

1. What is your feedback on the overall ambition and feasibility of the Net Zero Strategy pathway for domestic maritime vessel emissions?

1. We suggest the Net Zero Strategy Pathway shown in the consultation document does not showcase a trajectory that enables deep decarbonisation in a non-disruptive and cost-effective manner. From our recent work investigating international transitions, findings have shown that stagnation or inactivity until 2030 will cause a more disruptive transition; it means that a more rapid decarbonisation pathway is required (see red line in Figure 0.1). This is because in a period of stagnation (represented from 2020 to 2030) an accumulation of emissions will cause rapid global temperature rise. To remain within a carbon budget – equivalent to that of a 1.5-degree increase compared to 2008 level – a compressed timeframe of decarbonisation is necessary. Delaying emission reduction would amount to a more costly transition: every year of delay to the start of deep decarbonisation this decade adds approximately \$100 bn to the total cost of decarbonisation globally

3. Domestic emission reductions are a key driver to facilitate the launch of SZEf this decade. Developed nations, including the UK, must act as 'early adopters'; it is suggested that together, a group of the 32 developed nations have the ability to account for 2-3% reduction in global shipping emissions by reducing their domestic emissions by 15% by 2030 (ibid). The UN Climate Champions have set a target of 15% of zero emissions fuels by 2030 as the 'Breakthrough' amount required for domestic shipping.
4. International pilot projects can facilitate the transition and start reducing emissions by the creation of six green corridors globally by 2025⁴. UK ports could be a part of high-impact transatlantic and Asia-Europe green international corridors⁵ whilst launching regional green corridors and clusters within UK-UK shipping and short-sea neighbouring countries. This could unlock UK ports as bunkering hubs of zero emission shipping fuels and help the support the development of clean fuel clusters, in turn, providing security for ship owners/charterers who operate in the surrounding waters to invest in onboard technology.
5. Ports can take the role of decarbonisation hubs for multiple sectors by facilitating cross-sector collaboration, widen investment and thus accelerate the scaling of production of zero emission fuels. The cross-sector projects such as Humber Zero and Shoreham Port shows the importance of ports as decarbonisation hubs. These private and public-private collaborations can enable cross-sector, regional relationships to act as catalyst the hydrogen economy and launch SZEf into multiple sectors.
6. It will be easier for ship owners/charterers that operate their vessels within fixed routes to select an alternative fuel as they obtain more certainty in refuelling locations and infrastructural requirements⁶. Findings from our data indicate that 50% of total domestic emissions come from ferries and Ro-Ros⁷ i.e., ships that operate on specific routes and regions. These ship types could be an ideal platform to create regional corridors or clustering hubs to launch zero emission fuels in the domestic market before 2030. Especially since as a business case exists, whereby a lower proportion of ferries and Ro-Ro's operating costs come from fuel (25-30%), meaning the cost gap of conventional to alternative fuels will result in lower financial weight than ship owners/charterers who operate ships (e.g., global liners) with higher proportion of fuel costs in their operating costs.
7. With characteristic long lifespans, retrofitting from conventional shipping fuels to low/zero alternatives is crucial for shipping decarbonisation and seen as a key driver. Ships built today must be designed to be zero-ready or retrofittable to SZEf. It is predicted that retrofitting activity is significant in the 2030s and will need to encompass ships built today, and potentially ships built prior to 2022. Specifically, findings suggest

that the number of SZEf retrofits could be equal to the number of newbuilt SZEf ships overt the transition (see Figure 0.2)

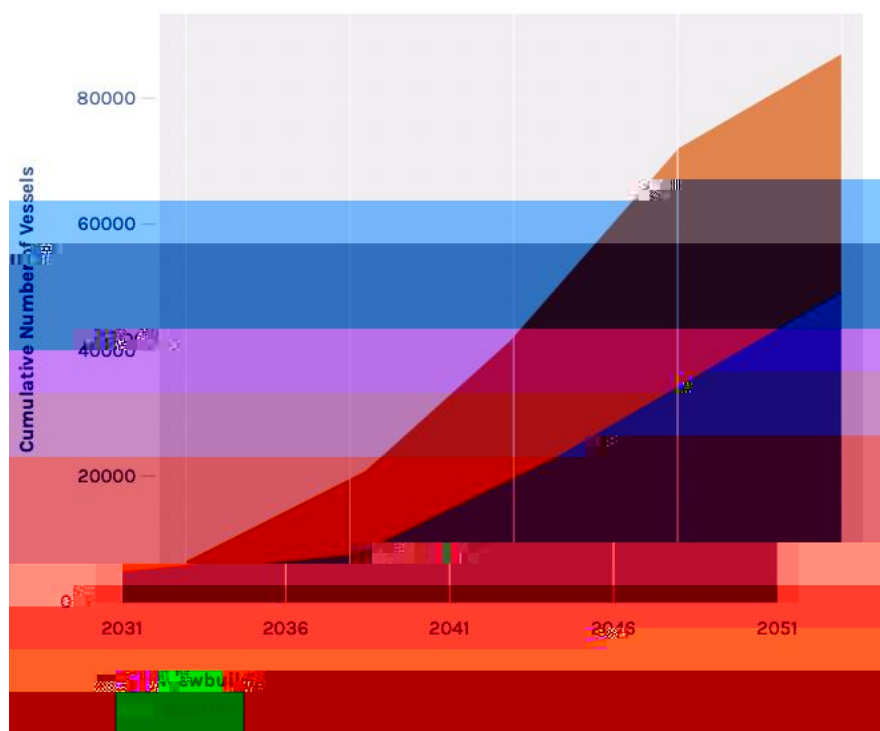


Figure 0.2 Magnitudes of newbuilt SZEf and retrofits to SZEf

2. What role do you think the following alternative fuels and energies may play in decarbonising domestic maritime sector vessels?

8. Hydrogen-based fuels are essential for domestic and international shipping decarbonisation. Specifically green hydrogen-based fuels or Scalable Zero Emission Fuels (produced from renewable electricity) in addition to battery electrification will have a dominant role in domestic decarbonisation⁸. Hydrogen is the building block of other shipping fuels e.g., ammonia and methanol. It is therefore essential in any pathway to decarbonisation to ramp up production of hydrogen. This was highlighted in our findings for the models in the DfT 2019 Clean Maritime Plan modelling.

9. It is important to distinguish between hydrogen production pathways to ensure reductions are made on a lifecycle basis as there are major concerns with the fugitive methane emissions from natural gas routes (i.e., grey, and blue production pathways) in upstream processes. Methane is 81 times more potent at global warming than carbon over a 20-year period⁹ and fugitive emissions are uncertain. It is likely that any progress

⁸ Frontier economics and UMAS "REDUCING THE UK MARITIME SECTOR'S CONTRIBUTION TO AIR POLLUTION AND CLIMATE CHANGE", 2019

⁹ IPCC, "Summary for Policymakers," in Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, 2021. doi: 10.1260/095830507781076194.

Table 0.1 At sea and at port emissions on domestic voyages

	3.2	2.4
	0.7	0.5

of a wider decarbonisation effort across multiple sectors. Domestic shipping decarbonisation in countries like UK can help drive the business case for development of UK hydrogen production and supply chain and enable business opportunities and jobs not just in shipping but other sectors reliant on hydrogen for their future competitiveness. This can also help grow the global availability of new energy supply chains that can be used by both domestic and international shipping.

26. Market Based Measures (MBM)/economic instruments such as carbon pricing and Command and Control measures (e.g., technical and operation measures taking the form of fuel mandates, CO2 standard, energy efficiency or others) can be implemented to incentivise the transition and can work in collaboration with each other²¹. Based on previous analysis, a carbon price could play a key role in enabling UK decarbonisation by 2050²². Carbon pricing is particularly useful early in a transition to help provide revenues to support early adoption during the emergence phase, and can be partnered with command and control policy used to ensure certainty of CO2 reductions.

27. Albeit an example taken from international shipping, even a

31. Analysis suggests that mandatory, absolute targets set by the government (such as achieving a specified GHG and air pollutant emissions reduction relative to a historic baseline by a specified date) can be the most appropriate and proportionate means for ensuring that environmental goals are realised²⁷.
32. Medium- to long-term targets should be supported by short- and medium-term checkpoints to help monitor progress and ensure action can be taken to keep actions aligned with the longer-term target.
33. Data and monitoring mechanisms are an essential enabler of achieving the target in a proportionate way. In the context of UK shipping, this implies the need for a credible and verifiable, yet proportionate, way to measure shipping emissions.

7. What are the most significant barriers to domestic maritime decarbonisation at scale (if appropriate, within your subsector)?

34. Much of the domestic shipping sector comprises of small companies. Access to capital is much more difficult to that of major ports who have access to commercial banks and local/regional funding²⁸. Therefore, smaller companies who operate in smaller ports and smaller vessel owners will struggle to raise the funds to commercially roll out alternative fuels bunkering and the installation onboard shipping technologies. It is therefore essential to provide financial support to smaller ports and small vessel owners, other than early-stage grants, to enable smaller companies who operate in non-major ports the necessary help to transition away from fossil fuels.
35. Ships owners that have a higher proportion of their operating costs arising from fuels

