

THE STRUGGLE TO MAKE GREEN AMMONIA THE MARITIME FUEL OF CHOICE

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Abstract

Synthetic ammonia produced with hydrogen from electrolysis is a promising green fuel for maritime logistics. Yet making the promise come true faces many socio-economic, technological, and environmental challenges. We aim to diagnose the drivers and constraints of the evolution of ammonia from its current potential to a functioning future fuel in maritime logistics. To do so, we develop a plausible narrative scenario of green ammonia evolution during the next 10-20 years. We begin by laying out the technological and climate-related drivers advancing the development of green ammonia. We then describe plausible constraints of green ammonia development as they unfold in multiple layers of increasing complexity during the technology's evolution. To make green ammonia an attractive alternative fuel requires the production of cost-competitive green hydrogen. This in turn requires a large surplus of low-priced green electricity, which in turn requires fundamental transformations in the entire European energy system. More hurdles arise during deployment. As a toxic substance, ammonia must meet stringent environmental and health regulations, which impose yet another layer of constraints on marine vessel design and environmental protection technologies. We construct the scenario with data from 10 interviews and 3 workshops with marine sector stakeholders in Finland, a literature review of marine sector's regulatory environment, and an analysis of the risks and uncertainties of new marine fuels. The key output of the analysis is a realistic assessment of policies needed to make green ammonia a future fuel in marine logistics.

Implications for sustainable maritime operation

According to the 2023 International Maritime Organization (IMO) strategy, emissions from international shipping should be reduced by at least 70% by 2040 (as compared to 2008). Alternative fuels are one central way of achieving this target. The two main contenders in this context are synthetic methanol and synthetic ammonia. Both methanol and ammonia figure strongly in optimistic scenarios, yet especially ammonia comes with a number of known hazards such as toxicity and risk for eutrophication in case of leakage. This makes ammonia both an interesting and ambiguous object of study in considering dimensions of sustainability in maritime operations: interesting, because it remains within the confines of the doable and plausible; and ambiguous, because it comes with potentially hazardous systemic challenges. As such, it presents a critical case that can offer useful general insights in the domain of deploying alternative fuels.