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Fuel analysis in shipping by segment

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FUEL ANALYSIS IN SHIPPING BY SEGMENT

MANAGEMENT SUMMARY

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1. SUMMARY

1.1 Preface

Founded in 2017, the German Maritime Centre (DMZ) is an independent, publicly funded, cross-industry think tank based in Hamburg. It focuses on future topics such as non-fossil fuels, zero-emission propulsion systems, modern safety systems and autonomous shipping. The focus is on questions of design as well as the implementation of research, development, and innovation in the maritime sector. These focal points serve to increase knowledge, further develop the state of the art, and strengthen the international competitiveness of Germany as a location for the sector.

At the beginning of 2021, the German Maritime Centre commissioned the company Ramboll with a "*Fuel analysis in shipping by segment*". The study presents the "fuel portfolio" currently used by the different fleet segments that characterise Germany as a shipping location and the replacement of these fuels with suitable alternative energy sources.

These alternative energy sources have great market potential regarding global emission reduction targets for greenhouse gases and compliance with limits for air pollutants[1] caused by maritime transport.

In the study, all energy sources examined, except for accumulators for saving electrical energy, are basically referred to as '*fuels*'.

The study looks at the stakeholders of the maritime industry in Germany. The analysis includes current fuel use and possible transformations of the operating fleet

- of German shipowners,
- carrying the German flag,
- built at shipyards in Germany and
- with port calls at German port locations.

Maritime shipping accounts for around 3 % of global CO_2 emissions worldwide.[2] As in other industries, emissions standards for greenhouse gases will also apply to shipping in the future. In 2018, the *International Maritime Organization* adopted a first strategy to reduce CO_2 emissions with saving steps until 2050. According to this strategy, CO_2 emissions caused by shipping in relation to maritime transport performance are to be reduced by at least 40 % by 2030 compared to the 2008 level. By 2050, the reduction should be at least 70 % compared to 2008. In addition, the absolute greenhouse gas emissions of international maritime transport also need to be at least halved by 2050 compared to 2008 levels. A revision of the strategy and an adjustment of the long-term target is planned for 2023.[3][4]

Against this background the maritime industry is facing a major challenge. This is especially true with an expected vessel service life of 20 to 25 years. The current investment decisions have a long-term influence on whether new or converted vessels can also be operated commercially successfully in the long term.

[1] (IMO, 2005)
[2] (IMO, 2021a)
[3] (IMO, 2018)
[4] (IMO, 2021k)

1.2 Study objectives and procedure

The aim of the study is to identify suitable alternative fuels with which greenhouse gas and air pollutant emissions can be successfully reduced in the various segments of German maritime and inland navigation. In addition to the ability of achieving emission reduction targets, the fuel options are also evaluated in particular regarding the technical maturity of the overall system.

In the context of the study, a technology-open approach is being pursued. A one-fits-all solution does not appear to be very suitable, not only against the background of the different properties of alternative fuels, but also in view of the heterogeneity of the shipping fleet in terms of type, age, size, power, transport task and routes. A broad catalogue of compressed and liquefied gases, fuels with low flash points and the use of accumulators is considered.

This study focuses on **three main areas**. The **first area** (chapters **Fehler! Verweisquelle konnte nicht gefunden werden.** and **Fehler! Verweisquelle konnte nicht gefunden werden.**) is a **fuel and fleet analysis**. The fuel analysis includes a compilation and detailed description of the fuels widely used in shipping and the addition of alternative fuels that may play a significant role in shipping in the future. Furthermore, the current fuel market is examined. In the fleet analysis, the German shipping fleet or ship segments with significance for the German maritime industry are presented. Using selected ship databases and portals for tracking ship positioning, information is referenced according to ship types and sizes, including among others age, motorisation, and routes.

The **second area** (chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**) is an **analysis of potential**. It shows to what extent and under what conditions which fuel alternatives are suitable for use in the various civil shipping segments. Key critical factors were identified that influence the successful market penetration of alternative fuels within the fleet segments.

In the **third area** (chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**), the findings of the analyses carried out are translated into **options for action** for the targeted development of an alternative fuel portfolio for the fleet segments and ship sizes considered.

Where appropriate for gaining knowledge, references are made to the development of liquefied natural gas as a marine fuel, to illustrate the technical and economic framework conditions for the use of alternative fuels. This includes, for example, experience with the placement of tank and fuel systems on board the various types of ships and correlations in the development of fuel prices. Where necessary for a holistic approach, the focus on the German ship fleet segments will be expanded to include an overview of general market conditions. A broader view is for example conducted for the entire maritime fuel demand or the market penetration of alternative fuels in the current global order book. The study reflects the current state of the art as well as the progress of currently pursued research and development approaches for the use of alternative fuels in shipping as of March 2022.

The propulsion of ships with wind power or nuclear energy was not considered.

1.3 Summary of the study results

The central fields of action for the development and practical implementation of an alternative fuel portfolio in shipping are stated below. They are based on the results of the fuel, fleet, and potential analysis. The results address the aforementioned stakeholders and decision-makers in the maritime industry in Germany. An overview of the study's corresponding recommendations for action can be found in **Fehler! Verweisquelle konnte nicht gefunden werden.** at the end of the study.

A key requirement for an alternative fuel portfolio in shipping is the legal and safety framework. The variety and diversity of alternative fuels is not yet comprehensively and reliably represented in these.

- The *International Maritime Organization* should create design specifications for ships using alternative fuels within the framework of the "*International Code of Safety for Ship Using Gases or Other Low-flashpoint Fuels*".
- At German federal and state level, the harmonisation of regulations and administrative acts for the bunkering of alternative fuels in German (sea)ports is necessary.
- Further training for the crew on the different fuels must be established. Only in this way it can be ensured that the personnel is properly and professionally familiar with the different properties and is able to deal with them.

To be able to use alternative marine fuels in the future, the widespread availability of electricity-based or biogenically produced energy sources must be ensured.

- To this end, the expansion of renewable energies and the creation of production capacities for corresponding biofuels and e-fuels must be accelerated.
- Due to the limited availability and in favour of investment security on both the supply and demand side, future purchase agreements for alternative fuels should be concluded between shipowner(s) and producer(s).

The provision of alternative fuels in shipping requires a network for distribution, as it has already been established in recent years for liquefied natural gas, for example. International shipping routes overlap at certain locations where bunkering hubs for established fuels already exist today and infrastructures for the import and export of various energy carriers are in place as well.

- These locations should be prioritised for development as bunker hubs for alternative fuels. The existing import and export infrastructures should be used as enabler for the supply of alternative fuels to shipping (e. g. distribution to bunker ships and fuel tank trucks).

The study concludes that the diversity of alternative fuels in conjunction with the heterogeneity of the shipping fleet will lead to a diversification of the shipping fuel portfolio in the coming decades. In this respect, the suitability of the alternative marine fuels examined varies depending on the type of ship, among other factors.

Based on the results of the fuel, fleet and potential analysis, the study evaluated which fuels are basically suitable for which ship types.

This study serves as a support for the stakeholders of the maritime industry in Germany in the development and practical implementation of an alternative fuel portfolio.

There is a need for further investigation and action: In particular, the current procedures for collecting emissions along the entire life cycle (well-to-propeller) need to be examined with a view to global greenhouse gas reduction targets.

It is recommended that analyses of the alternative fuel portfolio in shipping are regularly updated or checked to ensure that they are up to date.