Key takeaways from the *Global Maritime Decarbonisation Survey* and *Voyaging Toward a Greener Future* report

Straight from the ship's mouth

by Ewa Kochańska

The Global Centre for Maritime Decarbonisation and Boston Consulting Group conducted the *Global Maritime Decarbonisation Survey* earlier this year to reveal trends and the current state of decarbonisation in the maritime sector. The findings underline that while ambitions are high, investments are steadily increasing, and decarbonisation is a top priority for most stakeholders, the progress could be more consistent, and the greening efforts need a more holistic approach across the board. The report offers a clearer understanding of the industry's decarbonising progress and helps in designing targeted interventions for more effective emission reduction.

The survey included 128 shipowners and operators who collectively run 14,000 merchant vessels and generate around 500 billion US dollars in yearly revenue. The GCMD and BCG report *Voyaging Toward a Greener Future* analyses the survey results, offering policymakers and industry players guidance in developing targeted interventions to accelerate maritime decarbonisation. The proposed strategy involves collaborative efforts, innovative financing, awareness-building, infrastructure development, and cost-sharing mechanisms to drive widespread adoption of decarbonisation solutions.

Inescapable reality – the uphill road to net zero

The shipping industry is one of the main pillars of the world economy, accommodating 90% of global trade by transporting 11 billion tonnes of goods annually – 1.5t per person worldwide. Nonetheless, shipping is also responsible for around 3% of global greenhouse gas emissions.

Recognising that negative environmental impact, the International Maritime Organization (IMO) has set ambitious decarbonisation targets for the sector, aiming for net-zero emissions by 2050. Subsequently, IMO has introduced initiatives such as the Energy Efficient Existing Ship Index and Carbon Intensity Indicator. At the same time, the European Union targets the uptake of renewable fuels of non-biological origin via its FuelEU Maritime Regulation, and it will have included much of shipping (vessels ≥ 5,000 of gross tonnage) in its Emissions Trading System by 2024.

However, the complexity of the shipping industry in terms of geography, company & fleet size, investment capabilities, and more, poses challenges, requiring a concerted effort to overcome obstacles. The report says that shipowners and operators need a broad-ranging strategy covering critical elements (including a strategic plan, operational & technological efficiency, fuel transition, and shipboard carbon capture, SBCC) to reduce sector-wide carbon emissions.

Undoubtedly, the maritime industry is at a crucial stage in addressing carbon emissions, with a significant number of shipowners recognising the imperative to reduce their footprint. Most (73%) consider achieving net-zero operations a strategic priority, and 77% have established specific decarbonisation goals (with 54% aiming for net zero). Additionally, 87% of respondents have personnel dedicated to green initiatives, 55% have specialised sustainability teams, 27% have developed clear decarbonisation roadmaps, and on average, companies invest 2% of their revenues in green initiatives.

Yes, but…

Despite the good intentions, the increased awareness of environmental responsibility does not necessarily translate into adopting decarbonisation measures. Operational efficiency levers that cause minimal disruptions, such as weather routing and slow steaming, have high adoption; on the flip side, measures requiring collaboration, like cold ironing and just-in-time operations, see the opposite result. In the area of technological efficiency, established options like advanced hull coatings and engine improvements are widely adopted. In contrast, the industry does not embrace emerging technologies like super-light ships, wind propulsion, and air lubrication.

Exhibit 1 – Six critical elements needed to decarbonize shipping

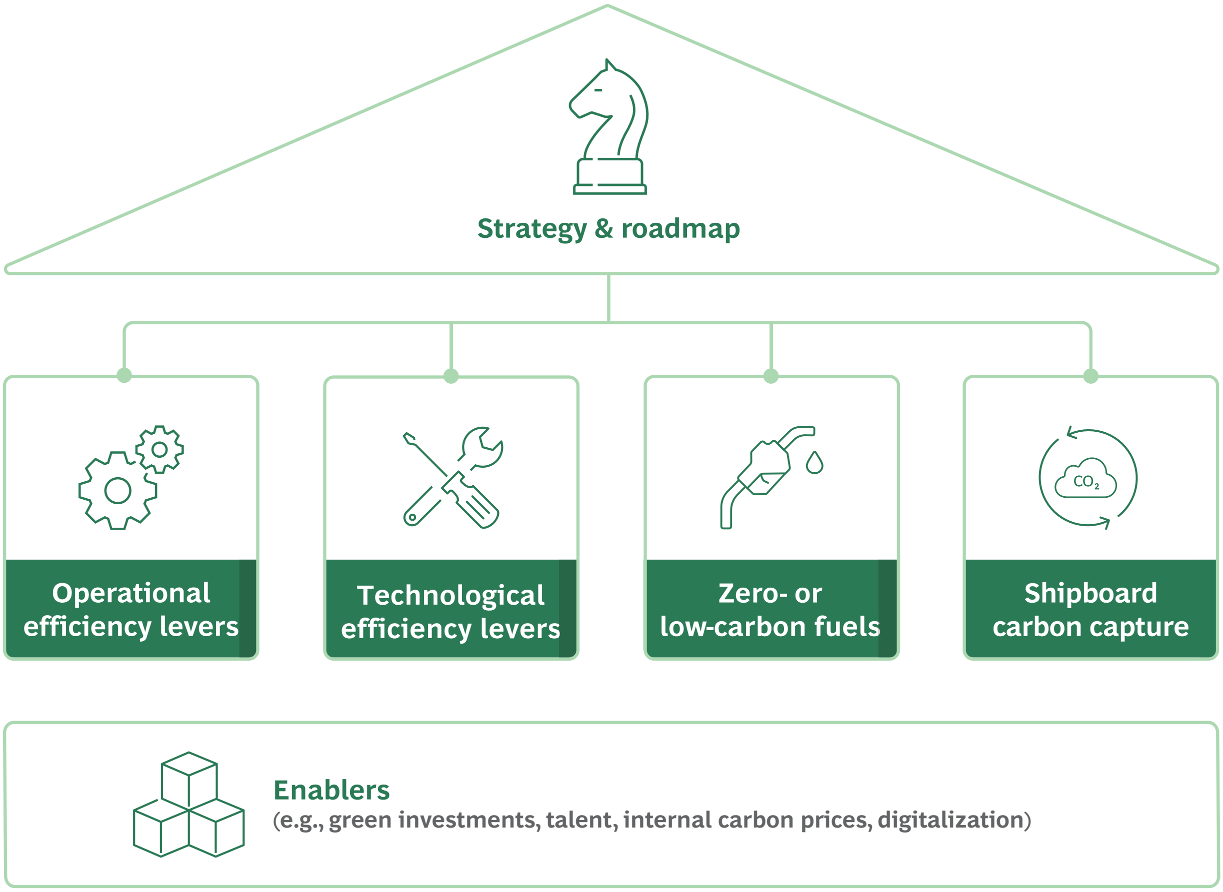
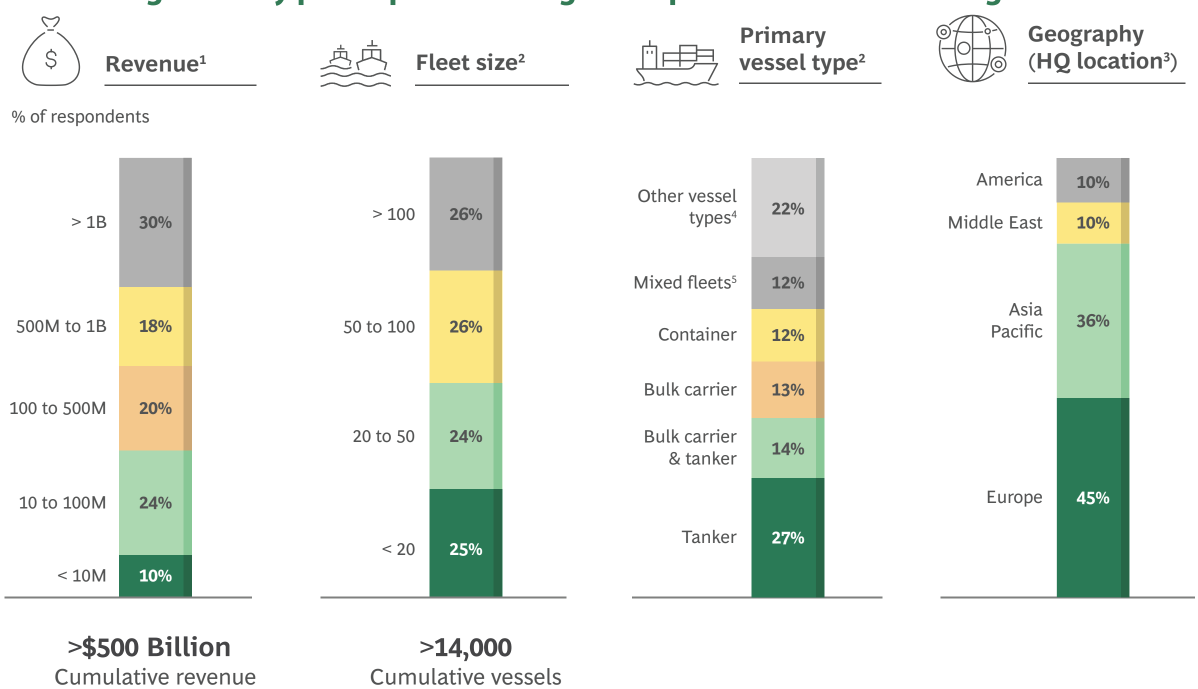


Exhibit 2 – Strong industry participation with good representation across segments

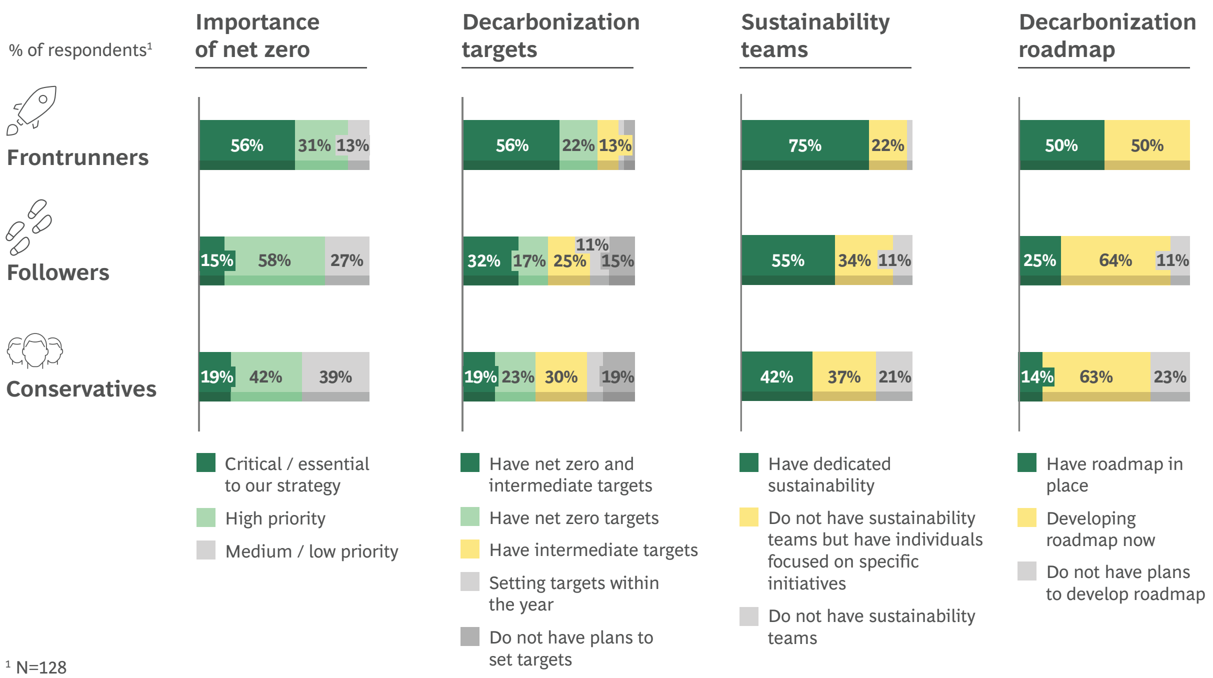


[1] N=123, [2] N=125, [3] N=128
[4] Other vessel types include fleets with a majority of vessels that are not containers, bulk carriers and tankers, e.g., ferries, cruises, Ro-Ro
[5] Mixed fleets comprise a mix of containers, bulk carriers and tankers

Efficiency measures can help reduce emissions in the short term, but achieving net zero requires a shift away from high-carbon fuels or the implementation of SBCC. Despite optimism about future fuels, such as methanol and ammonia, widespread adoption faces challenges such as limited supply and lack of proper infrastructure. Transitioning to green fuels has already been slow and will most likely remain so, while usage of drop-in fuels – like biofuels – is hindered by high cost and insufficient availability; extensive commercial implementation of SBCC is anticipated in the next five to ten years, dependent on comprehensive solutions for effective CO_2 capture and storage.

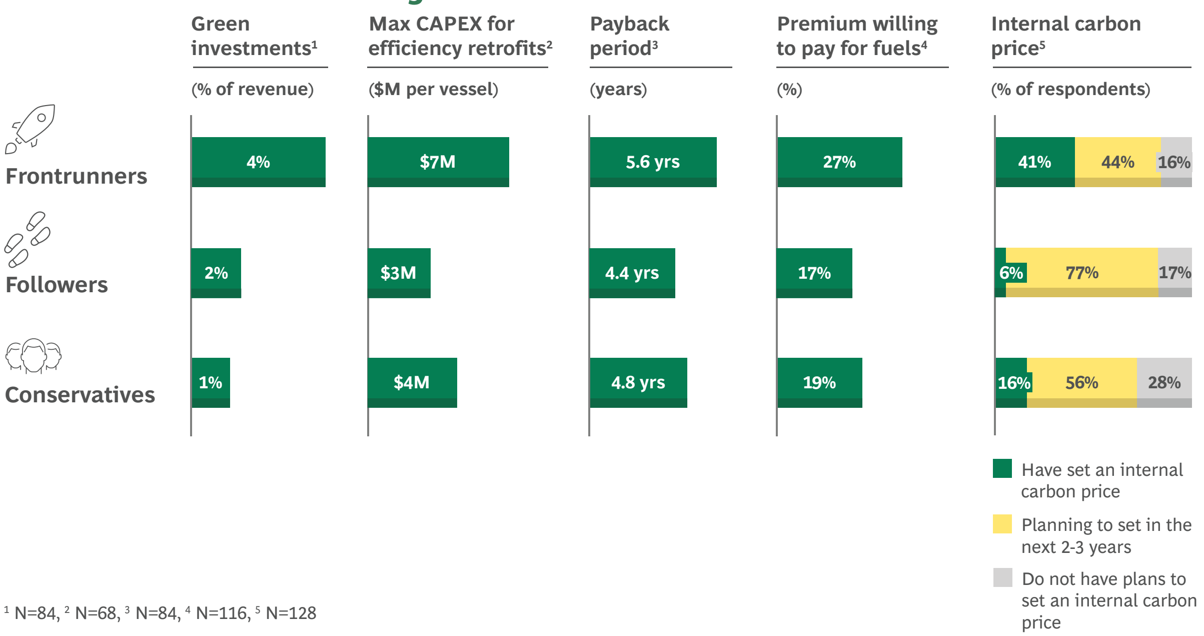
The survey has found that at this time, only 27% of maritime stakeholders possess a decarbonisation roadmap, and just 17% have implemented internal carbon pricing. These figures could very well change; 60% of respondents say they are developing decarbonisation roadmaps, and 62% may employ internal carbon pricing. Furthermore, about 75% of respondents express intentions to boost investments in green initiatives in the next five years and about 25% plan to increase such spending by over 30%.

Exhibit 4 – Frontrunners have set up dedicated sustainability teams and developed decarbonization roadmaps to realize their green agenda



[1] N=128
Note: Values less than 10% are not shown in this exhibit

Exhibit 5 – Frontrunners are willing to invest more to decarbonize their fleets



[1] N=84, [2] N=68, [3] N=84, [4] N=116, [5] N=128

Pace makes the race

The report put survey respondents into three groups – Frontrunners, Followers, and Conservatives – based on adoption levels of the operational and technological measures – to account for the diversity of business types and geography in the shipping sector.

The first group exhibits the highest commitment to decarbonisation, allocating

Technological efficiency levers

[1] N=128

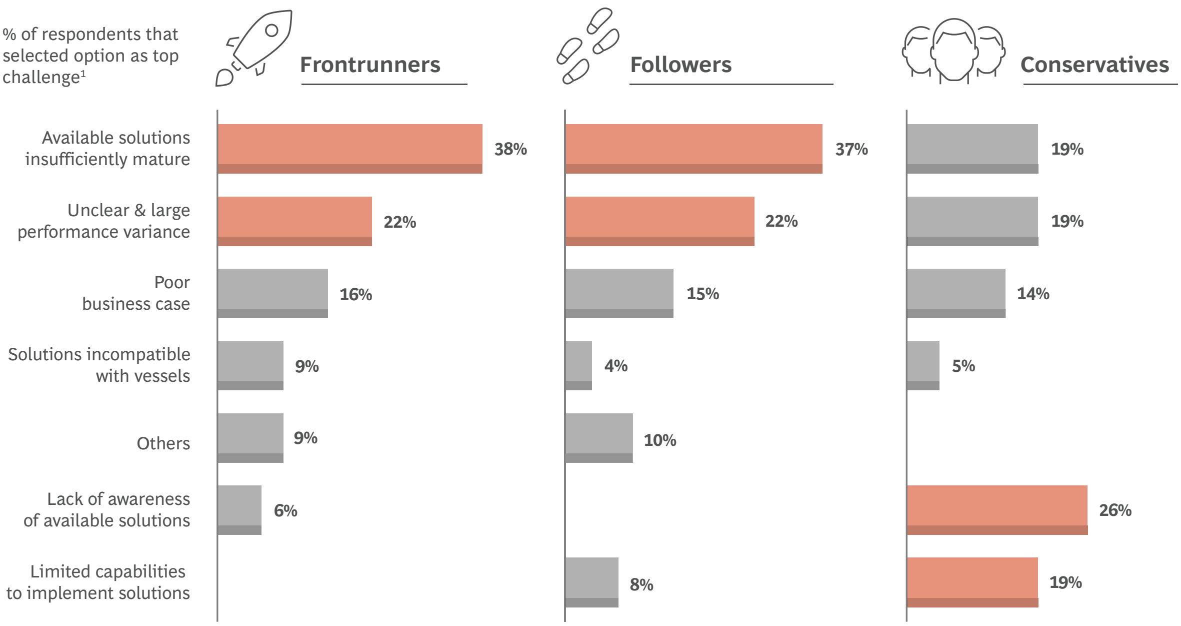
Note: Values less than 10% are not shown in this exhibit substantial resources to emission reduction and prioritising the path to net-zero operations. With clear targets and roadmaps, they are well-positioned to meet their goals, supported by dedicated sustainability teams and investment of 4% of total revenue in green initiatives. Frontrunners are willing to invest further in retrofitting vessels and green fuels, and 41% consider carbon pricing when making decisions. Their progress faces challenges mainly relating to technological and supply-side issues.

Followers acknowledge the importance of decarbonisation but prioritise solutions offering immediate value. With 73% considering net zero a priority, they have shorter investment horizons and allocate half of the revenues that Frontrunners do to green initiatives. Followers are willing to spend up to $3m/vessel for retrofits, opting for mature and cost-effective solutions over emerging ones.

Lastly, Conservatives recognise the need to reduce emissions but lag in adopting decarbonisation solutions. With 61% prioritising achieving net-zero emissions, 42% identifying a target, and only 14% coming up with specific roadmaps, they allocate fewer resources (1% of revenues) in this area, have limited implementation capabilities, and are

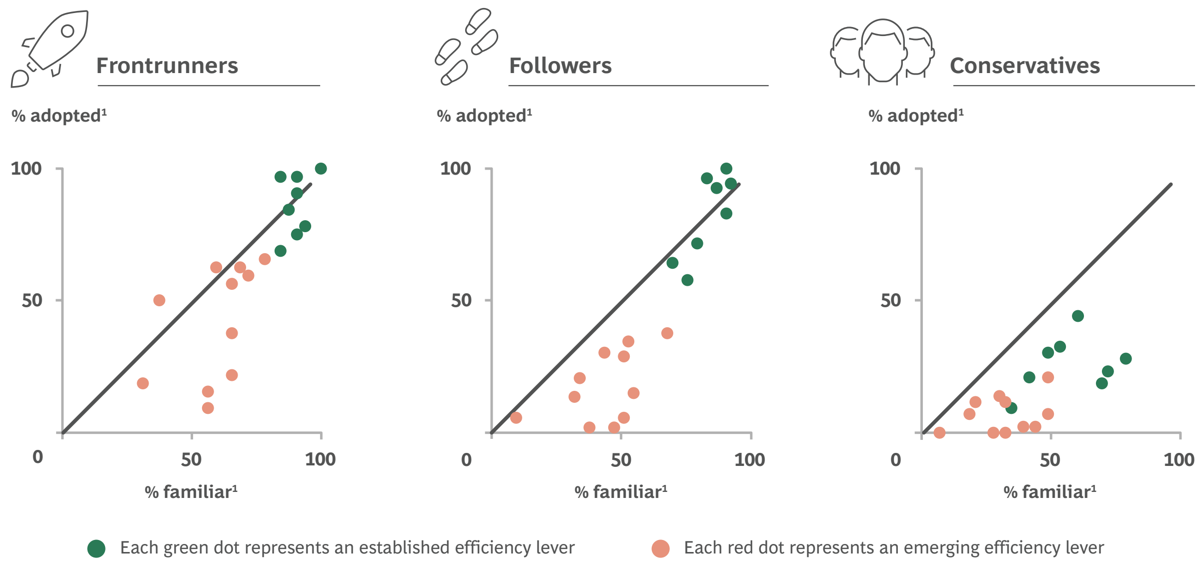
Exhibit 8 – Frontrunners and Followers face technology-related challenges; Conservatives struggle with lack of awareness and capabilities

Top challenges for adopting efficiency levers



¹ N=127

Exhibit 9 – Need to build familiarity and capabilities to accelerate adoption among Conservatives



¹ N=128

unfamiliar with many existing solutions.

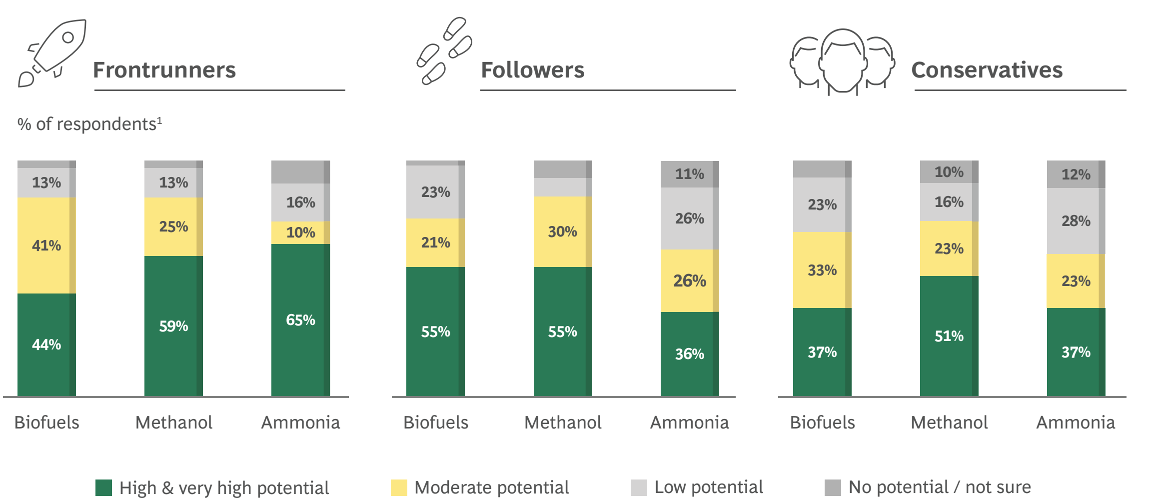
When comparing the three groups, a higher proportion of Frontrunners is present among shipowners and operators with larger fleets. Given the increased attention from the industry and clients, these companies have the motivation to pursue environmentally friendly practices. Furthermore, many container ship operators are Frontrunners, possibly due to higher environmental expectations from end customers. Then again, there is variability within each segment, e.g., Conservatives can be found in the large container segment and Frontrunners in small bulk carrier and tanker tonnage.

Options not entirely on the table

Shipowners and operators prioritise operational efficiency over technological solutions for maritime decarbonisation. The survey reveals operational methods are favoured due to lower costs and quicker implementation, while complex technological levers face slower adoption. Factors influencing technology take-up include cost, retrofitting ease, and advancement level. Cheaper and easier-to-integrate technologies, like improved hull coatings, are more prevalent, while advanced measures

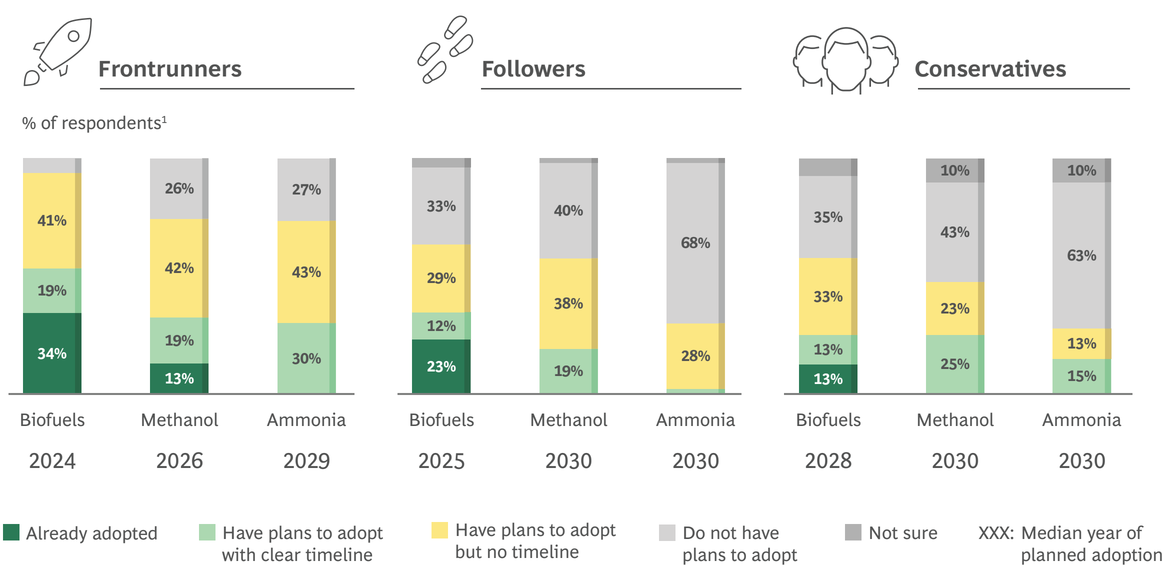
Exhibit 10 – Clear differences in fuel outlook between archetypes with Frontrunners planning to adopt future fuels as early as 2026

Long-term potential of each fuel



[1] N=128
Note: Values less than 10% are not shown in this exhibit

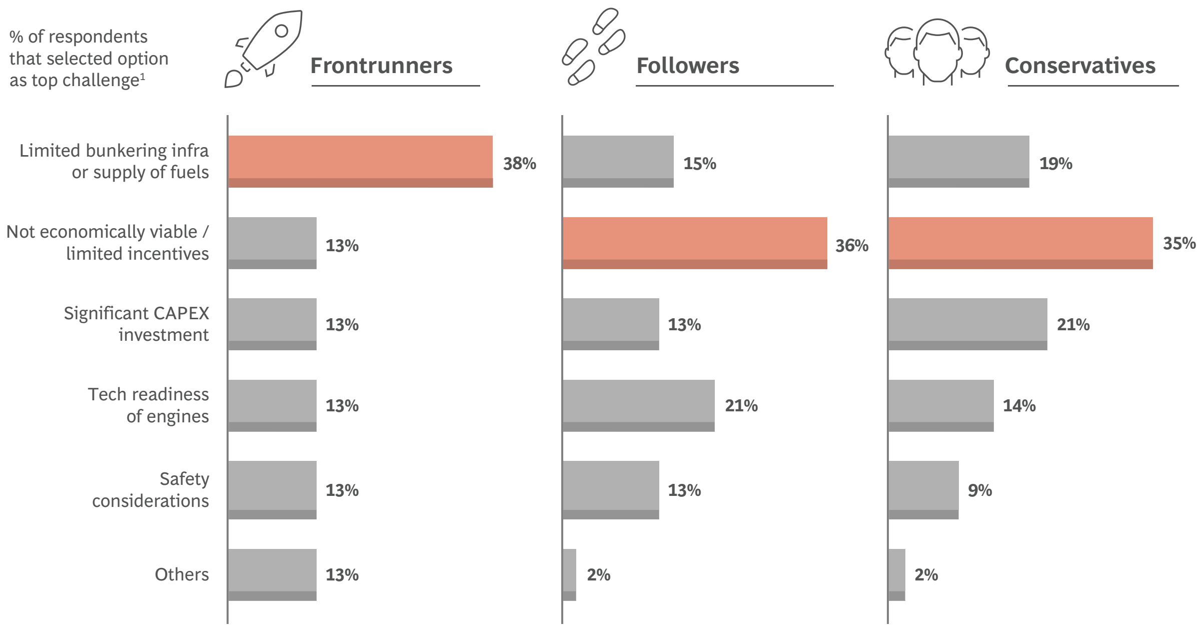
Current and planned adoption of each fuel



[1] N=124
Note: Values less than 10% are not shown in this exhibit

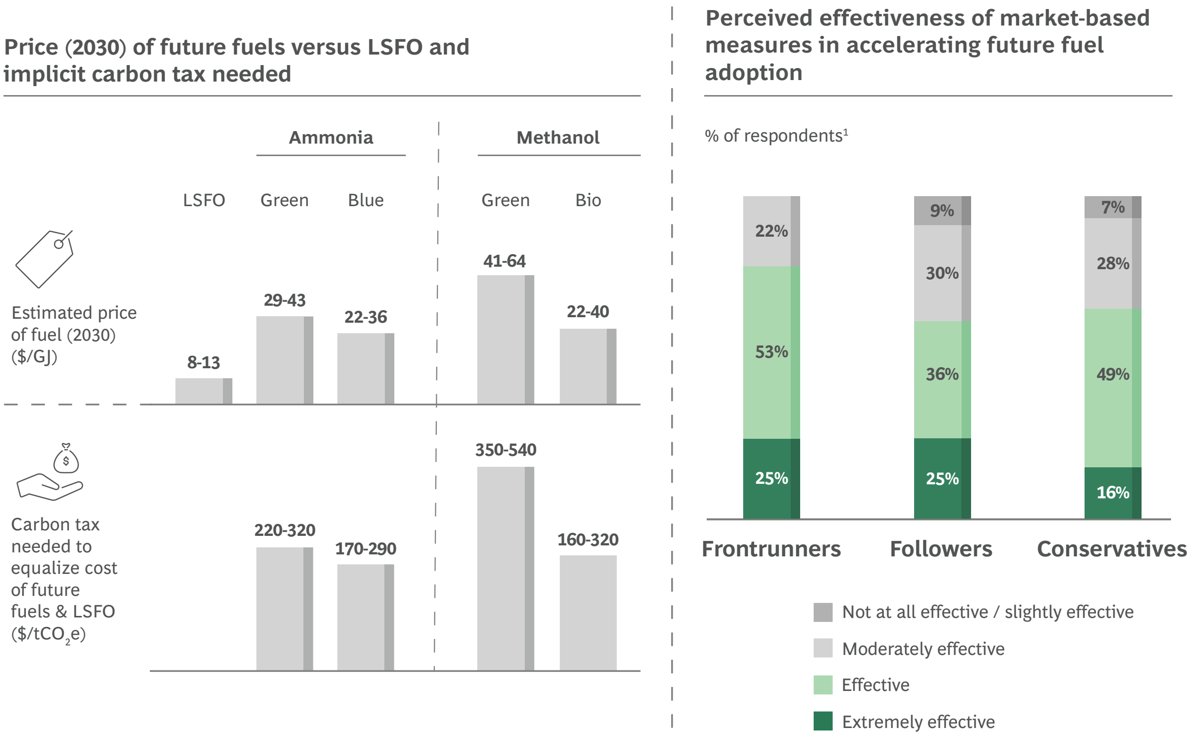
Exhibit 11 – Supply availability and economic viability are the biggest challenges for future fuel adoption

Top challenge for adopting future fuels (by 2030)



[1] N=128

Exhibit 12 – Near-term economics likely to be challenging for future fuels, cost-sharing and cost-equalization mechanisms critical



[1] N=128

Note: Ammonia and Methanol prices may vary significantly; range is determined by electrolyzer CAPEX, electrolyzer efficiency, natural gas price, source of carbon capture (bio vs point source vs DAC), carbon capture cost, LCOE, geography and macroeconomic landscape

Source: Maersk Mc-Kinney Moller Center, Yara Clean Ammonia, Methanol Institute, JP Morgan, IMO, BCG analysis such as hydrodynamic design face challenges. Emerging technologies like wind propulsion and air lubrication have low adoption due to uncertainty about investment return, and others like super-light shipbuilding materials and solar panels are still being developed.

Frontrunners are leading in both operational and technological efficiency, investing heavily in green initiatives and experimenting with nascent solutions. However, even they face challenges due to solution immaturity. Followers stay behind Frontrunners and invest less in green initiatives, preferring immediate and certain value. Increasing confidence, creative financing, and data-sharing initiatives would help address these challenges. Conservatives have lower adoption levels even for mature efficiency levers, lacking awareness, dedicated teams, and green investments.

The report recommends increasing familiarity with efficiency measures, providing contextualised solutions, and implementing awareness-raising efforts to accelerate efficiency in the lagging group. Generally, there is a need for increased investment in technological development, technical pilots, and a holistic approach to address adoption-limiting gaps in the entire sector.

De-risking

In terms of transitioning to zero- or low-carbon marine fuels, the report highlights methanol and ammonia. The former is more accessible in terms of adoption (because of its ease of handling and only minor adjustments to existing processes required), while the latter, although potentially cheaper for zero-carbon emissions, poses challenges such as extreme temperature in storage, toxicity, and delayed availability of ammonia-ready engines. Methanol production, however, involves challenges related to the availability and cost of biogenic or captured CO_2.

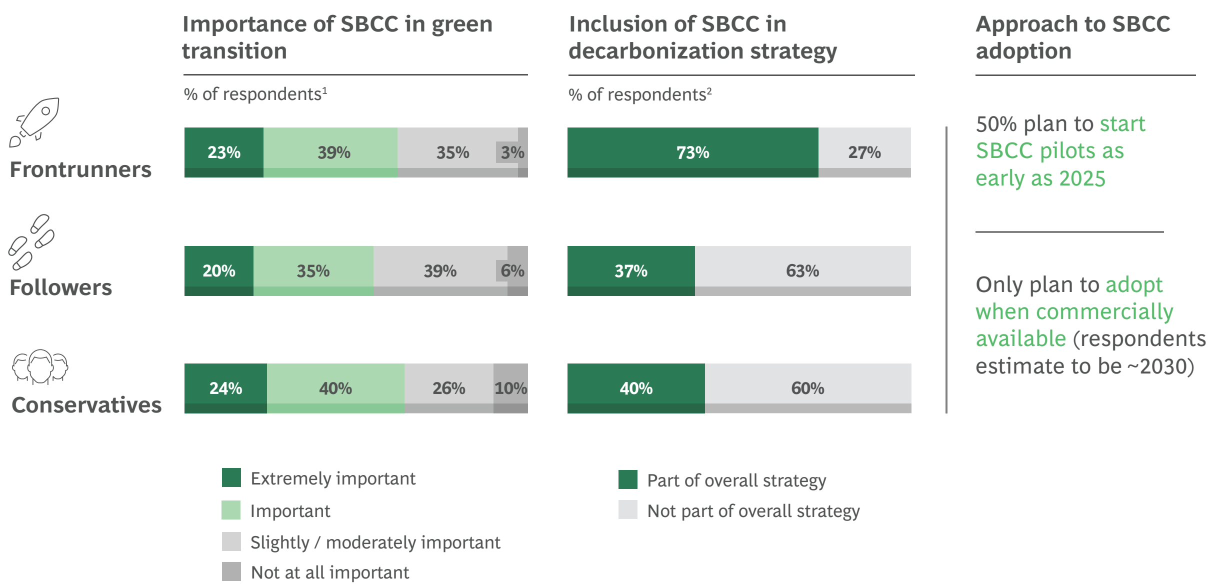
Upon surveying the three groups about switching to methanol, ammonia, or biofuels, Frontrunners show higher confidence in ammonia's long-term potential, as they are familiar with the fuel and can manage its challenges; Followers are partial to biofuels, which they view as "de-risked" at this point; and regarding ammonia, both Followers and Conservatives show caution compared to biofuels and methanol.

The main challenges in adopting future fuels include bunkering infrastructure and supply availability, with 38% of Frontrunners considering it the top obstacle. Followers and Conservatives, for their part, express concerns about the economic feasibility and incentives for green fuels. Additionally, the supply chain and port infrastructure for fuels like ammonia require immediate investment, and both ammonia and methanol have lower energy density than traditional bunker, reducing ship operating ranges. Survey results also show a preference for more frequent bunkering, necessitating extensive infrastructure development.

The report states that lowering premiums on green fuels is crucial for adoption, as estimates suggest green ammonia and methanol could cost significantly more than fossil fuels by 2030. Vessel age was named by nearly all survey respondents as a critical challenge for retrofitting, with older ships unlikely to adopt future fuels – that could mean over 60% of the fleet. Market-based measures, much higher carbon prices, and sharing costs among stakeholders are some solutions highlighted in the report.

Consequently, drop-in fuels (not requiring engine modification), especially sustainably sourced biofuels, are popular among those surveyed. By 2030, 35% of biofuel production is expected to be from second- and third-generation feedstocks (i.e., those not from edible sources). Challenges to biofuel uptake include limited supply, high emissions from first-generation feedstocks, and competition with aviation for feedstocks. Therefore, collaboration among fuel providers and ports is particularly important for securing a biofuel supply. Economic viability is also a significant challenge for biofuels, but they are considered more cost-effective than alternatives like low-carbon methanol or ammonia. Additionally, biofuels' environmental impact depends on factors such as the type of feedstock used (animal vs plant vs waste) and transportation distance; therefore, transparency in

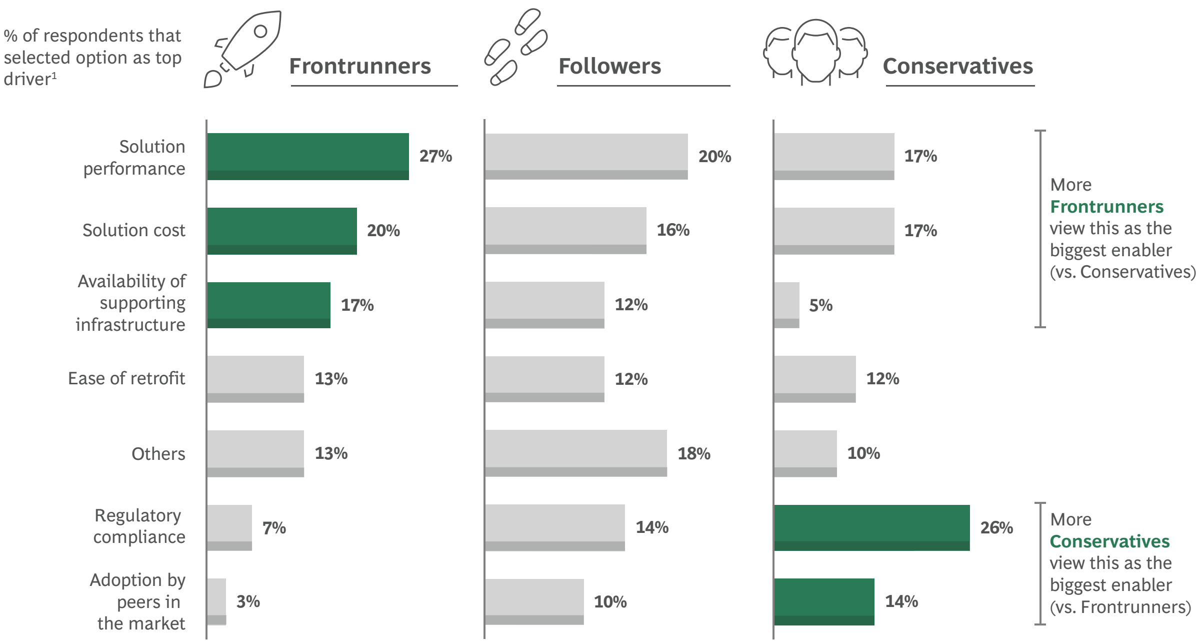
Exhibit 15 – Shipboard carbon capture (SBCC) seen as an important solution by most, with Frontrunners looking to pilot by 2025



[1] N=124, [2] N=123

Exhibit 16 – External pressures likely needed to drive adoption of shipboard carbon capture amongst Conservatives

Top drivers for adopting shipboard carbon capture



[1] N=123

well-to-wake biofuel emissions is vital to provide a comprehensive understanding and enable informed decision-making in the industry.

Catching the big carbon

The survey also found that SBCC could be pivotal in decarbonising the shipping industry. Positioned as a transitional solution alongside fossil fuels, SBCC aims to prevent CO_2 emissions and potentially result in a negative footprint, offering an additional income source through proper carbon pricing.

Despite being in the early stages, SBCC is undergoing industry pilots, adapting land-based carbon capture technologies for maritime use with solvent-based technologies, particularly amines, showing promise. However, the effectiveness of amine-based systems on ships depends on factors such as exhaust cleanliness, waste heat availability, energy for liquefaction, and storage space for liquefied CO_2. Exhaust cleanliness is crucial for operational costs, and vessels using alternative fuels may offer synergies for CO_2 liquefaction. Yet, amine-based SBCC systems can increase costs because they need more heat.

Furthermore, storing liquefied CO_2 requires special tanks, raising SBCC installation and maintenance expenses. Challenges also include reduced cargo space and the absence of guidelines for offloading captured CO_2, necessitating port infrastructure development. Therefore, a comprehensive study on offloading liquefied CO_2 from various vessels and a careful examination of existing policies is needed.

Regarding adoption, Frontrunners plan to trial and adopt SBCC solutions relatively soon (piloting by 2025), while Followers and Conservatives plan adoption only when this technology is commercially available. Key adoption factors include solution performance, cost, and supporting infrastructure availability. For Conservatives, in particular, regulatory compliance and peer adoption are crucial drivers for overcoming hesitations about SBCC adoption.

Five steps to future

The report suggests a few key actions to decarbonise the maritime sector. First, it recommends conducting technical pilots and facilitating data sharing for more nascent levers. Frontrunners should collaborate with solution providers in technical pilots addressing the entire value chain, while industry-wide data sharing, especially from these trials, could offer invaluable insights.

Second, there's a need to create innovative financing mechanisms to de-risk the adoption of less mature levers, such as 'pay-as-you-save' models, to shift upfront capital expenses to operational ones. Here again, collaboration among stakeholders will be crucial for tailored financing arrangements.

Third, supporting Conservatives to raise awareness, contextualise levers, and build capabilities is underscored. Classification societies and industry bodies could be instrumental in providing awareness and proper interpretation of future solutions.

Fourth, the report calls for building future fuel infrastructure and ensuring supply at ports to accommodate all groups (but mainly catering to Frontrunners who plan methanol and ammonia adoption by 2026 and 2029, respectively). Also, catalytic funding is critical for port infrastructure and green-fuel production installations.

Lastly, the report suggests developing mechanisms to share and equalise costs of adoption across the ecosystem by addressing green premiums through carbon pricing and strategies like buyers clubs committing to higher prices for green fuels. Additionally, transparency regarding emissions per cargo unit could encourage customers to share decarbonisation costs. □