TRANSITION PERSPECTIVE:

The Role of the Energy Sector in Shipping's Fuel Transition

October 2021

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*This document is a synthesis from the forthcoming report **A Strategy for the Transition to Zero-Emission Shipping,** prepared by UMAS for the Getting to Zero Coalition with funding from the Mission Possible Partnership. This synthesis highlights findings pertinent to the transition in landside energy systems needed to deliver zero-emission fuels, and to the actors and actions that are needed to enable the sector's decarbonization.*

Prepared by UMAS with funding provided by the Mission Possible Partnership

Shipping needs a supply of hydrogen

The shipping industry is a keystone of global trade and development, and it accounts for around 2-3% of global CO2 emissions. But if shipping is to play its part in helping to avert the worst outcomes of climate change, the sector needs to reach zero emissions of greenhouse gases by 2050. The rate of change will be high: the transition pathway for shipping is likely to follow an S-Curve, with a very rapid reduction in GHG emissions beginning sometime around 2030.

As depicted in Figure 1, this S-curve in emissions reduction will have to be mirrored in the **replacement of fossil fuels in shipping by new Scalable Zero-Emission Fuels (SZEF).**

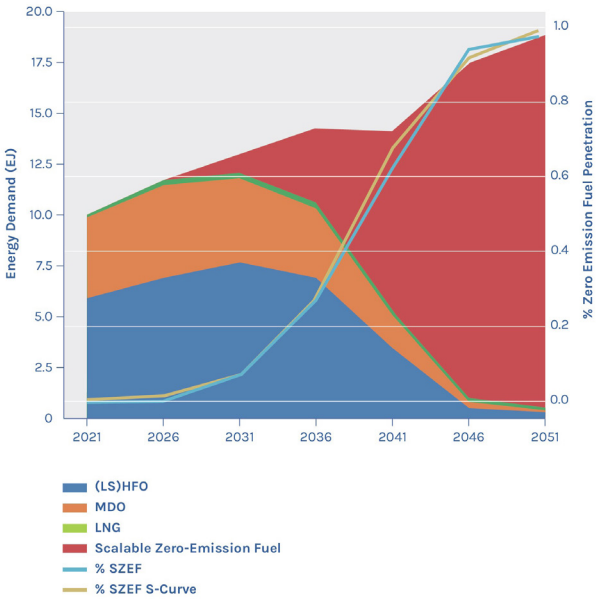

Figure 1: Modelled shipping sector energy demand mix to 2051.

Studies of past transitions suggest that the exact path is not predetermined and will emerge from the actions of industry and policymakers. For this reason, the report does not specify the fuels that will be used at any given time, nor their production technologies. Instead the study introduces the concept of Scalable Zero-Emission Fuels (SZEF). However, given the evidence of constraints on supply and therefore scalability of sustainable biofuel, as well as the societal/political obstacles faced by nuclear propulsion or

onboard carbon capture, the clear implication is that **shipping's transition is dependent on green hydrogen used as a primary feedstock of SZEF (e.g. ammonia, synthetic hydrocarbons/alcohols) or as a fuel itself in its liquid form.**

Shipping creates a reliable long-run off-take opportunity – and a means to drive investment

Decarbonising shipping is estimated to unlock in the range of $1-1.9 trillion of investment, with 87% of this needed for land-based infrastructure and production facilities, primarily associated with new production of hydrogen. **Shipping's decarbonisation is therefore a significant opportunity for a range of countries and corporates looking to stimulate investment in the broader energy transition.**

Shipping's demand for SZEF can support investment in green hydrogen for a number of reasons. From a business case perspective, serving the **shipping fuels market carriers lower risks for hydrogen producers than focusing on some other sectors** that have some scope for direct or battery-powered electrification (e.g. heat, road transport). Deep-sea shipping has no electrification option, thereby de-risking investments in green hydrogen capacity.

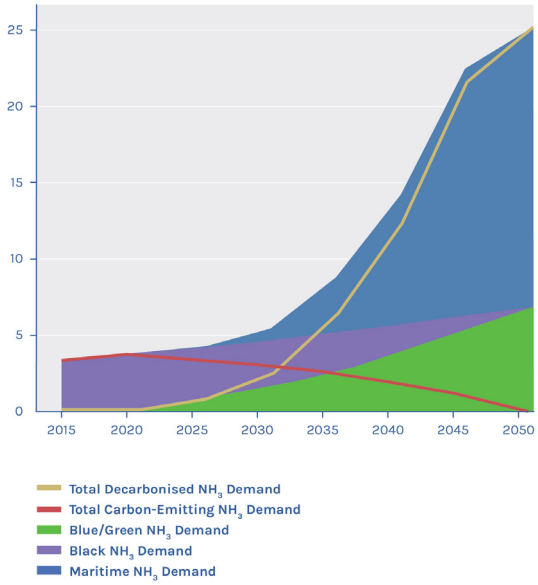

Figure 2 - Using ammonia as an example zero-carbon hydrogen-derived fuel, maritime demand will create additional pressure for the existing industrial ammonia production to decarbonise.

SZEF production for the maritime sector can **spread risk associated with when market demand for green hydrogen and derivative products will emerge, helping investors build more robust business cases.** One example, referenced in Figure 2, is the potential synergy between a decarbonization of ammonia production (for existing, primarily agricultural demands), with growth in green hydrogen/ammonia demand by shipping. The initial shipping demand for green hydrogen/ammonia production can develop in parallel to the first steps in decarbonizing fertilizer production

over the course of this decade – but then rapidly grows the market not just for the decarbonized commodity, but also for hydrogen/ammonia itself, further improving the business case for large-scale, long-term investment.

Shipping's transition creates significant opportunities for employment and investment in supply chains not just of the energy commodity itself, but all the equipment and manufacturing needed to create those supply chains. The report estimates the build-out rate required just to meet shipping's rapidly growing SZEF demand will reach around 30 additional full-scale plants (1.5GW each) per year at its peak (Figure 3).

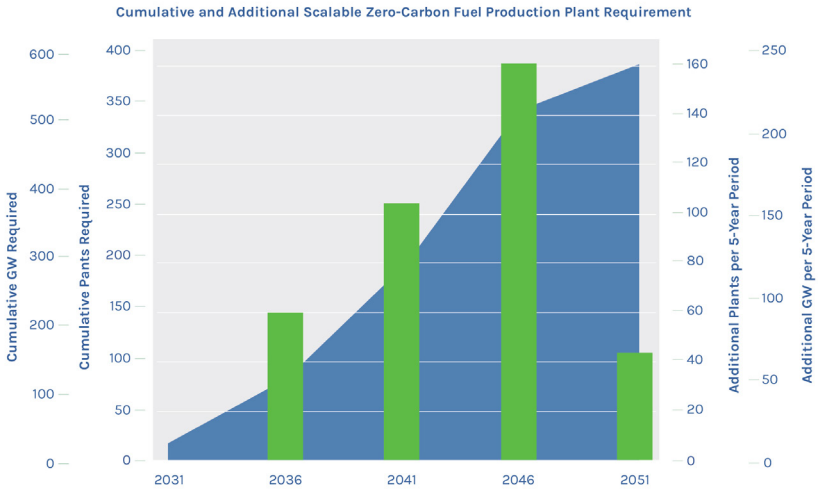

Figure 3 - Cumulative and Additional Scalable Zero-Carbon Fuel Production Plants to meet Maritime Demand. Assumes 1.51 GW / 47.6 PJ per plant-year.

There are opportunities for first movers in new fuel production in a range of geographies

With any transition, it can be hard to know where to start. Evidence gathered from previous transitions suggests that first movers in shipping's adoption of SZEF can be expected where the business case for moving to the new fuel can be built on alignment between ship-side opportunities and those on the land-side.

One way to seek out this alignment is to consider the nature of shipping routes/operation profiles and how well these match potential SZEF provision. Considering only vessels making regular, predictable voyages and a small number of port calls that also operate in close proximity to low-cost hydrogen production potential, **we estimate that about 10% of shipping's total fuel consumption has attractive fundamentals for moving to SZEF during the 2020s.** This analysis also shows, with some results presented in Figure 4, that there are opportunities in a number of locations globally, and a large amount of data available to help identify and develop those opportunities.

Figure 4: Identified first mover bilateral trade routes e.g. for ships shuttling back and forth between two ports from hydrogen-advantaged countries

However, it is also clear in the report that both collaboration within industry, and support and incentivization from policy, is essential for these opportunities to crystallise. Regulation at the International Maritime Organisation (IMO) could be a powerful tool but does not appear to be a necessary precondition: **National actions and plurilateral actions (taken by a small number of governments in coordination) can provide the initial stimulus needed** – and are shown to be able to impact a very significant share of the identified fuel demand. Examples of this already happening are provided, along with an identification of some of the leading candidate countries/regions that can move ahead of the IMO. **The transition can significantly benefit from clear and strong policy at the IMO**, but the chances of this happening sooner are improved if some of the initial tasks in shipping's transition are broadly distributed.

Considering the three phases of industry transitions we can expect a palette of actions to be relevant:

1. **Emergence phase (now):** National and plurilateral international action, industry investment, RD&D and a rapid increase in expertise narrows the price difference between fossil fuels and SZEFs. Use of SZEFs is still relatively low; most of the progress is observed in First Mover projects.

2. **Diffusion phase:** Costs of new technology are considerably lowered, primarily as a result of economies of scale and optimisation in the supply chain, as well as through improvements in technological performance. This lower cost makes commitment by industry (investment on a commercial basis) and policymakers (in the form of taxes and subsidies) more feasible. These support rapid adoption of the SZEFs, positive feedback loops, growing confidence in the transition and a further lowering of costs.

3. **Reconfiguration phase:** Standards, regulations and incentives help complete the transition; SZEF is now the principal fuel of the shipping industry and fossil fuels and associated infrastructure have been phased out.

Next Steps for the Energy Sector and Land-based Industry

There is not a single way forward, but a series of actions by different actors that can reinforce each other to unlock the above investment opportunities and achieve shipping's transition to zero emissions.

Industry leadership, collaboration and early-stage investment is critical for the 'emergence' phase – in which solutions are tested and evaluated, costs are reduced, opportunities and risks are crystallised. Investors and operators involved in the land-side energy infrastructure have a crucial role both in advancing fuel production technologies and in articulating the business case for these fuels in collaboration with the value chain. This can advantageously be undertaken on the many routes and corridors where alignment between ship- and land-side opportunity is strong.

Shipping has undergone transitions in the past and can do so again. The report shows this transition is an opportunity that will create new markets, new technology, new jobs alongside wholescale benefits for society. The energy sector and land-side actors can use this information to strategise, take action, invest, collaborate, communicate, share best practices and lessons learned, and to call for supporting regulatory mechanisms that secure market demand and enable the necessary supply of Scalable Zero-Emission Fuels.

A Strategy for the Transition to Zero-Emission Shipping will be published on 27 October 2021.