

Researchers can help shipowners achieve ambitious climate targets

April 16 2024, by Sølvi Normannsen



Credit: CC0 Public Domain

International shipping does not want to be a climate bad guy and is aiming to be emission-free by 2050. A new tool designed by researchers in Trondheim can help shipowners who are searching for green

solutions.

Shipowners around the world are in a very difficult position because they are having to order new ships now that will run on [fuel](#) and technologies that are not yet fully developed.

A new study suggests that ammonia could be a smart and energy-efficient fuel in the race to achieve net zero in shipping. Researchers at the Department of Industrial Economics and Technology Management (IØT) and the Department of Marine Technology (IMT) at NTNU and SINTEF Ocean are behind the study.

Help making choices in uncertain times

The researchers have developed a new model that can help shipowners and ship designers make [good decisions](#) in a time of great uncertainty. The [study](#) was recently published in *Maritime Transport Research*.

Postdoctoral fellow Benjamin Lagemann at the Department of Marine Technology describes the challenges the industry is facing. "They need to choose a machinery system and make plans for the future. At the same time, there is considerable uncertainty related to fuel prices, carbon pricing, fuel bunkering availability and safety," he says.

Anyone investing in new ships or upgrading their fleet must make decisions now, or have plans for how they intend to meet the climate requirements.

The ships that are now being ordered will likely be part of the international fleet in 2050.

They need to be equipped such that the enormous machinery can be converted to run on new types of fuel in the future. In shipping

terminology, this is called retrofitting.

"A lot is still under development, but the decisions made today will affect the possibilities for retrofitting and fuel choices in the future. This means that the shipowners have to commit to a decision to a certain extent, and thereby run the risk of not meeting future standards and expectations related to the environment," says Lagemann.

Supramax ships as an example

The study is based on a fleet of Supramax ships. The model incorporates factors such as emission figures from production to end use using a variety of different fuels, prices and other assumptions.

The ambition of the International Maritime Organization (IMO) is for shipping to be climate neutral by 2050. In addition, the industry must achieve major emission cuts by 2030 and 2040.

The NTNU researchers' model shows that IMO's ambitions have a strong impact on shipowners and ship designers' choice of propulsion systems.

"Anyone investing in new ships or upgrading their fleet must make decisions now, or have plans for how they intend to meet the climate requirements," says Professor Kjetil Fagerholt from the Department of Industrial Economics and Technology Management.

A lot is at stake, and shipowners need to act quickly. A standard Supramax cargo ship costs approximately NOK 300 million to build, and specialized ships can cost a lot more. The service life of these vessels is typically 20–30 years.

There is still a lot we don't know about the new low and zero-emission fuels, and how they will affect technology, machinery and propulsion

systems. This year, a carbon quota system for shipping will be introduced in the EU, but no one knows what the carbon prices will be in the future.

"All this makes future prices for the different fuels very uncertain," says Fagerholt.

Decisions must be sustainable

The researchers have fed all the variables into the models, and developed a probability distribution for how conditions might develop in the future.

"We create many different scenarios of what might happen, but don't draw any final conclusions on any of the outcomes," says Fagerholt.

Benjamin Lagemann says the model highlights many of the issues related to the choice of fuels, but not all of them. It requires few input parameters, and is therefore relatively easy to reuse. The intention is to give an indication of which solutions will work best over time.

Ammonia for the most ambitious

More than 80% of the goods in global trade are transported refrigerated. The Supramax ships on which NTNU researchers' models are based are about 200 meters long, transport dry loads and weigh between 58,000 and 65,000 deadweight tons. There are currently almost 3,000 ships of this type in operation, and they account for almost 10% of global transport operations measured in ton-miles.

It is not yet known what the requirements for emission cuts are going to be, so the researchers have studied two scenarios. One of them assumes a 90% cut in emissions by 2045. The conclusion is that the fleet should be

designed for ammonia-based propulsion systems. If the ambitions are lowered to a 50% cut in emissions, the model recommends liquefied natural gas, i.e., methane-based propulsion systems.

In recent years, many reports have indicated that ammonia could lead the fleet into an emission-free future. The acrid smell of this chemical that is used in detergents and agricultural fertilizers is something we all recognize. When properly produced and used, ammonia can be an energy-efficient fuel to replace today's polluting fossil fuels. Ammonia does not emit any CO₂, sulfur oxides or particles.

Providing advice for operating entire fleets

The researchers' work builds on previous research from postdoctoral fellow Benjamin Lagemann, showing how one single ship could be retrofitted over time to meet increasingly strict emissions requirements. They have now expanded the model to what they call a fleet perspective, and created two versions.

Simply explained, one version can suggest what shipping companies with many ships of different ages should do, and when it is smartest to do so. The other version will provide decision support to shipowners planning to build an entire fleet of new ships. One example is companies that are currently investing in building a fleet of completely new ammonia-powered ships.

When shipping companies invest, they want two things at once: the investment should yield the highest possible return while minimizing the danger of unwanted risk. A company with 12 ships can spread the risk over time by choosing three different technologies for fuel and engine types. All of them can be retrofitted, but not all of them need to be retrofitted at the same time.

When the researchers were asked if they know whether their models will actually be used by those who need them, Lagemann replies, "No, we don't know. But several industry actors, designers and shipping companies, both in Norway and abroad, have shown interest."

More information: Olav Loennechen et al, Maritime fleet composition under future greenhouse gas emission restrictions and uncertain fuel prices, *Maritime Transport Research* (2024). [DOI: 10.1016/j.martra.2024.100103](https://doi.org/10.1016/j.martra.2024.100103)

Provided by Norwegian University of Science and Technology

Citation: Researchers can help shipowners achieve ambitious climate targets (2024, April 16) retrieved 2 May 2024 from

<https://techxplore.com/news/2024-04-shipowners-ambitious-climate.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.