Executive Summary

What is the supply potential for low-carbon and renewable fuels for the shipping sector in Germany?

How can Germany prepare its ports for the ramp-up of renewable fuels in maritime shipping?

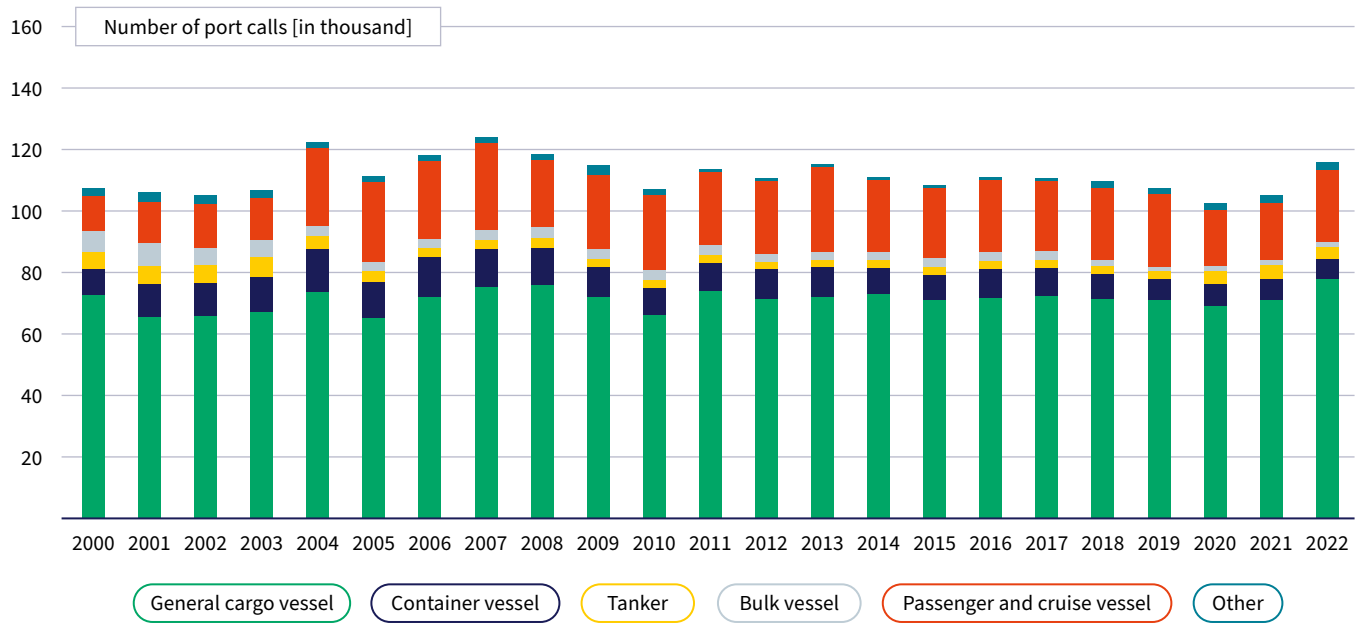
This market potential study, commissioned by NOW GmbH and performed by Ramboll, analyzed how bunker sales of low-carbon and renewable fuels could develop in German seaports and inland ports. In addition to the bunker volumes of alternative fuels to be made available in the future, the study also focused on the number and size of bunker vessels required to cover the potential demand in Germany and an estimate of the costs arising from the construction of these vessels. To guarantee the applicability of results in practice, the study was supported by an advisory board of experts representing shipping, shipbuilding, port infrastructure and bunker supply sectors as well as environmental advocacy.

Questions answered by this study:

1. What is the status quo of port calls, bunker structures, and bunker volumes?
2. Which development of future fuel options is likely?
3. What are the bunker volume scenarios for German seaports and inland ports?
4. How many bunker vessels and bunker facilities will be needed?

1. What is the status quo of port calls, bunker structures, and bunker volumes?

The data shows that German seaports have had **almost constant call figures in the past 20 years.**



Port calls by seagoing vessels in German ports by year and ship type

The total gross tonnage of seagoing vessels calling at German seaports and the associated theoretical potential of bunker sales have increased continuously since the year 2000 (except for the pandemic years). However, the numbers for the actual bunker volumes of maritime shipping in Germany since 2000 paint a contrary picture: **The bunker volumes of maritime shipping in Germany have been declining since 2016. Demand for bunkering in inland shipping, however, has remained very constant since 2007.**

2. Which development of future fuel options is likely?

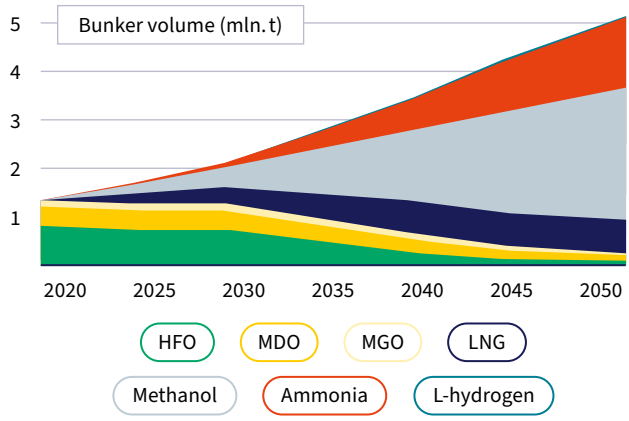
As part of the study, the alternative fuels **LNG, methanol, ammonia, and hydrogen, produced from renewable energy sources,** were considered as potential future fuel options. They are expected to generate lower production costs compared to traditional oil-based fuels produced by renewable energy sources on a long-term perspective. All alternative fuels have a lower volumetric energy density than conventional fuels, even when liquefied or compressed, which will affect almost all areas of the transport chain. As a result, **a larger total bunker volume can be expected in shipping in the future with the same or similar energy requirements, accompanied by a higher number of bunkering operations or a higher bunkering frequency.** Increases in efficiency, economies of scale through larger tonnage, shore power, etc. will counteract this trend. This will have a direct impact on the bunker infrastructure required.

Import terminals and/or production facilities for alternative fuels in Germany will be a key enabler for the development of a bunker market, as regional availability reduces logistics costs for long distribution routes and economies of scale can be realized through large storage volumes.

3. What are the bunker volume scenarios for German seaports and inland ports?

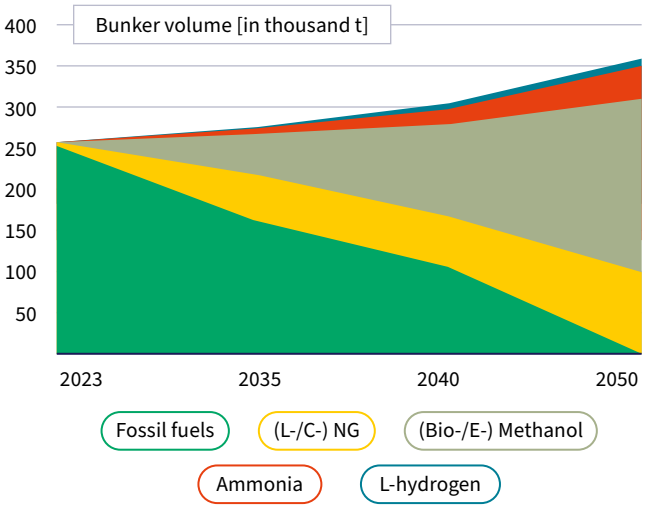
The basic framework for the scenarios developed is formed by the applicable regulations on emissions reduction for shipping. Most important: The IMO regulations, which were amended in 2023, and the FuelEU Maritime. For inland shipping, the requirements for the transport sector of the EU Green Deal and a declaration of intent to reduce greenhouse gas emissions from inland shipping, the "Mannheim Erklärung", apply. In addition, assumptions regarding traffic volume development, efficiency increases, age and composition of the fleet, vessel segments calling at German ports, regulatory framework conditions, or production paths for alternative fuels were considered.

According to these formal goals, **a significant increase in demand for methanol and LNG and, after 2030, also for ammonia for maritime shipping in terms of the total amount of energy required should be expected.** Hydrogen plays a rather subordinate role across all scenarios. **With complete defossilization, more than 90 percent of bunker volumes in the scenarios for 2050 cater to LNG, methanol, ammonia, and hydrogen produced from renewable sources.** The bunker volume scenario shown in the first graph on the right (significant increase in bunker volumes in Germany & complete defossilization) was taken as the basis for further steps of the study. This results in a doubling of the cumulative energy bunker volume and a quadrupling of the cumulative net bunker volume in tonnes by 2050.



Bunker volume scenario for maritime shipping (million tonnes)

In inland shipping, renewably produced C-/L-NG can play an important role in the short term and renewably produced methanol in the medium to long term. Ammonia and hydrogen will experience a slow market ramp-up after 2030. In particular, the existing safety regulations for using ammonia are hindering a more dynamic market adoption of this fuel.



Bunker volume scenario for inland-waterway and coastal shipping (thousand tonnes)

4. How many bunker vessels and bunker facilities will be needed?

Based on the bunker quantities of the scenario assumptions, potential bunkering concepts and operations along the German coast were identified for the years 2030, 2040, and 2050. It is assumed that ship-to-ship bunkering will remain the most important bunkering concept for maritime shipping in the future. In addition, many supporting bunkering operations will be carried out by trucks, similar to today's bunker structures, but these will only cover minor quantities.

The market analysis shows the following: Considering all the fuel types examined, **the North Sea will require 13 small, 5 large, and 4 very large bunker vessels, while the Baltic Sea will require 22 small, 2 medium, and 3 large bunker vessels by 2050.** The required number of bunker vessels is to be built up in several expansion stages over the entire period (up to 2050). The bunker ships will be the main means of distribution from the emerging terminals for alternative energy sources. At the same time, large bunkering units with a corresponding area of operation will cater to smaller bunkering units with a regional focus at locations without import and distribution infrastructure.

	Fuel	2030	2040	2050
Baltic Sea	**LNG**	5x small, 1x medium	7x small, 1x large	7x small, 1x large
	Methanol	4x small, 1x medium	4x small, 1x medium	6x small, 2x medium
	Ammonia	1x medium	1x large	5x small, 1x large
	L-hydrogen	1x small	1x medium	4x small, 1x large
North Sea	**LNG**	2x small, 1x very large	2-3x small, 1x large, 1x very large	2-3x small, 1x large, 1x very large
	Methanol	1x small, 1x very large	2x small, 1x large, 1 very large	4-5x small, 3x large, 1 very large
	Ammonia	1x small, 1x very large	1-2x small, 1x very large	3-4x small, 1x large, 1x very large
	L-hydrogen		1x very large	1x small, 1x very large

Required number of bunker vessel newbuilds (2030, 2040, 2050)

A cost estimate based on indicative newbuilding prices for tankers shows **a total investment volume of around € 1.74 billion** for the construction of these vessels. The calculation is essentially based on new construction costs in recent years for tankers and bunker units plus a fixed contingency to reflect material price leaps in the recent past as well as outfitting as a bunker vessel. **The additional quantity of bunker fuel required for inland shipping is estimated at around 100,000 tonnes per year in the long term.** The increase in volume depends heavily on the actual mix of bunker fuels in the inland shipping sector. New bunker infrastructures have to be established for hydrogen and ammonia applications as well as for the use of C-/L-NG. For methanol in particular, expansions and rededications of existing facilities for established fuels are conceivable. A metadata analysis of the locations of current bunker structures for inland shipping suggests that most bunker structures for inland shipping are in or near seaports with access to inland waterways.

Conclusion

The study shows that the provision of alternative energy sources for the bunker market in the German seaports and inland waterway network will likely become a service feature that can attract further shipping traffic to port locations. With the forecasted increase in bunker demand developing in parallel with the fuel mix towards emission-neutral fuels, there's a pressing need for a timely and ambitious development of an adapted bunker fleet.

Key take-away points from the Ramboll study:

+ German seaports have had almost constant call figures in the past 20 years, but the bunker volumes of maritime shipping in Germany have been declining since 2016.
+ The demand for bunkering in inland shipping has remained constant since 2007.
+ The demand for the ship fuels LNG, methanol, ammonia, and hydrogen, produced from renewable energy sources will likely increase – in the scenarios for complete defossilization, more than 90 percent of bunker volumes in 2050 cater to these fuels.
+ The number of bunkering operations, their frequency as well as total bunker volumes will increase with the same or similar energy requirements.
+ Import terminals and/or production facilities for alternative fuels in Germany will be a key enabler for the development of a bunker market.
+ The North Sea will require 13 small, 5 large, and 4 very large bunker vessels, while the Baltic Sea will require 22 small, 2 medium, and 3 large bunker vessels by 2050.
+ For these bunker vessel newbuilds, a total investment volume of around € 1.74 billion should be expected.
+ The additional quantity of low-carbon and renewably produced bunker fuel required for inland shipping is estimated at around 100,000 tonnes per year in the long term.

The full study **"Assessment of the Potential of Fueling Infrastructure for Low-Carbon and Renewable Ship Fuels in Germany"** is available for download on the **NOW-Website**

Imprint

The study was commissioned by NOW GmbH and accompanied by an advisory board from the maritime industry. The authors of Ramboll are solely responsible for the content of this study and its quality.

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