

SUMMARY

GREEN MARITIME 2022 – TECHNOLOGY, EMISSIONS, VALUE CREATION, AND EMPLOYMENT





Preface

Menon Economics analyses economic issues and provides advice to businesses, organisations, and public authorities. We are a consulting firm operating at the interface between economics, politics, and markets. Menon combines social and business economics expertise in fields such as social profitability, economic impact, business and competition economics, strategy, finance, and organisational design. We use research-based methods in our analyses and work closely with leading academic environments in most fields.

This is the summary from a Norwegian longer report. The entire report is available in Norwegian on our website www.menon.no

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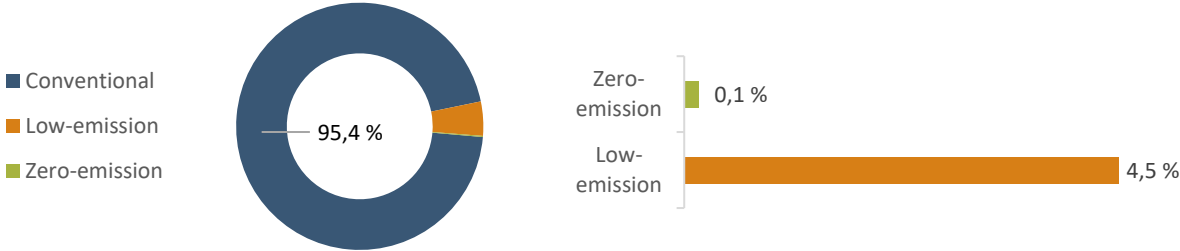
Menon Economics

Summary

Decarbonisation of the global fleet has merely scratched the surface.

Currently, global maritime transport represents 2.9 percent of global emissions (IMO, 2020). Norway, along with several other nations, has declared that international shipping must achieve zero emissions by 2050. This goal aligns with the temperature targets outlined in the Paris Agreement and signifies that the entire global fleet must undergo a transition towards zero-emission technologies or adopt solutions to capture and store emissions from ships. However, the initiative to decarbonise shipping is in its initial stages, indicating a significant undertaking lying ahead. As it stands, only 0.1 percent of all vessels are zero-emissions, and effectively none of the overall tonnage is zero-emissions. In practical terms, this means nearly the entire tonnage needs to be decarbonised starting now.

Figure 1: Distribution of the world fleet by fossil, low and zero-emission fuel. Source: Clarksons World Fleet Register



Norway is at the forefront, but progress towards zero emissions is needed.

Norway's maritime industry is at the forefront of the green transition. However, a substantial path remains to achieve zero emissions. As of this analysis, the Norwegian-owned fleet comprises 2824 ships. Among these, 1 percent are equipped with zero-emission technology. However, when evaluated by tonnage, the share reduces to a mere 0.1 percent. Despite this, the Norwegian-owned fleet scores higher in terms of low- and zero-emission ships compared to the global fleet, constituting 24 percent. This share includes vessels equipped with diesel-electric machinery within the offshore sector.

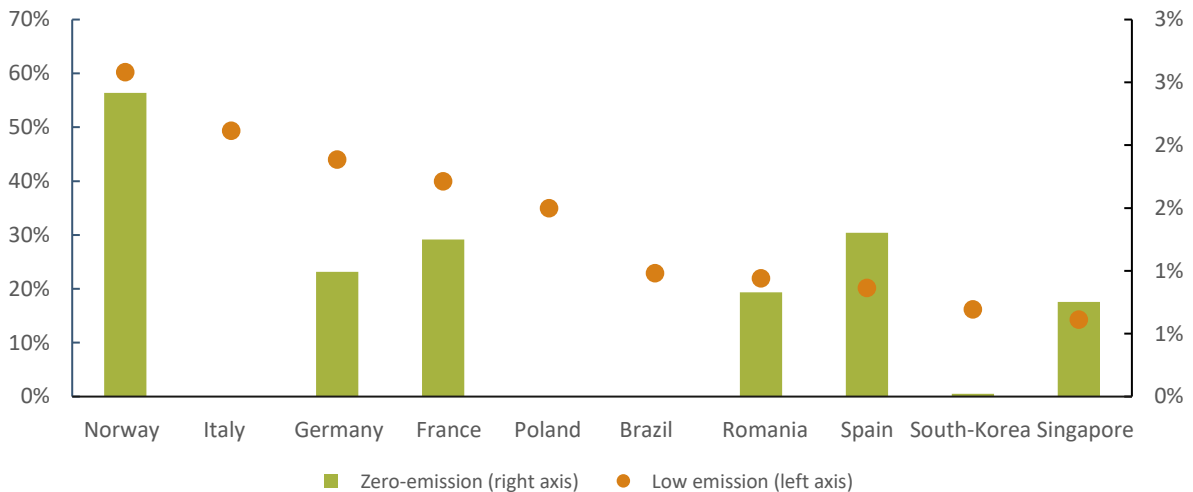
With few exceptions, decarbonization efforts have primarily involved small ferries and fjord cruise vessels, using battery and electric motor technology. However, several hydrogen-powered vessels are also in the pipeline. According to our calculations, 7 percent of vessels less than five years old, owned by Norwegian shipowners, are zero-emission. Nevertheless, these vessels are small, implying a significantly lower percentage when measured in terms of tonnage. Additionally, an increasing number of shipowners are gradually contracting ships with propulsion systems compatible with zero-emission fuels, such as ammonia and hydrogen, preparing them for a sustainable future.

Norwegian shipyards have led the way globally in the construction of low and zero-emission vessels.

Norwegian shipyards are global leaders in the construction of low and zero-emission vessels, with a higher proportion of these technologies in ships built at Norwegian yards than in any other shipbuilding nation. From

2018 to 2020, zero-emission solutions accounted for 7 percent of the total value (purchase sum) of vessels constructed at Norwegian facilities.

Figure 2: Share of low- and zero-emission vessels among the 10 largest shipbuilding nations since 2010, including orderbook up to 2024 (countries that have built more than 50 ships since 2010). Source: Clarksons World Fleet Register



The priority lies in reducing emissions, not just in the technology used.

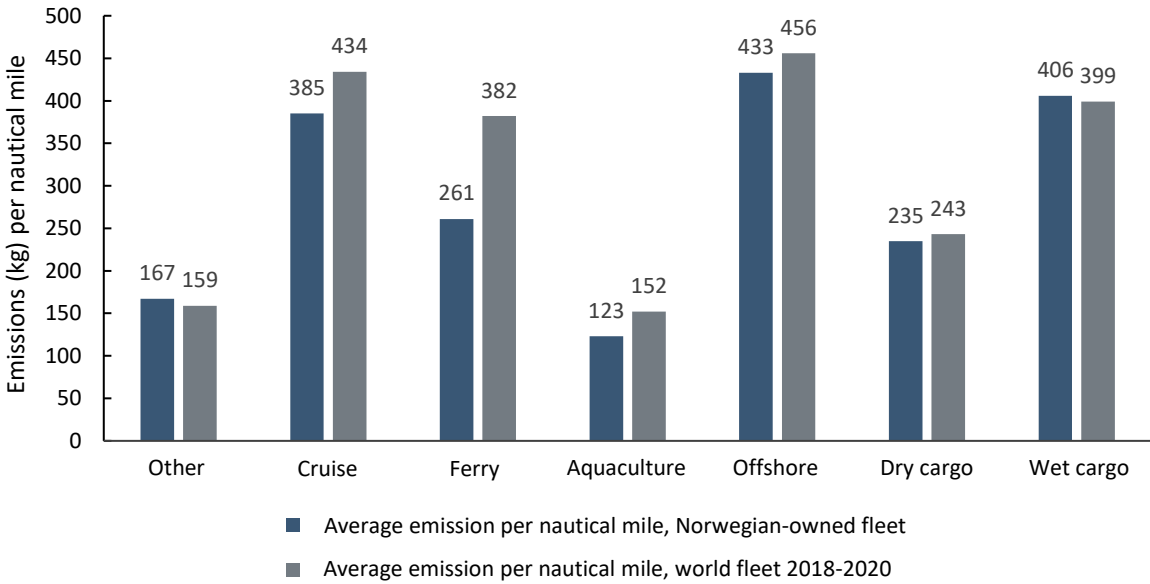
Emission reductions can be sourced from various fronts, including energy efficiency measures. The focus should not be solely on the propulsion systems and fuel, but more importantly on the actual emissions. Our analyses indicates that vessels owned by Norwegian shipowners emit less than the standard in most ship segments. Factoring in segment composition and ship size, Norwegian emissions per nautical mile are, on average, 20 percent lower than those from international vessels.

Norwegian-owned ships have lower emissions per nautical mile across most segments, including cruise, ferries, aquaculture, offshore, and dry cargo. Wet cargo segments, which include oil tankers, are an exception where emissions from Norwegian-owned vessels are slightly higher. Offshore vessels have the highest emissions overall, largely due to their powerful machinery and stationary operations, with emissions reaching 433 kg CO₂ per nautical mile in 2020. Cruise ships globally have the second-highest emissions, but Norwegian cruise ships emit somewhat less. Furthermore, Norwegian-owned cruise ships have adopted low-emission propulsion technologies more extensively than their international counterparts.

The emissions of Norwegian ferries are also significantly lower than the average international ferry. This can be attributed primarily to the fact that Norwegian ferries are more frequently electrified with hybrid solutions and that a large portion of the international ferry fleet is composed of older vessels with inefficient propulsion systems. The lowest emissions within the Norwegian fleet are reported within the aquaculture industry. Operationally, the well-boats and workboats often function similarly to offshore vessels, so their lower emissions can be attributed to their relatively smaller vessel size and correspondingly smaller onboard engines.

The second highest emissions in the Norwegian-owned fleet are observed within the wet cargo category. While these emissions are marginally higher compared to the international average for similar vessels, the differences are relatively small.

Figure 3: Average CO2 emissions (kg) per nautical mile for Norwegian-owned ships in various shipping segments in 2020 compared with the average for the period 2018-2020 among ships in the world fleet. Source: Menon Economics

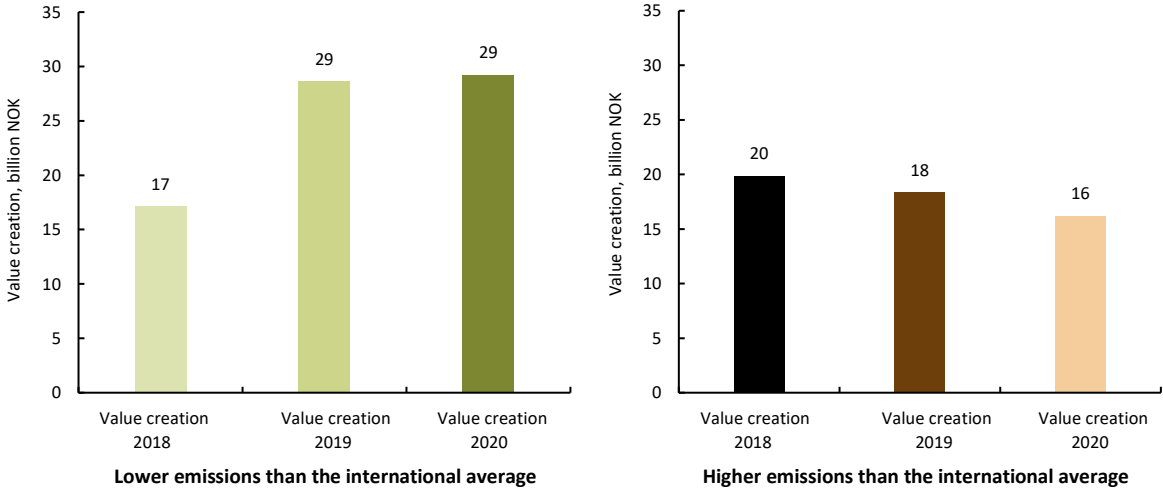


Green value creation and employment in shipping companies.

When we align the emissions data from ships with the financial data of their respective shipping companies, it becomes evident that a higher rate of emissions per nautical mile often correlates with greater value creation within the company. For example, when dividing shipping companies into two groups based on their emission intensity (CO2 emissions per nautical mile), we find that only 20 percent of value creation is generated by companies classified as having low emissions. Comparatively, the heavier emitters account for 80 percent of value creation. The gap is even more pronounced concerning employment: 82 percent of employees in Norwegian shipping companies work for firms that emit at a higher-than-average rate per nautical mile. This analysis is specific to emissions per nautical mile, not overall emissions. Several factors contribute to this observation—the most straightforward being that larger shipping companies operate energy-demanding, large ships, which naturally yield high emissions per nautical mile. This applies to both offshore and deep-sea shipping companies. An inferred conclusion from this data suggests that ongoing decarbonization efforts within the Norwegian fleet have had minimal immediate impacts on value creation and employment. However, this landscape is set to gradually evolve. This is in large part because small-scale vessels that travel short distances are more suited to electrification, coupled with the current limitations in infrastructure for refuelling with hydrogen and ammonia — the operational fuels apt for large, ocean-faring vessels. Nonetheless, an increasing number of prominent shipping companies have already initiated or have plans in the pipeline to construct ships that can run on hydrogen and/or ammonia.

80 percent of Norwegian shipping companies emit less per nautical mile than the international average in their segment. These companies generate 62 percent of value creation within Norwegian shipping and employ 65 percent of the workforce. Particularly within the cruise and ferry segments, Norwegian shipping companies distinguish themselves with lower CO2 emissions.

Figure 4: Total value creation of Norwegian shipping companies based on whether the companies' combined fleet is more environmentally friendly than the global average of ships. Source: Menon Economics



The green transformation in the maritime industry presents significant potential for value creation and employment growth in Norway.

The green transition in the Norwegian maritime industry is key to meeting Norway’s climate commitments and contributing to the global effort to meet the 1.5-degree target. Beyond meeting these climate goals, the transition presents a significant market opportunity for Norway’s maritime sector, promising to boost value creation and employment. It's critical to recognize that achieving climate objectives and generating economic value need not be at odds. In fact, by successfully navigating the green transition, Norway can establish a solid foundation for exporting innovative green technologies, equipment, systems, vessels, and shipping services.

The global market for shipping services is large, valued at approximately NOK 5,500 billion in 2021.¹ Norwegian shipping companies hold about 4.5 percent of this global market. The largest market share is in aquaculture, but we also have prominent positions in the offshore wind and oil/gas sectors. Within the most significant market segment, goods transportation (deep sea/short sea), the share is about 4 percent. Within this specific market, Norway continues to secure strong niche positions in areas such as chemical transportation, car freight, and shuttle tankers.

The size of the shipping markets is critical in determining the market opportunities for shipyards, equipment suppliers, and service providers. In the upcoming decades, the entire global fleet will undergo replacement or conversion to zero-emission vessels. This transition presents an enormous market opportunity, and Norwegian companies can build competitive advantages based on existing positions and Norway's lead role in developing and implementing green solutions for shipping. Specifically, Norway has a strong presence in markets where decarbonisation is most advanced, notably within passenger segments such as ferries and cruises.

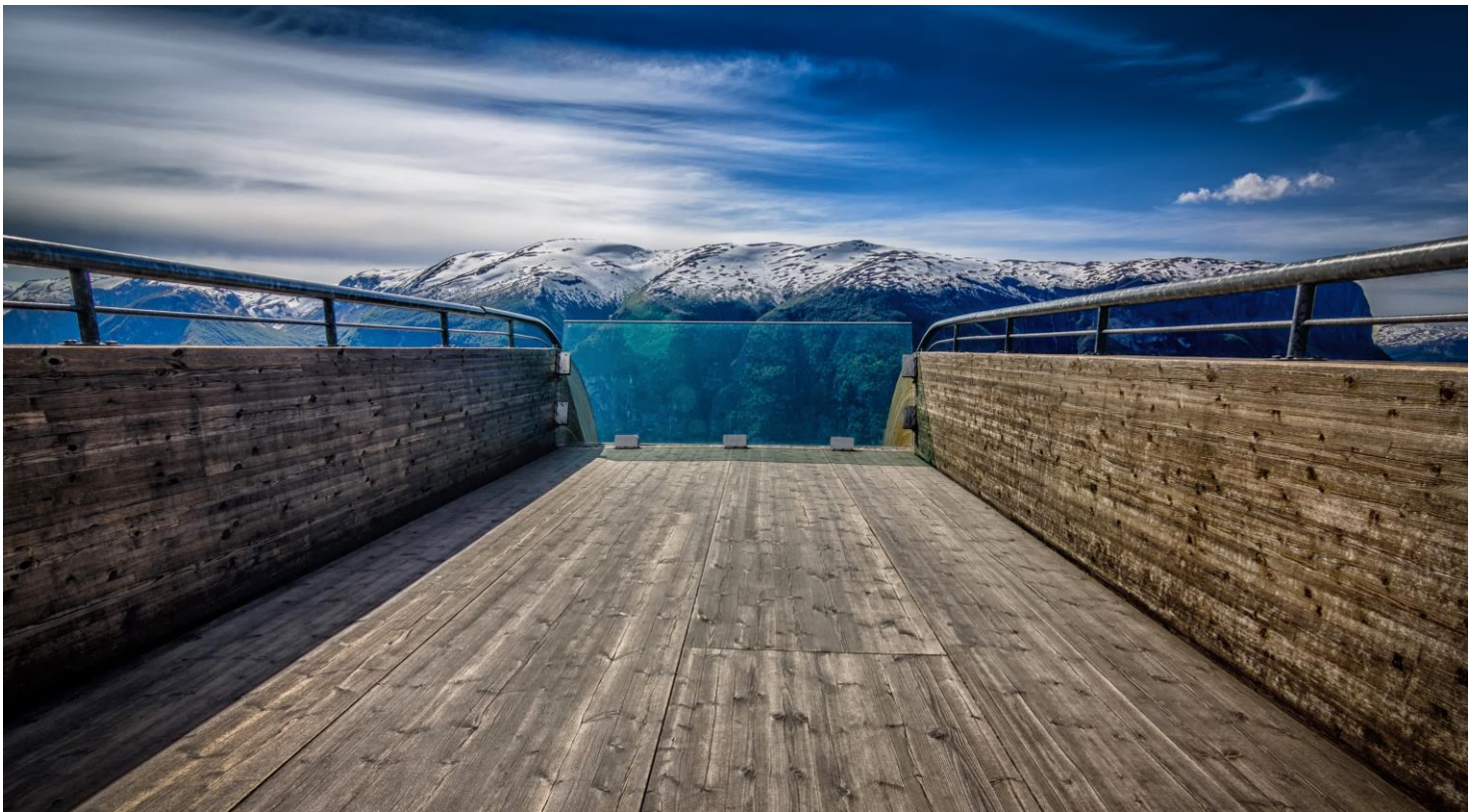
Additionally, there is a unique opportunity for the Norwegian maritime industry to help expedite the shift from fossil fuels to renewable energy sources. This opportunity lies primarily in fostering innovations and cost reductions in offshore wind technology, but in the long run, it also extends to floating solar and other energy sources.

¹ *Strategier for grønn maritim eksport 2022. Menon rapport #30/2022 (report in Norwegian).*

Norway is not alone in investing in green maritime.

While Norway (Oslo) is seen as the global hub for developing climate and environmental solutions for the marine industries², we are not alone in investing in the green transition within the maritime sector. Countries such as Singapore, the Netherlands, and Denmark are also making substantial long-term investments in the development and implementation of new propulsion systems and fuel types. On the technology front, South Korea, China, and Japan are particularly robust. They collectively hold 84 percent of all global patents relating to green maritime technology.

² Source: *Leading Maritime Cities of the World 2022*. The report is developed in collaboration between Menon and DNV.



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