Written evidence submitted by the Smith School of Enterprise and the Environment, University of Oxford (MAR0006)

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Research at the Smith School shapes business practices, government policy and strategies to achieve net-zero emissions and sustainable development. We offer innovative evidence-based solutions to the environmental challenges facing humanity over the coming decades. We apply expertise in economics, finance, business and law to tackle environmental and social challenges in six areas: water, climate, energy, biodiversity, food and the circular economy.

SSEE has several significant external research partnerships and Business Fellows, bringing experts from industry, consulting firms, and related enterprises who seek to address major environmental challenges to the University of Oxford. We offer a variety of open enrolment and custom Executive Education programmes that cater to participants from all over the world. We also provide independent research and advice on environmental strategy, corporate governance, public policy and long-term innovation.

This written evidence has been specifically prepared for and submitted on behalf of the Smith School of Enterprise and the Environment, University of Oxford, and Pinsent Masons, co-authors of the recent report Zero-Emissions Shipping: Contracts-for-difference as incentives for the decarbonisation of international shipping.

The Smith School of Enterprise and the Environment equips enterprise to achieve net zero emissions and the sustainable development goals, through our world-leading research, teaching, and partnerships. For more information on SSEE please visit: http://www.smithschool.ox.ac.uk

The Oxford Martin Institute for New Economic Thinking is a multidisciplinary research centre dedicated to applying leading-edge thinking from the social and physical sciences to global economic challenges.

Pinsent Masons is an international law firm which specialises in the energy, infrastructure, financial services, real estate and advanced manufacturing and technology sectors. The firm ranks among the top hundred law firms in the world by turnover.

Executive Summary

i. **An estimated 2.9% of global greenhouse gas (GHG) emissions are produced by the marine transportation sector, and pressure is increasing for international marine transportation to decarbonise; however, no clear strategy for doing so yet exists.**

ii. **Strategic ambitions outlined in the UK's *Maritime 2050* plan advocate taking action on clean maritime growth to enjoy the economic benefits of being an early adopter or fast mover, and enhancing the UK's competitive advantage in maritime law, clean fuel production and engineering, and green finance, among other areas.**

iii. **The Russian invasion of Ukraine has increased scrutiny on the UK's medium term energy security, and also highlighted the vulnerability of international shipping to price volatility in global markets for fossil fuels – making it an opportune time to push for a rapid global transition to clean energy.**

iv. **Several technologies are strong candidates for shipping decarbonisation and are at various stages of maturity in terms of development and adoption. For zero-emissions shipping technologies to become**

commercially viable, greater regulatory support and a step change in investment is required.

v. **While clean fuels have already seen a substantial decline in cost resulting from technological advances, particularly in renewable power generation, they remain significantly more expensive than their fossil fuel counterparts. Similar cost differentials in the power sector have been successfully overcome in recent years using innovative policy instruments.**

vi. **Oxford University researchers submitted written and oral evidence on net zero shipping to the Environmental Audit Committee in January 2022, proposing the use of a Contracts-for-Difference (CfD) scheme to encourage private investment and innovation in the development and uptake of technologies and fuels for zero-emissions shipping. This proposal supports the strategic ambitions of Maritime 2050.**

vii. **Key economic and institutional barriers to the implementation of such a scheme have now been eased, with the steep rise of fossil fuels reducing the cost differential with clean energy, and with the COP26 Clydebank Declaration pledging a collective effort by 22 signatory countries to take action to address barriers to establishing "green shipping corridors", including the use of regulatory frameworks and incentives.**

1. The Maritime 2050 plan provides a roadmap for the UK's leadership in clean maritime growth and innovation, focusing on the transition to zero-emission shipping. The plan aims to support an effective global response prompted by localised leadership. The DfT plan stresses the need to couple energy efficiency improvements with the development

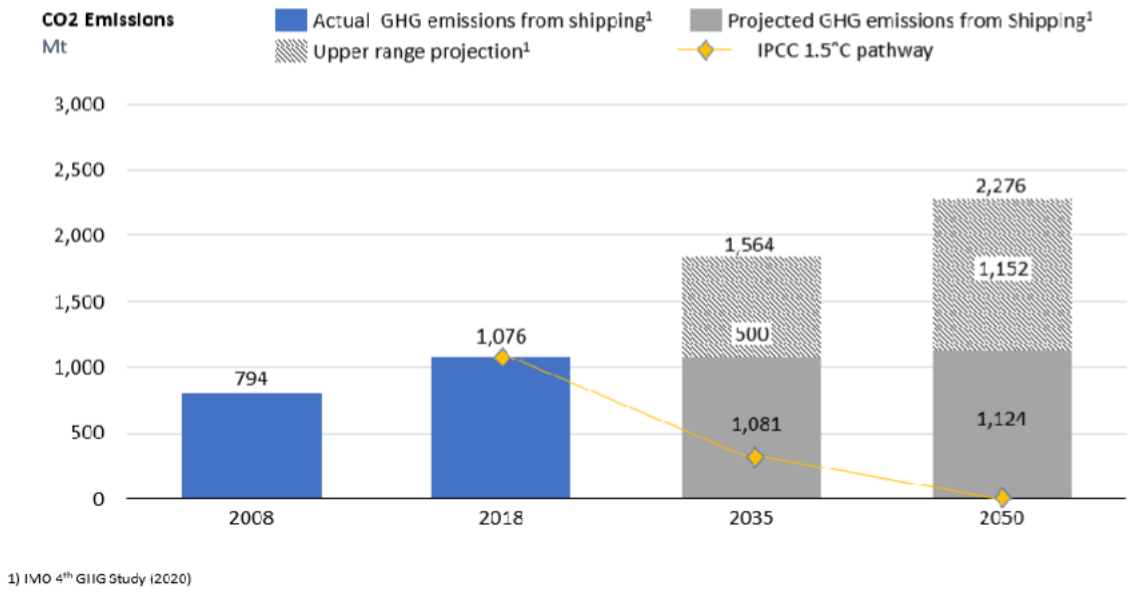
and use of zero-emission fuels such as green hydrogen and ammonia. It also acknowledges the substantial capital and operating cost barriers faced by maritime asset owners and operators in undertaking this transition. Maritime 2050 contains the foundational building blocks of a government-backed maritime sector focused "green financing" program that will contribute to the broader UK green transition plan and competitive positioning of the UK as a green finance hub.

2. The Maritime 2050 strategy functions nationally within the IMO's 2050 decarbonisation targets. These targets call for a reduction of emissions in the sector to 50% of 2008 levels by 2050. Without clear and strong decarbonisation policy, even this target, insufficient for meeting the UK's legal obligation to meet net zero emissions by 2050, will not be achievable. Shipping emissions are expected to remain steady or increase significantly over the next few decades, with the IMO itself predicting that the sector's emissions could increase by 90-130% from 2008 levels by 2050. As shown in Figure 1 below, the emissions gap between the range of projected shipping emissions and the net zero requirements of the Paris Agreement's aspirational target of 1.5C are daunting. The findings of the IPCC Sixth Assessment Report further bolster the importance of immediate action on decarbonisation. Action must be decisive, swift, and promote private sector participation.

3. In our 2021 report titled Zero- Emissions Shipping: Contracts-for-difference as incentives for the decarbonisation of international shipping, we propose the implementation and administration of a Contracts- for-Difference (CfD) scheme to encourage the development and uptake of technologies and fuels for zero-emissions shipping. By backing such a scheme nationally, the UK would benefit from a first-mover advantage, bolstered by existing success with CfDs. Additionally, our stakeholder interview process found interest from the European Commission (EU) in the use of such CfD schemes to decarbonise

shipping alongside the existing Emissions Trading Scheme (ETS). The UK is well-positioned to act as a significant initial provider of green (i.e., zero-emissions) fuel in the region, thanks to its relative abundance of low-cost green energy from existing old nuclear infrastructure and newer offshore wind energy. This combination positions the UK in a leading role for fostering international action on maritime related emissions reductions.

Figure 1: GHG Emissions Gap in Shipping



4. **CfD: Overview.** Fundamentally, a CfD is a subsidy mechanism intended to reduce the price gap between old and new technologies (Clark et al., 2021). This reduction can be achieved via CfD without the long-term market distortions generally associated with broad-based subsidies. Ultimately the financial burden of a CfD on government should be limited when compared with other subsidy mechanisms. Given sufficient cost declines the ultimate clean technology-driven solution may also result in significant cost savings (Ives, et al., 2021).

5. CfDs are attractive as a policy instrument. Chiefly, they mitigate the risk faced by suppliers of a new technology or commodity by

facilitating a payment to the supplier at a rate required for the economic viability of the supply. For optimal results, a zero-emissions shipping fuel CfD should maintain a level playing field among market participants. The CfD can also be coupled with an off-taker agreement to provide certainty to private sector investors that there will be a market for the new product.

6. The UK has been an early adopter and champion of CfDs in the offshore wind and solar energy markets. These CfDs are managed by the Low Carbon Contracts Company, a government-backed corporation responsible for CfD auctions, administration, and payment settlement. Substantial private investment, primarily in the offshore wind industry, has been attributed to the implementation of CfD schemes in the UK. This success has at least partly driven unexpectedly large declines in levelised costs and acted as an effective market risk hedge for investors at a discounted burden to government as compared to feed-in-tariffs or traditional direct subsidies (Clark et al., 2021).

7. **Framework.** We propose a framework for designing CfDs for international shipping, based on implementations of this instrument in other sectors, specific features of the shipping industry, and stakeholder views. We explore two options:

    i. A “Fuel-only” CfD, which is the simplest and most popular solution with stakeholders, providing shippers with zero-carbon emission fuels at the same price as Marine Gas Oil (MGO) or its equivalent in the relevant market. While this solution may not necessarily cover 100% of the costs of switching from to zero- emission shipping, or provide support for infrastructure and retrofitting costs, it can be applied transparently and equally to all shipping segments. It does not generally favour ‘non-liquid-fuel’, highly capital-intensive options like nuclear power.

ii. A “Total Cost of Ownership” (TCO)-based CfD, which covers all incremental costs associated with building and running a zero-carbon emission ship compared to a standard ship. This option is administratively much more difficult to manage and would likely require many variants to cover all shipping segments but is potentially better for fostering competition on fuel options, and for making progress on the cost of non-fuel capital components required to build and operate zero-emissions ships.

9. **Technology Overview.** The technology-neutral CfD approach we have taken would in principle allow for private investment to be crowded into several key clean technology options at various stages of development and adoption. In our report, we consider the popularity, current state of development, barriers to adoption and benefits of these key technologies, which include: **green ammonia**, **green hydrogen**, **synthetic fuels**, **wind and sail**, and **nuclear technologies**. Battery technologies may also be appropriate for shorter distances, although their low energy density effectively rules them out for long-distance shipping. A key point here is that the energy input to all these technologies must be “green” i.e., derived from a zero-emissions process.

10. **Economic Barriers.** The key barriers to large-scale private investment and adoption of such clean fuels are well- known and include high perceived technology risks, lack of supporting infrastructure, lack of a project pipeline, lack of stable and scalable fuel supplies, and perhaps most importantly their high relative costs in the absence of very high carbon pricing (or its equivalent) on existing fuels.

11. At present each of the alternative propulsion energy sources in 9. is costlier on an energy basis than conventional maritime fuels. Top contenders, including green ammonia and hydrogen, have substantial

upfront investment costs in addition to retrofitting bills or higher costs associated with new fuel engine development. However, the recent rise in prices on the market for internationally-traded fossil fuels, including conventional maritime fuels, has narrowed the differential, providing a window of opportunity to speed up the transition. Many market observers believe that high fossil fuel prices will continue for some time to come. Even if the price rise proves temporarily, it highlights the deleterious impact of price volatility in fossil fuel supplies and supports the case for reducing exposure of these critical inputs to geopolitical events. The disruption being experienced today points to the inherent volatility of fossil fuel markets that will continue to be observed in the coming decade as the world transitions to clean energy sources and the development of new oil and gas resources slows.

12. For economic parity, it is essential that zero-emission fuels trade at a price similar to, or less than, the global MGO benchmark rate. The shift to zero-emission fuels will undoubtedly raise costs for asset operators in the short term. Given the inherent inelasticity of demand for shipping services and the small proportion of consumer product prices represented by marine fuel costs, market participants also noted that any increased fuel costs could be passed on to consumers relatively easily and would not prove prohibitive so long as a level playing field is maintained, such that all shippers faced the same fuel costs (which, in the absence of a global carbon price, a CfD is designed to achieve). As zero-emission fuels are developed further, technological innovations – particularly in renewables – are expected to contribute to substantial cost declines for clean energy fuels (Iveset al., 2021).

13. **Institutional Barriers.** The slow pace of regulatory development at the IMO was seen by many stakeholders as one of the largest hurdles to global implementation of a CfD scheme. To satisfy the roadmap as set out in Maritime 2050 and the Clean Maritime Plan, the transition to zero-

emissions fuels must eventually be led by the IMO but regional, or route or sector-specific solutions are most likely to succeed in the short term.

14. When looking to other jurisdictions with the wherewithal to implement such a scheme, the EU may be a natural answer. The recent European Green Deal likely cannot on its own facilitate the required scale of private investment to successfully decarbonise the maritime industry, requiring the use of complementary policy measures. Despite this lack of maritime-focused facilitation beyond its expected inclusion in the ETS, the EU remains a critical trade partner of the United Kingdom, which may benefit a UK-based CfD scheme.

15. Notwithstanding 13 and 14 above, recent events highlighting the vulnerability and exposure of European countries to high fossil fuel prices and dependence on Russian oil and gas supplies, have led to a rapid rethinking of energy strategy and the role of clean energy within it, by the EU. Frans Timmermans, EVP for the European Green Deal was recently quoted as saying *"Let's dash into renewable energy at lightning speed."* Several European countries, most notably Germany, have redoubled their efforts to achieve a rapid energy transition – bringing forward a target to achieve 100% renewable energy by 15 years. Deals on green hydrogen supplies are also being struck between European countries and potential exporters of green hydrogen around the world – signifying a major market opportunity for zero-emissions shipping to emerge along these trade routes.

16. The COP26 Clydebank Declaration pledged a collective effort by 22 signatory countries to take action to address barriers to establishing "green shipping corridors", including regulatory frameworks and incentives. Signatories are required to facilitate partnerships in which:

i. Two or more signatories to the Declaration identify and take steps with relevant willing ports, operator(s) and others along the value chain to decarbonise a specific shared maritime route.
ii. A signatory to the Declaration takes steps with relevant willing ports, operator(s) and others along the value chain to decarbonise a specific domestic maritime route within the jurisdiction and control of a signatory.

A CfD mechanism designed on the basis of the options described in detail in our report, could be utilised as an enabling instrument to kick-start green financing for the decarbonization of the maritime sector, in line with either of the routes above, and harness innovation potential in the UK and beyond to drive down the cost of alternative fuels much more quickly than would otherwise be the case.

17. **Maritime 2050 and Government Policies and Regulation.** The UK merchant fleet is the 18th largest in the world and considerably well integrated with the European market. When combined with crown dependencies and overseas territories, it is the 10th largest. As a champion of CfD for renewable energy, the UK sits at the nexus of innovative financial tools and maritime influence. This positioning promotes the ability of the UK to act as a catalyst for the development of zero-emissions fuels globally. The availability of both cheap legacy nuclear technology and abundant renewable energy, itself deployed with the support of CfD mechanisms, and the political benefits of being a first mover with close integration into larger markets in the EU and further afield, make the United Kingdom the ideal candidate for the implementation of a government- affiliated CfD scheme

18. We submit for consideration the belief that a zero-emissions shipping future is not only an economically viable possibility, but that the UK has a leading role to play in making this future a reality. This is particularly true

given the window of opportunity that has now opened up, with global fossil fuel prices on an unpredictable and volatile upward trajectory, and greater global consensus among allied countries to decarbonize away from fossil fuel dependence and towards more secure and affordable clean energy options.