efficiency Existing Ship Index
EU	- European Union
ESG	- Environmental, Social, and Governance
ETS	- Emission trading scheme
GHG	- Greenhouse gas
GloTraM	- Global Transport Model
GMF	- Global Maritime Forum
GtZ	- Getting to Zero Coalition
GT	- gross tons
GFANZ	- Glasgow Financial Alliance for Net Zero
GW	- gigawatt
H₂	- hydrogen
HFO	- heavy fuel oil
IAPH	- International Association of Ports and Harbours
ICE	- Internal combustion engine
IGO	- Intergovernmental Organization
IMO	- International Maritime Organization
ITT	- International Transport Workers Federation

Acronyms

Kg – kilogram

LDCs – Less Developed Countries

LMA – Loan Market Association

LNG – liquified natural gas

LR – Lloyd’s Register

MarSTF – Maritime Sustainability Transitions Framework

MBM – Market Based Mechanisms

MEPC – Marine Environment Protection Committee

MtHFOe – megatons of HFO -equivalent

MW – megawatt

NAP – National Adaptation Plan

NDC – Nationally Determined Contribution

NGO – Non-Governmental Organization

NH₃ – ammonia

PP – Poseidon Principles

R&D – Research and Development

RD&D – Research, Development & Deployment

RINA – Registro Italiano Navale

SBTi – Science Based Targets Initiative

SEEMP – Ship Energy Efficiency Management Plan

SGMF – Society for Gas as a Marine Fuel

SIDs – Small Island Developing States

SLLP – Sustainability Linked Loans

SZEF – Scalable Zero Emission Fuel

TCFD – Climate-Related Financial Disclosures


TEU – Twenty Foot Equivalent Unit

UK – United Kingdom

UN – United Nations

UNEP – United Nations Environment Programme

UNEP FI – United Nations Environment Programme Finance Initiative


ACTION	PROGRESS	JUSTIFICATION WITH SOURCE
 TECHNOLOGY AND SUPPLY		
Key shipping industry actors commit to zero by 2050 and adopt SBTi	NOT ON TRACK	According to an analysis of organizations which have joined the ‘Race to Zero’ and committed to a target, 10 organizations fulfil this requirement as of June 2022. Some of these are amongst the largest shipowners including Maersk (Maersk, 2022), NYK (NYK, 2021) and Stena Bulk (Stena Bulk, 2021). Information on current DF fuel orders based on desk-based research shows 39 orders, and these are principally for Methanol (Sørensen, 2022). According to VesselsValue there were 1,286 bulk and 561 containers on the orderbook in 2021 (VesselsValue, 2021). This would mean an order of magnitude increase on order for DF vessels over the next 8 years if this action would be on track. It should be noted that Biomethane is not scalable, so it is not a SZEf. E-methane is scalable, but it is not competitive (to other e-fuels and so it is also not included. This is consistent with the definition used by the first mover coalition (WEF, 2022).
Cross-industry collaboration to develop smaller zero-emission ships	ON TRACK	According to ‘Mapping of Zero Emission Pilots and Demonstration Projects’ (GMF, 2022b) over 200 projects can be currently taking place, and amongst these at least 20% fulfil collaboration criteria. With this positive trajectory in new projects, it seems likely the industry is on track.
Develop small scale green zero emission fuel production facilities for maritime SZEf demand	NOT ON TRACK	Over 80 SZEf production facilities currently under development (GMF, 2022b). However, these mostly used for R&D, with SZEf production for shipping minimal. There is growing progress in regard to SZEf production (i.e., green hydrogen), but these commitments are generally for land-based infrastructure. Fuel supply solutions largely remain at pilot or small-scale commercial trial. Substantial scaling is required to meet the demand expected from growth in zero emissions vessels. Taking the lack of current progress under consideration reaching the set actions remains unlikely without further evidence of development as supported by other analyses (Lloyd’s Register, 2022a).
Develop large scale zero-emission fuel production facilities for maritime SZEf demand	NOT ON TRACK	Similar to the previous point, no large-scale facilities under development with principal focus on maritime ⁴⁶ . Globally, planned hydrogen production capacity will likely supply 1/3 of demand by 2030 across all sectors. The analysis if based on IEA forecasts (IEA, 2021) and internal analysis by UMAS based on government hydrogen capacity announcements. Since larger facilities should likely be under development after the small ones, current R&D commitments can be considered to put this development further on track, but further information will be required within the next 12 months to put it to at least it partially on track.
Large-scale maritime demonstration projects to demonstrate zero viability	PARTIALLY ON TRACK	Several large demonstration projects have currently been announced such as the: 8 methanol ships on order from Maersk (Maersk, 2021), 6 Methanol ships from CMA CGM (Lloyd’s List, 2022), and 10 NH ₃ /Methanol-ready ships on order by ONE (Ship&Bunker, 2022). In addition to these, orders several RD&D projects are currently under development which involve several public and private stakeholders (GMF, 2022b) across multiple SZEf options which make development and operation of large-scale maritime ships operating on SZEf highly likely. However, when taking into consideration necessary developments beyond ships, such as development of supply chains, there are limited projects which can be identified, and only one (i.e., Maersk) which includes agreements with fuel suppliers. Consequently, this action is considered only partially on track.
Majority of international shipping is zero carbon	NOT ON TRACK	When taking into consideration lack of progress regarding SZEf bunkering infrastructure, insufficient progress on orders of SZEf ready ships, and lack of policy support, it seems unlikely that under the current trajectory this target will be met.
Key technological developments in maritime fuel cell technologies take place	ON TRACK	Steady progress has been made on developing fuel cell technologies over recent years, including operational hydrogen fuel cell vessels (FuelCellWorks, 2021), development of fuel cell systems (ABB, 2022) and R&D into fuel cells (Sandia National Laboratories, 2022), with plans already in the pipeline for the first larger size fuel cell vessels (RECHARGE, 2020). With this in mind, the ambition is considered to be on track.

46 Based on UMAS analysis.

ACTION	PROGRESS	JUSTIFICATION WITH SOURCE
Government-energy industry collaboration to scale SZEF production	PARTIALLY ON TRACK	There are several dozen government support projects in place which are researching SZEF production (GMF, 2022b), in addition several national governments and the EU have announced plans for an increase in hydrogen production (European Commission, 2020). These developments offer promise that SZEF production will increase over time and when taken into consideration with announced national hydrogen strategies imply promising developments. However, more commitment in terms of financial support would be necessary to put the development firmly on track. Consequently, the ambition can be considered only partially on track.
Ports on at least 3 continents set out decarbonization strategies and pathways to zero carbon bunkering	ON TRACK	Multiple ports have announced decarbonization plans. Based on UMAS analysis of relevant literature, the number is well over 20 and includes some of the major ports in Europe, Asia, and North America, including, but not limited to: Antwerp-Bruges, Bremen, Busan, Hamburg, Los Angeles/Long Beach, Piraeus, Rotterdam, Singapore, Stockholm, Valencia. In addition, several ports are developing SZEF technologies in small scale projects, such as NH3 in Yokohama (City of Yokohama, 2022) and hydrogen in Rotterdam (Port of Rotterdam, 2022). With other plans in the pipeline in some of the busiest ports such as Singapore (Offshore Energy, 2021a), it remains highly likely that this action will be met.
Develop bunkering guidelines for SZEF	ON TRACK	The IAPH ⁴⁷ has a 'Clean Marine Fuels' Working Group (IAPH, 2022) and has worked on guidelines for LNG, in addition several other organizations such as SGMF (SGMF, 2022) are studying safety procedures of SZEF such as NH3 and methanol in the case of LR and the 'Methanol Institute' (Lloyd's Register, 2020). With this on-going work it remains highly likely that sufficient progress of bunkering guidelines for key SZEF will be ready.
 FINANCE		
Increase transparency in ship finance, improve usage of existing standards, and adopt stringent ESG standards and sign up to Poseidon Principles	PARTIALLY ON TRACK	There has been significant progress in ship finance, especially through the development of the 'Poseidon Principles', which currently has 28 signatories (Poseidon Principles, 2022c). In addition, there have been growing calls internationally for more transparency in maritime finance (SEI, 2022) with technological developments supporting increased transparency (Lloyd's List, 2021). However, further action on terms of regulatory developments, usage of already existing schemes by key maritime stakeholders is still very low ⁴⁸ within the shipping industry, and in terms of far more wide ranging adoption of industry standards such as the Poseidon Principles is necessary in order to fully reach the ambitions set out.
Develop risk-sharing framework (e.g., for first movers), such as Sustainability Linked Loans (SLLP), longer maturities for ship finance and green bonds (i.e., Climate Bonds Initiative)	PARTIALLY ON TRACK	The adoption of LMA 'Green Loan Principles' and the 'Sustainability Linked Loan Principles' (Norton Rose Fulbright, 2019) have supported a general move towards more sustainable financial mechanism in shipping finance, with several Nordic financial institutions developing financial guidelines for sustainable shipping (IPE, 2022). Similarly, the development of the 'Climate Bonds Initiative' for shipping (Climate Bonds, 2022) has further opened the door for more green finance in shipping. However, significant ambiguity remains surrounding the application of these principles, especially regarding benchmarking of corporate ambition levels (Oellingrath and Ray, 2022). In addition, significant progress is necessary in adoption of such initiatives by a wider range of mainstream shipping finance providers in order for the ambition to be fully on track.
Mobilize industry and finance support for large scale demonstration projects	PARTIALLY ON TRACK	Several US\$bn have already been committed to SZEF projects by industry via announcements such as those by Maersk (Maersk, 2021), CMA CGM (Lloyd's List, 2022), ONE (Ship&Bunker, 2022). However, this funding can still be considered relatively niche in comparison to the longer-term commitments necessary to reach the 2030 ambitions. Thus, this ambition is considered to be only partially on track, without larger longer term industry financial commitments in the 10s of US\$ billions.
Rapid deployment of investments on international routes and domestic shipping in key countries (i.e., national funds)	NOT ON TRACK	Even though the 'Clydebank Declaration' has so far been signed by 28 countries, representing some of the largest maritime nations in the world (UK Government, 2022), UMAS analysis shows that most committed funding for maritime decarbonization is for domestic shipping, and this is in the US\$100s millions and not in the US\$ billions necessary to initiate the necessary maritime transition. In addition, most of this funding is for demonstration projects and not for more mature project development and infrastructure construction.

⁴⁷ International Association of Ports and Harbours.

⁴⁸ Based on UMAS analysis.

ACTION	PROGRESS	JUSTIFICATION WITH SOURCE
Mobilize industry funding for large scale SZEf bunkering and production investment	NOT ON TRACK	Similar to the previous ambition, UMAS analysis shows limited commitment to development of bunkering infrastructure for SZEf. Some policy developments in principle support SZEf bunkering infrastructure development such as the EU 'Fit for 55' proposal, which proposes a change in bunker fuel taxation regimes to favour SZEf and highlights the importance of SZEf (European Parliament, 2022). However, there is limited commitment to further financial support.
Mobilize government support for large scale demonstration projects and to offset first loss risk	PARTIALLY ON TRACK	Substantial funds in \$100s millions are already mobilized for decarbonization and sustainable shipping ⁴⁹ , with examples from the UK of £206 million (Department for Transport, 2022), and several commitments by Norway (Ofstedal, 2020), Germany via national and EU funding (Offshore Energy, 2021b), and the EU, via allocation of general grants for maritime decarbonization projects exceeding several EUR100 million over the past 3 years ⁵⁰ . The funding currently in place for R&D in shipping shows a significant increase compared to even 1 year ago, especially with the development of decarbonization plans/ambitions for shipping. However, these commitments would have to be raised in size, scope and would have to take place in more countries, especially in east Asia and North America, to take this ambition from partially on track to fully on track.
Middle/low-income countries ramp up financing for large scale demonstration projects	NOT ON TRACK	There have been limited announcements of funding for large scale demonstration projects outside of G20 ⁵¹ . However, genuine opportunities exist in several countries currently under possible consideration such as South Africa, Mexico, and Indonesia (P4G, 2022).
Spread of finance schemes and market-based mechanism for shipping globally (i.e., reinvest scheme revenues into the industry)	PARTIALLY ON TRACK	There has been ongoing discussion within the IMO regarding development of MBMs for shipping (IMO, 2022a) which have been developing for over a decade, begun to mature more recently ⁵² . This combined with the previously mentioned developments on financial schemes lends some credence to the belief that this ambition is progressing in the right direction. However, within the IMO significant difference of opinion remains which means adoption of MBMs is still not definitely on track.
Development of key contracts for difference promoting SZEf in G20 countries and on green corridors	NOT ON TRACK	Based on UMAS internal analysis there have been some early discussions around the possibility of adoption contracts for difference in shipping and recent media attention has been given to the idea (Pandey et al., 2022), there remains limited political commitment at this stage. Commitment such as the 'Clydebank Declaration' (UK Government, 2022) and announcements of various 'green corridors' such as the proposal by C40 (C40, 2022) are pointing in the right direction. However, there has been limited commitment of funds in the orders of magnitudes necessary to reach 2030 5% goal.
Development of zero emission green corridor bonds	PARTIALLY ON TRACK	Climate bond developments have continued to progress, with general shipping bonds is also moving forward green corridor developments. However, more specific evidence of developments surrounding bonds catered for green corridors would be necessary to make these developments fully on track.
Phase out ship and fuel production/bunkering finance (i.e., banks and credit agencies) for fossil fuelled ships	PARTIALLY ON TRACK	Developments such as the 'Poseidon Principles' and their growing adoption, in addition to growing societal pressure regarding fossil fuel investments has led to some large investment bodies such as several significant pension funds moving away from fossil fuels (Financial Times, 2021). These pressures, combined with industry developments support an eventual phase out of fossil fuel support in shipping. However, due to the international nature of the shipping industry and lack of wider movement means that this ambition is only partially on track.
 POLICY		
Classification societies adopt robust zero-emission ready guidelines	ON TRACK	There has been growing attention by classification societies to develop various notations, guidelines, and classifications for zero emission fuels, examples come from LR (Lloyd's Register, 2022b), ClassNK (ClassNK, 2021) and DNV (DNV, 2022b). However, specific zero emission ready guidelines are still under developments in many classification societies and announcements of these are still in the pipeline. Currently, due to significant progress being made this section is considered on track.
Classification societies research and set operational and safety standards	PARTIALLY ON TRACK	There have been several announcements that research on development of safety rules for SZEf is taking place, including by LR (Lloyd's Register, 2021), DNV (DNV, 2022), RINA (RINA, 2021) and others. However, much of this work is still under development and further progress with pilots is necessary.

49 Based on UMAS analysis of funding available for shipping within the G20.

50 Based on UMAS analysis of existing SZEf-related projects funded by EU grants.

51 Based on UMAS analysis.

52 Based on UMAS analysis.

Annex

ACTION	PROGRESS	JUSTIFICATION WITH SOURCE
Governments publish 1.5°C aligned decarbonization plans for domestic shipping	PARTIALLY ON TRACK	55 signatories of the 'CVF Dhaka-Glasgow Declaration' support 1.5°C aligned GHG reduction targets for shipping (CVF, 2021). In addition, there have been several national government discussions about the importance of the 1.5°C goal such as in Norway (NSA, 2020), Sweden (Government of Sweden, 2021) and by the highest levels at the UN (UN, 2021). However, concrete 1.5°C aligned national commitments for shipping are still sparse.
Governments create tax incentives for usage of SZEZ in shipping	PARTIALLY ON TRACK	Developments such as proposal by the EU within the 'Fit for 55' proposal (European Parliament, 2022), in addition to national level developments show promise. However, more progress in a wider range of G20 countries is necessary in order to close the 'Competitiveness Gap' between SZEZ and fossil fuels (GMF, 2022a).
Governments create MBMs for domestic shipping (i.e., carbon price)	PARTIALLY ON TRACK	Announcement of the inclusion of shipping into the EU ETS (European Commission, 2022), discussions in the UK of bringing shipping into the national ETS (Reuters, 2022) show a growing level of policy thinking of utilizing MBMs for shipping, especially in the case of domestic shipping. However, if domestic shipping is to reach its 2030 15% goal by 2030 (and significantly more in some countries), larger ambitions and covering more countries will be necessary.
Governments set production targets for zero carbon fuels (intermodal usage)	PARTIALLY ON TRACK	Multiple countries have rolled out hydrogen production strategies (KPMG, 2021). However, these targets are not shipping specific. UMAS internal analysis has concluded that 850GW of electrolyser capacity is required by 2030 for all sectors – roughly 200 Mt hydrogen. However, currently, only 260GW has been announced worldwide. This would mean if shipping were to be on track for the 2030 5% goal (60GW demand) the sector would have to warrant 23% of the globally produced hydrogen. Considering the high demand of other sectors, further ambitions are necessary to put this ambition on track, as under current targets this is not fully on track.
Most national governments completely phase out fossil bunkers in domestic shipping	NOT ON TRACK	There has been limited discussion within national government on this point and based on UMAS analysis there is no direct evidence of exact proposal for this in the medium term.
Submission to IMO of NAPs ⁵³ to address GHG emissions from international shipping	PARTIALLY ON TRACK	NAPs are voluntary commitments in IMO for shipping decarbonisation while other multilateral/IGOs have their own voluntary or legally binding climate/environmental commitments (i.e., UNFCCC's NDCs). In this case, Parties could update their NDCs to include actions to address international shipping emissions). So far 7 IMO member states have submitted NAPs (IMO, 2022b) to the IMO, this shows progress in the area. However, significantly more country, especially within the G20 would have to submit their NAPs (with high ambitions of at least 1% domestic shipping decarbonization by 2030, and potentially going up to 50%) to put shipping, and in particular domestic shipping in line with the 2030 goal.
Multiple nations make plurilateral commitments to decarbonize shipping	ON TRACK	This high-level goal on its own has limited policy weight but serves an important societal purpose in bringing shipping decarbonization to a wider media visibility. So far 8 G20members have outlined some type of ambition for maritime decarbonization ⁵⁴ . In addition, 14 countries have signed the 'Zero Emission Declaration' on zero emission shipping by 2050 (Government of Denmark, 2021). Consequently, the target can be considered on track.
International agreements on zero carbon shipping route creation (at least 3 global and 3 regional routes)	PARTIALLY ON TRACK	There are currently 18 green corridor projects under varying levels of developments ⁵⁵ these have a wide ranging global and regional span. However, for this ambition to be fully on track further progress on development of these corridors would be necessary. Even though several commitments their development exist, such as the 'Clydebank Declaration' (UK Government, 2022) further policy levers offering direct regulatory support would be necessary in order to fully put this ambition on track.
IMO to agree mid- and long-term measures for shipping (e.g., MBMs and non-MBMs) which are aligned with 5% SZEZ and decarbonization by 2050.	PARTIALLY ON TRACK	There has been growing discussion at the IMO regarding adoption of a revised IMO GHG Strategy (IMO, 2022c), in addition, apart from the already mentioned national commitments for MBMs in shipping, several other nations such as Japan have proposed their versions of a shipping MBM (Financial Times, 2022). In addition, the 55 signatories of the 'CVF Dhaka-Glasgow Declaration' also support ambitious GHG reduction targets for shipping (CVF, 2021). However, current lack of agreement to the type and scale of MBMs in shipping imply that progress on these discussions and reaching the necessary level of ambition will not be easy.
IMO require new ships to be zero-emission ready, e.g., 'GHG Reduction Plan with zero emission propulsion capability'	NOT ON TRACK	There has been very limited progress at the IMO regarding these developments, based on analysis of IMO materials.

53 National Allocation Plans.

54 Based on UMAS analysis of publicly available data.

55 Based on GMF analysis.

Annex


ACTION	PROGRESS	JUSTIFICATION WITH SOURCE
IMO adopts measures in energy/operational efficiency	ON TRACK	Work has continued at the IMO through MEPC 78 and on the 2022 development of guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP) and on the guidelines for ship fuel consumption, development of the attained Energy efficiency Existing Ship Index (EEXI) and other short-term measures (IMO, 2022d).
IMO adopt guidelines to estimate well-to-tank GHG emissions and regulation/incentives for SZEf	PARTIALLY ON TRACK	Development of lifecycle GHG guidelines has continued at the IMO via the work of the ISWG-GHG 12, MEPC 78 and is progressing (IMO, 2022d). However, discussions around incentives for SZEf are faced with differing opinions which somewhat slow progress.
IMO agrees on comprehensive decarbonization strategy and zero by 2050 target	PARTIALLY ON TRACK	The IMO is currently revising its Initial GHG Strategy. However, based on a UMAS analysis of existing information available from the IMO, the differences between member states remain significant and progress in specific areas will likely take sufficient effort. Currently over 20% of member states have shown support a zero-shipping target by 2050; based on UMAS analysis of MEPC 78 and prior analysis of MEPC 77 (Shaw and Smith, 2021).
Global agreement on gradual phase out and ban of fossil bunkers	NOT ON TRACK	Based on UMAS analysis of available report in this area, there has been limited progress on any such development.
 DEMAND		
Freight purchasers ⁵⁶ commit to buying 5 mTEUs of zero emission freight and commercialize zero-emission shipping to consumers (i.e., utilise coZEV, and similar mechanism) ⁵⁷	PARTIALLY ON TRACK	Based on the coZEV Ambition Statements there are currently 9 ambition leaders who have committed to a 2040 decarbonization target, with this number potentially increasing in the immediate term (coZEV, 2022). However, further support for the target is necessary, and in addition work towards 2030 will require significant increase in ambition and commitment, so the target is considered only partially met.
Shipowners, charterers, and freight purchasers conduct feasibility studies for mid-term SZEf demand with potential producers	PARTIALLY ON TRACK	Based on UMAS analysis of available information there is not much evidence of this happening so far. However, when looking at current pilot and demonstration projects, several include ‘freight forwarders, charterers customers, cargo owners’ (GMF, 2022b) showing a certain level of engagement with maritime decarbonization. Consequently, without further commitment, this ambition can be considered partially on track.
Freight purchasers participate in system demonstrations	PARTIALLY ON TRACK	As mentioned in the previous segments a dozen freight purchasers are already involved in freight demonstration projects (GMF, 2022b), but more detailed data on the type of projects and freight purchasers involved necessary to put this development fully on track.
Freight purchasers’ market/commercialize zero-emission shipping to end customers ⁵⁸	NOT ON TRACK	There is limited evidence of this taking place.
Functional market for zero emission cargo in existence - with rates, and robust value chain	PARTIALLY ON TRACK	There is limited evidence of such developments taking place. However, developments in commitments in several other areas show promising insights that by2025 niche markets could start appearing, more evidence is necessary to put this development fully on track.
Development of first “Green Corridors” for zero-emission shipping	PARTIALLY ON TRACK	Based on GMF analysis there are 18 green corridor projects currently under varying levels of development, and these include a wide range of partners, such as the C40 LA-Shanghai corridor (C40, 2022). Even though most of these are in the early planning phases, current commitment in terms of progress would be sufficient to put this development fully on track.
Shipping companies commit to buying zero-emission propulsion ready vessels (i.e., fuel tank, system, and engine)	ON TRACK	Several such projects have currently been announced such as the: 2 SZEf-ready vessels by LR/SHI (Lloyd’s Register, 2022c), 8 methanol ships on order from Maersk (Maersk, 2021), 6 Methanol ships from CMA CGM (Lloyd’s List, 2022), and 10 NH3/Methanol-ready ships on order by ONE (Ship&Bunker, 2022), and 72 ammonia-ready vessels for MSC (Maritime Executive, 2022a). The scope of these numbers is quite promising, and currently this action can be considered on track.

⁵⁶ If container responsible for at least 50,000 TEU of annual goods traffic, or bulk equivalent.

⁵⁷ Based on UMAS analysis.

⁵⁸ Based on the MarSTF conceptual framework, to reach the 5% goal, various types of engagement are necessary. In some cases, convincing consumers to pay a premium can be a way of creating a separate niche market.

Annex

ACTION	PROGRESS	JUSTIFICATION WITH SOURCE
32 developed nations decarbonize domestic shipping to 30% zero carbon fuels by 2030	NOT ON TRACK	Based on previous discussions of evidence from policy and commitments there is limited evidence to support that the necessary conditions are in place for such an ambition to be met.
G20 countries issue domestic shipping tenders with zero carbon clauses and set out plans for inter-modal zero fuel usage	NOT ON TRACK	Apart from some isolated examples in shortsea fleets such as in the case of Norwegian battery-electric ferries (Sæternes, 2022), there is insufficient evidence of policy movements in this direction to put this action on track.
 CIVIL SOCIETY		
Indigenous groups, SIDS and LDCs become more prominent and increase participation in shipping decarbonization negotiations	PARTIALLY ON TRACK	In 2021, the ‘Regional Coordination Operations Center’, both representing SIDS and LDCs form different perspectives have concluded ‘agreements of cooperation’ with the IMO (IMO, 2022e), in addition in 2021 the ‘Inuit Circumpolar Council’ became an IMO observer (IMO, 2022f), it is likely that this trend will continue and that more organizations will become engaged with the IMO in the future. However, it remains to be seen to what extent these organizations will influence development of IMO guidelines and rules.
Climate change NGOs increase focus on shipping decarbonization with representatives from both global south and north.	ON TRACK	As previously presented evidence has shown there has been a growing focus on shipping decarbonization in the NGO sector, especially within the last few years, it is likely that this focus will continue.
Consumer labelling of goods that have come from sea becomes mainstream	PARTIALLY ON TRACK	Scientific evidence has shown that product labelling can help to reduce its climate impact (Edenbrandt and Lagerkvist, 2021). There are already multiple product labelling choices available, including in the climate impact area. With a growing range of societal development onto shipping is seems likely that existing labelling schemes will gradually grow and encompass shipping. However, more evidence is needed to support this action being fully on track.
Key labour organizations voice support for decarbonization	ON TRACK	In 2021 the International Transport Workers Federation (ITF) published their position on Sustainable Shipping (ITF, 2021), setting out fundamental principles for a just transition to sustainable shipping, this was the first time that the maritime workforce supported maritime decarbonization and subsequently a Just Transition Maritime Taskforce was launched at COP26 to assess the skills gap for seafarers and across the maritime supply chain.
Green Skills Gaps identified and recommendations in place to address for both jobs at sea and across the supply chain	PARTIALLY ON TRACK	Work has commenced under the ‘Just Transition Maritime Taskforce.’
Local NGOs surrounding top 50 global ports calling for air pollution mitigation	ON TRACK	Based on UMAS analysis and previous work (Baresic, 2020) for several years there has been growing NGO presence in several key European ports. Over the past year there has been an increased pressure, especially on USA and European ports by NGOs with regards to their shipping emissions (Maritime Executive, 2022b). It seems highly likely that this trend will continue and through time become more visible in most global regions.

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