CLIMATE ACTION IN SHIPPING

PROGRESS TOWARDS SHIPPING'S 2030 BREAKTHROUGH

UCL Energy Institute

GETTING TO ZERO COALITION
GLOBAL MARITIME FORUM

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This report is a joint effort between the UCL Energy Institute and the Getting to Zero Coalition.

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Foreword

Bridging the gap between shipping targets and real-world action at speed and scale

Dan Ioschpe,
COP30 Climate High-Level Champion, Brazil

The past year has reminded us that the path to net zero is rarely a straight line. Record global temperatures and increasingly frequent extreme weather events continue to demonstrate the growing costs of climate change, reinforcing the need to accelerate emission reductions. At the same time, shipping has had to navigate economic and political turbulence, with growing pressures on global trade, energy security, and supply chains. The industry's decarbonisation is moving in tandem with the wider forces of our time.

That context makes this report's findings all the more important. Now in its fifth year, the 'Climate action in shipping' report offers an honest account of where the sector stands. There has been real momentum in some areas, and a widening gap between ambition and implementation in others.

Consider what has been achieved in twelve months. The first large ammonia-fuelled vessels completed sea trials, and the first ship-to-ship ammonia bunkering took place. The number of ports offering methanol bunkering rose from 19 to 29. Deliveries of methanol-capable container ships saw the largest single-year gain on record, with the in-service tonnage capable of running on scalable zero-emission fuels tripling. The global shipping finance portfolio saw its strongest year-on-year improvement in climate alignment since the Poseidon Principles were established. These results all flow from decisions taken years ago by first movers across the value chain, and they show a transition already underway.

The report is just as candid about areas that are not moving fast enough. Ordering of zero-emission-capable vessels has slowed. Demand signals from cargo owners have weakened, and capital flows have plateaued. Much of this traces back to a single cause: uncertainty. The opportunity to deliver regulatory clarity must be seized.

As governments prepare for the next round of climate negotiations in November 2026, international shipping remains a priority. The road from COP30 to COP31 is about accelerating the implementation of solutions. It's about turning commitments into measurable progress on the water and in ports. Clear policies and effective implementation need to work hand in hand to achieve the speed and scale required to decarbonise the industry.

The report confirms that a net-zero pathway by 2050 remains achievable. When pursued well, decarbonisation activities will not only reduce emissions but also enhance competitiveness and improve energy security, all while supporting development in producing countries and trading nations alike.

We extend our thanks to our partners at University College London and the Getting to Zero Coalition for this report. Their work shows where progress is being made and where the barriers to faster change remain. The task now is to restore momentum where it has slipped, and to keep shipping on course to meet its decarbonisation goals.

UCL Energy Institute

The UCL Energy Institute hosts a world leading research group which aims to accelerate the transition to an equitable and sustainable energy and trade system within the context of the ocean. The Shipping and Oceans Research Group's multi-disciplinary work on the shipping and ocean system leverages advanced data analytics, cutting-edge modelling, and rigorous research methods, providing crucial insights for decision-makers in both policy and industry. The group focuses on three core areas: analysing big data to understand drivers of historical emissions and wider environmental impacts, developing models and frameworks to explore energy and trade transition to a zero emissions future, and conducting social science research to examine the policy and commercial structures that enable the decarbonisation of the shipping sector.

Learn more at:
www.ucl.ac.uk/bartlett/energy/research/shipping

GETTING TO ZERO COALITION
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The Getting to Zero Coalition is a community of ambitious stakeholders from across the maritime, energy, infrastructure, and financial sectors, supported by key IGOs, knowledge partners, and other stakeholders committed to the decarbonisation of international shipping, and endorsed by several governments. The ambition of the Getting to Zero Coalition is to have commercially viable zero-emission vessels operating along deep-sea trade routes by 2030, supported by the necessary infrastructure for scalable net zero-carbon energy sources including their production, distribution, storage, and bunkering. The Coalition is managed by the Global Maritime Forum, who initially founded the Coalition together with the World Economic Forum and Friends of Ocean Action.

Learn more at:
www.globalmaritimeforum.org/getting-to-zero-coalition

Executive summary

Progress towards shipping's 2030 breakthrough target of scalable zero-emission fuels accounting for 5-10% of the sector's total fuel usage is lagging behind where it needs to be. Supply-side technology progress continues, but regulatory uncertainty, worsened by the failure to adopt the Net-Zero Framework, persists. With corrective steps taken, particularly across policy, demand, and finance actions, the gap between targets and real-world progress can still be closed this decade.

5-10%

of all the fuels used by the shipping industry in 2030 need to be scalable zero-emissions fuels (SZEF).

Roughly 5-10% of all the fuels used by the shipping industry in 2030 need to be scalable zero-emissions fuels (SZEF) for the industry to be on track to meet the International Maritime Organization's (IMO) 2023 greenhouse gas (GHG) emissions reduction ambitions. This tipping point was coined 'shipping's 2030 breakthrough'. Reaching this target equates to having 0.6-1.2 exajoules (EJ) of energy from SZEF (approximately 15-30 million metric tonnes (Mt) per year of heavy fuel oil equivalent (HFOe) or around 600-1200 of some of the larger (approximately 15,000 twenty-foot equivalent unit (TEU)) container ships running on SZEF). This report tracks progress across the five levers of change—technology and supply, demand, finance, policy, and civil society—to establish whether the industry is on track towards this goal.

This year's report indicates mixed progress in moving towards the 2030 goal. Although several action levers remain partially on track due to individual steps taken across the shipping value chain to advance the energy transition, overall performance indicators lag behind what is needed. In several cases, progress has not only slowed relative to previous years but regressed. In particular, the reporting period of this study captures a reversal of momentum in the IMO's policymaking process following the failure to adopt the Net-Zero Framework (NZF) in October 2025. The NZF is seen as key to delivering on the commitments and objectives of the 2023 IMO Strategy on Reduction of GHG Emissions from Ships. Surveys conducted since the decision in October have revealed adverse impacts of the delay across the five levers of change, most notably in company-level decisions that were paused or cancelled when the NZF did not proceed as expected. This impact can also be traced through to the wider ecosystem, particularly the finance and demand levers, which have been negatively affected by shifts in sentiment and political leadership.

That said, important progress has continued in terms of supply and technology. It is still feasible to reach (or even exceed, in the very best case) the high levels of SZEF production in 2030 and 2035 that would be consistent with a trajectory to reach net-zero emissions in 2050 (e.g., consistent with the 2023 IMO GHG Strategy). As in previous editions of this report, the risk remains that the overall ability to meet that trajectory is hampered not by a lack of SZEF supply but by a shortage of SZEF-capable vessels linked to a lack of early clarity in shipping's regulation. Where perceived risks intersect (e.g., the risk of insufficient SZEF supply justifying ordering of conventional fossil-fuelled vessels), these narratives can reinforce each other negatively. This is why positive action aligned to this progress tracker, wherever possible across the levers, is now urgently needed to not only ensure that the levers falling behind are course-corrected, but also to support the actors sustaining progress in this period, enabling their actions to lay the foundation for a continued energy transition when the other levers are better aligned.

600-1200

15,000 TEU container ships running on SZEF needed to reach breakthrough target.

Specific key developments in the last 12 months

Table 1 (below) summarises progress for each indicator. More detailed breakdowns of progression and key 2030 goals are provided in Table 2, and the full historical record of each indicator's progress since the first report in 2022 is provided in **Annex 1**.

Table 1: Summary of progress by indicator

Technology and supply	Demand	Finance	Policy	Civil society
Partially on track	Not on track	Not on track	Not on track	Partially on track

Technology and SZEF supply

Overall progress remains strong, with an increase in expected SZEF production volumes and notable developments in SZEF-fuelled vessel sea trials, retrofitting, and bunkering.

Progress observed over the last 12 months has remained strong. Sea trials of the first large ammonia-fuelled vessels with two-stroke engines have been successfully completed, building upon those of smaller ammonia-fuelled supply vessels and tugboats fitted with four-stroke engines. The first ship-to-ship ammonia bunkering operation has also been undertaken. A number of firsts have also been observed in retrofit technology, with Everllence, Wärtsilä and WinGD all announcing new methanol retrofit offerings; other firsts include retrofits of ammonia-fuelled vessels and a two-stroke methanol engine conversion. Meanwhile, shipyards continue to expand capacity in anticipation of future newbuild and retrofit volumes.

SZEF bunkering and supply chains have also continued to make progress, with the number of ports offering methanol bunkering estimated to have increased from 19 to 29 across all geographic regions, according to Clarksons Research. At least two further offtake agreements for green ammonia have been signed, and plans are now in place to establish an ammonia bunkering supply chain in Singapore before the end of the decade.

Progress on SZEF supply has been more varied. Although the number of announced country-level hydrogen strategies has continued to increase, only a small number of countries provide public support for green hydrogen initiatives through production, subsidisation, or other regulatory measures. According to the International Energy Agency's (IEA) Hydrogen Production and Infrastructure Projects Database, announced 2030 volumes of low-carbon hydrogen production (including both electrolytic and carbon capture pathways) declined for the first time, with 80% of the decline attributed to electrolytic volumes. Nevertheless, production volumes expected in 2030 from currently operational or post-final-investment-decision projects have risen fivefold to 4.2 million tonnes per annum. Production costs for green hydrogen remain substantially above levels needed to meet the breakthrough target of USD $1.5-2.0 per kilogram by 2030. With that said, significant reductions in SZEF production costs have been observed in Asia, including in government-supported reverse auctions facilitated by the Solar Energy Corporation of India.

To ensure consistency between production forecasts across both fuels, this edition of the report features new underlying data on current volumes of e-methanol and e-ammonia production. The latest figures suggest that total SZEF production remained below 0.02 EJ in 2025, falling short of the 0.10 EJ breakthrough target for that year and indicating that this milestone is likely to be surpassed in 2028 instead. In a markdown of projected volumes from last year, figures produced for this report suggest that the 2030 target of 0.6 EJ is likely to be surpassed at some point between 2032-35 under 'low' and 'medium' ramp-up scenarios. Overall, the technology and supply lever is considered partially on track.

4.2 million tonnes per annum

Production volumes expected in 2030 from currently operational or post-final-investment-decision projects have risen fivefold.

Demand

Progress on the demand lever has varied, with the last year's noteworthy increase in SZEF-capable tonnage being counterbalanced by order book regression, a lag in estimated SZEF demand, and a weakening of demand-side conditions.

In terms of fleet SZEF compatibility, progress remains off track, though this year's data paints a more divergent picture than the simple stagnation reported in 2025. The long-anticipated wave of methanol-capable container ship deliveries finally landed in 2025, tripling methanol-capable in-service tonnage from 2.3 to 7.7 million gross tonnage (GT) and pushing the SZEF-capable share of the active fleet from 0.41% to 0.77%. This was the largest single-year capability gain on record, delivered through 56 newbuilds totalling 5.4 million GT. At the same time, the order book regressed, with SZEF-capable orders falling from 9.5% to 5.7% of total GT ordered. Both methanol- and ammonia-compatible ordering fell (as a share of total ordered GT) relative to previous years, which may have serious implications if the trend continues. Fossil-fuelled ships therefore dominate the orderbook, leaving very limited optionality for the overall fleet's fuel compatibility as we approach the early 2030s.

The 2024 shift away from conventional fuels thus appears to have been a one-off pulse driven by a few large operators rather than a structural break in ordering behaviour. With one additional year of fleet data, current expected estimates put potential SZEF demand at approximately 0.08 EJ (~2 Mt HFOe) in 2026, 0.45 EJ (~12 Mt HFOe) by 2030, and 0.86 EJ (~23 Mt HFOe) by 2035—equivalent to about 80, 450, and 860 15,000 TEU container ships running on SZEF, respectively, against the ~600 ships needed to meet the 5% breakthrough goal in 2030. An exponential trajectory, which assumes the orderbook resumes its pre-2025 growth rates, would deliver a global fleet capacity to use a steady increase in SZEF fuel of 0.13 EJ (~3.5 Mt HFOe) in 2026, 0.70 EJ (~19 Mt HFOe) in 2030, and 2.62 EJ (~70 Mt HFOe) by 2035—sufficient to clear the 0.6 EJ 5%-aligned 2030 target. The gap between the expected and upper bounds for 2030 (0.45 vs 0.70 EJ) illustrates the catch-up required from current ordering behaviour to remain on the breakthrough trajectory.

Demand for SZEF services is partially on track. More shipowners, ports, and shipyards have set or formally committed to short- and long-term net-zero targets than in 2024, with validated long-term net-zero targets nearly doubling to 11. However, a small but notable number of actors—six shipowners and two ports—had their Science Based Targets initiative (SBTi) commitments withdrawn over the past year. The number of Getting to Zero Coalition members offering zero-emission shipping services more than doubled (from four to nine). Still, cargo owners' willingness to pay a premium for low-carbon shipping fell from 4.5% to 3.0%, and the share of cargo owners expecting to pay more within five years dropped from 65% to 45%. Taken together, this is a significant weakening of demand-side conditions and has a direct bearing on both the SZEF business case and the bankable demand needed to support supply-side investments. Although there are signs that operators are increasingly offering zero-emission services to cargo owners, the demand from those owners is not keeping pace with that growth. This further confirms that the market alone is unlikely to drive a shift in the ordering of SZEF-compatible fleets.

2.3m ↗ 7.7m gross tonnage

Methanol-capable in-service tonnage tripled, pushing the SZEF-capable share of the active fleet from 0.41% to 0.77%.

Finance

Progress on the finance lever is mixed. There has been a meaningful step forward in aligning disclosed shipping debt, but issuance of shipping-specific sustainable debt has plateaued.

Progress on the finance lever was mixed in 2025. There has been a meaningful step forward in aligning disclosed shipping debt, but issuance of shipping-specific sustainable debt has plateaued. The Poseidon Principles Annual Disclosure Report 2025 shows the most positive year-on-year movement since the framework's establishment. Signatories' collective average climate alignment score improved by 7.7 percentage points relative to the IMO minimum trajectory (+11.7%) and by 6.6 percentage points relative to the striving trajectory (+18.4%). The number of signatories disclosing alignment at or near the required trajectories roughly doubled, with three signatories (out of 35) now fully aligned with the minimum trajectory. Petrofin, a specialist global shipping/finance consultancy, reports that global ship finance across all forms of lending grew to approximately US $680 billion at the end of 2025 (up from ~$625 billion), with the 30 Poseidon Principles signatories holding a combined portfolio of over $200 billion. This means roughly 29% of global ship finance is now covered by transparent, IMO-aligned climate disclosure. For lenders whose shipping debt size is known or estimated by Petrofin, the weighted-average alignment score improved significantly to 9% for the minimum trajectory and 16% for the striving trajectory, compared to 16% and 23% (respectively) the year before.

29%

of global ship finance is now covered by transparent, IMO-aligned climate disclosure.

By contrast, shipping-specific sustainable debt issuance has plateaued. Approximately $3.0 billion was issued to shipping-related entities through green loans, green bonds, sustainability-linked loans, and transition instruments in 2025, down from $3.4 billion in 2024. Energy producers and technology providers issued an additional $11.2 billion, bringing the total tracked across both groups to $14.2 billion in 2025. None of these instruments guarantees that funding will be put towards SZEF, SZEF-capable vessels, or related infrastructure. Equally, there may also be other, less sustainable debt being used for low- or lower-energy projects. The Climate Bonds Initiative reports that green, social, sustainability, and sustainability-linked (GSS+) debt cumulatively reached $6.8 trillion by the end of 2025. $1.0 trillion of that total was issued last year alone, and shipping's share of the pool remains around 0.3%. A single deal—Hapag-Lloyd's $1.1 billion green loan in February 2025—accounted for 37% of all shipping issuance last year, and only $0.29 billion (10%) of shipping issuance was Climate Bonds Initiative-approved, all from a single issuer (NYK Line). This suggests that most 'green' shipping issuance is self-labelled rather than externally verified against a recognised standard.

Benchmark modelling suggests the NZF would generate $11-12 billion per year in revenues[1] between 2028 and 2030 (roughly four times today's annual shipping sustainable-debt issuance). The design of the framework's revenue-allocation guidelines will help determine the extent to which finance can meaningfully accelerate SZEF supply and demand to help meet 2030 and 2035 objectives. Progress on the finance lever is therefore partially on track to align shipping portfolios, but not to align the flow of capital.

1. Alternative formulations of the NZF under consideration may produce different levels of revenues but also may change how and to whom those revenues are distributed.

Policy

The failure to adopt a global regulatory framework marked a significant setback for the policy lever, yet there have still been multiple examples of strong progress at the national and regional levels over the last year.

Following significant policy turbulence in 2025, this lever is now not on track. Although the draft NZF was approved at MEPC 83 in April 2025, it was not adopted at the extraordinary session in October 2025, which was adjourned for one year. It's still unknown whether the regulation will enter into force, meaning the policy clarity expected in 2025 was not delivered. The broad structure of the NZF is still being negotiated, including a fuel standard, GHG pricing, a fund to support low-income countries, and a reward mechanism for using zero- or near-zero-emission fuels. On a positive note, MEPC 84 in April 2026 saw a return to more constructive and orderly negotiations, as well as majority support for using the NZF as the basis for further work, strengthening the potential for a variant of the NZF to be adopted later in 2026. However, major uncertainties remain regarding the final strength of the package, the definition and treatment of eligible fuels, including zero and near-zero emission fuels (ZNZ), and the wider implementation architecture, including life cycle assessment, certification, compliance, registry, and fund guidelines. This uncertainty impacts the other levers directly (finance, demand) and indirectly (technology).

During this period of delayed IMO certainty national and regional policy has become more important, and there has been some movement in this area.

During this period of delayed IMO certainty, national and regional policy has become more important. There has been some movement in this area, including support for new funding and infrastructure in the UK, the development of methanol bunkering licences and ammonia standards in Singapore, the implementation and continuation of the FuelEU regulation in Europe, and further progress on national action plans in several Global South countries. However, these measures remain uneven, geographically concentrated, and—in many cases—still focused on planning, infrastructure preparation, or pre-commercial support rather than the broader package of concrete incentives likely to drive large-scale SZEF uptake. As a result, while some parts of the policy lever remain active and several enabling developments continue, the overall policy environment is no longer advancing at the speed or with the certainty needed to support the 5% SZEF breakthrough by 2030. The lever is therefore not on track.

Civil society

Civil society work has continued in areas like workforce standards, training and skills, and participation in IMO negotiations, but progress must accelerate for the lever to be on track.

8

The total number of the top 50 ports with active campaigns identified.

The civil society lever remains partially on track. Participation by climate-vulnerable and Indigenous actors has increased, with Pacific and other island states continuing to play a climate leadership role in IMO negotiations, and the Inuit Circumpolar Council remaining active at the IMO. Progress on workforce-related issues continued in 2025, including updated labour standards and more structured industry work on diversity, well-being, and career pathways. There has also been increased training and skills for alternative fuels, such as the Maritime Just Transition Task Force's train-the-trainer handbooks and Hong Kong's administration-led programme for safe handling of methanol, ammonia, and hydrogen fuels. However, these advances remain uneven and concentrated among leading organisations rather than embedded across the sector as a whole.

Local NGO action around ports remains geographically limited as well. Despite continued advocacy on clean air, port electrification, and zero-emission shipping, only eight of the world's top 50 container ports (concentrated mainly in North America and Northwest Europe) actively hosted campaigns in 2025. Collectively, these developments suggest positive movement, but not yet at the scale needed for the lever to be on track.

Key recommendations

Based on the evidence presented across the current levers and actions, the report makes the following recommendations:

1. **The IMO should adopt the NZF 'as is' within 2026 to create the policy clarity and direction the ecosystem urgently needs.** The uncertainty caused by the failure to adopt NZF at MEPC.ES2 in October 2025 was the single most transition-regressive event of the five years this report has been running. Reversing this trend through the adoption of the NZF in 2026 is therefore also the single most important step to counter the momentum loss outlined in this report and to provide the confidence the industry needs to take the actions that will drive the sector's transition forward.

2. **Reward mechanisms for zero- or near-zero GHG emission technologies and fuels ZNZ must provide immediate SZEF business case certainty.** Getting approval on guidelines for a reward mechanism that provides extra support for SZEF (e-fuels, e-ammonia, and e-methanol) is still the minimum requirement needed to drive both supply- and demand-side investment, to help the sector reach the high targets for SZEF-capable ships and fuel production, and build the confidence needed to unlock the wider set of ecosystem actions that are still not on track.

3. **Regional and national policies need to underwrite SZEF use to protect emerging early adoption.** Even if the NZF is adopted in 2026, the regulation cannot enter into effect before 2029, and last year's events may dampen expectations about how feasible it will be to finalise implementation during this period. Regardless of what happens next at the IMO, the climate action regression documented in this report indicates that sub-global actors need to step in to generate momentum by de-risking first-mover action.

4. **The private sector needs to better mitigate the risks of 'wait and see' and adopt a clearer valuation of optionality.** The value chain needs to urgently collaborate on tools and commercial structures that can support balanced and robust decision-making despite policy uncertainty. This needs to include evaluating the relative value of different design options in a way that transparently assesses their overall upsides and downsides.

Contents

Overview

As 2030 approaches, this report builds on last year's and continues to consider the broader decarbonisation context through 2035. This is partly to align with the NZF and partly to track how SZEF and the transition are both progressing towards the initial 5-10% milestone and scaling up through emergence into a mass-market transition. If the 2050 decarbonisation trajectory is to be realistically achieved, the S-curve should be well within the diffusion phase of the transition (see **Figure 1**) by 2035; therefore, this report now includes projections of SZEF supply and demand up to that year. Although shipping's current use of SZEF remains very low, these estimates show continued growth in both supply and demand potential, suggesting increasing opportunities to accelerate SZEF adoption under appropriate market and policy conditions.

The 2026 edition of the 'Climate action in shipping' report represents the fifth in this series. It also concludes the analysis of many of the 2026 targets.[2] The milestones specified in 2022 show which areas of action are lagging and need additional effort.

This report begins by examining how progress toward targets has evolved since 2022—specifically, whether estimates of key indicators have been consistent, whether targets are becoming more on track over time, or whether they are tending to fall further behind. The report then considers each lever in more detail.

2. Most of the 2026 targets can be fully assessed as they specified progress that is needed before 2026. However, some can only be fully assessed in next year's progress report when there is access to the data for the full period (Jan-Dec) 2026.

Evolution of progress (2022-2026)

The first progress report in this series (2022) featured several enabling-condition milestones to be achieved by 2025. Having passed that milestone year, it makes sense to take stock of how progress has tracked against these initial targets. Overall, the findings suggest we're falling short of initial breakthrough targets, but only by a matter of years. On the one hand, falling short of expected rates of progress can undermine ambition. However, the results should also be considered in a more positive context; being only a few years behind still offers the possibility of catching up this decade, as long as remedial improvement actions are taken quickly.

Technology and supply

- Technological progress has remained strong year-on-year since the inception of this report. Despite the successful commercialisation of new methanol- and ammonia-based technologies, it remains unclear whether adoption will scale at a rate consistent with the 2030 breakthrough objectives. The first edition set an objective of having 10 projects on track and 20 ongoing collaborations by 2030. The number of successful pilot and demonstration projects has far exceeded these targets, and technology development and commercialisation in general (e.g., methanol and ammonia engine development) has been strong enough that these objectives can be considered achieved.

10

The first edition set an objective of having 10 projects on track and 20 ongoing collaborations by 2030. The number of successful pilot and demonstration projects has far exceeded these targets.

- In terms of green hydrogen production, the milestone for 2025 was to have at least 50 hydrogen strategies in place. At first glance, this target has been easily achieved, with the latest figures from the IEA's Annual Hydrogen Report indicating the figure now stands at 65. However, it's clear that many of the commitments in these strategies will not be met, and the number of countries providing public support for green hydrogen production supply chains remains small. The production capacity of green hydrogen across all end-use cases continues to progress, but is substantially lower than the total figures implied within published hydrogen strategies.

- With respect to SZEF production, the 2025 target was to reach 0.1 EJ of supply. The latest figures suggest that total SZEF production capacity fell short of this objective, remaining below 0.02 EJ in 2025. Figures indicate that 0.1 EJ of SZEF production capacity is instead likely to be reached by 2028.

- Another preliminary milestone was to reach green hydrogen production costs of $2 per kilogram by 2025. Based on recently agreed-offtake agreements for subsidised e-ammonia production, production costs have dropped to around $3.25 per kilogram, thereby remaining above the initially targeted levels for 2025. Nevertheless, there has been modest ongoing progress across all years in which this report has been published.

Demand

- Looking back on the breakthrough milestones set for 2025, demand has been the most consistently lagging of the five levers. However, this year's data shows that the gap is not related to the number of vessels with SZEF capability (which is increasing), but rather to the actual use of SZEF on board those vessels. Price, competition, and regulation are clearly not at the points needed for SZEF to be used more widely.
- On net-zero target-setting, the 2025 milestone called for 20-30 shipowners or operators and 10-20 ports or yards to have set SBTi-approved targets. To date, around 15-18 shipowners and 14 ports have adopted targets through the SBTi, placing the sector just below that target. The year also saw net retreats, with six shipowners and two ports having their commitments withdrawn. This appears to be due to a delisting step that SBTi takes if a company has not submitted concrete net-zero targets and plans within 24 months of its initial commitment. It is unclear why these companies initially filed with the SBTi and then did not follow through with detailed plans and targets.

15–18

To date, around 15-18 shipowners and 14 ports have adopted targets through the SBTi.

- The milestone of having roughly 100 15,000 TEU equivalent ships running on SZEF by 2025 was not met. There was, however, a surge in SZEF-capable tonnage, with methanol-capable tonnage tripling to 7.7 million gross tonnes across 56 newbuilds, lifting the SZEF-capable share of the active fleet from 0.41% to 0.77%. The volume of SZEF actually consumed on those vessels, though, remains negligible.
- Potential demand reached only around 0.07–0.08 EJ heading into 2026, short of the 0.1 EJ target for 2025, and the order book regressed (the SZEF-capable share of new orders fell from 9.5% to 5.7% as owners shifted towards LNG dual-fuel) rather than moving towards the target of having all new orders be SZEF-capable. Cargo owner willingness to pay a premium also fell from 4.5% to 3.0%.

9.5% ↘ 5.7%

The order book regressed (the SZEF-capable share of new orders fell from 9.5% to 5.7% as owners shifted towards LNG dual- fuel).

- The results show the core demand-side challenge that SZEF faces. Drivers of SZEF uptake remain unconvincing (e.g., market willingness to pay, lack of policies to drive SZEF adoption, and high costs). As time goes on, we are getting closer to the point at which mass-market deployment of SZEF use will be necessary to achieve the industry's overarching climate objectives.
- Though the demand indicators are a few years behind the 2025 objectives, the scale of last year's delivery wave shows that catching up will still be possible if demand-side signals strengthen.

Finance

$1.1bn

Hapag lloyds $1.1bn green loan accounted for over a third of the 2025 total green loan issuance.

- Against the 2025 finance targets, there seems to be genuine progress on alignment but continued stagnation on the flow of new capital. The aim for 2025 was to have as much of the shipping finance portfolio as possible below 10% misaligned with the targeted trajectory to meet 2050 goals, with a greater share below 5% misaligned than in 2022. There was greater progress towards this goal in 2025 than ever before since the Poseidon Principles were established, with signatories' simple-average climate alignment score against the IMO minimum trajectory improving by 7.7 percentage points (from +19.4% to +11.7%), the number of signatories disclosing a score at or below +10% doubling from 8 to 16 out of 35, and three signatories reporting fully aligned portfolios for the first time. While portfolios remain misaligned on average relative to the targets, if this year-on-year alignment continues, it would be an important trend and transition signal.
- The goal to maintain or grow the flow of sustainability-linked and green finance into shipping has not been met. Issuance to shipping-related entities has been stuck in a $2.4- $ 3.4 billion range for three years ($3.0 billion in 2025). A single transaction (Hapag-Lloyd's $1.1 billion green loan) accounted for 37% of the 2025 total, and only about 10% of overall issuance was externally verified against a recognised standard. Shipping still only represents roughly 0.28% of the global aligned GSS+ debt pool.[3]

3. This does not include issuance of blue bonds, like, for example the one issued by DP World.

Policy

Despite the NZF not being adopted yet, there has been good progress on the technical work, with several key guidelines now quickly evolving.

- Progress at the IMO has moved further off track this year. While the draft NZF was approved at MEPC 83 in April 2025, it was not adopted at the extraordinary session in October 2025, which was adjourned for one year. As a result, the framework has still not entered into force, key elements of the implementation architecture remain unresolved, and the policy clarity expected in 2025 has not been achieved. Despite this outcome, there has been good progress on the technical work, with several key guidelines now quickly evolving. A further positive is that the MEPC 84 meeting in April 2026 saw a return to more constructive and orderly negotiations and, following majority support for using the NZF as the basis for further work, sets the potential for adoption of a variant of the NZF later in 2026. However, due to uncertainty and shortcomings in progress on the key issue of policy adoption, the IMO mid-term measures indicator remains off track in this year's report.
- National and regional policies to support SZEF have shown some further progress, but not at the pace or scale needed to compensate for delayed IMO certainty. While there are indications of movement in the right direction, such as funding for clean maritime fuels and infrastructure in the UK, Singapore's bunkering measures, continued FuelEU implementation (started in Jan 2025), and new IMO national action plan development in several Global South countries, progress remains uneven and concentrated in a small number of jurisdictions. Much of this activity remains focused on planning, infrastructure preparation, and early support, rather than on the broader package of measures likely to drive large-scale SZEF uptake.

Civil society

- Although civil society mobilisation has continued to develop (e.g., through engagement at the IMO, workforce-focused initiatives, and local advocacy around ports), the scale and breadth of progress remain uneven. There have been positive developments in the visibility of climate-vulnerable and Indigenous actors in shipping decarbonisation negotiations, as well as in work on labour standards, diversity, career pathways, and training for the green transition (e.g., upskilling seafarers to work on SZEF-capable ships). However, there are still significant challenges to overcome and further work to be done on these issues.
- The sector has not yet seen the growth in engagement and impact that was expected by 2026, particularly in terms of broader least developed country (LDC) participation, consistent industry-wide adoption of just transition practices, and the geographic spread of local civil society action beyond a small number of ports and regions.

Projecting supply and demand of SZEF for 2035

The 2023 IMO GHG Strategy includes a target of having zero or near-zero (ZNZ) GHG emission technologies, fuels and/or energy sources represent at least 5%, striving for 10%, of the energy used by international shipping by 2030. This target stems from the understanding that ZNZ fuels will be needed at a larger scale to then meet the IMO's 2040 and 2050 objectives. This includes a wide range of potential production pathways and feedstocks, but for the purposes of this report series, the focus is on two specific ZNZ fuels: e-methanol and e-ammonia. This study therefore excludes biofuels, less-polluting fossil fuels (including liquefied natural gas), blue fuels,[4] and some e-fuels[5], with a thorough justification for this definition provided in **Annex 3**.

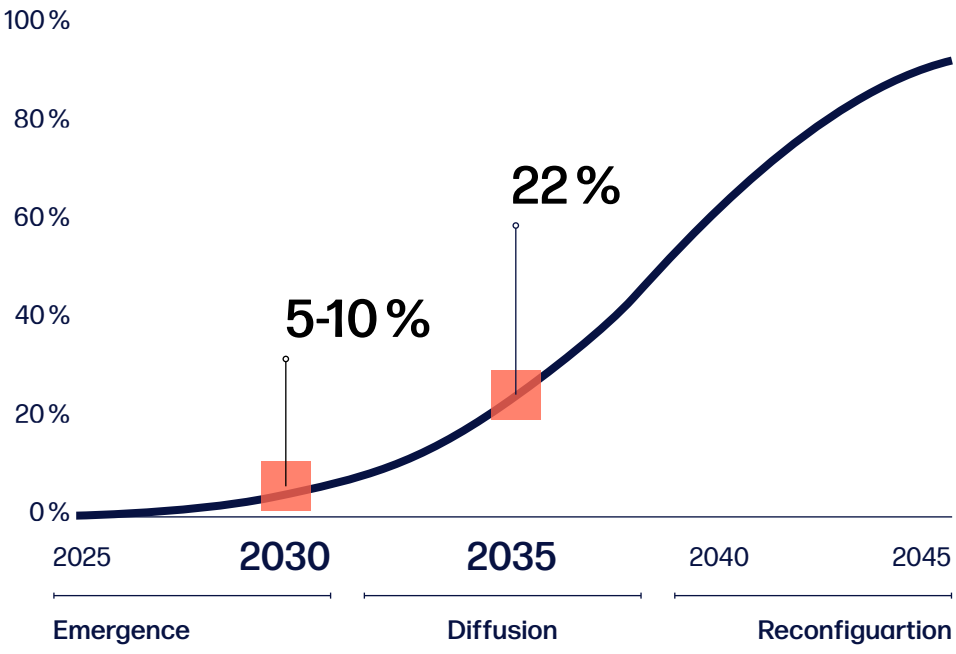
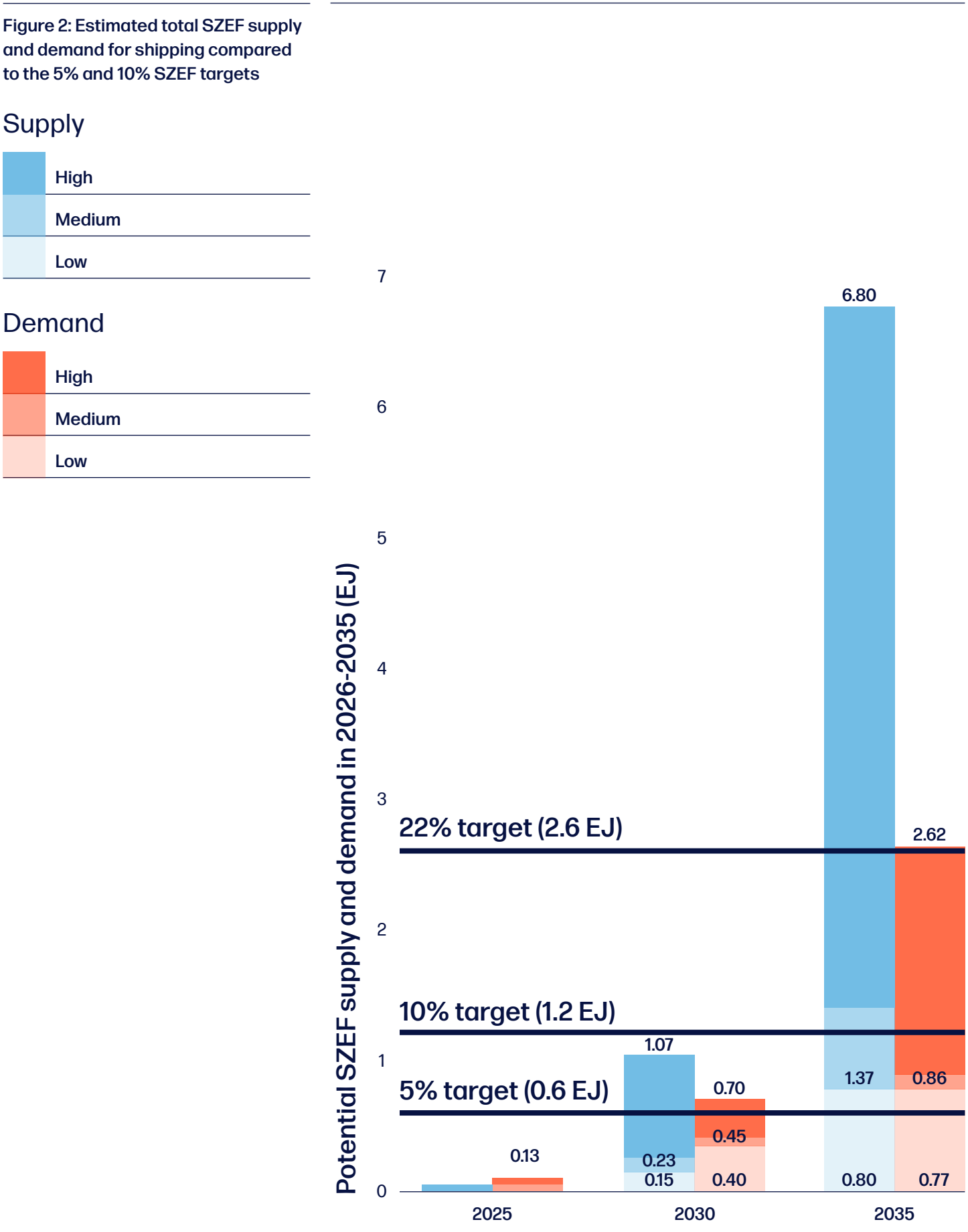


Figure 1: Estimated annual increase in total SZEF share required to reach full maritime decarbonisation by 2050

The uptake of SZEF between 2030 and 2050 needed to reach net-zero is modelled by calibrating an S-curve (see **Annex 2** for an explanation of the theoretical foundations of this S-curve) between those two milestones (**Figure 1** above). The S-curve captures the typical pattern of new technology adoption: starting slow, accelerating as costs fall and confidence grows, and tapering off as the market saturates. From this curve, SZEF would need to represent 0.6-1.2 EJ, or 5-10% of shipping's energy demand in 2030, 2.6 EJ and 22% in 2035, and 7.2 EJ in 2040 to reach the 100% target in 2050.

4. i.e., fuels derived from fossil fuel sources, such as hydrogen produced from natural gas with the application of carbon capture.
5. i.e., fuels that are produced using hydrogen from renewable electricity-powered electrolysis paired with sustainable carbon or nitrogen, such as e-ammonia, e-methanol and e-methane.

Figure 2: Estimated total SZEF supply and demand for shipping compared to the 5% and 10% SZEF targets



The fifth edition of this report continues to track progress toward SZEF adoption by 2030, but it also provides insights into what the future could hold for SZEF beyond that rapidly approaching horizon. To put the 5-10% SZEF goal in context, 5% represents a minimum of 0.6 EJ, equivalent to 15.8 Mt of HFOe, 5.3 Mt of hydrogen, 29.8 Mt of e-ammonia, or 28.1 Mt of e-methanol.

Figure 2 presents this report's projections of SZEF supply and demand potential for 2026, 2030, and 2035. The methodology used to derive these figures has been updated for this edition, reflecting the maturation of SZEF supply chains. Further details are provided in **Annex 2**. Under the best scenario, SZEF supply intended for maritime use is expected to reach up to 0.02 EJ in 2026, falling short of both the 2025 breakthrough goal of 0.10 EJ and the maximum potential energy demanded by the fleet (e.g., if all ships capable of using SZEF were to consume only SZEF) of 0.08-0.13 EJ. In 2030, SZEF supply is expected to range from 0.15-1.08 EJ based on current project capacities, compared with 0.40-0.70 EJ of potential vessel demand. It should be noted that the 'high' values in these represent optimistic scenarios in which all planned production capacity is built. For this to happen, though, policy would need to see a step change to drive both confidence and finance, ultimately unlocking a much higher conversion of projects through to completion than has been seen to date. By contrast, the demand-side projection for 2030 has a narrower range of uncertainty, given the expectations for ordering rates and fleet turnover that underlie the calculation.

There is still uncertainty around how SZEF supply and demand will develop by 2035, due in large part to the lack of clarity about how policy and, therefore, investment decisions will unfold over the next 5-6 years. However, the results fundamentally emphasise that small changes in the trajectories of those decisions can produce dramatically different SZEF scenarios (for both supply and demand) as soon as 2035. In the 'low scenario', both supply and demand are estimated to be of a similar magnitude and represent somewhere between 5-10% of the total energy mix. In this case, shipping's transition would be about five years behind the trajectory modelled in **Figure 1**, making full decarbonisation by 2050 significantly more difficult. The 'middle' scenarios would also make the 2035 target challenging to reach, consistent with the overall evaluation that shipping's transition is currently not on track. The 'high' scenarios are able to meet or even, in the case of supply, exceed the SZEF targets. This indicates that if the right actions are taken, it is still possible to course-correct for 2035 and align the sector's overall trajectory towards net-zero.

SZEF supply intended for maritime use is expected to reach up to 0.02 EJ in 2026, falling short of both the 2025 breakthrough goal of 0.10 EJ and the maximum potential energy demanded by the fleet of 0.08-0.13 EJ. In 2030.

Summary of progress

The table below highlights the five levers, the industry's current progress against them, and the goals set for 2030. The next section of this report provides a more detailed analysis of each lever.

Table 2: Summary of progression and key goals by 2030

Change lever	Progress	Scale of progress on actions	Goals by 2030
Technology and supply	Partially on track	↗ 2/7 actions on track → 5/7 actions partially on track	▪ Green hydrogen production costs $1.5-$2.0/kg depending on the region. ▪ 60 GW green hydrogen electrolyser capacity. ▪ 0.6 EJ of SZEF supply available by 2030 and 0.1 EJ by 2025 (indicative).
Demand	Not on track	→ 1/6 actions partially on track ↘ 5/6 actions not on track	▪ 600 15k TEU container ships-equivalent of SZEF demand (0.6 EJ). ▪ 8.75-12.5% of all TEU-miles to be on SZEF by 2030, if other shipping segments also scale up demand proportionally (to container shipping) to run on SZEF. ▪ All delivered and ordered ships to be SZEF-capable. ▪ Majority of existing SZEF-ready tonnage to be converted to full SZEF capability.
Finance	Not on track	→ 1/2 actions partially on track ↘ 1/2 actions not on track	▪ Increased alignment of shipping debt to a 1.5 trajectory, with at least 2/3 or more of all shipping debt to be tied to Poseidon Principles trajectories. ▪ Continued growth in the issuance of sustainability-linked loans to maritime actors, with the cumulative amount of sustainability-linked loans and bonds to reach $50 bn.
Policy	Not on track	↗ 2/6 actions on track → 1/6 actions partially on track ↘ 3/6 actions not on track	▪ Adoption of an ambitious shipping economic instrument with regulatory support for 5%-10% SZEF adoption. ▪ Top 20 countries by maritime traffic have ambitious domestic decarbonisation policies with increased hydrogen production commitments.
Civil society	Partially on track	→ 4/5 actions partially on track ↘ 1/5 actions not on track	▪ Increase in the number of SIDS/LDC co-sponsoring IMO proposals. ▪ NGO pressure at the local and national levels to drive change. ▪ Workforce upskilling/retraining programmes in place.

Key recommendations

Based on the evidence presented across the current levers and actions, the report makes the following recommendations:

1. **The IMO should adopt the NZF 'as is' within 2026 to create the policy clarity and direction the ecosystem urgently needs.** The policy package includes both long-term expectations on energy GHG intensity reductions and a GHG price, fund, and reward mechanism to support early adoption of SZEF, providing the minimum architecture needed to ensure a gradual ramp-up in global SZEF use. The uncertainty caused by the failure to adopt NZF at MEPC. ES2 in October 2025 was the single most transition-regressive event of the five years this report has been running. Reversing this trend through the adoption of the NZF in 2026 is therefore also the single most important step to counter the momentum loss outlined in this report and to provide the confidence the industry needs to take the actions that will drive the sector's transition forward.

2. **Reward mechanisms for zero- or near-zero GHG emission technologies and fuels ZNZ must provide immediate SZEF business case certainty.** Even if the NZF is adopted in 2026, the global business case that will drive early SZEF investment is still critically dependent on how the policy guidelines ultimately outline the rewards for using ZNZ (any technologies, fuels, or energy sources with a well-to-wake GHG emissions intensity below 19 gCO2e/MJ before the end of 2034). Getting approval on guidelines for a reward mechanism that provides extra support for SZEF (e-fuels, e-ammonia, and e-methanol) is still the minimum requirement needed to drive both supply- and demand-side investment, help the sector reach the high targets for SZEF-capable ships and fuel production, and build the confidence needed to unlock the wider set of ecosystem actions that are still not on track.

3. **Regional and national policies need to underwrite SZEF use to protect emerging early adoption.** With the hiatus in progressive momentum at the IMO—momentum that played a large role in the global SZEF and climate action progress seen in previous reports—the role of other policy actors (particularly national and regional governments) in providing stability and enabling shipping's energy transition has increased in importance, yet many of the actions needed by these actors are still not on track. Even if the NZF is adopted in 2026, the regulation cannot enter into effect before 2029, and last year's events may dampen expectations about how feasible it will be to finalise implementation during this period. Regardless of what happens next at the IMO, the climate action regression documented in this report indicates that sub-global actors need to step in to generate momentum by de-risking first-mover action.

4. **The private sector needs to better mitigate the risks of 'wait and see' and adopt a clearer valuation of optionality.** The current uncertainty in policymaking and the pause—or, in some cases, reversal—of transition momentum has led to higher risks stacking up for the private sector. There are still policy scenarios that could trigger sudden change (e.g., adoption of the NZF in 2026), but with transition sentiment and progress weakened by events in October 2025, the market is more likely to find itself unprepared for global regulation when it arrives. Therefore, the value chain needs to urgently collaborate on tools and commercial structures that support balanced, robust decision-making despite uncertainty, including evaluating the relative value of different design options, in a way that transparently assesses the options' overall upsides and downsides.

System change levers

This section tracks progress against each action within the five-system change, presenting the key findings and detailed breakdowns of each action and its respective timeline.

Technology and supply

Signal of change

Having passed a third round of factory acceptance testing in China, WinGD's X52DF-A-1.0 two-stroke ammonia engines are set to be installed across a range newbuild tanker vessels and bulk carriers. The most recent announcement features two medium-sized gas carriers, the first of which has now entered commercial service, both of which are capable of using their cargo as fuel when transporting ammonia. WinGD now has an orderbook of over 40 X-DF-A engines covering a range of vessel types.

Overview

The technology and supply actions in this edition continue to focus on both the sufficiency of technological development and the scale-up of supply to be consistent with the 5-10% goal. All indicators remain the same as those in previous editions, but have been restructured in their presentation. The methodology for deriving SZEF production figures has been updated for this edition of the report, reflecting the maturation of SZEF supply chains since the report's inception. A historical breakdown of how progress in the technology and supply lever has been assessed over time is provided in **Annex 1**, and this edition of the report assesses the technology and supply lever as partially on track.

The definition of SZEF used in this report series is based on the assumptions that such fuels need to be scalable (i.e., current consumption can be matched in the future), able to achieve GHG intensity reductions of 90-100% on a full life cycle (well-to-wake) basis, and competitive in cost of production in the foreseeable future. Applying these assumptions to the available evidence on different fuel and energy production pathways, feedstocks, and technology transitions, this report, at its inception in 2022, focused its technology, supply, and demand analysis on two specific SZEF options: e-ammonia and e-methanol. Following a re-review of the relevant evidence and modelling (**Annex 3**), these two specific SZEF are still anticipated to be the dominant ZNZ fuels in the long run. **Annex 3** also further reviews the scientific literature on another potential SZEF, e-methane, and confirms that there is no basis to support its inclusion alongside e-ammonia and e-methanol.

This report's focus on these specific SZEFs stems from the above assumptions about their expected end state in 2050. However, the evidence does not clarify the potential transition pathways or the potential complementarity of other technologies, fuels, and energy sources to achieving both that end state and steady GHG emission reduction objectives while new fleet and energy supply chains for those ZNZ fuels develop. Although not analysed in the same way as e-ammonia or e-methanol or measured against specific progress indicators, the wider technology and supply is discussed below.

1. Technology pilots and demonstration projects

On track

- In its 2025 publication 'From pilots to practice: methanol and ammonia as shipping fuels', the Getting to Zero Coalition compiled the views of around 40 companies and organisations to understand the current state of methanol and ammonia as potential shipping fuels. The report introduced a new framework for assessing the maturity of scalable zero-emission fuels, breaking down the 'emergence phase' of shipping's energy transition into three sub-stages: 1) Proof of concept, reached once a fuel has been shown to be safe and effective in real-world demonstrations; 2) Initial scaling, reflecting small-scale commercial adoption of the fuel on specific routes and ports; and 3) Maturity, marking the fuel's development into a widely available solution with limited barriers to uptake. The report found that methanol continued to progress in its initial scaling phase towards full technological maturity, whilst ammonia has entered its initial scaling phase.

- In the last 12 months, both technologies have made incremental progress in development. Ammonia has achieved several important firsts, allowing it to partially close the technological gap with methanol. Recent milestones include the completion of the first sea trials of ammonia-powered vessels, the first successful ship-to-ship bunkering transfers (conducted in-port) and the signing of two offtake agreements for green ammonia by CMB Tech and Itochu. The ammonia supply chain is also maturing, with a number of independent consortia, such as the partnership between NYK, Yara and Golden Island Bunkering, now aiming to offer ammonia bunkering services. These developments mean that some form of competitive ammonia bunkering market could be feasible between 2028 and 2030.

- In terms of methanol, early movers are finding it relatively easy to adopt, with key components (e.g., engines, fuel tanks and supply systems) easily available. One notable advancement over the last 12 months has been the first offtake agreement for e-methanol, which was previously limited to bio-pathways.

- Challenges remain across both technologies. There has been steady progress in understanding the safety of ammonia as a marine fuel, but the industry still lacks practical experience with fuel handling on board. Methanol is likely to remain challenged by both the availability of biogenic carbon feedstock and the persistent cost gap against current fuels. Overall, however, the continued strong growth in technological progress suggests that the indicator remains on track.

2. Key technological developments

Partially on track

- Key technological developments of the last 12 months include the successful testing of WinGD's new, larger two-stroke X52DF-A-1.0 ammonia engine. The engines are set to be installed on a number of alternative vessel types, including two dual-fuel gas carriers ordered by Exmar. The first of these vessels is now in service and able to reduce tank-to-wake GHG emissions by over 90% when using its ammonia cargo as fuel. There has also been a rise in the adoption of wind-assisted propulsion technologies on vessels, with two of five planned Maersk tankers now fitted with these systems.

WinGD's new, larger two-stroke X52DF-A-1.0 ammonia engine installed on dual-fuel gas carriers reduces tank-to-wake GHG emissions by over 90%.

- Retrofit technology providers and yards continue to build capability and capacity in anticipation of high demand in the future. Over the last 12 months, Everllence, Wärtsilä, and WinGD all announced new methanol retrofit offerings. Everllence, for example, completed successful sea trials of a methanol-fuel retrofit of COSCO Shipping's two-stroke container vessel Libra, similar to the retrofit of the Maersk Halifax in 2024. Despite these updates, there is still a bottleneck in shipyard capacity for newbuild and retrofit projects, with newly ordered vessels unlikely to be delivered until close to 2030.
- E-methanol and e-ammonia bunkering infrastructure continues to develop, but the fuel supply chain will need to be improved in order to achieve rapid scale-up. For e-methanol, this will require an increase in upstream production volumes, while e-ammonia will need downstream acceleration in bunkering infrastructure. Although there has been strong progress in technological development, the scale-up in the production and adoption of these technologies means this indicator is only considered partially on track.

3. SZEF bunkering and supply chains at key ports

Partially on track

- A recent SZEF bunkering highlight has been the signing of a memorandum of understanding (MoU) between Singapore's Maritime and Ports Authority and Sumitomo Corporation, "K" Line, and NYK Bulkship. The consortium will jointly conduct a front-end engineering design study for a newbuild ammonia bunkering vessel in Singapore, which fulfils around one-fifth of global bunkering demand. Singapore's Maritime and Ports Authority has also authorised ITOCHU subsidiary ZETA Bunkering to conduct ammonia bunkering trials starting in 2027. Despite these updates, the overall availability of non-fossil fuel bunkering services remains predominantly limited to grey (using natural gas) and bio-production pathways.
- As of April 2026, Clarksons Research[6] indicates that there are 29 ports offering some type of methanol bunkering, up from 19 compared to the 12 previous months. Another 32 ports plan to start developing methanol bunkering services, including seven planning to begin this work in 2026. The total number of ports either currently offering or planning to offer methanol bunkering reached 61, increasing up from just 38 the year before.
- Clarksons Research also indicates that four ports have established ammonia bunkering capability as of April 2026, which remains unchanged from the year before. A further 38 ports plan to begin developing ammonia bunkering capacity, up from 28 the year before. This means 42 total ports currently offer or plan to offer ammonia bunkering services.
- The fact that 29 ports now offer methanol bunkering services marks a significant improvement from last year and strengthens methanol's practical feasibility as a potential fuel for vessel operators worldwide. Ammonia bunkering service offerings saw no increase in the 12 months to April 2026, but the increase from 28 to 38 in the number of ports planning to develop ammonia bunkering capacity indicates that the availability of these services is likely to grow in the near future. These results also indicate good progress toward the Zero-Emission Shipping Mission's 2030 target of having 20 key ports offering well-to-wake zero-emission bunkering across at least three continents. For these reasons, the indicator is considered partially on track.

6. Clarksons Research. (2026). Port & Infrastructure Intelligence Monthly. April 2026.

4. Government hydrogen strategies

Partially on track

- Previous editions of this report have highlighted statistics on government-level national hydrogen strategies. Although these were initially useful as an indicator of government ambition for green hydrogen production, announced targets are no longer a reliable basis for projecting expected supply volumes. Nevertheless, the fact that these targets are now irrelevant is itself an indicator of the strong growth of green hydrogen development. Direct and indirect public support schemes remain essential for the majority of green hydrogen production business cases. Direct public support typically takes the form of regulation (mandating production volumes), subsidisation (to reduce the cost gap with incumbent fuels), or direct investment in energy infrastructure that private finance is reluctant to cover, whilst indirect support might include land allocation practices.

65
Total number of published hydrogen strategies.

- Since last year's report, Bolivia, Italy, Laos, Paraguay, and Switzerland have released hydrogen strategies, bringing the total number of published strategies to 65. Despite this increase, the number of countries actively backing green hydrogen projects with direct mandates, subsidisation schemes, investment or via indirect land-allocation practices is far lower. This list includes the US (via its Inflation Reduction Act), China, India, Australia (via its Hydrogen Head-start Program), Japan, Korea, the EU Hydrogen Bank, Canada (via its refundable Clean Hydrogen ITC), Chile (via its CORFO electrolyser subsidies and state-land allocation), Saudi Arabia (via its state-backed NEOM project) and Morocco (via large-scale land allocation under its Morocco Offer). This mixed evidence suggests that government-led support for hydrogen remains partially on track.

5. Electrolyser and hydrogen production capacity

On track

- In its latest Global Hydrogen Review 2025, the IEA reveals that low-emissions hydrogen production (both electrolytic and carbon capture pathways) grew by 10% in 2024 and is on track to reach 1 Mt in 2025, but still represents less than 1% of global production.
- The pipeline of new low-carbon hydrogen production projects remains volatile. For the first time, the maximum possible production volume in 2030 has declined due to project delays and cancellations from 37-49 million tonnes, 80% of which is associated with electrolytic volumes.
- Nevertheless, the number of low-emissions projects receiving a final investment decision increased by almost 20% since last year's report. In addition, the expected production capacity of operational and confirmed projects is set to reach 4.2 million tonnes per annum by 2030, a five-fold increase from the last report and 4% of production volume. Overall, the indicator is assessed as being on track.

6. Cost of green hydrogen production

Partially on track

Lowest Indian renewable hydrogen price was $3.08/kg in February 2026. It remains unlikely that costs of green hydrogen production will drop to 5% breakthrough levels by the end of the decade

- The breakthrough objective includes a target to achieve a green hydrogen production cost of between $1.5-2.0/kg by 2030, depending on geographic region. As of May 2026, Platts, part of S&P Global Energy, assesses India's renewable hydrogen term contract at $3.19/kg, whilst the lowest Indian renewable hydrogen price was $3.08/kg in February 2026. It remains unlikely that costs of green hydrogen production will drop to 5% breakthrough levels by the end of the decade, but the IEA does expect the cost gap between low-emissions hydrogen and that produced with unabated fossil fuels to narrow by 2030.
- Production costs for SZEF remain stubbornly high, but there are signs of progress. In the previous edition of this report, the lowest renewable ammonia production costs (associated with the NEOM and Fertiglobe offtake agreements) was between $825-878 per tonne. As of May 2026, Platts assessed Australian e-ammonia delivered to Far East Asia as being $762 per tonne, and as of March 2026, the IMO's Future Fuels Dashboard shows green ammonia prices at $842 and $881 per tonne in the Far East Asian and Northwest European markets, respectively. The dashboard also suggests that 100% sustainable methanol bunkering is priced at $1,030 per tonne.
- The first successful bids submitted as part of reverse auctions facilitated by the Solar Energy Corporation of India (SECI) saw lower prices. Three 10-year contracts have been agreed for volumes of between 60,000-75,000 tonnes of e-ammonia, each fixed for a price of between $596-641 per tonne, and another contract for 85,000 tonnes per year was agreed at a fixed price of $580 per tonne, translating to a green hydrogen production price of around $3.25/kg. With that said, it's important to note that these prices were observed within a policy-supported auction framework tied to domestic Indian offtake, rather than an equivalent merchant clearing price. For example, the prices from the IMO Future Fuels dashboard are for delivered bunker prices as opposed to production or offtake prices.

Though this indicator is unlikely to meet the 2030 breakthrough objective, the signs of progress on SZEF production costs suggest that it is at least partially on track.

7. SZEF production

Partially on track

- The methodology for deriving SZEF production figures has been updated for this edition of the report to reflect the maturation of SZEF supply chains over time. Most notably, this edition now sources aggregate e-methanol and e-ammonia production statistics from Gena Solutions[7], which applies an updated methodology. **Annex 2** explains in more detail why certain fuel pathways have been excluded from the definition of SZEF and the changes to the methodology underpinning these figures. In **Figure 3**, SZEF production capacity is expected to range from 0.005-0.016 EJ in 2026, depending on the share of total volumes intended for maritime use.

7. GENA Solutions. (2026). E-Methanol and Renewable Ammonia Project Pipeline by Region and Status - April 2026.

- This updated projection paints a slightly less optimistic picture, with the breakthrough target of 0.6 EJ in 2030 (listed as achieved under the medium and high scenarios in last year's report) only being achieved in the high scenario under the new methodology. This is also under the assumption that all announced projects reach production and are allocated for maritime use, thereby representing an optimistic theoretical upper bound. By 2035, however, it's expected that the 0.6 EJ target will be met across the low, medium and high scenarios in 2035, 2032, and 2029, respectively. The 10% objective of 1.2 EJ is achieved under the medium and high scenarios in 2035 and 2031, respectively, and the 2035 objective of 2.6 EJ is met under the high scenario in 2033.

Figure 3: Estimated total supply of SZEF for maritime use compared to the 0.6-1.2 EJ 2030 target needed to meet the 5-10% SZEF goal

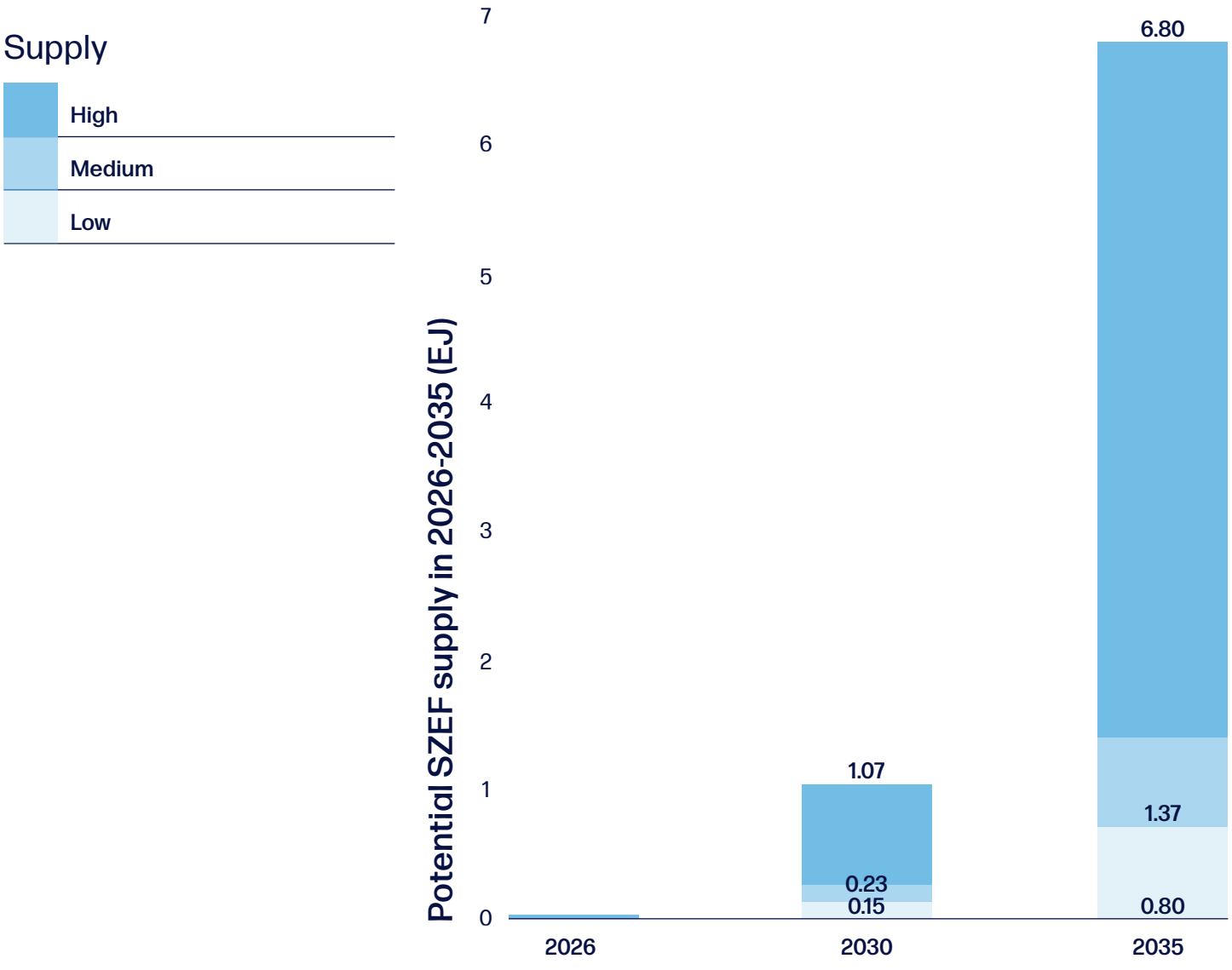


Table 3: Technology and supply lever progress

Tracking progress

Partially on track

		2025	2030
Technology pilots and demonstration projects	On track	▪ 10 projects on track. ▪ 20 collaborations.	
Key technological developments	Partially on track	▪ Ammonia engines commercially available.	
Hydrogen strategy developments	Partially on track	▪ 50 hydrogen strategies.	▪ 100 hydrogen strategies.
Cost of green hydrogen production	Partially on track	▪ Green hydrogen production cost $2/kg.	▪ Green hydrogen production cost reaching $1.5/kg in some regions.
Electrolyser and hydrogen production capacity	On track		▪ 60 GW green hydrogen electrolyser capacity for shipping offtake.
Scale-up of SZEF production	Partially on track	▪ 0.1 EJ (indicative target).	▪ 0.6 EJ (equating to 29.8 Mt ammonia or 28.1 Mt of methanol).
SZEF bunkering and supply chains at key ports	Partially on track		▪ 20 key ports covering at least three continents offering well-to-wake zero-emission bunkering by 2030.

Progress of alternative technologies at a glance

Efficiency and wind-assisted propulsion systems (WAPS)

Although decarbonising the shipping industry requires reconfiguring energy supply chains away from fossil fuels, many near-term actions can reduce the demand for onboard energy storage and use. Most activities to reduce this demand are also helpful under the current fossil-fuel energy paradigm, offer early opportunities for emission reduction, and support the development of future energy supply chains, helping to reduce the scale of new energy production needed. This category includes onboard renewable energy technologies, such as WAPS and solar, as well as technological and operational improvements that increase energy efficiency. Evidence suggests ongoing progress in deploying all these technologies, and steady improvements (1-2% per annum) are evident in energy efficiency indicators[8]. According to a recent study, a maximal deployment of WAPS technology on wind-suited ships could lead to an absolute reduction in international shipping GHG emissions of around 4-5% (relative to a BAU scenario).

1–2%

per annum improvements in deploying WAPS technologies.

Electrification pathways

Economic constraints make battery propulsion difficult for ocean-going shipping, even under optimistic forecasts of cost reductions and technological development.

Options for shipping electrification include the connection of a ship to a shore power source when alongside, also known as cold ironing, or battery storage onboard of electricity for use on a voyage. Both have seen advancement, with increasingly ambitious deployments of batteries (larger ships, longer endurance) and active engagement from Chinese companies CATL and BYD and Norway's Corvus, among others. However, in practice, economic constraints make battery propulsion difficult for ocean-going shipping, even under optimistic forecasts of cost reductions and technological development. Cold ironing helps address the small share of emissions generated when a ship is alongside, and deployment is increasing in line with regulations and initiatives, particularly in Europe and North America. The infrastructure/grid upgrades required to bring the electricity supply to the ship pose a challenge, though, for both forms of electrification.

8. As detailed in MEPC 84-6-2 by IMO Secretariat

Progress of alternative technologies at a glance

Other alternative fuels

According to data from DNV's Alternative Fuels Insight platform, only 1% of the ships in operation and 15% of those currently on order are capable of operating on alternative fuels, as of May 2026. There has been a decline in this trend over the last 12 months, with only 9% of new contracts being for alternative-fuel-capable ships. Most of these ships, both in operation and on order, relate to methane capability (e.g., LNG).

In addition to developments in fuel compatibility, the fuel supply chain is evolving, with conventional fossil fuel feedstocks facing competition from biomass pathways. IEA data shows biofuels, particularly biodiesel, accounted for around 1% of North American and European maritime fuel sales in 2024 (negligible elsewhere) and, with increased policy support, have the potential to grow to ~5% by 2030.

Under the expected decarbonisation policy, vessels that are LNG-capable will either need to retrofit to enable the use of e-methanol or e-ammonia, or source bio- and e-fuel variants of methane or conventional fuels. E-methane production has developed over the last year, with an injection into the European gas grid, for use in mass-balance bunkering.

Advanced nuclear

Advanced nuclear needs regulatory, safety, liability and non-proliferation developments if it's to be competitive going forward.

Nuclear propulsion is a mature technology in defence and ice-breaking vessels, with pressurised water reactors being the dominant technology currently in use. Although these reactors do not lend themselves well to competitive operation on commercial/merchant vessels, the resurgent research into both small and advanced modular reactors (competitor technologies to the pressurised water reactor), has led to speculation that a variant of these new reactor technologies, if deployed successfully on land, may then be suitable for marinisation. Despite various announcements of collaborations and studies on nuclear propulsion for commercial shipping, there is little evidence to support the speculation and rhetoric at this point. Competitiveness will depend on whether land-based installations can reach deployment and then scale at a cost that justifies their marine potential. In addition to the techno-economic progress required for any potential scalable deployment, advanced nuclear would also need regulatory, safety, liability, and non-proliferation developments added to existing agreements.

Demand

Overview

Demand for SZEF from stakeholders across the value chain is key in moving shipping towards the 5-10% goal, setting the pace and ambition of the transition and stimulating supply. Demand is tracked by looking at the existing vessels that are either retrofit-ready or capable of using SZEF now, and at how this fleet is likely to grow, along with other qualitative indicators of key industry activity[9]. It was estimated that demand for about 0.1 EJ (2.6 Mt HFOe) of SZEF would need to materialise by 2025 and then increase quickly to approximately 0.6-1.2 EJ by 2030 to meet shipping's breakthrough goal. The 2025 target has not been met.

The latest projections for potential SZEF demand still fall short of the 0.6-1.2 EJ (15.8-31.6 Mt HFOe) needed to meet the 5-10% goal for 2030. However, they are materially higher than in the 2025 edition because the methanol-capable tonnage coming into service tripled year-on-year. The upper bound, which models a return to the pre-2025 trajectory of accelerating SZEF-capable ordering, clears the 5%-aligned target by 2030 but still falls short of the 10% target.

Table 4: Demand potential for SZEF in EJ

Scenario	2026	2030	2035
Lower ↓	0.077	0.402	0.771
Expected →	0.08	0.447	0.857
Upper ↑	0.13	0.696	2.618

9. Please note that demand tracks capability for using SZEF, which does not imply active usage of SZEF.

1. Industry actors set and commit to net zero targets

Partially on track

- Several new stakeholders have set or formally committed to short- and long-term net-zero targets in the last 12 months, indicating continued positive momentum towards potential SZEF demand. The number of shipowners and ports with validated long-term SBTi net-zero targets rose from 8 to 11, and those with validated short-term targets rose from 25 to 26. The total of stakeholders publicly setting or committing to long-term net-zero targets now stands at 17, comfortably meeting the 2025 ambition of 5-10 shipowners and 1-5 ports and shipyards with long-term commitments.
- For the first time, however, the sector has seen meaningful net commitment retreats. Six shipowners (CMA CGM, Evergreen Marine, Crowley Maritime, Stolt Tankers, Adani Ports, and GSL Global Star Logistics) and two ports (LBC Tank Terminals and Royal Vopak) had their SBTi commitments withdrawn over the past year after failing to submit validated targets within the initiative's 24-month rule.

35

35 GtZ industry members now publish third-party validated progress against their transition targets.

- The second edition of the Getting to Zero Coalition Action Framework, released in May 2026, received 95 submissions (86 from industry members and 9 from supporting organisations), up from 76 in 2025. Across the 79 industry members assessed on their transition planning—which now combines target-setting and transition-plan disclosure into a single action—12 companies (15%) have targets and plans third-party validated, 25 (32%) have set them publicly, and 15 (19%) have set them internally only. The overall action score is 43%. In terms of progress reporting, 35 of 79 industry members (44%) now publish third-party-validated progress against their targets, up from 28 last year, and the action has achieved 65% of the maximum possible score, making it the strongest performing action in the 'creating enabling conditions' category.

Table 5: Stakeholder targets and commitments to net zero[10].

Stakeholder	Short-term targets set	Committed to short-term targets	Long-term net-zero target set	Committed to long-term net zero	Under SBTi tracking
Shipowners, operators, and charterers	15	3	8	3	18 (24 incl. withdrawn)
Ports, shipyards, and related facilities	11	3	3	3	14 (16 incl. withdrawn)
Total	**26**	**6**	**11**	**6**	**32** (40 incl. withdrawn)

Source: Science Based Targets initiative (SBTi) Target Dashboard, accessed May 2026. SBTi sectors used: 'Water Transportation' (24 entries, six of which had commitments withdrawn) and 'Water Transportation-Ports and Services' (16 entries, two of which had commitments withdrawn). Shipyards are not tracked as a dedicated SBTi sector and are essentially absent from this dataset.

10. The second Getting to Zero Coalition Action Framework consolidated the previous 'Action 1: Set GHG emission reduction targets' with the action on transition planning, including new tier definitions and the exclusion of 'not applicable' responses from scoring. To maintain a stable year-on-year methodology, **Table 5** is now solely sourced from the SBTi Target dashboard.

2. Zero-carbon freight use grows

Not on track

- Progress on the commercial use of zero- or low-carbon freight remains slow, and on the demand side, has materially regressed over the last 12 months. Boston Consulting Group's (BCG's) fifth annual Shipping Decarbonisation Survey, released in April 2026, polled 125 cargo owner-side decision-makers (heads of logistics, supply-chain directors, and other executives who determine cargo owners' choice of maritime providers), and cargo owners' average willingness to pay a premium for low-carbon shipping fell from 4.5% in 2024 to 3.0% in 2025, the lowest level since 2022. The share of those who expect to be willing to pay more over the next five years dropped from 65% to 45%, and the share of those holding both scope 3 targets and a dedicated low-carbon shipping budget fell from roughly 60% to 50%. The primary and most frequently cited barrier was the high cost of low-carbon fuel relative to its benefits. Beyond the cargo owner survey, the same BCG analysis reports that 60% of carriers see regulatory uncertainty as a barrier to optimising fleet, investment, and commercial decisions, and 57% of shipowners (alongside 64% of cargo owners) expect further delays in the implementation of binding IMO requirements. BCG attributes the overall decline in willingness to pay to regulatory uncertainty, the unresolved fuel-cost gap, and broader geopolitical and economic pressures that are pushing cost management up the corporate agenda[11].

- On the supply side, however, the Getting to Zero Coalition Action Framework's second edition shows that early-stage momentum has more than doubled. Of the 38 Coalition members to whom the 'commercialising zero-emission shipping services' action applies (freight forwarders, cargo owners, customers, shipowners, operators, and managers), nine now actively offer 'zero-emission'[12] shipping services as a product, up from just four last year. Of these nine, four reported that their offerings are growing year-on-year, and five have launched products that are not yet scaling. No company has yet had zero-emission products accounting for ≥10% of their total product offerings.

- The demand side of the Action Framework confirms BCG's finding; the new 'procuring zero-emission shipping services' action shows that only four of 14 applicable cargo owners and forwarders (29%) report procuring any zero-emission services at all, and no company has achieved year-on-year increases or ≥10% of cargo procured with zero-emissions. This is a regression from 2025, when one company reached that level of progress.

- As of yet, there are no significant examples of cargo being moved at scale on SZEF. The Zero Emission Maritime Buyers Alliance (ZEMBA) remains the most visible mechanism for connecting cargo owners directly with SZEF supply. ZEMBA's second tender was awarded to Hapag Lloyd, who will deploy e-methanol on a large dual-fuel container ship that runs a trans-oceanic route, and North Sea Container Line (NCL) will also deploy an e-ammonia-powered container ship on a Northern European trade lane.

- Based on these findings, the indicator remains not on track, and the trajectory has, in fact, worsened. Supply-side offerings have doubled (from four to nine carriers), but cargo owners' willingness to pay has fallen by a third in a single year and procurement at scale has regressed. This gap between willingness to pay and procurement remains the primary bottleneck, and the BCG findings suggest it is widening rather than narrowing.

11. The SBTi's Corporate Net-Zero Standard V2.0 (June 2026) introduces an implementation hierarchy that recognises market instruments like book-and-claim. Under earlier versions, cargo owners could not generally count such purchases toward their Scope 3 targets.

12. The definition used for 'zero-emission' is broader than the SZEF definition used in this report. The indicator is therefore a broad measure of willingness to pay to reduce emissions, rather than a specific measure of demand for SZEF. The Action Framework does not specify an emissions boundary (well-to-wake or tank-to-wake) for this action: companies self-report their service offerings, which are then graded against the tier criteria. In practice, the commercial products cited by Coalition members – such as Hapag-Lloyd's Ship Green – are predominantly based on certified waste- and residue-based biofuel blending, with reductions verified on a well-to-wake basis but typically delivering 80–90% cuts rather than zero emissions. Most of these offerings, therefore, rely on fuels that do not meet the SZEF criteria used in this report (well-to-wake intensity below 19 gCO_2e/MJ, excluding biofuels; see **Annex 3**). The increase from four to nine companies should accordingly be read as growth in commercial low- and zero-carbon freight products broadly, rather than in SZEF-specific services.

3. Growth in the share of SZEF-capable vessels in the active fleet

Not on track

- SZEF-capable vessels are those that can run on SZEF without further modifications, whereas SZEF-ready vessels would require some level of retrofit to use alternative fuels. The two fleets are tracked separately, as SZEF-ready notations (i.e. vessels labelled as methanol-ready or ammonia-ready) aren't yet well understood, consistently applied, or standardised. This leaves uncertainty about how much modification an individual vessel would need to go from 'ready' to 'capable'.
- Total gross tonnage of active or in-service vessels grew 4.5% by the end of 2025, reaching 1,511 million GT (up from 1,446 M GT last year). The share of SZEF-capable GT almost doubled, increasing from 0.41% to 0.77%, which is the largest single-year gain on record. The share of methanol-capable vessels tripled, increasing from 0.16% to 0.51%, due to the delivery of 56 new methanol-capable ships.
- The LNG-capable share of the total fleet GT grew from 7.10% to 8.52%. LNG, however, does not meet the SZEF criteria. Hydrogen-capable tonnage remains marginal (0.04%), and there are still no ammonia-capable ships in active service despite a substantial ammonia order book (with deliveries expected in H2 2026).
- Despite the uptick in methanol-capable tonnage, the share of fleet GT actually using SZEF in operation remains negligible, with capability being built up faster than the SZEF supply and demand needed to operate it.

4. Growth in the share of SZEF-ready vessels in the active fleet

Not on track

- SZEF-ready tonnage has grown from 1.42% to 2.48% of the total fleet GT since the previous report (excluding LNG-only-ready). Including LNG-only-ready tonnage, total alternative-ready tonnage stands at 3.39%. In the last year, SZEF-ready deliveries totalled 16.8 million GT across 255 ships, compared with 5.8 million GT of SZEF-capable deliveries across 60 ships. This indicates that owners remain hesitant to commit to full capability.
- The biggest movers in the SZEF-ready fleet were ammonia-ready tonnage (growing from 0.71% to 1.29%, with 97 ships totalling 9.3 M GT delivered in 2025) and methanol-ready (growing from 0.35% to 0.62%, with 120 ships totalling 4.4 M GT). Multi-fuel readiness notations continued to grow (ammonia-methanol at 0.20% of the total fleet GT, LNG-methanol at 0.13%, and ammonia-methanol-LNG at 0.06%), reflecting owners' preparations for fuel-pathway uncertainty.
- There is still a lack of clarity and consensus on what these notations mean, and fuel 'ready' tonnage is therefore not considered a sure sign of potential demand for SZEF. For that reason, it is not included in potential demand calculations.
- Ready tonnage now outweighs SZEF-capable tonnage in the fleet (2.48% vs 0.77%), a ratio that has held year-on-year and can likely be attributed to the up-front difference in cost between a fully SZEF-capable ship and a SZEF-ready ship.
- Growth in SZEF-ready tonnage is a significantly weaker signal towards actual demand for SZEF uptake.

5. Share of order book with SZEF-capable vessels

Not on track

9.5% ↘ 5.7%

The SZEF capable order book fell by 36%, from 9.5% to 5.7%.

- The order book grew by 8.3% year-on-year in terms of GT, but the composition regressed. Conventional-only tonnage rose from 54% to 61% of the order book, reversing the 2024 shift away from conventional fuel.
- The SZEF-capable share of the order book fell from 9.5% to 5.7%, a 36% relative drop in one year. In terms of absolute GT, methanol-capable orders fell 31% (8.37 to 5.76 M GT), and ammonia-capable orders fell 84% (636k to 101k GT).
- LNG and LNG dual-fuel held steady, making up around 31% of orders. Container ships drove most of the order-book expansion (33.1 to 48.1 M GT, and increase of 45%), but with a heavier conventional and LNG mix than the 2023-2024 ordering wave.
- The 2024 momentum away from conventional ordering, therefore, appears to have been a one-off catch-up of Maersk-style methanol newbuilds rather than a trend break. With the NZF discussion delayed and SZEF supply remaining scarce, ordering reverted toward fossil pathways in 2025.

6. Share of order book with SZEF-ready vessels

Not on track

- The total alternative-ready share of the order book inched up in the last year from 21.9% to 22.7%, but the SZEF-ready share (excluding LNG-only-ready) dipped slightly from 20.2% to 19.4%.
- The mix appears to be rotating from single-fuel toward multi-fuel hedges. New triple-fuel readiness notations have grown sharply since their introduction last year, with ammonia-methanol-LNG-ready rising from 0.37% to 0.99% of orders. Similarly, the ammonia- and methanol-ready share nearly tripled (from 1.43% to 4.35%), and the ammonia-LNG-ready share quadrupled (from 0.26% to 1.10%).
- Although the methanol-ready share continued to grow (from 8.21% to 9.89%), single-fuel ammonia-ready orders fell sharply (from 8.71% to 1.97%), likely reflecting owner uncertainty over which SZEF will dominate.
- Given the lack of clarity around what 'ready' implies operationally, SZEF-capable tonnage remains the better indicator of how the industry is moving toward SZEF adoption.

Table 6: Capable and ready orderbook profile

	Share of the orderbook (% of GT)		
	2023	2024	2025
SZEF-capable	6.1	9.5	5.7
SZEF-ready	14.1	20.2	19.4
Total	20.2	29.7	25.1

*Note: Ordered vessels can often update their notation towards SZEF before delivery.

Table 7: Fuel preferences in the orderbook

Fuel capability	Share	Fuel readiness	Share
Conventional only	61.30%	Methanol-ready	9.90%
LNG and LNG dual-fuel	30.80%	Ammonia- and methanol ready	4.40%
Methanol and methanol dual-fuel	5.30%	LNG-ready	3.30%
Other gas dual-fuel	0.90%	Ammonia-ready	2.00%
Hydrogen and hydrogen dual-fuel	0.34%	Ammonia-LNG-ready	1.10%
Ammonia dual-fuel	0.09%	LNG-methanol-ready	1.10%
		Ammonia-methanol-LNG-ready	1.00%
		Hydrogen-ready	0.01%

*Note: The numbers shown here may not be exhaustive and are based on a single source taken to include orders up to the end of 2025 (Clarksons World Fleet Register, 2026)

Table 8: Demand lever progress

Tracking progress

Not on track

		2025	2030
Industry actors set and commit to net-zero targets	Partially on track	▪ 20-30 shipowners or operators, as well as 10-20 ports or yards, are committed to both near- and net-zero targets for 2050.	▪ 30+ ship owners or operators have net-zero targets and commitments, with at least half already taking stated actions.
Zero-carbon freight use grows	Not on track	▪ 5-10% of TEU-miles to be SZEF if transition led by container ships alone. If other shipping segments also scale proportionally, then about 1.5-3% of TEU-miles need to be SZEF.	▪ 8.75–12.5% of all TEU-miles to be SZEF if other shipping segments also take up SZEF.
Growth in the share of SZEF-capable vessels in the active fleet	Not on track	▪ 100 15,000 TEU container ships capable of running on SZEF, or 20-30 15,000 TEU ships, if other shipping segments scale their use of SZEF proportionally.	▪ 600 15,000 TEU equivalent ships capable of running on SZEF, or about 150 ships if other segments take up SZEF at a similar pace. ▪ 18-36 Mt/year of SZEF to be demanded by the alternative-fuel-capable fleet. ▪ All delivered ships in 2030 to be SZEF-capable.
Growth in the SZEF-ready vessels in the active fleet	Not on track	▪ SZEF-ready ships in the fleet to become SZEF capable at their first dry dock on or before 2025.	▪ All SZEF-ready vessels ordered before 2030 have been converted to SZEF capability.
Share of orderbook with SZEF-capable vessels	Not on track	▪ All new orders to be SZEF-capable or SZEF-only.	▪ All new orders to be SZEF-capable or SZEF-only.
Share of orderbook with SZEF-ready vessels	Not on track	▪ All new orders to be SZEF-capable or SZEF-only.	▪ All new orders to be SZEF-capable or SZEF-only.

Finance

Overview

Finance is a critical change lever in facilitating the transition to SZEF, both by encouraging and facilitating its uptake and by discouraging the uptake of non-SZEF-supportive fuels, vessels, and related infrastructure.

Two indicators measure the impact of finance on the transition towards SZEF. The first covers transparency and alignment of existing ship financing with IMO targets (for example, through the Poseidon Principles), indicating how finance is shifting and adapting. The second tracks lenders' appetite to provide sustainability-linked loans, bonds, and other instruments to the shipping industry. This can help identify changes in how capital flows to critical areas of the industry and how important sustainability is to the loan of that capital. It remains unclear whether labels attached to such financing ultimately translate to material ESG improvements.

1. Increase in the share of shipping debt aligned with the IMO's decarbonisation trajectory

Partially on track

- The Poseidon Principles Annual Disclosure Report 2025 shows the most positive year-on-year movement since the framework was established in 2019. Signatories' simple-average climate alignment score against the 2023 IMO GHG Strategy minimum trajectory improved by 7.7 percentage points to +11.7% (+19.4% last year), and the average against the striving trajectory improved by 6.6 percentage points to +18.4% (+25.0% last year). A positive score indicates misalignment—portfolios are emitting more than the IMO trajectories allow—so both groups remain misaligned on average, but the gap to alignment has narrowed materially.
- If the alignment scores were to be weighted by the size of each financier's portfolio, the alignment scores are approximately +9% to the minimum trajectory and +16% to the striving trajectory.
- The number of signatories disclosing a minimum trajectory score of +10% or lower doubled from 8 to 16 out of 35, and the equivalent count for the striving trajectory doubled from 4 to 8 out of 35. For the first time, three signatories are fully aligned (≤0%) with the minimum trajectory and one signatory is aligned with the striving trajectory.
- Membership grew from 35 to 36 leading shipping-finance institutions. The 35 disclosing signatories (the new signatory joined in early 2025 and is not required to disclose until next year's report) together represent approximately three-quarters of global shipping finance. The latest report saw an average reporting percentage of 95.1% (up from 93.3%), the highest since the Poseidon Principles were established. Twenty-nine signatories disclosed 90% or more of their eligible shipping portfolio, and nine disclosed 100%.

- This year's improvement was driven by a combination of updated IMO trajectories, changes in fuel consumption and operating profiles across both cargo vessels (notably tankers and chemical tankers) and passenger vessels (Ro-Pax), plus a small number of retrofits flagged by individual signatories. Both the maximum and minimum scores moved roughly 20 percentage points closer to alignment year-on-year, a material improvement that indicates progress was broadly distributed rather than driven by a handful of outliers.
- Alignment remains misaligned on average against both trajectories, however, and the 2030 trajectory checkpoint is now only four years away. Given the steepness of the trajectories between 2025 and 2030, the slow pace of fleet renewal flagged in the demand section, the order-book regression seen in 2025, and now the 12-month delay to the NZF, sustaining 6-8 percentage points of improvement per year through 2030 (the pace required to bring portfolios into alignment) will be difficult. This year's gain is encouraging, but it is not guaranteed to repeat.

2. Increase in the issuances of sustainability-linked loans and bonds to the shipping industry

Not on track

- Approximately $3.0 billion was issued through sustainability-linked loans, green bonds, transition bonds, or other similar loans to shipping-related entities in 2025, down from $3.4 billion in 2024. After three years of tracking, shipping-specific sustainable issuance has not broken out of the $2.4–3.4 billion annual band.
- An additional $11.2 billion was issued to energy producers and technology providers in 2025, down from approximately $12 billion in 2024, which brings the total tracked across both groups to $14.2 billion for 2025 (compared to $15.4 billion in 2024). None of this lending guarantees or implies application to SZEF, SZEF-capable vessels, or related infrastructure.
- According to the Climate Bonds Initiative, GSS+ (green, social, sustainability and sustainability-linked) debt globally totalled $1.0 trillion in 2025, with cumulative aligned volume at $6.8 trillion. Shipping's cumulative tracked total is up from $15.9 billion at the end of 2024 to approximately $18.9 billion at the end of 2025. This represents about 0.28% of the global aligned cumulative pool, a share that has not materially changed year-on-year.
- A single deal, Hapag-Lloyd's $1.1 billion green loan in February 2025, accounts for 37% of all 2025 shipping issuance. Excluding the 2025 Hapag-Lloyd issuance, the remaining issuance falls to $1.9 billion, meaningfully below 2024 levels. Other notable lending in 2025 included Norsk Hydro ($571 million EU green bonds, classified by Clarksons as Integrated Cargo/Shipping Group), Associated British Ports ($405 million sustainability bond), NYK Line (three Climate Bonds Initiative-approved transition bonds totalling $287 million), and SFL Corporation ($150 million sustainability-linked bond).

~10%

of shipping green loan issuance was Climate Bonds Initiative-approved.

- Within 2025 shipping issuance, green-labelled loans dominated by value ($1.79 bn, or 60% of total share), but sustainability-linked loans dominated by count (four of 14 deals). Only $0.29 billion, or 10% of shipping issuance, was Climate Bonds Initiative–approved in 2025, and all 10% came from a single issuer (NYK Line). This reinforces that most 'green' shipping issuance is self-labelled rather than externally verified against a recognised standard.

- Issuance levels remain well below what is required to align with 2030 trajectories. The decision to delay the NZF discussions by 12 months removes—at least temporarily—the central regulatory signal that was expected to drive capital towards SZEF-related projects. In order to materially shift the SZEF-related financing trajectory between now and 2030, growth in sustainable debt issuance for shipping would need to accelerate sharply from current levels, and against a more uncertain policy backdrop. Once strong regulatory mechanisms are in place, these labels may become less meaningful as capital flows naturally towards more obvious business cases.

Table 9: Finance lever progress

Tracking progress

Not on track

		2025	2030
Increase in the share of shipping debt aligned with the IMO's de-carbonisation trajectory	Partially on track	▪ Alignment of known portfolios to be below 10% for as much of the observed shipping debt as possible. A greater percent of this is below 5% than in 2022 (more than 14%).	▪ Given stricter targets for the 2030 Poseidon Principles trajectory, the same requirement as in 2025 to stay below 10%, with a larger share required to be below 5%.
Increase in the issuances of sustainability-linked loans and bonds to the shipping industry	Not on track	▪ Maintain or increase the share of total sustainability-linked debt issued to shipping. ▪ Total cumulative amount to reach at least $20 bn (twice the 2022 level).	▪ An increasing amount of funds is being issued to maritime actors, with the cumulative total of sustainability-linked loans and bonds reaching $50 bn.

Policy

Signal of change

In the past 12 months, there has been a sharper split between continued action and delayed global regulatory certainty. Classification societies have continued to advance practical safety frameworks for alternative fuels, including ClassNK's updated alternative-fuels guidelines, IACS's new Unified Requirement (UR) H2 for ammonia release mitigation systems, and Lloyd's Register's first guidance notes for onboard hydrogen generation. At the same time, despite the uncertainty around the NZF, national and regional actors have continued to advance measures such as Singapore's methanol bunkering licences and the EU's new Industrial Maritime Strategy, Ports Strategy, and Sustainable Transport Investment Plan.

Overview

Policy actions are related to multiple industry actions, national, regional, and international commitments, and regulatory developments that facilitate the decarbonisation of domestic and international shipping. This year, the multi-level nature of the policy lever has become more important than in previous editions; while the IMO remains central to setting the industry's long-term global framework, the delay in adopting the NZF has heightened the importance of national and regional action to sustain transition momentum and provide interim support for SZEF. As a result, this year's assessment places greater emphasis not only on whether policy frameworks exist, but also on whether they are strong enough to bridge this period of uncertainty and support early SZEF uptake.

1. Classification societies research and set operational, bunkering and safety standards for SZEF

On track

- In the last 12 months, classification societies have continued to play an important role in setting SZEF standards for technical provisions, safety, operations, and bunkering. For example, ClassNK updated its Guidelines for Ships Using Alternative Fuels, which cover methyl/ethyl alcohol, LPG, ammonia, and hydrogen, the International Association of Classification Societies (IACS) published a new Unified Requirement (UR H2) establishing harmonised requirements for ammonia release mitigation systems on ammonia-fuelled ships, and Lloyd's Register issued its first guidance notes for the safe design, installation, and integration of hydrogen generation systems on ships.
- Classification societies are also increasingly helping translate emerging fuel concepts into practical implementation pathways. In December 2025, Lloyd's Register and the Belgian Federal Public Service for Mobility and Transport collaborated to produce interim guidelines for gas carriers to use ammonia as fuel, providing a clearer path for early project development.
- This further builds on the IMO's progress in various safety guidelines, e.g., specific fuel safety guidance, including the Marine Safety Committee (MSC) adopting new guidelines for ammonia-fueled vessels, providing support for progress in classification society standard setting.

2. National/regional governments publish action plans to decarbonise shipping

Partially on track

- Previous national and regional policy commitments remain in place, but it is unclear whether they will compensate in any way for the lack of global policy certainty in 2025. Some national and regional action has continued over the last year; in November 2025, the UK published final policy details around the inclusion of domestic maritime in the UK ETS, with the regime starting on 1 July 2026. Around the same time, the European Commission adopted the Sustainable Transport Investment Plan to rapidly accelerate the energy transition of the aviation and waterborne transport sectors. The plan, which is expected to mobilise at least €2.9 billion by the end of 2027 (with €293 million earmarked for maritime fuel projects), will employ instruments such as double-sided auctions, contracts for difference, and guarantees to unlock investment and scale up the production of renewable and low-carbon fuels. Additionally, in March 2026, the European Commission launched the Industrial Maritime Strategy and the EU Ports Strategy, aimed at mobilising EU, national, and private investment for fleet decarbonisation, clean fuels, and port infrastructure.

- The Global South has also seen progress over the last year. In September 2025, GreenVoyage2050 issued a new call for expressions of interest to support the development of maritime national action plans (NAPs) to address shipping emissions. In 2026, Colombia, Senegal, and South Africa were selected as new partner countries for NAP development, and Nigeria launched work on its own NAP. These examples suggest that national planning in Global South countries is still progressing. However, much of the activity remains at the stages of roadmap development, technical assistance, and early capacity building rather than at fully operational policy delivery.

- With the NZF adoption delayed, stronger national and regional plans are now more important, not only to signal intent and complement IMO action, but to sustain momentum until global regulation eventually enters into force. Progress, for this indicator, remains partially on track.

3. Government policies targeting SZEF adoption in maritime

Not on track

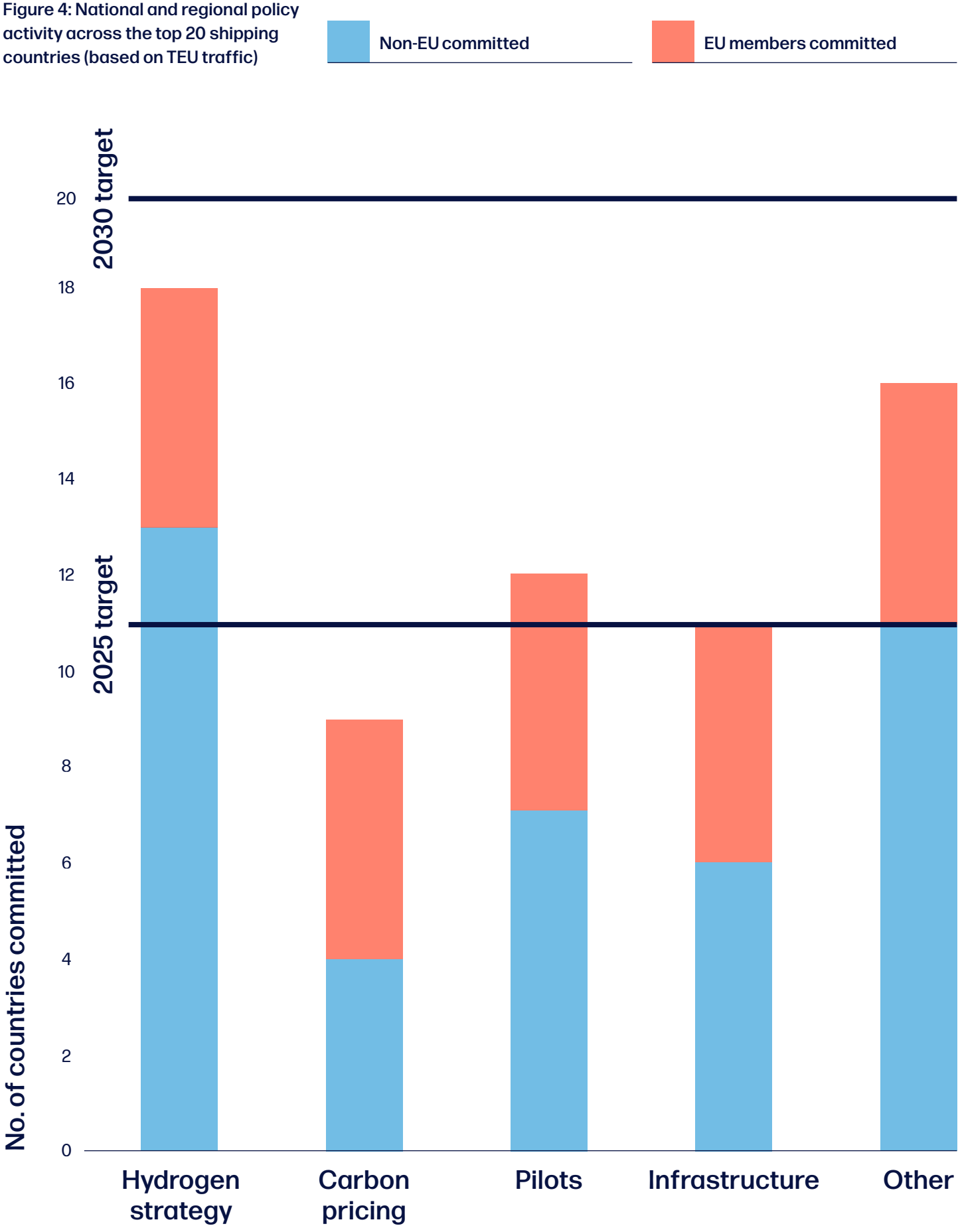
- Since the last edition of this report, governments have continued to introduce more concrete maritime-specific measures. However, these actions remain limited in scope and geography. In March 2026, the UK government announced £271 million to support clean maritime fuels and infrastructure, granted through the Clean Maritime Demonstration Competition and the Zero Emission Vessels and Infrastructure fund. In Germany, the government has put aside €400 million to co-finance the construction of shore power and bunkering facilities for alternative fuels and to develop green shipping corridors. In Singapore, the government announced in January 2026 that it had awarded three methanol bunkering licences and would publish its first technical reference for ammonia bunkering in 2026. The EU Industrial Maritime Strategy and Ports Strategy, announced in March 2026, also committed to further support for clean fuels, port investment, and fleet decarbonisation. Through the EU Sustainable Transport Investment Plan, €293 million is earmarked for maritime fuel projects under the Innovation Fund.

- This year, the indicator should be judged against a tighter standard than previously because indirect support (e.g., hydrogen strategies, pilots, or general decarbonisation signals) is no longer enough. What is more important now is whether governments have put measures in place to compensate for the delay in IMO certainty, such as operational bunkering frameworks, demand-side support, revenue support, mandates, or strong retrofit and newbuild incentives. The examples above show some progress, but they remain geographically concentrated and weighted towards infrastructure preparation, implementation guidance, and pre-commercial support, rather than the broader package of measures likely to drive large-scale SZEF uptake. With the adoption of the IMO NZF delayed until 2026 at the earliest, progress on this action remains off track.

- Given the growing importance of national and regional action, **Figure 4** provides a broad overview of how policy activity is developing across the top 20 shipping countries. The analysis is calibrated to the original assessment of what was needed when these actions and levers were first defined, rather than the higher standards called for in this year's report[14].

14. The 'top 20' countries metric refers to the top 20 countries by TEU traffic, based on the information from the United Nations Conference on Trade and Development, to better reflect countries which can have a profound impact on adoption of SZEF as early movers. These include Belgium, Brazil, China, Germany, India, Indonesia, Italy, Japan, Malaysia, Netherlands, Philippines, Singapore, South Korea, Spain, Thailand, Turkey, United Arab Emirates, United Kingdom, United States, and Vietnam.

Figure 4: National and regional policy activity across the top 20 shipping countries (based on TEU traffic)



4. IMO to agree mid- and long-term measures aligned with 5% SZEF and decarbonisation by 2050

Not on track

- This indicator requires a different framing from last year's report. At MEPC 83 in April 2025, the draft IMO Net-Zero Framework, including a global fuel standard and a GHG pricing mechanism, was approved as an amendment to MARPOL Annex VI. However, this approval did not make the measures legally binding. The draft text was then circulated to member states with a view to their formal adoption of the NZF at the extraordinary MEPC session in October 2025.
- That adoption, however, did not happen. Instead, at MEPC/ES.2 in October 2025, member states agreed to adjourn the session for one year. This means the draft amendments were not adopted and therefore could not proceed towards entry into force. The extraordinary session will be reconvened at the end of 2026, and member states will continue to work towards consensus in the interim. In addition to introducing delay, this development added uncertainty about the content of the global regulatory framework and about whether it will be capable of supporting 5% SZEF uptake by 2030.
- The distinction between approval, adoption, and entry into force is therefore critical this year. Once adopted, the regulations are expected to enter into force 16 months later under the tacit acceptance procedure. This means that the legal start date of any global regulation has now certainly shifted later than was assumed in last year's report.
- The absence of adopted mid-term measures in 2025 also means that several IMO outcomes remain plausible in 2026. These scenarios, described in Table 10, are potential pathways rather than predictions, intended to illustrate what different IMO outcomes in 2026 could mean for the 2030 breakthrough. This scenario framing also draws on the current IMO procedural status and recent external scenario analysis and modelling analysis of possible NZF outcomes.
- While the 2023 IMO GHG Strategy and the broad structure of the proposed mid-term measures remain in place, the delay in NZF adoption and the widening range of possible 2026 outcomes mean that IMO-level policy is no longer progressing with the timing or certainty needed to support the 5% SZEF breakthrough by 2030. This indicator is therefore assessed as remaining not on track.

Table 10: Scenarios illustrating what the different IMO outcomes in 2026 could mean for the 2030 breakthrough targets

Scenario	IMO policy signal	Implication for the 2030 breakthrough	Main takeaway
1. Delayed but broadly intact package in 2026	A delayed but still broadly credible global framework emerges in 2026, with the core NZF architecture agreed at MEPC 83 preserved, and sufficient clarification on reward design and implementation guidelines.	The 2030 breakthrough becomes substantially harder to achieve, but still possible. This would likely support a late acceleration in the second half of the decade rather than the smoother scaling path originally hoped for.	The priority becomes speed and clarity; the reward mechanism, ZNZ definition, and associated guidelines would need to be finalised quickly and in a way that gives credible support to scalable fuels.
2. Adoption in 2026, but with a weak or partial package	A formal agreement is reached, but key elements remain too weak or ambiguous to materially improve the business case for SZEF. This could include a broad ZNZ definition, insufficient reward allocation, or continued uncertainty around implementation.	This is the most problematic middle-ground outcome. A framework would exist on paper, but lack the strength to unlock the pace of fuel, vessel, and infrastructure investment needed to reach the breakthrough target.	In this scenario, national and regional actors would still need to do much of the practical work of creating demand and reducing early-mover risk.
3. No credible global package in 2026 or prolonged delay	Adoption is delayed again, or the resulting package remains too uncertain to guide commercial decision-making. The global signal is therefore weak and fragmented.	The likelihood increases that the breakthrough is delayed beyond 2030. The transition becomes more uneven, with progress driven by a smaller group of regions and first movers rather than by a coordinated global framework.	This scenario places much greater weight on national and regional policy to compensate for weak global coordination and keep transition momentum alive.

5. IMO implementation architecture for the NZF (LCA, certification, reward, compliance and fund guidelines)

Not on track

- Like the one above, this indicator is not on track and is better understood through a broader framing than in previous editions. The issue is no longer only whether the IMO is improving well-to-tank GHG guidance, but whether the wider implementation architecture of the Net-Zero Framework is becoming usable. Following the events of October 2025, the IMO confirmed that member states would continue technical work on implementation in the meantime. At the Intersessional Working Group (ISWG-GHG 20) later that month, delegates discussed how best to develop guidelines on topics such as fuel certification; ZNZs and rewards for their use, the IMO Net-Zero Fund, GHG fuel intensity (GFI) calculation and compliance approaches, and the IMO GFI Registry. The group also invited submitters to merge draft texts into more consolidated guidelines for the next session. These developments show that the work has widened well beyond well-to-tank factors alone, but much of the implementation architecture remains under construction.
- Work on the LCA framework has continued but remains mostly incomplete. ISWG-GHG 21 in April 2026 also made progress on follow-up work, including the LCA framework, the sustainable fuel certification scheme, and the GFI Registry. The approved draft text already outlines some of these key implementation elements, but they still depend on guidelines that need significant work. Progress under this action remains not on track.

6. IMO to agree on a comprehensive decarbonisation strategy and zero-by-2050 target

On track

- The 2023 IMO GHG Strategy is still in place and continues to provide the overarching framework for shipping decarbonisation. This includes the ambition for zero- or near-zero GHG emission technologies, fuels and/or energy sources to represent at least 5%, striving for 10%, of shipping energy use by 2030, and for international shipping to reach net-zero GHG emissions by or around 2050.
- However, this subsection is now more constrained than in last year's report. The main issue is no longer whether the IMO has a strategy, but whether that strategy is being translated into binding and usable rules quickly enough. The IMO continues to present the NZF as the tool intended to implement the 2023 GHG Strategy, but its adoption is not guaranteed. The 2023 GHG Strategy also remains formally under review, with a view to adopting a revised IMO GHG Strategy in 2028. On that basis, this action remains on track, even though the timing of implementation has become a greater concern.

Table 11: Policy lever progress

Tracking progress

Not on track

		2025	2030
Classification societies research and set operational, bunkering and safety standards for SZEF	On track	▪ In place in at least five large classification societies.	
National/regional governments publish action plans to decarbonise shipping"	Partially on track	▪ In place for 10 out of top 20.	▪ In place for 20 out of top 20.
Government policies targeting SZEF adoption in maritime	Not on track	▪ In place for 10 out of top 20 countries across the board.	▪ In place for 20 out of top 20 countries across the board.
IMO to agree mid- and long-term measures for shipping (e.g., market-based mechanisms (MBMs) and non-MBMs) which are aligned with 5% SZEF and decarbonisation by 2050	Not on track	▪ Mid-term measures agreed.	▪ Long-term measures agreed.
IMO adopt guidelines to estimate well-to-tank GHG emissions and regulation/ incentives for SZEF (now 'IMO implementation architecture for the NZF (LCA, certification, reward, compliance and fund guidelines)')	Not on track	▪ In place.	
IMO agrees on comprehensive decarbonisation strategy and zero by 2050 target	On track	▪ In place.	▪ The IMO adopts a 2028 IMO GHG Strategy (e.g., a further revision), reinforcing and building further ambition relative to the 2023 IMO GHG Strategy.

Civil society

Signal of change

In September 2025, the Maritime Just Transition Task Force (MJTTF) launched its first seafarer training frameworks to guide the development of seafarer training programmes for working on ships powered by ammonia, methanol and hydrogen.

Overview

The importance of the civil society lever remains as critical this year as it was in the previous edition. In tracking this lever, the report continues to analyse factors such as participation by climate-vulnerable and Indigenous actors in IMO negotiations, a just transition for seafarers, developments in labour standards, local NGO and community engagement around ports, and diversity, career pathways, and training. This year's analysis suggests that mobilisation has continued across these different areas, but that progress remains uneven and often concentrated among leading organisations and regions. Overall, the lever remains partially on track.

1. Indigenous groups, small island developing states (SIDS) and least-developed countries (LDCs) become more active and prominent in shipping decarbonisation negotiations

Partially on track

- In the last year, climate-vulnerable states' participation in negotiations remained visible and, in some respects, became stronger. Multiple Pacific, Caribbean, and African island states continued to push for ambitious and equitable IMO climate measures in 2025, having attracted support from over 50 nations for the NZF's levy-based approach in early 2025.
- This engagement continued into 2026 through formal IMO submissions. For example, Fiji, Kiribati, Nauru, Palau, Tuvalu, and Vanuatu submitted coordinated proposals to MEPC 84 calling for the NZF to be adopted 'as is' without further weakening. This demonstrated that vulnerable states are not only participating but also shaping the text under negotiation.
- Indigenous representation has also improved since last year. In December 2025, the IMO Assembly endorsed permanent consultative status for the Inuit Circumpolar Council, which strengthened the institutional presence of indigenous voices in global shipping governance.
- However, leadership is still concentrated in a relatively small number of well-supported SIDS, while broader LDC involvement remains less visible. Continued reliance on dedicated participation and training support mechanisms, such as GHG-SMART, the Voluntary Multi-Donor Trust Fund and the recently adopted Capacity Development Strategy, also indicates that capacity and funding constraints continue to limit more widespread engagement.

2. Fundamental just transition principles in terms of global labour standards, gender/diversity, and health/safety

Partially on track

- The last year has seen further progress on labour standards, gender/diversity, and health/safety in the context of seafarers. However, this is still only considered partially on track. Amendments were adopted to the Maritime Labour Convention in 2025, covering violence and harassment onboard, recognition of seafarers as key workers, shore leave, repatriation, and medical and occupational safety. In addition, industry-led work has become more structured, with the All Aboard Alliance's Sustainable Crewing Guidelines setting out practical measures to improve working and living conditions. These guidelines were developed through collaboration with 12 shipping companies and pilots involving more than 400 seafarers.
- However, while leading companies are moving beyond minimum compliance, these practices are not yet embedded across the wider sector. The All Aboard Alliance Insights 2025 report, based on self-assessment data from 26 member companies, points to more strategic action on diversity, equity, and inclusion. However, recent work in this space continues to highlight persistent barriers around safety, career progression, retention, and fair treatment. Progress is therefore visible but not yet broad enough to suggest that just transition planning is fully aligned with labour standards, gender equity, and a health-and-safety-first approach across the shipping sector.

3. Seafarer recruitment with support for career pathways and reduced attrition

Partially on track

- Amid a projected shortfall of 90,000 trained seafarers by 2026, there has been further—but only partial—progress around developing seafaring career pathways and reducing attrition. In 2025, the All Aboard Alliance launched a new 2026-2030 strategy that includes 'flexible and attractive careers' as a core goal, and the Sustainable Crewing Guidelines also set out practical measures to improve working conditions and make careers at sea more attractive.
- However, analysis suggests that there are still significant barriers to recruitment, progression, and retention. Recent Global Maritime Forum research highlights continuing problems around discrimination, certification and qualification difficulties, and weak transitions from sea-based to shore-based roles, especially for female seafarers. The 2025 Pregnancy at Sea report highlights the avoidable safety risks and attrition that are still created by unclear processes and limited support. Progress on this indicator is therefore evident, with greater attention to career pathways, seashore mobility, and retention. However, that progress is not yet significant enough to suggest that attrition and recruitment challenges are being addressed across the wider industry.

4. Skills and training investment, strengthening of training standards, delivering fair training and monitoring skills

Partially on track

MJTTF launched its first seafarer and instructor training frameworks.

- There has been further progress over the last year on both training provision and training standards. The IMO's interim guidelines on training for seafarers on ships using alternative fuels and new technologies, issued in 2025, were formally approved for ammonia and methanol at the Maritime Safety Committee session 111 in May 2026. Industry-led work has advanced in parallel, with the All Aboard Alliance's 2026–2030 strategy prioritising upskilling and transparency, the Sustainable Crewing Guidelines calling for rank-specific criteria for tasks, training, and appraisals, and Singapore's Maritime Energy Training Facility's digital platform intending to expand training on the safe handling of alternative marine fuels and new technologies.
- In September 2025, the MJTTF launched its first seafarer training frameworks to guide the development of training programmes for seafarers working on ships powered by ammonia, methanol, and hydrogen, whether they are senior officers or in entry-level or operational roles. In April 2026, Hong Kong launched the world's first administration-led 'training-the-trainer' programme for green maritime fuels. Hosted at the Hong Kong Polytechnic University, organised by the Hong Kong Maritime and Port Development Board, and delivered by the MJTTF for Hong Kong Shipowners Association member companies, the courses focus on upskilling maritime instructors to safely handle zero- and low-carbon marine fuels, including ammonia, methanol, and hydrogen.
- Despite these developments, the lever can still only be considered partially on track. This is mainly because much of the progress is around guidance, pilot initiatives, and leading company practice, rather than a globally embedded and equitable training system. The All Aboard Alliance's Insights 2025 report points to continued unevenness in company processes, and the IMO is still developing the guidelines to support consistent training across fuels and technologies. Significant work therefore remains to ensure that training standards, fair access to training, and skills monitoring are aligned with the wider industry's green transition needs.

5. Local civil society actors surrounding the top 50 global ports calling for air pollution mitigation, GHG reduction, and adoption of zero-emission fuels

Not on track

- Local civil society pressure around ports remains visible but geographically uneven. Based on this year's screening of the top 50 container ports, only eight ports had active campaigns (Rotterdam, Antwerp, Los Angeles, Long Beach, New York–New Jersey, Mundra, Savannah, and Houston) that focused on local air pollution, community health, fossil-fuel expansion, shore power, electrification, and zero-emission shipping (Table 14 in **Annex 2**). Examples include Rotterdam's ongoing campaign against the fossil-port model, Antwerp's continued legal and advocacy action around fossil expansion, Ship It Zero and allied pressure around the San Pedro Bay port complex, New York–New Jersey and Houston Clean Ports Report Card initiatives, and continuing civil society scrutiny of pollution impacts around Mundra.

- Compared with the 2025 edition, this year's findings suggest that port-side advocacy remains active and, in some locations, is becoming more structured and institutionalised. However, it has not yet broadened across the global port system. Publicly documented campaigning remains concentrated in North America and Northwest Europe, with only very limited evidence of similar activity in major ports in East and Southeast Asia, Latin America, and the Middle East. The total number of the top 50 ports with active campaigns identified in this year's scan remains the same as in the previous edition (eight). In some cases, these campaigns have started to raise objections around the risks associated with SZEF, highlighting the importance of mitigating SZEF safety and environmental risks (non-GHG). This includes helping ensure a balanced and fair transition for local and port communities impacted by SZEF deployment and use.

- This indicator remains not on track. While some notable campaigns have achieved visibility and helped push issues such as clean air, port electrification, and zero-emission shipping further into public debate, the scale of mobilisation remains far below what is needed to shift overall conditions across the global port network. This is also well below the report's longer-term benchmark of NGO activity at 25 of the top 50 ports by 2030.

Table 12: Civil society lever progress

Tracking progress

Partially on track

		2025	2030
Indigenous groups, SIDS, and LDCs become more active and prominent in shipping decarbonisation negotiations	Partially on track	▪ Participating and co-sponsoring key IMO proposals.	
Fundamental just transition principles in terms of global labour standards, gender/diversity and health/safety	Partially on track		▪ Transition planning aligned with the Maritime Labour Convention.
Seafarer recruitment with support for career pathways and reduced attrition	Partially on track	▪ Address seafarer attrition.	▪ Support seafarer career pathways.
Skills and training investment, strengthening of training standards, delivering fair training, and monitoring of skills	Partially on track		▪ 450,000 seafarers to be retrained and upskilled.
Local civil society actors surrounding the top 50 global ports calling for air pollution mitigation, GHG reduction, and adoption of zero -emission fuels	Not on track	▪ NGOs at eight of top 50 ports.	▪ NGOs at 25 of the top 50 ports.

Annex 1

Progress since the tracker's inception

Table 13: Progress over time on key indicators

Lever	Indicator	Edition 2022	2023	2024	2025	2026
Technology and supply	SZEF pilots and demonstration projects (now 'Technology pilots and demonstration projects')	Partially on track	On track	On track	On track	On track
	Cross-industry collaboration (now 'Technology pilots and demonstration projects')	On track	On track	On track		
	Key technological developments	On track	Not on track	Partially on track	Partially on track	Partially on track
	SZEF bunkering and supply chains at key ports	-	-	-	Partially on track	Partially on track
	Government hydrogen strategies	Partially on track	On track	On track	Partially on track	Partially on track
	Electrolyser and green hydrogen production capacity	-	Partially on track	Partially on track	On track	On track
	Cost of green hydrogen production	-	Partially on track	Partially on track	Partially on track	Partially on track
	SZEF production	Not on track	Partially on track	Partially on track	Partially on track	Partially on track
Demand	Industry actors set and commit to net zero targets	-	On track	Partially on track	Partially on track	Partially on track
	Zero-carbon freight use grows	Not on track	Not on track	Not on track	Not on track	Not on track
	Growth in the share of SZEF-capable vessels in the active fleet	-	Not on track	Not on track	Not on track	Not on track
	Growth in the SZEF-ready vessels in the active fleet	-	Not on track	Not on track	Not on track	Not on track
	Share of orderbook with SZEF-capable vessels	-	Not on track	Not on track	Not on track	Not on track
	Share of orderbook with SZEF-ready vessels	-	Not on track	Not on track	Not on track	Not on track
Finance	Increase the share of shipping debt aligned to trajectories needed to meet 2030/50 targets	-	Partially on track	Not on track	Not on track	Partially on track
	Increase in the issuances of sustainability-linked loans and bonds to the shipping industry	-	Partially on track	Not on track	Not on track	Not on track

Lever	Indicator	Edition				
		2022	2023	2024	2025	2026
Policy	Classification societies research and set operational, bunkering, and safety standards for SZEF	Partially on track	On track	On track	On track	On track
	National/regional governments publish action plans to decarbonise shipping	Partially on track	On track	On track	Partially on track	Partially on track
	Governments' policies targeting SZEF adoption in maritime	Partially on track	Partially on track	Partially on track	Not on track	Not on track
	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	Partially on track	On track	Not on track	Not on track
	IMO to adopt guidelines to estimate well-to-tank GHG emissions and regulation/ incentives for SZEF (now 'IMO implementation architecture for the NZF (LCA, certification, reward, compliance, and fund guidelines)')	Partially on track	Partially on track	Partially on track	Not on track	Not on track
	IMO to agree on a comprehensive decarbonisation strategy and a zero by 2050 target	Partially on track	On track	On track	On track	On track
Civil society	Indigenous groups, SIDS, and LDCs become more active and prominent in shipping decarbonisation negotiations	Partially on track	Partially on track	Not on track	Partially on track	Partially on track
	Fundamental just transition principles in terms of global labour standards, gender/diversity and health/safety	-	-	Partially on track	Partially on track	Partially on track
	Seafarer recruitment and attrition with support for career pathways, addressing attrition and recruitment	-	-	Partially on track	Partially on track	Partially on track
	Skills and training investment, strengthening of training standards, delivering fair training, and monitoring of skills	-	-	Partially on track	Partially on track	Partially on track
	Local civil society actors surrounding the top 50 global ports are calling for air pollution mitigation, GHG reduction, and adoption of zero -emission fuels	On track	On track	Partially on track	Not on track	Not on track

Annex 2

Technical annex

Definitions

The definition of actions includes:

- **Technology and supply** – Key actions relating to the development of necessary on-board and shore-based infrastructure and technology for SZE-fuelled ships, such as electrolysers, fuel cells, internal combustion engine modifications, bunkering infrastructure, and production facilities.
- **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, avoiding supply issues and facilitating a possibility for rapid production scale-up.
- **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.
- **Policy** – Necessary policy developments both at the national and international levels to facilitate the adoption of SZEF, such as economic and technical measures, guidelines, and agreements.
- **Civil society** – Individual, workforce, and community engagement and action, including the provision of future decent work, increasing participation of underrepresented groups in shipping climate change discussions, such as small island developing states (SIDS) and least-developed countries (LDCs), indigenous communities, and a range of other diverse communities.

Actions are evaluated as:

- **On track** – The actions and targets of the actions are progressing in line with requirements. All the actors involved are progressing in their respective developments toward reaching the 5-10% goal.
- **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, significant progress that still falls short of the set target, or significant informal discussions/developments point to future progress, but no official announcements have yet been made.
- **Not on track** – The action and associated targets are not progressing in line with the requirements necessary to reach the 5% goal.

ZNZ uptake by 2035

While the objective of 5-10% of ZNZ in shipping by 2030 is part of the 2023 IMO GHG Strategy, there is no quantified target for 2035. ZNZ fuels will be needed at scale by the 2040s, particularly e-fuels, as the energy-efficiency gains and fuels with limited carbon benefits (e.g., LNG, food-crop biofuels) are insufficient to meet the 2040 target and achieve carbon neutrality by 2050. What the uptake of ZNZ between 2030 and 2050 could look like is largely uncertain, as new technologies uptake do not tend to be linear over time but characterised by setbacks, accelerations and tipping points.

Technology uptake has often been represented by an S-curve in the literature, where an early phase of development and experimentation, characterised by slow growth, is followed by an accelerated phase, and the final phase is slower as the technology becomes dominant in the market. This shape is based on a strand of literature explaining the diffusion of a technology by learning effects and economies of scale, which means that the technology's attractiveness increases and therefore diffusion accelerates as the technology gains ground, which has some resonance with the theoretical framework of socio-technical transitions, which serves as the theoretical framework for this report based on the MarSTF framework.

However, the MLP literature insists on the agency of actors and the limits in projecting a technology uptake which is driven by social processes and sometimes unpredictable events. Furthermore, this shape has been empirically observed in the uptake of various low-carbon technologies, such as electricity generation from wind and solar (, and more recently in shipping regarding the uptake of electronic engines and LNG as a marine fuel). Furthermore, the concept of non-linear S-curve-like uptake based on learning effects has been used to represent shipping technology uptake, although with a different mathematical modelling than the one presented below.

We therefore calibrate an S-curve starting at zero SZEF use in 2025, rising to the 2030 target (5-10% of the energy demand), and so that the uptake enters its final phase of expansion with a slowdown of growth in the 2040s. The formula of the curve is represented as follows:

$$share\ ZNZ = \frac{1}{1 + a \times e^{-b \times year\ from\ start}}$$

With a = 30, b = 0.3

Technology and supply

This edition sees no change to the indicators analysed as part of the Technology and Supply section, they have been restructured in terms of their presentation.

SZEF production to 2035

The methodology used to generate SZEF production figures has been updated for this version of the report. The initial method used to evaluate these figures was developed when e-volume production was in its infancy, whereas today supply chains for such fuels are more mature and larger in scale. The new methodology takes a more straightforward approach, benefiting from the most recent projections of expected production volumes by 2030 and incorporating feedback that previously published figures were optimistic.

The first important difference in this edition of the report is that aggregate e-ammonia and e-methanol statistics have been sourced from Gena Solutions. E-ammonia (i.e., from electrolysis using renewable electricity) is assumed to account for all 'renewable ammonia' figures provided, where it accounts 99.95% in practice. E-methanol is assumed to relate to synthetic methanol produced using electrolysis, excluding bio-methanol. Aside from the change in input data, the updated methodology used to generate SZEF production estimates is as follows: SZEF production volumes associated with years preceding 2026 are taken from 'operational' projects in the database only.

- Projections of SZEF production volumes between 2026 and 2030 are evaluated as the sum of 'firm' (i.e., 'operational', 'under-construction' and 'engineering-phase', not 'pre-feasibility/feasibility') capacity and 30% of 'pre-feasibility/feasibility' capacity in the case of 'low' and 'medium' scenarios. For the 'high' scenario, projections are taken as the sum of 'firm' with 100% of 'pre-feasibility/feasibility' volumes, thereby representing a theoretical upper-bound optimistic case.

- Projections of SZEF production volumes between 2031 and 2035 are evaluated using an assumed compound annual growth rate (CAGR) applied to production volumes estimated for the previous year, starting with 2030 volumes.

- The CAGR is assumed based on those observed in the historical data. For e-methanol and e-ammonia, CAGRs of 30% and 50% are assumed, respectively.

- Production volumes are then converted into equivalent energy, before 'low', 'medium' and 'high' scenarios are produced based on the expected share that can be allocated to maritime uses, representing 40%, 50% and 75% for methanol and 10%, 20% and 50% for ammonia.

It's reasonable to assume that the inclusion of 30% 'pre-feasibility/feasibility' volumes is overly optimistic, but it's important to bear in mind that the input dataset reflects a 'snapshot' of production projects at the time of publication in April 2026. Further additions to the dataset can be expected in the coming years, contributing to 2030 production volumes. In addition, the NEOM Green Hydrogen Project took around two years from the start of construction to reach 80% completion, so it seems fair to assume that a reasonable proportion of projects not currently under construction or in the engineering phase will still be ready by 2030.

Overall, the 2025 and 2030 SZEF production figures derived from the data are smaller than those published via the alternative datasets used last year. E-methanol estimates align reasonably well with last year's input dataset sourced from the Methanol Institute. However, a significant difference was found between the 2030 e-ammonia volumes projected using the new data and those projected using the previously used Ammonia Energy Association (AEA) data. Specifically, e2030 volumes with Gena Solutions data were found to be one-third of those suggested in the AEA dataset, and this discrepancy has led to a downward forecast in the 2030 SZEF production estimates.

Demand

Ship-equivalent fuel demand estimates

The equivalent number of 15,000 TEU vessels that would be needed to reach 0.1 and 0.6 EJ is calculated by using fuel consumption estimates from the 4th IMO GHG Study for an average vessel of this size and type, and then comparing to the total amount of fuel needed if it were, for example, methanol to cover 0.1 or 0.6 EJ in energy. A 5% efficiency improvement has been added to account for changes since 2018. 20,000 MJ/Mt is used as the energy content of methanol, 18,800 MJ/Mt for ammonia, and 40,490 MJ/Mt for HFO, to facilitate conversion.

2025, 2030, and 2035 required TEU estimate

Using data from the 4th IMO GHG Study on the days at sea, average speed, and median TEU capacity in each size category, it is possible to estimate the average expected TEU miles sailed for each size class of container ship. This is multiplied by the total number of vessels in each size class to estimate the total TEU miles provided in 2018 by the entire fleet. Similarly, based on 600 15,000 TEU ships being needed to cover 0.6 EJ in 2030, the total TEU miles these 600 ships would sail in a year is estimated and used to work out the relative share of total TEU miles that would then potentially need to be SZEF-capable. This amounts to about 40% of all TEU miles, but since the container fleet accounts for about 25% of all merchant shipping emissions (based on 2018 estimates), the required TEU miles are reduced proportionally. An error margin is added to account for uncertainty in TEU-mile growth (or decline) from 2018 to 2025 and 2030, fuzziness in average speed and time spent at sea, the resolution loss when using size-class-level averages, and uncertainty in how size classes themselves might evolve. This leads to the 8.75-12.5% TEU-miles estimate for 2030 and a similar estimate of 1.5-3% for 2025 targets, both of which hold if other segments adopt SZEF in proportion to their contribution to global emissions.

Estimated total SZEF-capable tonnage and potential demand for 2026, 2030, and 2035

The average growth in GT over the last five years (2020-2024) for the fleets with different fuel capabilities is calculated based on Clarksons WFR (2025) data, combined with the average GT ordered based on the same source, and then extrapolated to get 2025, 2030, and 2035 estimates of total SZEF-capable GT. This defines the 'low' trajectory for 2030 onwards. For the 'high' scenarios, an S-shaped growth path is used, allowing ⅓ of all delivered tonnage in 2030 to be SZEF-capable, ⅔ in 2035, and close to all delivered tonnage being SZEF-capable from 2040 onwards. The 'medium' scenario sits roughly between the 'low' and 'high' growth paths.

Civil society

Table 14: Actions at the top 50 Container Ports

Port	Active NGO(s)	Focus area(s)	Campaign description
Shanghai	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Singapore	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Ningbo-Zhoushan	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Shenzhen	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Qingdao	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.

Port	Active NGO(s)	Focus area(s)	Campaign description
Guangzhou Harbor	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Busan	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Tianjin	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Jebel Ali, Dubai	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Port Klang	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Rotterdam	Advocates for the Future and Extinction Rebellion Netherlands	GHG reduction, air pollution, fossil phase-out, zero-emission shipping	Campaigns continue to target the Port of Rotterdam's fossil footprint, calling on the port authority to phase out fossil activities and reduce climate and pollution impacts. Extinction Rebellion actions have also targeted highly polluting cruise traffic.
Hong Kong	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Antwerp	ClientEarth with Belgian and Dutch partners	GHG reduction, air pollution, fossil expansion opposition	ClientEarth and partners continue legal and advocacy action against the INEOS Project One petrochemical project in the Port of Antwerp, arguing it would worsen climate impacts and air pollution.
Xiamen	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Tanjung Pelepas	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.

Port	Active NGO(s)	Focus area(s)	Campaign description
Los Angeles	Pacific Environment/ Ship It Zero, Coalition for Clean Air, and Earthjustice	Air pollution mitigation, zero-emission ships, zero-emission trucks and cargo-handling equipment	NGOs continue pressing for faster zero-emission shipping and stronger port-equipment rules to protect frontline communities around the San Pedro Bay port complex.
Tanger Med	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Suzhou	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Long Beach	Pacific Environment/ Ship It Zero	GHG reduction, zero-emission shipping, clean air, port electrification	Ship It Zero remains active around Long Beach and the wider San Pedro Bay complex, pressing for zero-emission ocean freight and full port electrification. Long Beach also has a city resolution supporting 100% zero-emission shipping.
Laem Chabang	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Kaohsiung	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Ho Chi Minh City	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Guangxi Beibu	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
New York-New Jersey	Parents Engaging Parents New Jersey, Friends of the Earth, and Pacific Environment	Clean air, shore power, zero-emission port solutions, community health	A frontline-community-led Clean Ports Report Card campaign is pressing the Port Authority of New York and New Jersey to adopt stronger zero-emission measures and improve air quality for nearby residents.

Port	Active NGO(s)	Focus area(s)	Campaign description
Mundra	Centre for Financial Accountability (CFA/ CENFA)	Air pollution, health impacts, industrial emissions around port complex	Civil-society scrutiny around the Adani-run Mundra port complex continues, highlighting cumulative air-pollution and community-health impacts from new industrial projects in and around the port area.
Hamburg	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Tanjung Priok	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Colombo	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Hai Phong	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Cai Mep	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Jawaharlal Nehru Port (Nhava Sheva)	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Rizhao	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Lianyungang	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Yingkou	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.

Port	Active NGO(s)	Focus area(s)	Campaign description
Savannah	Friends of the Earth and community advocates	Shore power, diesel-emissions reduction, environmental justice	Current advocacy highlights the need to reduce port-connected air pollution as the Port of Savannah expands, including calls for shore power and stronger protections for nearby communities.
Manila	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Santos	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Valencia	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Abu Dhabi	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Dalian	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Colon	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Yantai	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Algeciras	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Piraeus	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.

Port	Active NGO(s)	Focus area(s)	Campaign description
Tokyo	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Bremen/ Bremerhaven	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Tanjung Perak	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Houston	Environmental Community Advocates of Galena Park, Air Alliance Houston, and Friends of the Earth	Diesel pollution, truck idling, clean air, zero-emission port solutions	Community and environmental groups are campaigning on freight-related diesel and truck pollution and, through the Clean Ports Report Card, pressing the Port of Houston for stronger zero-emission and air-quality measures.
Dongguan	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.
Balboa	None identified in current update	–	No clearly documented qualifying local civil society campaign identified in public sources reviewed for this first-pass 2026 update.

Annex 3

Evidence base for the focus on e-methanol and e-ammonia as SZEF

This annex explains why some fuel pathways are not counted as SZEF in this report. The purpose is not to exclude all potential contributions from these fuels, but to clarify which pathways are better aligned with the report's 2030 breakthrough framing and a credible 2050 decarbonisation end state.

The report, in general, applies three broad tests:

1. **Whether a fuel pathway is likely to be scalable to a material share of international shipping energy demand**
2. **Whether it can deliver very deep well-to-wake GHG reductions**
3. **Whether it can become cost-competitive with appropriate policy support**

This is consistent with the logic used in previous editions, where SZEF was defined as fuels capable of scaling to 200–300 Mt HFOe, delivering 90–100% lifecycle GHG reductions, and becoming cost-competitive in the foreseeable future.

Table 15: Consideration of different fuels to be included in the scope of this report

Fuel	Treatment in this report	Rationale
Biofuels	Not counted as SZEF	Biofuels can provide near-term emissions reductions, but sustainable supply is limited and faces competing demand from other sectors. Their lifecycle emissions also depend strongly on feedstock, land-use effects and certification
Fossil LNG and other lower-carbon fossil fuels	Excluded	LNG can reduce some air pollutants and may offer limited CO_2 reductions compared with conventional marine fuels, but it remains fossil-based and is exposed to methane slip and upstream methane leakage. It therefore does not represent a zero-emission end-state pathway.
Blue fuels	Not counted as SZEF	Blue hydrogen-derived fuels may reduce emissions relative to unabated fossil fuels, but they rely on fossil feedstocks, high carbon capture rates, low upstream methane leakage, and durable CO_2 storage. These residual risks make them less robust as zero-emission fuels than renewable hydrogen-derived pathways.
E-methane/e-LNG	Treated as a conditional low-GHG methane pathway, not SZEF	Academic literature recognises e-methane as a hydrogen-derived synthetic fuel/electrofuel. This includes e-methane, e-methanol and e-ammonia as hydrogen-based synthetic fuels that could substitute fossil fuels and support the clean energy transition, while noting that e-methane is only renewable and lower-GHG when produced with renewable electricity-based hydrogen. Another study similarly describes e-methane/green methane as compatible with existing gas infrastructure, and another study assesses methane alongside hydrogen, methanol, ammonia and Fischer–Tropsch fuel as power-to-X options for deep-sea shipping. None of these studies argues that e-methane (with equivalent ZNZ-compatible GHG intensity to e-methanol or e-ammonia) has the cost-competitiveness with other e-fuels to be likely to play a significant role in shipping's overall fuel mix in 2050. However, comparative maritime studies find that e-methane/e-LNG has weaker climate performance than other e-fuels due to methane slip and leakage, and a prospective LCA finds that e-LNG does not meet the 2050 FuelEU Maritime GHG target.
Other speculative or niche pathways	Not included in core tracking unless evidence strengthens	Some options may become relevant in specific segments or regions but are not currently supported by sufficient evidence on scalability, cost, safety, infrastructure readiness, or 2050-aligned deployment.

Among these pathways, e-methane/e-LNG is discussed in slightly more detail because it is both a hydrogen-derived synthetic fuel and compatible with existing LNG infrastructure, meaning it is more likely than other excluded pathways to be presented by some stakeholders as a candidate zero-emission or 2050-aligned fuel.

However, being an e-fuel is not sufficient for inclusion as SZEF. To be included as a relevant fuel in shipping's 2030 breakthrough assessment, the question is whether a fuel can combine life cycle climate integrity, scalability, and plausible cost competitiveness at the scale required for shipping's 2050 transition end state. In the literature, the most relevant comparative maritime LCA and techno-economic studies do not support the treatment of e-methane/e-LNG as a leading zero-emission shipping fuel pathway.

Kanchiralla et al. (2024) assess biofuels, electrofuels, blue fuels, battery-electric propulsion, and onboard carbon capture across several ship types. They find that e-ammonia, e-methanol, and liquid e-hydrogen in fuel cells offer the highest climate mitigation potential. E-ammonia appears among the most cost-effective e-fuel options. In contrast, they find that e-methane and biomethane used in internal combustion engines have the lowest potential for climate impact reduction among the assessed e-fuel and biofuel pathways, due to methane slip in the engine and leakage during distribution. They also note that e-methane has the highest global warming potential among e-fuels due to methane slip and fugitive emissions during liquefaction and distribution.

In another study, prospective LCA compares e-ammonia, e-methanol, e-Fischer–Tropsch diesel, and e-LNG for maritime applications in Europe against FuelEU Maritime targets. The study finds that e-ammonia, e-FT diesel and e-methanol could meet the 2050 FuelEU Maritime GHG target, but e-LNG could not. The reason is ship-level methane slip, which causes e-LNG to exceed the 2050 well-to-wake GHG target.

This, however, does not mean e-methane has no possible role. It means that its climate performance is more conditional than that of other e-fuels. In addition to other similar e-fuels (e.g., e-methanol), it requires low-emission liquefaction and distribution and verified near-zero methane slip across the value chain. Without all these conditions, e-methane/e-LNG is unlikely to deliver the life cycle climate performance required for a robust zero-emission shipping pathway.

The second line of evidence comes from fleet-wide transition models and 2050 fuel-mix scenarios. These are important because the 5% breakthrough is not only about what can reduce emissions in the short term, but also about scaling the fuel pathways most likely needed in a 2050-aligned end state.

UCL/UMAS modelling has consistently found a strong long-term role for ammonia. In the International Maritime Decarbonisation Transitions technical annex, a comparison with previous modelling results finds that both model runs achieve full decarbonisation in 2050 with the fuel mix dominated by ammonia. The same analysis also notes that the general prediction of ammonia as the dominant fuel in 2050 aligns well with the wider literature, with ammonia making up the largest share of the fuel mix in all reviewed decarbonisation scenarios, except one DNV scenario.

Similarly, the IEA Net Zero Roadmap assigns ammonia the largest share of shipping fuel in 2050. In its aviation and shipping dashboard, the IEA projects that bioenergy, hydrogen, and hydrogen-based fuels increase from less than 1% of shipping and aviation energy consumption today to almost 15% in 2030 and 80% by 2050. For shipping specifically, ammonia accounts for 44% of final energy consumption by 2050, compared with hydrogen at 19%, biofuels at 19%, and methanol at 3%. E-methane is not presented as a major end-state shipping fuel in this pathway. This provides justification for e-ammonia, albeit less so for e-methanol as a SZEF. The International Renewable Energy Agency also places renewable ammonia at the centre of shipping decarbonisation, describing it as the backbone of sector decarbonisation and estimating that it could represent around 43% of the shipping fuel mix by 2050.

The Lloyd's Register Future of Maritime Fuels review is useful because it compares multiple fuel-mix projections rather than relying on a single model. It finds that, among hydrogen-based fuel scenarios, combined blue and e-ammonia capture between 20% and 60% of the market by 2050, with an average share of 46%. It also finds that e-ammonia is the most widely adopted maritime fuel in the long term, with an average market share of 35% in 2050. E-methane is included in some scenarios, but it and other methane-based pathways do not emerge as consistently dominant hydrogen-based end-state fuels.

The DNV/IMO Comprehensive Impact Assessment has slightly different findings. The results are not explicit about the share of the total end-state fuel mix taken by specific e-fuels, although they are clear that e-fuels dominate the fuel mix relative to biofuel and blue fuel in the end-state (the modelling incorporates constraints on the share of energy mix that biofuel can take, acknowledging the supply constraint of biofuel and competition). E-LNG is consistently more expensive than e-ammonia across all scenarios. DNV finds that reward mechanisms in levy and feebate scenarios can incentivise uptake of e-ammonia and e-LNG, and that e-ammonia, e-LNG, and bio-LNG can collectively achieve the highest uptake in scenarios combining a levy with a reward mechanism. However, the same report notes that fuel uptake is highly sensitive to relatively small changes in levy and reward levels. Therefore, this evidence is best interpreted as showing that policy design can materially affect methane/e-LNG uptake, as well as e-ammonia uptake, rather than as proof that e-methane is a robust or consistently preferred 2050 end-state fuel.

The literature recognises e-methane as a hydrogen-derived e-fuel and notes a conditional role, especially for LNG-compatible ships and infrastructure. However, maritime-specific LCA evidence shows that its climate performance is undermined by methane slip and leakage, and fleet-wide 2050 transition models generally point to hydrogen-derived fuels (specifically ammonia, methanol, and hydrogen) as the main components of a 2050 net-zero emissions end-state.

For this reason, this report does not count e-methane/e-LNG as a SZEF. It is more appropriate to recognise it as a possible conditional low-GHG methane pathway, while reserving the SZEF category for fuels with stronger evidence of scalability, life cycle climate integrity, competitiveness, and alignment with 2050 decarbonisation scenarios.

CLIMATE ACTION IN SHIPPING

PROGRESS TOWARDS SHIPPING'S 2030 BREAKTHROUGH

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