



Beyond the horizon

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The maritime industry is heading towards a technological revolution driven by decarbonization. Powered by improved collaboration and propelled by developments in clean energy, digitalization and applied research, this future will offer greater sustainability and much higher efficiency. The latest update to the **Low Carbon Outlook** sees ABS explore how broad efforts to reduce emissions can help navigate towards a net zero shipping industry.

The revised International Maritime Organization (IMO) Greenhouse Gas (GHG) Strategy (IMO GHG Strategy) indicates a time of transition for the marine industry, with a focus on sustainability and efficiency. Rather than simply adapting to the green energy transition, the maritime sector also actively influences it.

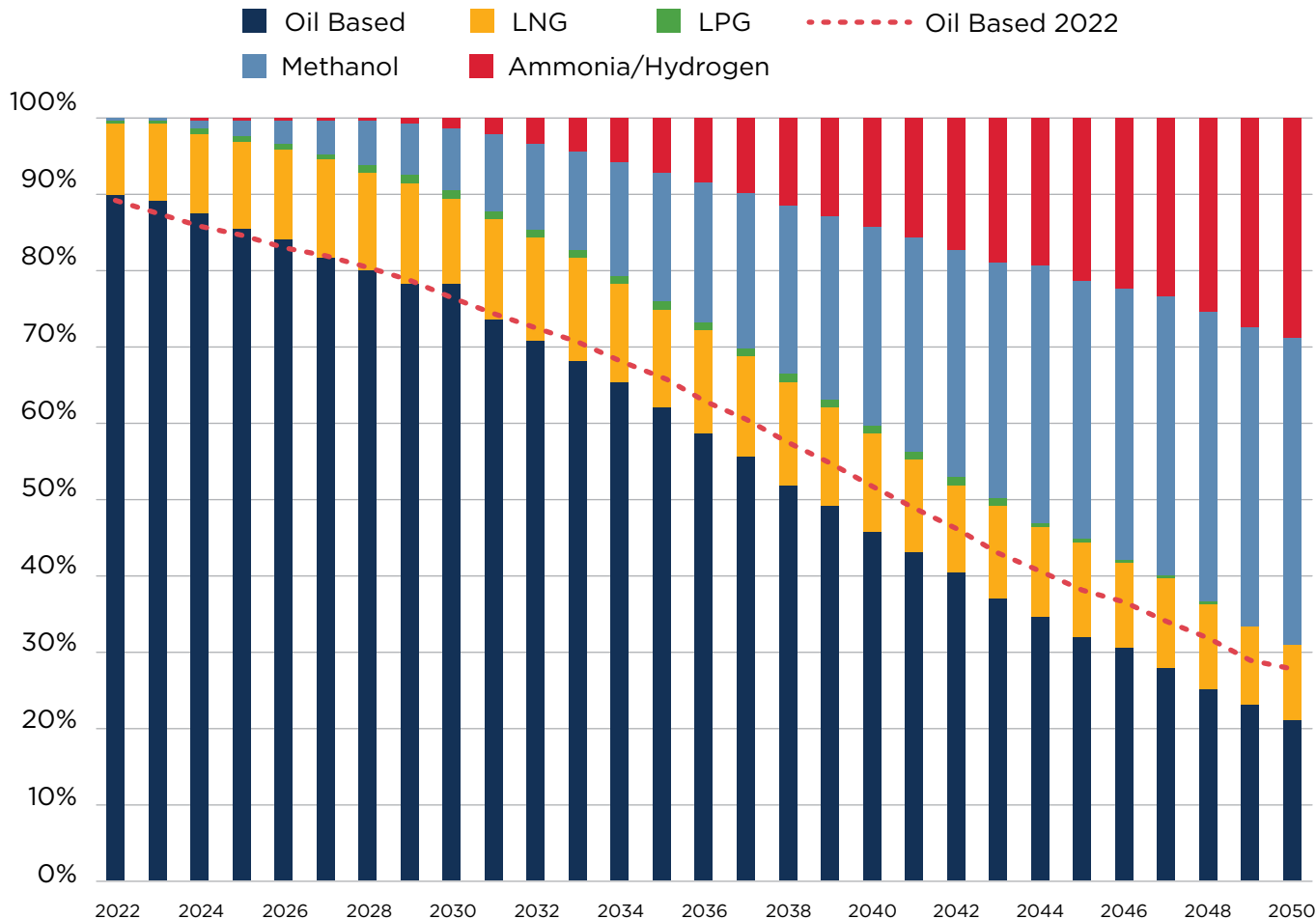
The shipping, ports and logistics businesses are propelling the global shift towards sustainable energy solutions by transporting its critical elements: carbon, ammonia and hydrogen. These and other issues are examined in detail in the newest release of our *Low Carbon Outlook*, this time going under the title *Beyond the Horizon: View of the Emerging Energy Value Chains* – which focuses on the

impact of decarbonization in a global context and examines the solutions by sector.

Heads up: challenges!

The transition to greener technologies will require substantial investment. New safety measures will need to evolve, especially when considering the characteristics of the alternative fuels being currently

Fig. Fuel mix (heavy fuel equivalent)¹



¹ Ship types included: oil & chemical tankers, dry bulk carriers, container ships, LPG, LNG, car carriers, general cargo, ro-ro, ro-pax, and cruise ships
Source: ABS' Low Carbon Outlook. Beyond the Horizon: View of the Emerging Energy Value Chains (2023)

considered by the marine industry. For example, ammonia, one of the alternative fuels under scrutiny nowadays, has unique handling and storage requirements.

One of the critical components of the global decarbonization challenge is the evolution of the energy industry, which will support the creation of an alternative, low-carbon fuel supply chain. The *Outlook* comprehensively analyses the current energy sector and highlights the upcoming challenges and possibilities. Not unsurprisingly, we find the global energy market at a crossroads. With energy consumption rising to meet greater consumer demand and a pressing need to simultaneously reduce carbon footprints, a definitive shift toward renewable and low-carbon energy sources is required.

ABS carried out extensive research in support of the updated publication to evaluate the potential effects of using alternative, low-carbon fuels in the shipping industry. Based on this extensive research and the most current information from Q3 2023, we looked at different scenarios up to 2050 and their effect on the forecasted fuel mix.

Another layer of complexity in the equation is the current geopolitical events that will likely impact the future fuel mix.

Whereas these have had a distortive impact on mature energy markets, their ability to impact a transitioning energy market is disproportionately smaller.

The regulatory backdrop

The 2016 Paris Climate Agreement was a historic point in global environmental policy. With nearly 200 nations ratifying it, almost all of the world has collectively pledged to address the growing risk of climate change by reducing anthropogenic GHG emissions. The Agreement established a specific target: limit the rise in world average temperatures to below +2°C above pre-industrial levels, with an aspirational goal of +1.5°C. The ways to achieve this goal, however, were open to interpretation and change.

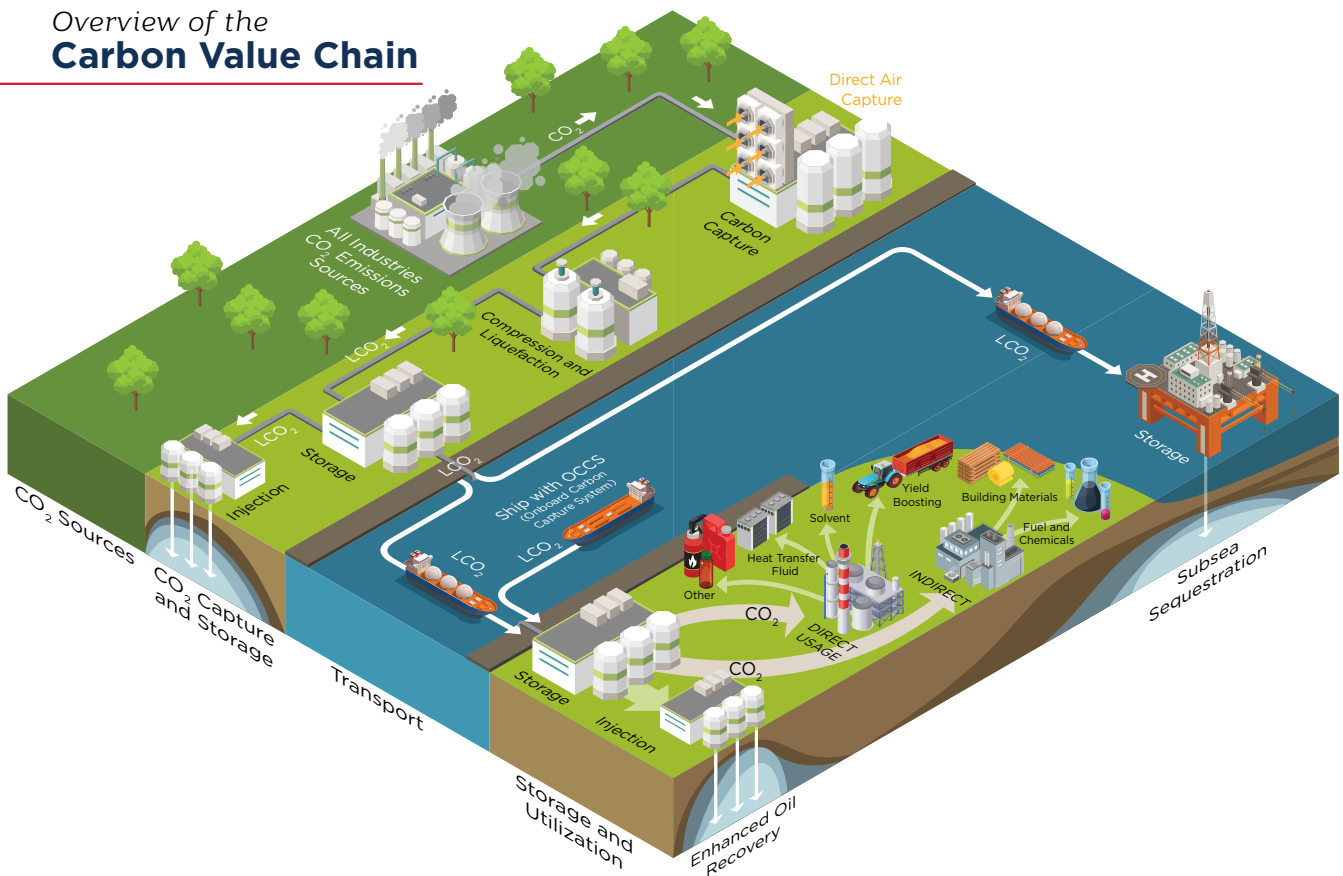
The International Maritime Organization took an important step in this direction in 2018 when it introduced the IMO GHG Strategy. It reaffirmed the maritime industry's commitment to significantly lowering its carbon footprint during the 21st century. This step not only indicated increased regulatory ambition but also emphasized the need to improve the efficiency of global transport services, which are essential for modern commerce and trade.

In the following years, IMO has developed and put into effect a number of new regulatory measures by working with other bodies that set regulations. These policies aimed to reduce GHG emissions from maritime activities while promoting the development of advanced fuels and technologies that could further reduce the sector's footprint.

The 2023 IMO GHG Strategy reaffirmed IMO's commitment to accelerating the reduction of GHG emissions from maritime operations and established the ambitious net-zero goal by or around 2050. As revised at the IMO's 80th meeting of the Marine Environment Protection Committee, this strategy will lead to significant changes in the maritime industry. Vessels will need to switch from traditional fuels to greener alternatives, which might involve engine upgrades and the development of new fueling infrastructure. Improved energy efficiency measures, such as better hull designs and operational changes like optimized routing, will be essential.

Additionally, vessels may need to be equipped with real-time emission monitoring and reporting systems (and in the EU, they certainly will have to do so in order to find themselves within the block's Emission

Overview of the Carbon Value Chain



Trading System), which will require crew training for effective implementation and compliance. Older ships may also see challenges with retrofiting, thus potentially putting them at a commercial disadvantage. However, new, more efficient and compliant ships might see an increase in market value.

Emission reduction

The transportation of carbon, ammonia, and hydrogen as cargo highlights the maritime industry's significance in bridging the gaps between production, storage and consumption in the global energy landscape. As the maritime sector looks ahead and dives deeper into the complexities of these three value chains, it becomes clear that shipping is more than a spectator in the global green energy revolution. Instead, it serves as a critical facilitator and enabler.

While intriguing, the research into alternative fuels and their development in volumes required by the shipping industry presents its own set of obstacles in terms of supply, cost, infrastructure and safety. Concurrently, energy efficiency technologies (EETs) provide a practical and realistic pathway to improve ship operational efficiency and thus reduce carbon footprint. As a result, EETs are expected to play a broadly

supportive role in the majority of decarbonization projects. For example, **onboard carbon capture, while still in its early stages of development, has the potential to transform the way the maritime industry manages carbon emissions.**

The carbon value chain – which includes core elements like the capture, utilization, storage and transportation of (liquefied) carbon dioxide – is an integrated step for carbon emissions management, from source to potential utilization or sequestration. The maritime industry can support carbon capture activities worldwide by providing safe and efficient transportation, thereby assisting in efforts to reach a carbon-neutral future. Ships built to transport liquid carbon as cargo are emerging as an essential link in the carbon value chain. These vessels help to ensure that liquid carbon is transported safely and efficiently from capture sites to utilization (e.g., in e-methanol as marine fuel production) or storage facilities.

Understanding and improving the carbon value chain will become increasingly vital as the global economy steps up its efforts to combat climate change. The maritime industry, which accounts for a substantial portion of international

trade, will be at the centre of making this value chain a reality.

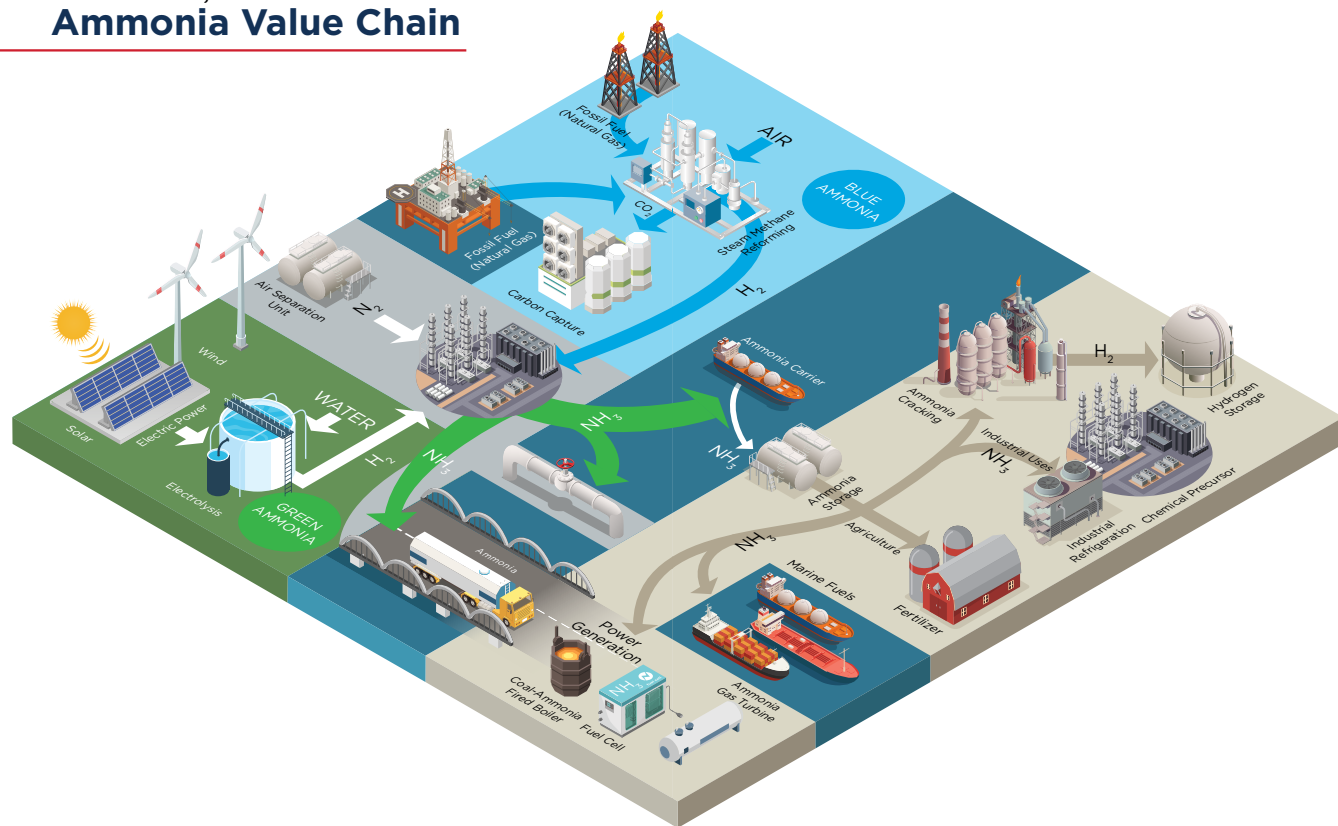
New fuels

Investments in liquefied natural (bio)gas, ammonia and methanol dual-fuel vessels continue to grow quickly, prompting industry discussion and debate around which alternative fuels can be produced and provided at the necessary scale and affordable prices.

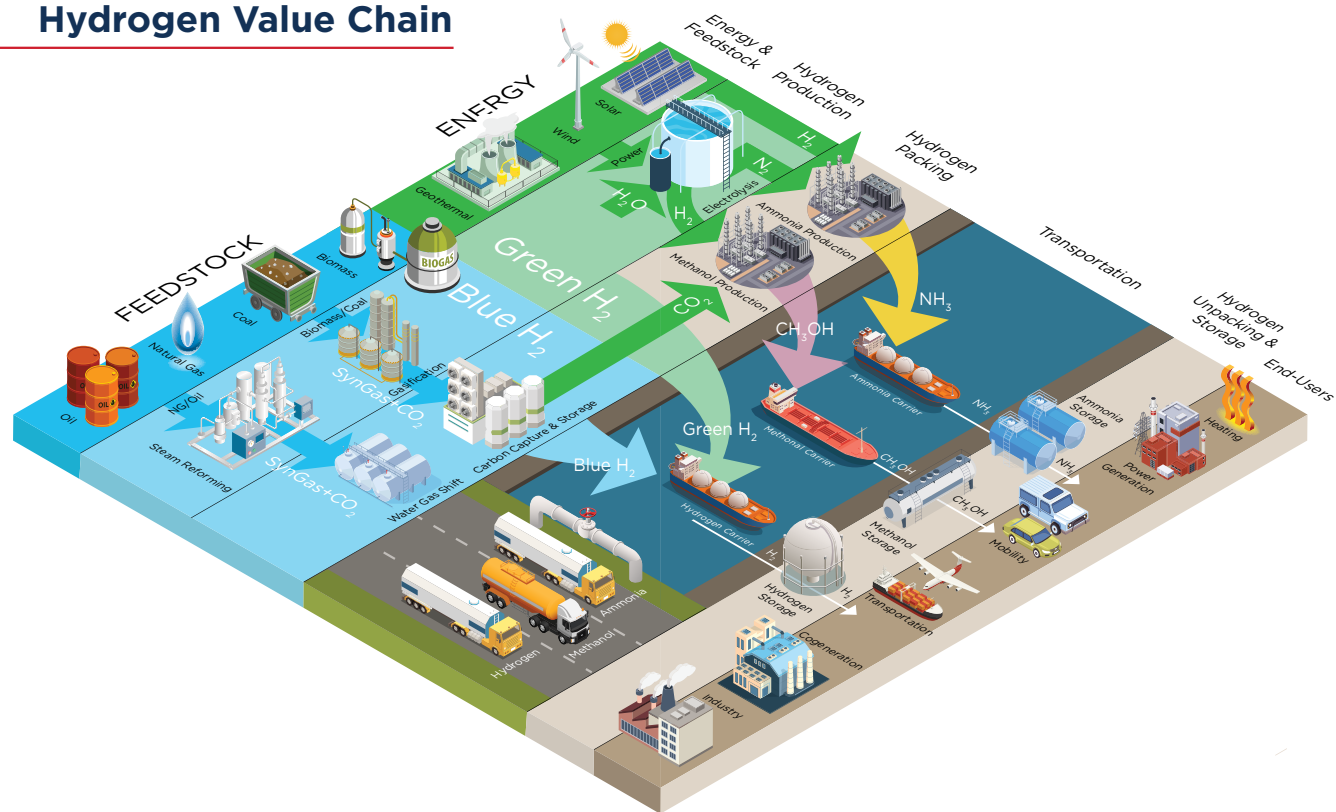
For the latest *Low Carbon Outlook*, ABS re-examined the supply and demand data for alternative fuels and updated the future fuel mix to reflect the latest market information. In addition, the study looked at how the recent adoption of the revised IMO decarbonization strategy and the 2050 net-zero targets affect the projected future fuel mix.

By combining the derived ship demand with a forecast for a changing fuel mix in deep-sea shipping, the scenarios for worldwide energy consumption are translated into global fuel consumption by ship type. With the updated findings, ABS sees that by the year 2050, demand for fossil fuels has the potential to be marginally lower than what was estimated in the previous edition of the *Low Carbon Outlook*, once again underlining the need for carbon capture technologies.

Overview of the Ammonia Value Chain



Overview of the Hydrogen Value Chain



With solid potential as a green fuel, ammonia represents a twofold opportunity for the maritime industry. While it can be used as an alternative bunker fuel, it must also be transported as cargo. As countries and industries investigate ammonia-based energy solutions, the maritime industry is at the forefront, ensuring regional supply. Ammonia will play a major role in the wider energy matrix because of its ability to store and transmit energy effectively, as well as its carbon-free emissions. As the world deals with energy storage and transportation challenges, ammonia's position as an energy carrier has become increasingly important, providing a sustainable answer to some of our biggest energy challenges. The importance of the ammonia value chain in the global green transition cannot be overstated. As the world works to reduce its carbon impact, ammonia stands out as a potentially viable fuel option and critical cargo.

Commonly referred to as a long-term fuel option, hydrogen will continue to grow as a key component in the worldwide endeavour to build a sustainable energy landscape. Its importance in the transportation industry, as a commodity and likewise a potential (marine) fuel, will increase in step with mounting energy

transition pressures and tightening emission limits. The maritime industry's acceptance of hydrogen represents a bold step towards a more sustainable future. More than tackling its own carbon impact, shipping's embrace of the hydrogen value chain positions it as a vital actor in the global green energy revolution. Transportation of hydrogen, particularly its green version derived from renewable sources, is critical to creating a worldwide hydrogen economy. With its huge network and experience, the maritime industry is primed to be a cornerstone of this initiative.

The future

As the maritime industry – and shipping in particular – navigates the challenges of the energy transformation, investing in cutting-edge solutions that can significantly lower the carbon footprint of its operations will be critical. This involves adopting alternative fuels, EETs and novel solutions such as onboard carbon capture systems.

This transition to greener technologies will require significant investment and will incur initial expenses that change the dynamic of shipping's commercial relationships. But in the long term, shipping operations will benefit not just from lower emissions but also from reduced fuel use and simplified regulatory compliance.

Considering the characteristics of the alternative fuels being investigated by the maritime industry, it is also clear that safety procedures and protocols, as well as seafarer training, will also need to evolve. Despite the challenges, the maritime industry remains dedicated to decarbonization and supporting the broader energy transition.

The investments already being made in energy efficiency technologies, new fuels and smarter operational strategies – as well as evaluations of carbon capture and other new technologies – illustrate the direction of travel. With the support of research, analysis and data produced by classification societies such as ABS, shipping's journey towards net zero will continue. □



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