Reducing emission cost on Baltic

Balancing environmental benefits with economic feasibility poses challenges for shipments to and from Finland, particularly in the Bay of Bothnia where winter traffic faces severe ice conditions. Addressing this challenge is crucial to avoid escalating costs for future exports and imports.

Shipments in the Baltic Sea are primarily regulated by both national and international regulations. However, progressively tightening emission targets introduce additional limitations.

The International Maritime Organisation (IMO) has set a target to reduce shipping emissions by 40 % by 2030 (from 2008 levels). EU aims to cut greenhouse gas emissions by 55 % by 2030 (from 1990 levels) and to become climate-neutral by 2050, while Finland's goal is to reach overall carbon-neutrality by 2035.

In response to global environmental concerns and the green transition, there is also a growing demand from exporters and investors for low-carbon maritime transportation.

Three main solutions

There are three main solutions to achieve lower emissions in shipping: utilising alternative fuels, improving the energy-efficiency of vessels, and enhancing logistics.

The development and adoption of low-carbon and/or fossil-free fuels is advancing steadily, offering an efficient way to reduce emissions. Unfortunately, they currently come with a higher price than traditional fossil fuels.

"Forecasting the price level in ten years, when emission reduction targets are fully in effect and demand peaks, is challenging," notes Senior Naval Architect Tommi Hietamäki from Aker Arctic, who is focusing on solving these cost-related issues.

"Therefore, other measures to compensate, at least partly, for the higher fuel costs are essential," he emphasises.

Energy-efficient vessels

Improving the energy efficiency of merchant vessels is a key solution. Vessels can be developed to utilize less energy, i.e. less fuel consumed through better hydrodynamics, improved ice performance, utilization of energy-efficient machinery, and even auxiliary propulsion systems such as wind propulsion.

The maritime logistic system in Finland can also be enhanced. This involves utilising larger cargo vessels, reducing the speed of vessels, changes in harbour operations, and reconsideration of transportation routes.

Challenges in ice

The Finnish-Swedish winter navigation rules require all vessels arriving and departing Finnish harbours to have certain level of performance in ice when assistance restrictions are in force. This is enforced through minimum power requirements or verification through ice model tests. However, the tightening emission regulations have resulted in many new cargo vessels having lower sailing speed and lower installed power. This reduces CO_2 emissions per ton-mile of transported cargo which is a positive development.

"However, these vessels struggle in ice conditions, a trend that current developments are exacerbating," Hietamäki says.

Consequently, the need for new modern icebreakers capable of assisting these new types of cargo vessels efficiently is growing.

Updates to winter navigation rules

Hietamäki believes that cargo vessels with smaller engines should be allowed into Finnish-Swedish ports if they have sufficient ice strengthening. Strengthening merchant vessels' hulls and propulsion systems, in addition to considering specific ice going properties in hull form development, can make them suitable for ice conditions without compromising their open water capabilities.

"We have recently developed a new bow geometry which enables a large ship to follow a smaller icebreaker by widening the channel by itself without losing any of the open water features," Hietamäki explains.

Additionally, modern icebreakers, such as *Polaris* and the future Swedish icebreakers, are extremely efficient in assisting cargo vessels with their agility, speed and flushing capabilities.

"Therefore, doubling or tripling current vessel sizes would not be a problem even in Bay of Bothnia winter conditions. We estimate that doubling the ship size can reduce fuel usage per transported ton of cargo with 25 %," Hietamäki highlights. "This would, however, require changes in the winter navigation rules."

Study to evaluate costs

Aker Arctic is experienced in conducting logistics studies where economic feasibility and emissions are calculated. In this way, both the price and the CO_2 emission per transported ton-mile of cargo are quantified.

In numerous projects, we have conducted initial transportation studies to identify the most efficient system alternatives. These have included evaluating the most effective and

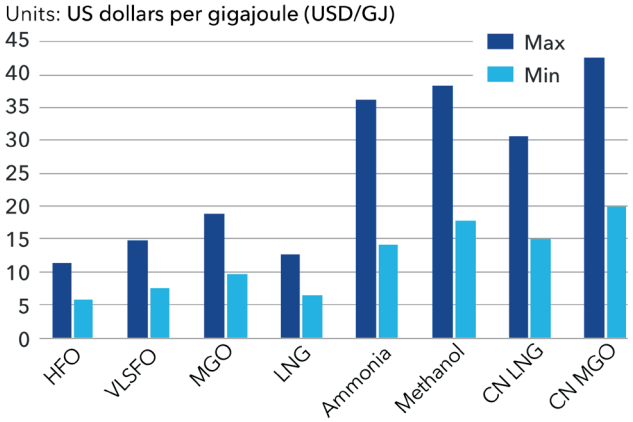
Sea shipments

Photo courtesy of Arctia

cost-efficient options for cargo vessels, transportation schedules, supporting icebreakers, and possible other vessels. Lifecycle analysis (LCA) and lifecycle cost (LCC) calculations are part of these evaluations.

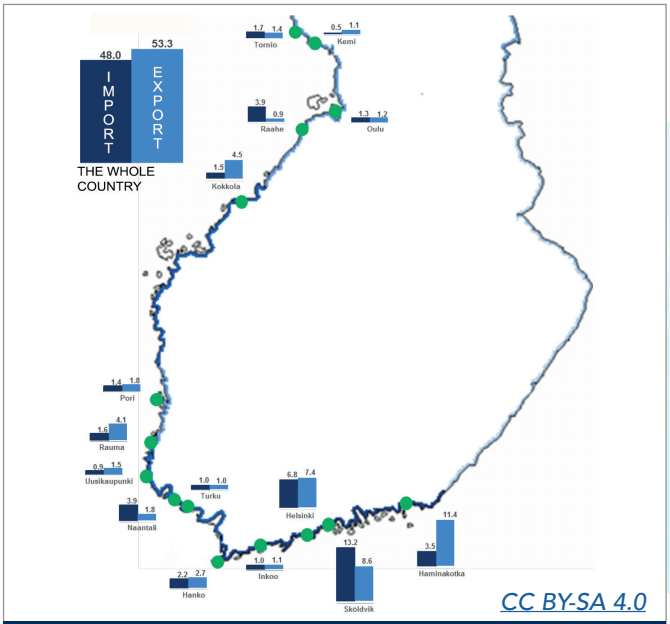
"A logistics study could be done for the entire Baltic Sea transportation system, or for smaller sub-entities," Hietamäki says. "However, time is running, as changes are not happening overnight. The Finnish Transport and Communication Agency (Traficom) is already considering solutions because stability in regulations is a prerequisite for acquiring new vessels." ■

Estimated high and low prices for fuels in 2050. The prices shown include both production and distribution costs and have been taken as a global mean average of all regions. Fossil-fuel prices do not include carbon price

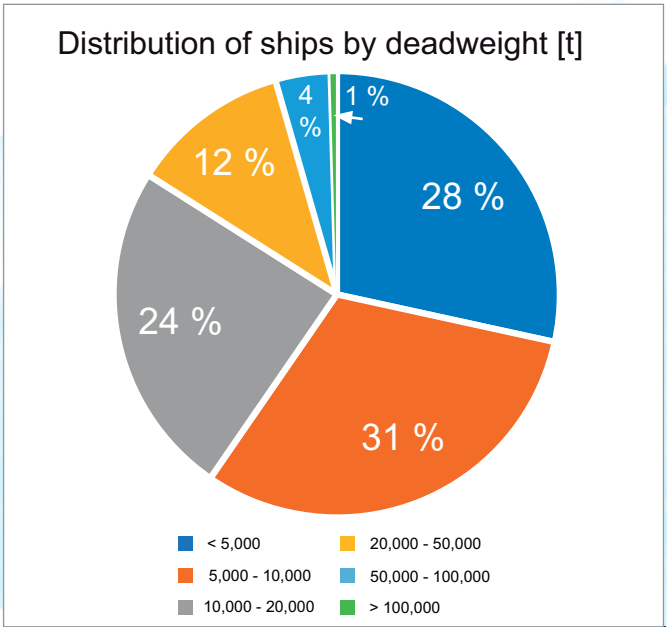


Key: Heavy fuel oil (HFO); very low sulphur fuel oil (VLSFO); marine gas oil (MGO); liquefied natural gas (LNG); carbon-neutral liquefied natural gas (CN LNG); carbon-neutral marine gas oil (CN MGO)

Estimate of fuel prices in 2050. Compared to current price level, fuel prices will likely double. Source: DNV, Energy Transition Outlook 2023, Maritime Forecast to 2050.



Finnish exports and imports at various harbours 2019. Source Ministry of Transport and Communications report 2022.



Distribution of merchant vessels by deadweight in Bay of Bothnia. Data from IHS Maritime Portal.