Consultation response to "Plotting the Course to Zero"

The government must set binding, time-bound targets to cover all shipping emissions for which the UK is responsible

October 2022

Executive summary

The government is paying increasing attention to the urgent question of maritime decarbonisation, most recently with the announcement of £60m Phase III funding for the Clean Maritime Demonstration Competition, the proposed inclusion of a proportion of the UK's domestic maritime emissions in the UK Emissions Trading Scheme (UK ETS), and plans to consult on the use of maritime shore power and phasing out the sale of new non-zero-emission vessels. These developments are welcome. However, faced with the tremendous scale of the emissions reduction challenge, a step-change is needed in the government's ambition for the forthcoming refreshed Clean Maritime Plan.

The decision to pass responsibility for the regulation of the UK's international emissions, some 60% of the total, to the International Maritime Organisation (IMO) is an evasion of the UK's legal obligations under the Paris Agreement, and undermines both national decarbonisation efforts and the UK's credibility as a climate leader. Furthermore, using the refreshed Clean Maritime Plan to set only indicative, non-binding decarbonisation targets will not provide even a foundation for an effective regulatory framework or the necessary certainty for business to make the considerable investments required right across the maritime value-chain.

T&E supports the position of the Tyndall Centre[1], which sets out that UK domestic and international maritime CO2 emissions should be cut by 50% by 2030, reaching zero by 2040, for compliance with the Paris Agreement temperature goals. These recommendations are based on analysis of the latest Intergovernmental Panel on Climate Change (IPCC) data and application of the principle of common but differentiated responsibilities (CBDR)[2], and mean an emissions reduction trajectory more ambitious than the example pathway presented in the Net Zero Strategy pathway. Critically, emissions must start to reduce immediately, with deep cuts required this decade.

This will require unprecedented levels of investment in all parts of the maritime sector and beyond, stemming from a bold, decisive and integrated policy and regulatory framework. Therefore, the

[1] https://documents.manchester.ac.uk/display.aspx?DocID=62470
[2] https://www.tandfonline.com/doi/full/10.1080/14693062.2021.1991876

refreshed Clean Maritime Plan must commit to a suite of policy and regulatory interventions, to include binding, time-bound targets that result in immediate and sustained emissions reductions. Interventions should include:

- Broadening the proposed scope of the UK ETS to CO2e, capture 50% of the UK's international emissions and reduce the qualification threshold to 400GT for all commercial and service vessels;
- Expanding the existing Clean Maritime Demonstration Competition into a broader clean shipping commercialisation fund, for maritime clusters and a Contract for Difference (CfD) to support e-fuel supply;
- Establishing a maritime RTFO to place a zero-carbon e-fuel and electricity mandate on marine fuel suppliers;
- Introducing a marine fuel greenhouse gas intensity standard on vessel operators, measured in gCO2e/MJ with pooled compliance[3], with dedicated quotas for green hydrogen-based marine fuels; and
- Implementing a zero-emission berth standard in ports, including a shore side electricity (SSE) mandate where appropriate.

The UK is well-placed to become a world-leader in maritime decarbonisation. The UK has a relative competitive advantage across a number of essential technologies including e-ammonia, e-hydrogen and battery-electric propulsion. The government is successfully operating or in the process of implementing a variety of policies to drive decarbonisation in the transport sector, including the support, regulate and ban (SRB) framework for electric vehicles; the Renewable Transport Fuel Obligation (RTFO) for lower-carbon motor fuels; and a mandate for sustainable aviation fuel (SAF). These policies provide a framework that could be adapted and developed to drive decarbonisation in the maritime sector. Freeports and Enterprise Zones create favourable investment conditions for the development of zero-emission maritime technologies.

The refreshed Clean Maritime Plan is a golden opportunity for the government to capitalise on these strengths as part of a visionary policy and regulatory framework commensurate with the scale of the challenge. The government must step up.

[3] Vessel operators would need to demonstrate compliance with the target, for example by presenting to the Administrator at the end of each reporting period evidence that the aggregated GHG intensity of all fuels used during the reporting period is at / below the target threshold. Evidence - for example, verified certificates corresponding to quantities of fuel used - could be pooled at different levels: an operator's fleet, a sub-sector (eg container vessels) or even the entire domestic or international fleet. Practically, this could mean that the most suitable vessels / sub-sectors move first, generating surplus compliance certificates which could then be traded with operators needing to reach the standard. The existing RTFO provides a blueprint.

Overview

This submission summarises Transport and Environment (T&E's) views in response to the questions posed in the UK Domestic Maritime Decarbonisation Consultation: Plotting the Course to Zero[4]. T&E is Europe's leading clean transport think tank and campaigning group. It was created as a member organisation over 30 years ago and now has staff in 6 countries, with 63 member organisations across 24 countries. It has had a UK office since 2019. T&E is a founding member of the Clean Shipping Coalition, which has observer status at the International Maritime Organisation (IMO). T&E is also an active member of the European Sustainable Shipping Forum, which acts as an expert group advising the EU Commission on technical maritime issues.

UK Department for Transport data shows that in 2019[5], UK domestic shipping activity produced 6.1MT CO2e, accounting for ~5% of domestic transport emissions, whilst UK international shipping activity produced an additional 7.5MTCO2e[6]. The sector remains one of the most challenging to decarbonise without regulatory guidance, and practical steps towards decarbonising the sector are, thus far, at a very early stage.

T&E believes that complete decarbonisation of the UK maritime sector well before 2050 can and must be achieved through a major technological push combining energy saving and efficiency measures and a wholesale switch to 100% renewable, additional electricity and e-fuels (such as, e-ammonia and e-hydrogen). There should be zero reliance on emissions removals.

This is achievable, but the scale of the challenge is vast. The Tyndall Centre recommend that the UK's domestic and international emissions should fall by 50% by 2030 based on 2008 levels, reaching zero by 2040, to be compatible with the Paris Agreement temperature goals[7]. T&E analysis estimates that by 2050, the UK's shipping sector will require 84TWh of renewable energy, or 23% of all transport energy demand[8]. This sits alongside a similar energy demand from the aviation sector.

If the government rises to the challenge, significant opportunities exist. Research undertaken by UMAS, E4Tech and Frontier Economics[9], cited in the consultation, shows the UK's relative competitive advantage in certain zero-emission technologies essential to maritime decarbonisation, including hydrogen and

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[4] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1092399/uk-domestic-maritime-decarbonisation-consultation-plotting-the-course-to-zero.pdf

[5] We have cited 2019 data as being more representative of normal sector activity than 2020 (the most recent year for which UK data is available at the time of writing) owing to the impacts of pandemic.

[6] https://www.gov.uk/government/statistical-data-sets/energy-and-environment-data-tables-env

[7] https://documents.manchester.ac.uk/display.aspx?DocID=62470

[8] https://www.transportenvironment.org/wp-content/uploads/2021/07/T&E%20Briefing%20-%20feasibility%20study%20renewables%20for%20decarbonisation.pdf

[9] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815666/economic-opportunities-low-zero-emission-shipping.pdf

ammonia production, and battery-electric propulsion. The same research indicates a potential UK market in these and other technologies worth **$650-890m/yr** by the middle of the century, and it is reasonable to assume these and other benefits would be greater under an ambitious decarbonisation policy scenario. The UK is already a global leader in maritime professional services. The UK's independence from the EU regulatory environment means policies to drive maritime decarbonisation can be tailored to the UK and the unique academic, research and development (R&D), technological and commercial capabilities and opportunities presented. Enterprise Zones, Investment Zones and Freeports are offering enhanced capital allowances and business rate discounts precisely at the moment when the UK needs to invest heavily in alternative marine fuels and the maritime clusters to supply them. These opportunities must be brought to bear on the decarbonisation challenge.

The Course to Zero consultation sets out many options for decarbonising the UK's domestic maritime sector. The breadth and extent of these options is welcome, and we have given these due consideration as part of this submission. However, T&E believes that the approach set out in the consultation is fundamentally flawed on two key points:

1. The presentation of domestic and international maritime emissions as separate issues requiring separate policy responses

This is neither practical nor realistic. All maritime emissions result from a single, global system of fuel supply irrespective of where they are produced. Eliminating those emissions will require enormous capital and operating expenditure over decades, to deliver a whole-system response covering all vessel types and operations. But with perhaps the exception of battery-electric, the fundamental technological requirements of zero-emission shipping do not differ significantly between domestic and international operations. Developing a policy and regulatory framework that applies only to domestic vessels, but which ignores the question of international shipping for which the UK is responsible, is illogical and would almost certainly result in an inefficient deployment of zero-emission marine fuels, energies and associated infrastructure.

The inclusion of consultation questions about the impact of international policies for UK domestic decarbonisation shows the government is considering this. Given that international maritime emissions will be included in the Carbon Budgets from 2033, a rational approach to the design of a policy and regulatory framework for maritime decarbonisation would treat the sector as a whole, rather than seeking to separate out a tranche of less than half of the UK's maritime emissions based solely on where they are produced.

This policy problem is being driven by the government's insistence that the regulation of the UK's share of international shipping emissions is the exclusive responsibility of the International Maritime Organisation (IMO). This is quite simply untrue, and to maintain otherwise is an abdication of legal responsibility for

some 60% of the UK's shipping emissions. Legal analysis undertaken for T&E by the NGO Opportunity Green[10] finds that,

"…the UK is under a legal obligation to keep emissions to the temperature limits agreed in the Paris Agreement and as the UK Climate Change Committee pointed out, this cannot be done without tackling international shipping."

The same analysis also says,

"The legal obligation to reduce emissions from international shipping falls directly on the UK and not on the IMO. The UK is a signatory to the Paris Agreement, while the IMO is not… waiting for the IMO to act therefore inevitably violates the UK's obligations under the Paris Agreement. International law requires the UK to take action on international emissions… "[11]

If the government does not act on the UK's international shipping emissions, the burden of unabated emissions falls on other sectors; and as the IMO is not capable of agreeing policies consistent with the goals of the Paris Agreement, the UK is obligated under international law to ensure that its domestic policy framework is able to do so. Including the UK's international shipping emissions in the 6th Carbon Budget, although a welcome step, does not fulfil that obligation or even indicate how it will be fulfilled. Were the UK to rely on as-yet hypothetical IMO regulation which fails to materialise, absent a domestic framework to regulate international emissions the UK will then be in breach of its legally-binding Carbon Budgets. This is a considerable risk for the government to be taking.

We welcome the government's continued commitment to net zero by 2050 and international climate leadership. However, the European Union and the United States are currently showing more climate leadership than the UK on the regulation of international shipping emissions. The EU's amended emissions trading scheme (ETS) will include 50% of the international emissions for which the bloc is responsible. Similarly, the Lowenthal Clean Shipping Act[12] proposes to regulate emissions from international shipping by placing an operational fuel carbon standard on international vessels wishing to call at US ports. The legal basis for the regulation of emissions on the high seas is therefore proven. The UK's approach of insisting that the regulation of international emissions falls exclusively to the IMO sits at odds with the Clean Maritime Plan (CMP) commitment to the UK to 'moving faster than other countries and faster than international standards[13]'. The UK must reconsider its approach and take responsibility for its international maritime emissions.

T&E calculates that including both domestic and the UK's share of international shipping emissions in the UK ETS at a price of £80/tonne carbon dioxide equivalent (CO_2e) would create a revenue stream for the

[10] https://www.transportenvironment.org/discover/uk-legal-obligations-on-international-shipping/
[11] https://www.transportenvironment.org/discover/uk-legal-obligations-on-international-shipping/
[12] https://lowenthal.house.gov/sites/lowenthal.house.gov/files/ASL-Clean-Shipping-Act-2022.pdf
[13] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf

exchequer worth £1.08bn/year[14]. The Course to Zero consultation sets out that maritime decarbonisation could cost ~£800m/yr from the mid-2030s; and at a time when the UK's national debt is considerable, but when parts of the global shipping sector have profited more during the Covid crisis than during the past 60 years combined,[15] regulating the UK's share of international shipping emissions in this way makes perfect sense. T&E will shortly publish a position paper on why the UK must regulate its share of international shipping emissions, where we will explore this issue in more detail.

2. The assertion that the refreshed Clean Maritime Plan will only set indicative targets.

At its introduction, the Course to Zero consultation lists a number of challenges to shipping decarbonisation and then goes on to say,

> *"However, these challenges must be overcome if the UK is to meet its climate commitments and responsibilities. The evidence available demonstrates the extraordinary risk that climate change poses to our lives and livelihoods around the globe. The most recent report by the Intergovernmental Panel on Climate Change (IPCC) underlined the continuing urgency of combating GHG emissions to prevent and mitigate the worst impacts of a rising global temperature. The UK government has continued to affirm that inaction on climate change is not an option."*

In acknowledging the IPCC report, the UK presumably concurs with the IPCC's "code red for humanity" contained in the August 2021 IPCC report, which emphasised the need for short-term reductions.[16]

Contrast this with a strategy - the refreshed Clean Maritime Plan - that proposes only indicative, non-binding targets that "may inform, and subsequently be complemented by regulatory measures which include setting statutory targets within a given policy area."[17] This is in response to a climate threat the government describes as "extraordinary" and a technological transition challenge the scale of which has never been seen before, whose effective regulation has defeated the efforts of the international community as represented by the IMO. A strategy whose strength stems from indicative, non-binding targets and a vague acknowledgement of the possibility of future statutory targets is inadequate for a

[14] https://www.transportenvironment.org/wp-content/uploads/2022/06/TE-Consultation-Response-Developing-the-UK-ETS.pdf

[15] Financial Times (September 2022). 'Hard landing threat hangs over booming container shipping industry.' Retrieved at: https://www.ft.com/content/f4c3a643-bc32-4b50-a311-059a9268a20b

[16] https://news.un.org/en/story/2021/08/1097362

[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1092399/uk-domestic-maritime-decarbonisation-consultation-plotting-the-course-to-zero.pdf

"hard to abate[18]" sector responsible for 5% of the UK's emissions inventory and on its own, a dereliction of the government's duty under the Paris Agreement.

Businesses and financial institutions need predictability and policy certainty to invest. As stated by UMAS, E4Tech and Frontier Economics in 2019, "Significant financial investment is likely to be required for the development and widespread uptake of abatement options… This requires a stable policy landscape that is able to provide the market with sufficient confidence that the market opportunities will be sustainable over the longer term. Where policy is uncertain or unstable, this could be a significant barrier."[19] Providing only indicative targets will block investment.

The UK is gambling with its legally-binding obligations under the Paris Agreement. In so doing, significant legal and reputational risks emerge. This is not the action of a climate leader. The refreshed Clean Maritime Plan must commit to a policy and regulatory framework commensurate with the scale of the challenge. It must set binding, time-bound decarbonisation targets and include all shipping emissions for which the UK is responsible.

Firstly, the framework must regulate the UK's share of international maritime emissions by including them in the UK ETS. It must also capture a greater share of domestic emissions by broadening the scope of the ETS, to all vessels above 400GT. It must create demand for zero-emission fuels and energies by mandating their use and it must provide support to fund the purchase of the vessels to use those fuels and energies. It must provide significantly more ambition and funding for the development of the maritime clusters required to produce and supply zero-emission fuels and energies. It must address the issue of at-berth emissions in ports, which T&E analysis suggests are responsible for ~10% of domestic maritime emissions. And it must use effective economic instruments to implement a support package for zero-emission fuels and energies, covering both capex costs at the initial development phase and also ongoing opex support for fuel supply.

Happily, the government is not starting from scratch. T&E welcomes the proposed inclusion of domestic maritime emissions in the UK Emissions Trading Scheme (ETS), and with amendments as detailed in this submission, the ETS could become a powerful driver of maritime decarbonisation. The Renewable Transport Fuel Obligation (RTFO) is a mandate-driven market mechanism supplying renewable motor fuels of proven carbon and sustainability standards for the road and non-road mobile machinery (NRMM) sectors in the UK, and has been operating successfully for over 15 years. An effective demand-generating regulation to supply zero-emission marine fuels and energies could be based on this.

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18 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1092399/uk-domestic-maritime-decarbonisation-consultation-plotting-the-course-to-zero.pdf

19 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815666/economic-opportunities-low-zero-emission-shipping.pdf

Government has also demonstrated real vision using the support, regulate and ban (SRB) framework to introduce electric vehicles: another mechanism whose adoption we recommend for maritime decarbonisation. The establishment of UKSHORE and the £23m Phase I, £12m Phase II and £60m Phase III Clean Maritime Demonstration Competition will provide sorely-needed seed-funding for the first steps towards the creation of maritime clusters. And T&E welcomes the government's commitment to consulting both on how to support the uptake of shore power (which includes consideration of air quality), and also on the potential for a planned phase-out date for the sale of new non-zero-emission domestic vessels. These policies and commitments demonstrate that complete decarbonisation of the UK maritime sector is possible with enough ambition.

Our key policy recommendations are therefore as follows:

- Broaden the proposed scope of the UK ETS to capture CO2e and include 50% of the UK's international emissions under the UK shipping MRV regulation; reduce the ETS qualification threshold for both domestic and international vessels to 400GT and include all commercial and service vessel types;
- Expand the existing Clean Maritime Demonstration Competition fund into a broader clean shipping commercialisation / development fund, capitalised partly or wholly from ETS revenues resulting from the expanded ETS scope (~£1.1billion/year) as proposed above, to provide significant additional capital for maritime clusters and a Contract for Difference (CfD) for the development of marine e-fuel supply chains;
- Establish a Renewable Maritime Energy Obligation (RMEO) or similar, using the structure of the RTFO as a blueprint, to place a zero-carbon e-fuel and electricity mandate / quota on marine fuel suppliers, increasing incrementally over time;
- Introduce an operational marine fuel greenhouse gas intensity standard on vessel operators, measured in gCO2e/MJ with pooled compliance[20], increasing incrementally every 3-5 years and designed with sufficient stringency and dedicated quotas for the use of green hydrogen-based marine fuels.
- Implement a zero-emission berth standard in ports (designed to ensure that both climate and air quality goals are met) which could include a shore side electricity (SSE) mandate where appropriate and drive the deployment of other zero-emission technologies such as hydrogen for electricity generation when cold-ironing.

We have commented in further detail on these recommendations throughout this submission.

[20] Vessel operators would need to demonstrate compliance with the target, for example by presenting to the Administrator at the end of each reporting period evidence that the aggregated GHG intensity of all fuels used during the reporting period is at / below the target threshold. Evidence - for example, verified certificates corresponding to quantities of fuel used - could be pooled at different levels: an operator's fleet, a sub-sector (eg container vessels) or even the entire domestic or international fleet. Practically, this could mean that the most suitable vessels / sub-sectors move first, generating surplus compliance certificates which could then be traded with operators needing to reach the standard. The existing RTFO provides a blueprint.

Specific answers to individual questions

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

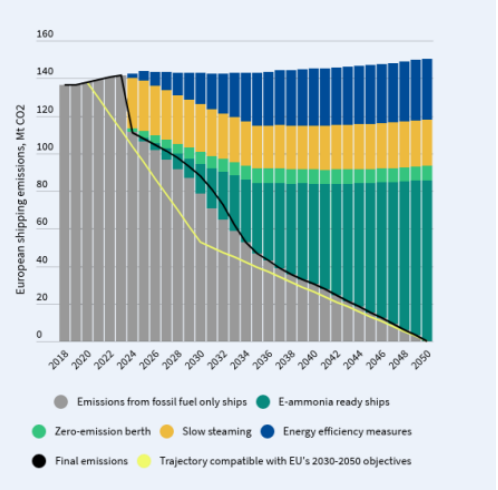
The ambition to reduce emissions nearly to zero by 2050 is good (although we advocate for zero emissions in 2050 and zero reliance on emissions removals). The feasibility however is not. As depicted in the consultation, the emissions reduction trajectory starts too late to be feasible, missing a critical target of a 50% reduction by 2030 on 2008 levels, as shown by Tyndall Centre research[21] to be required for compatibility with the Paris Agreement temperature goals. The apparent absence of the considerable abatement potential of energy efficiency measures in the immediate future is a significant contributing factor.

Deep emissions cuts are required this decade. Further, T&E questions the technical feasibility of any emissions reduction scenario that hardly deviates from the baseline until around 2032. The emissions reductions trajectories depicted in the consultation are in consequence enormously steep, and this risks presenting major technical challenges that may be simply too great to overcome in the time available, a view we share with the Tyndall Centre:

"It is not possible to leave shipping decarbonisation until the 2030s, as the required emissions trajectories in the 2030s to stay compatible with the Paris 1.5 degrees C goal would become so steep as to be infeasible. Deep emissions cuts in the 2020s are therefore essential."[22]

This is of particular concern if the trajectory is to be driven only by non-binding, indicative targets, as proposed in this consultation.

T&E analysis of the European shipping sector, whose modelling included the UK[23], shows that significant emissions abatement is possible almost immediately through efficiency measures including slow steaming (see graphic).



The Clean Maritime Plan describes the government's ambition of "all vessels operating in UK waters" to be "maximising the use of energy efficiency options" by 2025. There is a discrepancy between the emissions abatement scenarios set out in the consultation, the CMP's stated

[21] https://documents.manchester.ac.uk/display.aspx?DocID=62470
[22] https://documents.manchester.ac.uk/display.aspx?DocID=62470
[23] Analysis undertaken in 2021 using 2020 emissions data, when UK emissions were still reported as part of the EU database.

ambition for energy efficiency measures by 2025 and the modelled abatement potential of such measures demonstrated by T&E analysis.

T&E advocates a policy and regulatory approach for the refreshed CMP that includes energy efficiency, slow steaming and zero-emission berths, but also emissions trading and an operational fuel greenhouse gas intensity standard introduced without delay. We have commented on these in more detail elsewhere in this submission.

2) What role do you think the following alternative fuels and energies may play in decarbonising domestic maritime sector vessels (within your subsector, if appropriate)? What evidence do you have to support this opinion?

Some fuels and energies, notably e-ammonia, e-hydrogen and electricity, are essential for maritime decarbonisation. Others, such as LNG, biofuels and nuclear, should be avoided at all cost.

T&E analysis of the European shipping sector[24] models the initial deployment of sustainable e-fuels produced from renewable electricity from the mid-2020s, with rapid take-up in the 2030s. Of these fuels, green ammonia appears to be the cheapest, with green liquid hydrogen gradually catching up by 2050. However, given the superior energy density and lower storage costs, T&E considers that green ammonia is likely to remain the cheapest e-option for ocean-going vessels from the total cost of operation perspective. T&E is calling for a 6% maritime e-fuel mandate by 2030 as part of the proposed FuelEU Maritime Regulation, an approach that could also be effective in the UK. Our response to Qu15 provides further detail.

T&E analysis of UK renewable electricity potential for transport sets out that in 2050, the UK shipping sector will require 84TWh of renewable electricity[25], or 23% of all transport electricity demand. In our base case (high electrification) scenario, this is divided between direct electrification (19%), hydrogen (27%) and ammonia (54%). In its response to the recent Targeting Net Zero consultation from July 2021, the Department for Transport said that it is "likely that hydrogen and other renewable fuels of non-biological origin (RFNBO) will be fundamental for other modes that may not be able to fully decarbonise otherwise, such as shipping and aviation".[26] Furthermore, analysis underpinning the government's recent Hydrogen Strategy suggested transport demand could potentially reach 140TWh in 2050.[27] T&E welcomes the government's anticipation of very large quantities of renewable hydrogen being required for transport, although we affirm that hydrogen for transport applications should be

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[24] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1103897/targeting-net-zero-next-steps-for-the-renewable-transport-fuels-obligation-government-response.pdf

[25] Includes all domestic shipping and outbound journeys from the UK

[26] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1091633/targeting-net-zero-next-steps-for-the-renewable-transport-fuels-obligation-hydrogen-and-renewable-fuels-of-non-biological-origin.pdf, p.4

[27] Hydrogen Analytical Annex, box 4.

produced only from 100% renewable, additional electricity, and should be directed exclusively into the shipping and aviation sectors.

Battery-electric technologies will be essential, but are likely initially to be used for short, predictable routes such as ferries, which points towards a primarily domestic application. Although we acknowledge discussion of the theoretical potential of battery-electric systems for large, international applications[28].

T&E is particularly opposed to the use of LNG as a maritime fuel. LNG is made up primarily of methane, a powerful greenhouse gas 86 times more potent than CO2 over a 20-year period (and 36 times more potent over a 100-year period). Choosing fossil LNG over renewable marine fuels goes against the Global Methane Pledge[29] signed by the UK after COP26 which aims to cut methane emissions by 30% between 2020 and 2030. It also goes against the World Bank's recommendations asking policymakers to not support the development of bunker LNG, given uncertainties around its greenhouse gas benefits.[30] In fact, according to a 2020 study by the International Council on Clean Transportation[31] (ICCT), the climate benefits of relying on LNG as a fuel are small: "Over a 100-year time frame, the maximum life-cycle GHG benefit of LNG is a 15% reduction compared with MGO, and this is only if ships use a high-pressure injection dual fuel (HPDF) engine and upstream methane emissions are well-controlled"[32].

Furthermore, LNG has the very real potential to increase emissions[33] owing to methane leakage both upstream and also on board vessels[34]. Unburned methane from engine exhausts (methane slip) remains an issue regardless of whether the fuel is of fossil or renewable origin. According to a study by the ICCT published in September 2022, "even with 100% renewable LNG emissions in 2030 are 6% would be higher than 2019"[35] over a 20-year period (due mainly to methane slip). By developing the use of LNG at a domestic level, the UK risks locking in assets that are compatible with LNG only. LNG vessels will over time increase demand for bio-LNG and e-LNG, both of which present problems.

Insufficient resources exist to produce sustainable bio-LNG for the maritime sector as well as other industries. The limited domestic production of waste-based biofuels would lead to high imports of LNG, which would in return lead demand for unsustainable crop-based feedstocks produced outside Europe. The graph below compares the demand for bio-LNG compared to the demand for gas from European (including UK) households, trucks, and shipping, illustrating a significant gap.

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[28] https://chargedevs.com/newswire/researchers-say-electric-ships-could-economically-serve-40-of-todays-sea-routes/?utm_source=ChargedEVs.com+Email+Newsletter+Opt-in&utm_campaign=2f87862d0c-Daily+Headlines+RSS+Email+Campaign&utm_medium=email&utm_term=0_6c05923d39-2f87862d0c-343849693

[29] https://www.globalmethanepledge.org/

[30] https://openknowledge.worldbank.org/handle/10986/35437

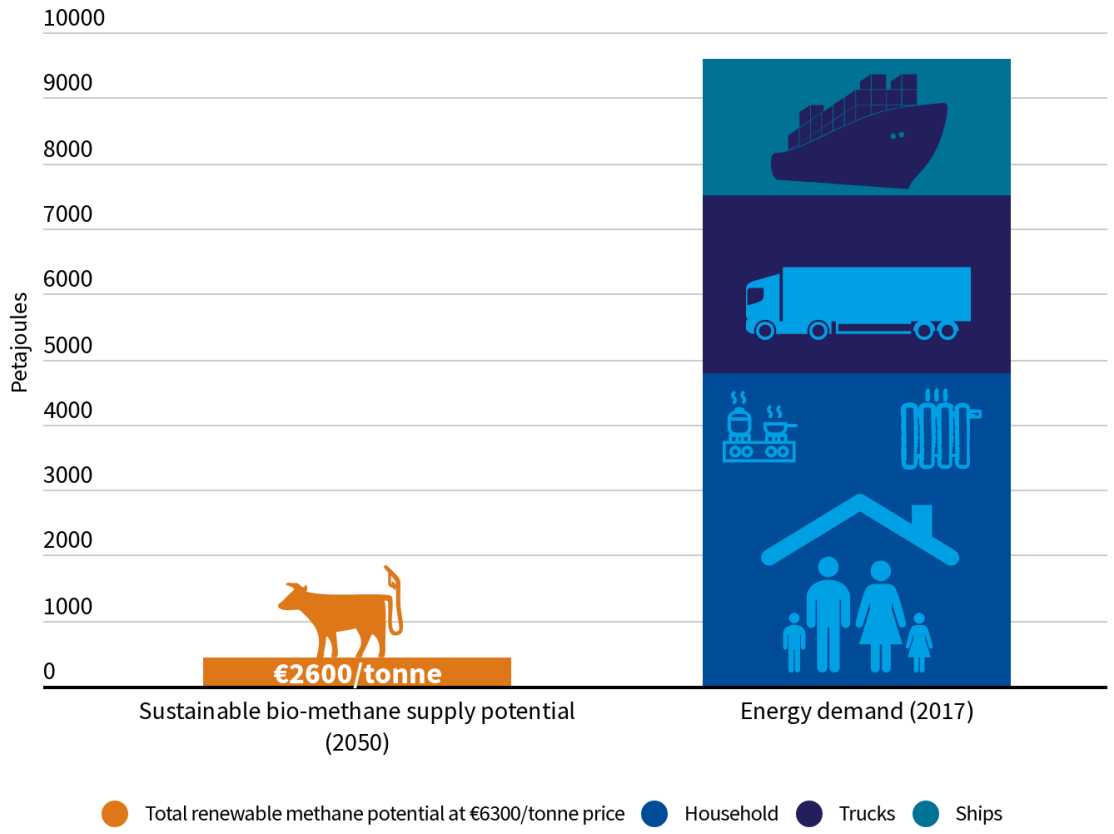
[31] https://theicct.org/wp-content/uploads/2021/06/LNG-as-marine-fuel-working-paper-02_FINAL_20200416.pdf

[32] https://theicct.org/wp-content/uploads/2021/06/LNG-as-marine-fuel-working-paper-02_FINAL_20200416.pdf

[33] https://openknowledge.worldbank.org/handle/10986/35437

[34] https://www.transportenvironment.org/discover/methane-escaping-from-green-gas-powered-ships-fuelling-climate-crisis-investigation/

[35] https://theicct.org/publication/lng-marine-fuel-sep22/



Notes: The chart is conservative as it compares 2050 supply with 2017 demand. This supply would only be feasible at a retail price of €6300/t (excluding taxes), which is more than 10 times higher than the current LNG prices. Energy demand for households is limited to natural gas demand only.

Sources: ICCT (2018), Eurostat (2017), UNFCCC (2017).

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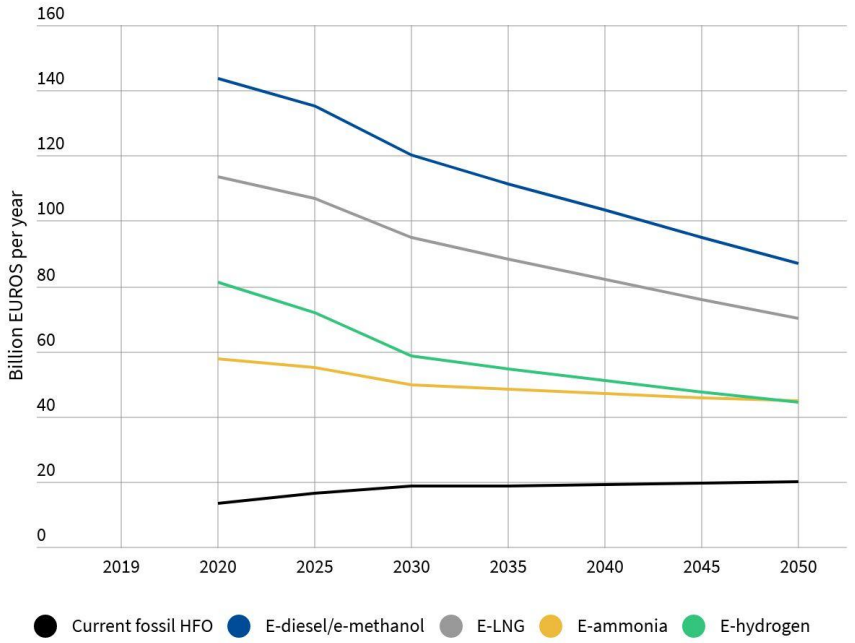
The manufacture of e-LNG requires a source of carbon, and direct-air capture (DAC) technology is likely to be required. However, the costs are uncertain, and T&E considers that shipping companies are likely be discouraged from using e-LNG on cost grounds as the below graphic illustrates:

How much would e-fuels cost to EU shipping?

(Ricardo EAE e-fuel cost estimations)



Source: T&E estimations based on fuel consumption projections for EU shipping (full MRV scope) and cost of e-fuel production with high DAC from Ricardo EAE, 2020.

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There is a role both for on-board solar and wind-assist technologies - see our comments at Qu3.

While carbon-based synthetic fuels such as e-methanol or e-methane with direct CO2 air capture (DAC) can theoretically be sustainable, they are likely to come at a cost premium compared to non-carbon-containing hydrogen carriers. This will likely have implications on their adoption by the shipping sector. As advised by the Climate Change Committee,[36] biofuels should not be used in shipping, even in the short-term, as this does not represent the best use of bioenergy and will simply prolong the life of the existing high-carbon infrastructure.

Nuclear-powered commercial shipping presents notable challenges: nuclear technologies are banned in various jurisdictions of the world meaning nuclear-powered vessels cannot sail universally. Nuclear technology carries considerable waste, security and safety risks and is at odds with non-proliferation treaties.

[36] https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Shipping.pdf

3) What value do you think different efficiency and energy saving measures could have in helping to achieve domestic maritime vessel decarbonisation?

Energy efficiency and energy saving measures can be used immediately to achieve significant emissions reductions.

T&E analysis of the European shipping sector demonstrates that up to one third of shipping emissions could be eliminated by energy efficiency measures alone and, when combined with operational measures, could achieve a fuel economy improvement of up to 41% by 2030[37]. Measures include wind-assist, on-board solar and hull-air lubrication. Some can be implemented immediately and can be driven by mandates, effective carbon pricing or a combination of both. Given the necessity to reduce emissions this decade, the case for action on energy efficiency is indisputable.

Furthermore, T&E analysis of the most efficient pathways to electrify UK transport[38] shows that measures to ensure ships operate as efficiently as possible, such as slow-steaming, wind assistance and improved use of cargo space, are needed to reduce energy demand from the sector.

As noted at our response to Qu1, the short-term emissions savings resulting from the immediate implementation of energy efficiency and energy saving measures are absent from the emissions reduction trajectories set out in the consultation which, even under the accelerated emissions reduction scenario, show almost no deviation from the baseline until around 2032 at the earliest.

Recent research by the Tyndall Centre demonstrates up to 24% CO2 emission reductions in a year are possible by employing wind propulsion systems that incorporate route optimisation[39], whilst the Climate Change Committee, in its sector report on Carbon Budget 6, recognises the significance of fleet efficiency improvements (via a combination of slow steaming, operational optimisation, ship hull design and new engine efficiency improvements, onboard renewable power generation (e.g. solar) and wind propulsion systems) and recommends increased R&D funding in these areas[40].

Energy efficiency measures can be deployed swiftly to deliver short-term emissions abatement. In the longer term however, their role is to ensure the most efficient operation of vessels pursuant to minimising consumption of zero-emission fuels. As zero-emission fuels are estimated to cost at least four times today's conventional fuels, efficiency measures must be implemented in combination with, and not as a substitute for, zero-emission fuels and energies.

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37 https://www.transportenvironment.org/wp-content/uploads/2021/07/202104_Shipping_Technological_Roadmap_to_Decarbonization.pdf

38 https://www.transportenvironment.org/wp-content/uploads/2021/07/T&E%20Briefing%20-%20feasibility%20study%20renewables%20for%20decarbonisation.pdf

39 https://documents.manchester.ac.uk/display.aspx?DocID=62470

40 https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Shipping.pdf

Shore side electricity (SSE) can be considered both as an energy efficiency and energy saving measure, given its capacity to reduce emissions at the point of use. The UK has only 2 SSE facilities, at Southampton and Orkney. The UK's deployment of SSE is behind some EU countries, including Germany (4) and France (3) according to the UK Chamber of Shipping. SSE can make a significant difference to maritime emissions, because vessels are required to report at-berth emissions under the UK MRV.

T&E supports a number of the points listed by the UK Chamber of Shipping on SSE, which calls for a regulatory framework to drive SSE uptake across ports and fleets by 2030, prioritising ports and vessels with predictable port calls (including containerships, tugs and offshore vessels) and the highest achievable impact on predicted emissions[41]. T&E also recognises that implementing SSE in the UK is likely to be more challenging than in some EU Member State ports due to, inter alia, challenges in determining liability for costs, and electricity grid capacity constraints. A more general "zero-emission berth" standard as suggested in the government's recent call for evidence on SSE, covering both GHG and other air pollutants (e.g. SOx, PM, NOx), may be more suitable for the UK initially, but which could include a requirement for SSE under certain conditions. A zero-emission berth standard is included in the proposed FuelEU Maritime regulation[42], which would set a SSE mandate by 2030 on containerships, cruise ships and ferries, unless ships use alternative zero-emission technologies to power their energy needs while in the port area. Alternative technologies should be both zero-GHG and zero-pollution, such as hydrogen fuel cells, onboard batteries or onboard generation of wind or solar energy. Such a goal-based mandate would allow ports to determine the most cost-effective option based on quantity of domestic vs international traffic and the influence of international regulations. This echoes pledges from ports around the world to make available SSE by 2028[43].

4) How should the technological transitions required to decarbonise the domestic maritime sector best be supported? What evidence do you have to help refine our understanding in this area?

T&E's views on the technological and operational changes needed to decarbonise the shipping sector (and the associated policy and regulatory frameworks) include future fuel and energy requirements, and costs vs benefits. They are expressed variously throughout this submission, so we will not reiterate them here. However, we sound a note of caution with regard to trade-offs between short- and long-term emissions reductions and the use of "interim" fuels.

Interim fuels are being promoted in some areas of the industry as necessary for the transition to net zero. Such fuels include LNG, whose (potentially) low(er)-carbon substitutes include biomethane and e-methane, and other biofuels including biodiesel as a substitute for traditional fossil marine fuels. T&E considers that the use of these fuels in marine applications is a dead-end. Together with the Climate Change Committee, T&E opposes any use of bioenergy in the maritime sector as an inappropriate use of a scarce resource that will serve simply to prolong the life of the incumbent fossil fuel infrastructure and

[41] https://ukchamberofshipping.com/latest/uk-chamber-shipping-mandate-green-shore-power-ports-and-ships/
[42] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0562
[43] https://www.ecologie.gouv.fr/sites/default/files/declarationoosmodif1608.pdf

deter investment in zero-carbon alternatives. Furthermore, the use of synthetic hydrocarbons such as e-methane is not a cost-effective solution. T&E advocates a policy approach that reduces energy requirements and emissions in the short-term through energy saving and energy efficiency, whilst at the same time investing heavily in zero-carbon e-fuel development, for large-scale deployment in the 2030s. We have commented on this approach in detail elsewhere in this submission.

5) Are you able to provide any additional evidence on the costs and benefits associated with decarbonising UK domestic maritime vessels?

Yes.

Whilst T&E does not hold data on the overall or sub-sector specific costs of maritime decarbonisation in the UK, T&E analysis shows that maritime decarbonisation will not lead to large increases in the cost of shipping commodities. The analysis is at EU level and makes certain assumptions around the impacts of a more ambitious FuelEU Maritime regulation and ETS. However, the results obtained for a fully hydrogen-powered ship are very much relevant for the UK. The study shows that running containerships on 100% renewable hydrogen-based fuels would add a maximum of €0.08 to the cost of a pair of shoes shipped from China to Europe. Similarly an average TV and refrigerator shipped to Europe would respectively cost a maximum of €1 and €8 more. For an average TV that costs about €300, this would represent a maximum of 0.3% in price if all the costs are passed on to the final consumer.[44] Whilst for illustrative purposes for this consultation, the analysis demonstrates that the cost increases to a range of commodities resulting from green shipping are insignificant.

T&E acknowledges the various benefits of maritime decarbonisation as described in the consultation, including for climate, air quality and the economy more broadly. We have no further insight into these at this stage, but we offer the following comments:

Government's assessment of the social costs of carbon emissions tells an incomplete story. As flagged by the Tyndall Centre's recent policy briefing on decarbonising shipping, the Clean Maritime Plan uses an outdated Treasury Green Book value to determine if carbon savings have net societal benefits[45]. That carbon savings value tripled in the government's 2021 update, meaning 90% of maritime emissions reductions now have net societal benefits (compared to an estimated 26-34% of benefits using the old value).

While not additional evidence, we flag the analysis of UK economic opportunities of maritime decarbonisation undertaken by UMAS, E4Tech and Frontier Economics in 2019. The strengths of the UK maritime sector are compelling, both in decarbonisation technologies such as hydrogen, ammonia and battery-electric, and also in maritime professional services including finance, vessel chartering,

[44] Figure 3, "Running ships on 100% green hydrogen would add just cents to most consumer goods" in T&E 2022 study "Cost of clean shipping is negligible"
[45] https://documents.manchester.ac.uk/display.aspx?DocID=62470

insurance, legal and educational services[46]. The government must ensure the UK capitalises on these strengths.

6) How should intermediary, indicative decarbonisation targets for UK domestic maritime sector vessel emissions be formulated?

T&E does not offer views at this stage on the different sub sector emissions inventories, nor which to prioritise for decarbonisation or over what timeframe. The aggregated maritime emissions inventory must be consistent with a Paris Agreement-compliant emissions reduction pathway, and we affirm that the most effective method of ensuring this is to set binding, time-bound targets covering vessel energy efficiency and energy saving, SSE, e-fuel supply / use and operational fuel greenhouse gas intensity. Our response to Qu14 provides more detail.

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

All of these barriers exist because shipping, and its dependence on carbon-based fossil fuel, is a classic example of market failure at the global level. On that basis, T&E does not consider that any one barrier is more significant than the others, as effective policy and regulatory interventions to internalise the pollution costs of the shipping sector will need to address them all. Government must intervene, boldly, decisively and now.

Nevertheless, we consider that addressing the current **absence of demand for zero-emission marine fuels and energies** must be a policy priority for the government, and that doing so through the implementation of an integrated policy, regulatory and support framework including binding, time-bound targets will overcome many of the barriers identified in the consultation.

It is insufficient to create a supply of green fuels (eg via a mandate) on its own, because without other interventions there will be no market for such fuels. The shipping sector stands apart from aviation due to different propulsion system requirements. Whilst most aircraft can use sustainable aviation fuel (SAF) - notably, e-kerosene - without significant modification to engine and fuel systems, there are no feasible, large-scale, drop-in, zero-carbon fuels currently available to the maritime sector. Whilst some existing internal combustion engines can be modified to burn e-ammonia, the vessel retrofit requirements are considerable. Further, integrating e-hydrogen fuel cells or battery-electric technologies can only be achieved cost-effectively and at scale in new-build vessels designed specifically for their use.

We have seen the practical limitations of a lone UK policy to enable the supply of e-hydrogen to the maritime sector through the recent modifications to the Renewable Transport Fuel Obligation (RTFO). Whilst this development is welcome and means the economics of supplying renewable e-hydrogen for

46 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815666/economic-opportunities-low-zero-emission-shipping.pdf

use in maritime applications may now be more favourable thanks to the provision of Development Fuel Renewable Transport Fuel Certificates (dRTFCs), DfT statistics indicate no e-hydrogen supplied to the UK maritime sector in 2022[47]. The absence of any market or regulation-driven demand from ships to use this fuel is likely to be the reason for this.

8) Which international policies, programmes, and initiatives do you expect will have the most impact on how the UK's domestic maritime sector decarbonises?

This is difficult to answer because it means considering the decarbonisation requirements of domestic vessels as separate from international vessels. We disagree with this approach and have commented further at the introduction. However, international policies (and the international vessels they capture) are likely to impact the UK port sector (which we presume is included in the definition of the UK's "domestic maritime sector"), as follows:

- **Shore power:** China and the State of California have introduced shore power requirements, whilst those within the EU (through the Alternative Fuels and Infrastructure Regulation, AFIR, and the FuelEU Maritime Regulation) and at the US Federal level are in development. International vessels calling at UK ports will require shore power, which will require greater deployment of the technology. We have commented on this in more detail at our response to Qu3.
- **IMO regulations (notably EEDI, EEXI, EEOI and CII)** apply to vessels making international voyages only so the direct impact of such policies are negligible in the UK. However, the IMO regulations work as CO2 standards, and are having a pernicious impact by driving the global shipping sector towards LNG and fossil methanol. This could have knock-on effects for UK port infrastructure if international vessels calling at UK ports require these fuels.
- **FuelEU Maritime:** the proposed fuel carbon standard is likely to result in some demand for green e-fuels within the EU, although T&E analysis indicates that without amendments (notably, bringing forward the incremental fuel carbon reduction standard by 5 years and a dedicated hydrogen quota, see our response to Qu15 for more detail), the industry will likely continue its move towards LNG which would still be a compliant fuel well into the 2040s. UK vessels making port calls in the EU will need to comply with the Regulation.
- **Green shipping corridors**: T&E notes the current press around the creation of green shipping corridors, and the UK's leadership on the Clydebank Declaration at COP26. This is welcome, although the UK needs to be more active in driving the creation and development of corridors and fostering the necessary industry collaborations. Even absent the creation of green corridors, port infrastructure needs to be built as a matter of urgency, to service vessels' requirements on shore power and zero-emission fuels. An efficient use of such infrastructure at the development phase would be in the service of both international and domestic zero-emission vessels so careful consideration should be given to both domestic and international requirements concurrently in this scenario.

[47] https://www.gov.uk/government/statistics/renewable-fuel-statistics-2022-first-provisional-report

- **The Lowenthal Clean Shipping Act** was tabled in the United States Congress earlier this year and proposes a Federal fuel greenhouse gas intensity standard similar to, but more stringent than, the proposed FuelEU Maritime Regulation. If passed into Federal law in its current form, the Act would apply to all US and international vessels calling at US ports and require full decarbonisation of their emissions by 2040[48].

For the UK, the combined impacts of these policies could be a greater requirement for hydrogen-based fuels, other alternative marine fuels and shore-power from EU and UK vessels frequenting EU and UK ports. T&E supports scaling up deployment of shore power and e-fuels (we have commented on this elsewhere), but strongly opposes any further investment in LNG as a shipping fuel, and the UK should not pursue this, or policies related to LNG infrastructure, under any circumstances. Our response to Qu2 refers in greater detail.

9) What do you think are the key lessons from international policies, programmes, and initiatives that we should consider in our approach to decarbonising the UK domestic maritime sector?

The UK can look internationally both for lessons and examples relevant to implementing a domestic policy and regulatory framework for maritime decarbonisation. Key lessons of direct relevance to UK maritime decarbonisation policy include the following:

- **The UK must not exclusively rely on the IMO for the effective regulation of international emissions.** As we have set out at the introduction, the IMO has proven itself incapable of agreeing and implementing a maritime decarbonisation framework that is consistent with the goals of the Paris Agreement. The UK must implement a policy and regulatory framework that covers all emissions for which it is responsible.
- **The EU ETS could contribute more fully to maritime decarbonisation.** The EU ETS will soon include 50% of the international emissions for which the bloc is responsible. However, as set out in our EU ETS policy briefing from November 2021, further changes are needed. These include the provision of maritime Contracts for Difference (CfDs) to de-risk operational costs for first-moving companies; and reducing the qualification threshold from 5,000GT to 400GT[49]. We recommend these policies for the UK ETS and have commented in more detail at our response to Qu10.
- **The proposed FuelEU Maritime regulation risks locking in LNG as a marine fuel until 2046 unless strengthened.** Currently under consideration at triologue, the proposed regulation includes a goal-based fuel carbon intensity target measured in gCO2e/MJ energy used, increasing in stringency every five years. Such a standard would be highly effective in driving e-fuel uptake if stringent enough. However, the current EU standard could permit the use of LNG until 2046, thus providing a blueprint for the UK to improve upon as per T&E recommendations for the Regulation. Our answer to Qu15 provides further detail.

[48] https://lowenthal.house.gov/sites/lowenthal.house.gov/files/ASL-Clean-Shipping-Act-2022.pdf

[49] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf

- **The Alternative Fuels and Infrastructure Regulation (AFIR) requires ports to invest in LNG infrastructure.** This should be avoided at all costs in the UK. LNG is not a viable alternative to traditional fossil marine fuels and its use is entirely incompatible with the UK's climate objectives. We have commented in detail on this elsewhere in this submission.

Examples of effective policies and programmes in development in other jurisdictions include the following:

- **Shore Side Electricity (SSE)**: currently mandated by FuelEU Maritime and the AFIR. China and the State of California have introduced SSE requirements. International vessels calling at UK ports will increasingly require SSE. The UK government must act to address the lack of SSE in UK ports. Mandating a quantity of SSE under a zero-emission berth standard is one option to achieve this. We have commented on this further at our response to Qu3.
- **REFuelEU:** will mandate e-fuels for aviation. This is also the approach adopted by the UK via the SAF mandate. The UK needs a demand-generating regulation for clean shipping fuels and the structure of the SAF mandate could guide a maritime e-fuel mandate.
- **EU Energy Tax Directive (ETD):** The EU's decision to revise the zero-rating for marine fuels in the ETS as part of its Fit For 55 package is a strong proposal to reduce fossil fuel subsidies while diminishing the risk of tankering (vessels bunkering outside a certain jurisdiction). This is achieved by setting tax rates relatively low and implementing carbon pricing to ensure the external costs of fossil fuel use are internalised. Furthermore, the EU's ETD revision means that the UK can set strong taxes for marine fuels without risk of tankering, as all close-by jurisdictions also set these taxes;
- **EU Taxonomy**: entered into force in January 2022. It labels green capex and opex investments in zero-emission ships, as well as efficiency measures for a transition period to 2025;
- **REDIII**: will mandate a minimum share of e-fuels to be supplied to the transport sector. A subtarget for maritime is in discussion; and
- **National measures:** The Norwegian Parliament has adopted a measure to halt emissions from cruise ships and ferries in the West Norwegian Fjords by 2026[50]. The measure is driving the development of zero-emission technologies in Norway.

10) Are there any additional interventions targeting economic barriers that the government could explore introducing to complement and enhance our current approach, in the short, medium, and long term?

Yes.

The UK ETS is the primary economic instrument to internalise the pollution costs of the maritime sector, and we welcome the government's proposal to include a proportion of UK domestic maritime emissions.

[50] https://whc.unesco.org/en/news/1824

However, the ETS could capture a much greater proportion of UK maritime emissions and in so doing, provide funding for further, much-needed decarbonisation.

As we have said at Qus 9 and 14, the scope of the UK ETS should be expanded. In the interest of moving faster than other countries (an ambition of the Clean Maritime Plan), the ETS should be broadened to include at least 50% of the international emissions for which the UK is responsible, all relevant GHGs from shipping rather than just CO2 (which means modifying the UK MRV accordingly), and all vessel types (not just those carrying cargo and passengers). The qualification threshold should be lowered from 5000GT to 400GT. As we set out in our response to the UK ETS consultation, a threshold of 400GT is in line with all pre-2018 IMO legislation (EEDI, EEXI and SEEMP)[51]; and indeed has been called for by shipowners[52] at the EU level. Expanding the UK ETS to capture international maritime emissions could be done via an amendment to the Statutory Instrument establishing the UK ETS (the Greenhouse Gas Emissions Trading Scheme Order 2020) rather than amending primary legislation because the Climate Change Act gives the government powers to establish emission trading schemes so that no further primary legislation was required[53].

If the UK does not have sufficient appetite to apply carbon pricing to international maritime emissions at present, they could be still be included in the ETS on a free, non-transferable emissions allowance allocation basis, without the need to surrender permits: in other words, emissions from international voyages will be part of the UK ETS but operators will not be required to pay for them at this stage. Alternatively, the UK could regulate emissions from international voyages between the UK and areas that have imposed similar measures (eg the EU/EEA). These would be a useful interim measure in preparing the industry for tighter future regulation.

Emissions may be regulated more accurately via the ETS if the UK's approach is amended from a fuel-sales basis to an activity basis, as used at EU and global levels. Basing emissions on fuel sales skews and masks the UK's true contribution to international emissions. This is partly due to the ease of bunkering in neighbouring jurisdictions, but also because where a vessel bunkers has little relation to its actual work. This was highlighted by the Climate Change Committee as something the UK needs to look at very carefully. The report states that the UK should:

"Build upon the proposals for the UK Emissions Trading Scheme and the UK MRV regulations to explore options for an activity-based measure of UK shipping emissions. This should include exploring the benefits of changing the emissions accounting approach for international shipping, to ensure that a fair share of

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51 https://www.transportenvironment.org/wp-content/uploads/2022/06/TE-Consultation-Response-Developing-the-UK-ETS.pdf

52 https://www.transportenvironment.org/discover/application-of-the-polluter-pays-principle-to-shipping-ets/

53 Section 44(1) of the Climate Change Act 2008 provides the power for the UK to establish trading schemes relating to greenhouse gas emissions and the Greenhouse Gas Emissions Trading Scheme Order 2020. S.I. 2020/1265 established the UK ETS.

emissions for voyages to and from the UK are captured within the UK's inventory even if vessels refuel in other jurisdictions."[54]

The UK should use part or all of the ETS revenues from domestic and international shipping to support maritime decarbonisation. We consider this to be the most fair and equitable way to share the costs of maritime decarbonisation across the sector and associated supply-chains. T&E welcomes the creation of UKSHORE, and the £23m Phase I, £12m Phase II and £60m Phase III Clean Maritime Demonstration Competition (CMDC) R&D funding. However, this funding on its own is inadequate for the development of maritime clusters, as being one of the CMP's stated objectives by 2035. In addition to clusters, further funding is required for de-risking and establishing e-fuel production and supply-chains at the development phase; for domestic operators wishing to invest in zero-emission vessels (which could be differentiated according to the capacity of such operators to absorb the costs); and for institutions to develop safety and handling protocols for alternative fuels.

ETS revenues could be directed either through a dedicated innovation fund under the ETS; or, if none exists, into a clean maritime commercialisation fund that could be an evolution of the existing CMDC. Such a fund could be used to capitalise further CMDC rounds and provide a Contract for Difference (CfD) for the development of e-fuel supply chains. The CfD would complement policies to guarantee e-fuel use (eg an e-fuel obligation on vessel operators using the existing RTFO structure as a blueprint as described at our response to Qu14). The government could also consider how to support financial products such as residual risk insurance for first-movers.

At the EU level, it should be noted that the creation of a dedicated "Ocean Fund" for maritime decarbonisation R&D, using EU ETS revenues, is currently under discussion at triologue; and also that earmarking EU ETS revenues for maritime decarbonisation has the backing of the European Parliament. If the UK included international maritime emissions in the ETS as we propose, the bulk of revenues would be provided by large, international ship operators who are much better able to accommodate decarbonisation costs than smaller, domestic operators. It is interesting to note that the annual fuel, non-fuel-operating and capital decarbonisation costs for the domestic shipping sector as set out in the consultation, even when combined, amount to less than the projected annual revenues from an ETS that includes both domestic and international emissions.

Further options to support the sector exist around marine fuel taxation, and discounts for green ships such as reduced berth fees or differentiated harbour dues.

11) What are the potential benefits and impacts of mandating or incentivising the incorporation of energy efficiency and energy saving measures on board domestic maritime vessels, where possible?

As we have said at our response to Qu3, T&E analysis demonstrates that up to one third of shipping emissions could be eliminated by energy efficiency measures alone and, when combined with

[54] 2022 Progress Report to Parliament, Climate Change Committee, June 2022.

operational measures, could achieve a fuel economy improvement of up to 41% by 2030[55]. Given the necessity to reduce emissions this decade, the case for action on energy efficiency is indisputable.

The IMO energy efficiency standards (EEDI and EEXI) for new and existing vessels are too weak in practice to drive decarbonisation of the global maritime fleet at the rate required to meet the objectives of the Paris Agreement. The International Council for Clean Transportation (ICCT) estimates that EEXI, as proposed, would reduce CO2 from the 2030 fleet by 0.7% to 1.3% from a baseline without the EEXI, due to the continuing prevalence of slow steaming.[56] The fact that many new-build vessels are achieving efficiency improvements in excess of the 2025 IMO EEDI requirement has been shown to be due to normal market conditions (global freight rates and fuel costs), rather than the regulation itself.[57]

The government could mandate efficiency measured in kWh/T-nm or Mj/T-nm with pooled compliance, differentiated according to vessel type and size category, given varying degrees of potential to improve efficiency (i.e. fuel economy) and according to sub-sector. The mandate could be technology-neutral to allow sub-sectors to select the least-cost options, and phased in incrementally to spread costs and allow for expected rates of re-fleeting. Effective carbon pricing could also drive the uptake of measures.

T&E has estimated at-berth emissions in the UK by comparing EU MRV data before and after the UK's withdrawal from the European Union. Owing to the method of calculation this estimate should be considered approximate but across the sector, at-berth emissions are ~10% (acknowledging significant variations between subsectors) of total domestic maritime emissions. This is significant, and gives an indication of the emissions abatement potential of cold-ironing at berth, which could at least in part be realised by the provision of SSE. As stated at our answer to Qu3, we recognise that the UK faces challenges in this regard when compared with other neighbouring port states, and we recommend a zero-emission berth mandate that includes SSE where appropriate. Alternatives to SSE that offer zero-emissions, for example via the provision of hydrogen to compatible vessels, could in theory achieve the same goal. Critically, any zero-emission berth mandate must be compatible with both climate and air quality objectives, thereby precluding LNG.

12) What are the potential benefits and impacts of developing a zero-emission capability standard, either as a mandate or incentive for new ships? What do you think is a reasonable definition of zero-emission capability?

A zero-emission standard can be transformative, but must be defined correctly, and introduced concurrently with policies to ensure supplies of zero-emission fuels are available.

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55 https://www.transportenvironment.org/wp-content/uploads/2021/07/202104_Shipping_Technological_Roadmap_to_Decarbonization.pdf

56 https://theicct.org/sites/default/files/publications/Marine-EEXI-nov2020.pdf

57 https://www.transportenvironment.org/discover/almost-three-quarters-new-ships-carrying-consumer-goods-already-exceed-imos-post-2025-energy/

We are seeing a sizeable industry response to the proposed introduction of a zero-emission vehicle mandate in the UK, which will effectively drive uptake of electric vehicles. A zero-emission maritime standard, as a technology-neutral instrument, allows the introduction of fuels / energies and technologies most appropriate to vessel class, size and use.

However, in the development of any standard, great care must be taken. Introducing a zero-emission standard must be done in conjunction with ensuring that adequate quantities of fuel / energy are available and can be supplied reliably to vessels; doing otherwise carries the risk of stranded assets and / or failure to fulfil national decarbonisation obligations. Government should also consider how to support smaller operators without the capital to invest in zero-emission vessels (and we have commented on this in more detail elsewhere in this submission). This would avoid the risk of operators (for example) purchasing dual-fuel vessels and then continuing to use high-carbon fossil fuels because zero-carbon alternatives remain unavailable.

A zero-emission-capable standard should be defined in legislation and should target vessel operation, not vessel design. For example, if the government mandates the use of e-fuels and signals that this will grow over time, operators are free to choose fuels / technologies to meet the target at least cost according to needs across the different sub-sectors.

13) Are you aware of any domestic or international regulatory measures that you think currently discourage progress toward maritime decarbonisation, and should be reviewed by the government?

Yes.

We have commented on international regulatory measures at our answer to Qu9, so will not provide a detailed response here. However, suffice to say that we consider the **IMO's energy efficiency and carbon intensity standards** to be actively incentivising LNG and fossil-based methanol in global shipping, and the UK must take care to avoid replicating a similarly weak standard at the domestic level. The same is true of existing provisions in the draft **FuelEU Maritime fuel carbon standard** proposal from the EU Commission (which will likely encourage LNG unless targets are tightened and dedicated targets for e-fuel uptake are introduced), and the **EU AFIR,** which requires LNG port infrastructure. As expressed elsewhere in this submission, any policies encouraging LNG must be avoided. If the UK is considering introducing port air quality standards, LNG must not be permitted to meet such a standard owing to its incompatibility with Net Zero. And limiting the scope of the UK ETS to domestic vessels forgoes £600m/yr from international emissions, that could be used to fund maritime decarbonisation.

Fossil fuel subsidy is a policy operating both internationally and domestically which actively discourages maritime decarbonisation. Globally, the absence of effective taxation on marine bunker fuels does nothing to break the tremendous inertia of the existing, high-carbon global shipping infrastructure. Even at today's elevated prices, bunker fuels remain a beneficiary of a significant, market-distorting subsidy because the pollution costs associated with their use remain largely external to the market. Nationally,

relief from marine fuel duty can be claimed for marine voyages[58], which effectively encourages fuel use. This is a subsidy, because the environmental costs of carbon and other pollutants resulting from the use of marine bunker fuels are largely externalised. Placing an appropriate level of taxation on these fuels would not disadvantage the UK compared to other jurisdictions, and begin to level the playing-field between the costs of traditional fossil fuels versus renewable alternatives.

The National Policy Statement (NPS) for ports, part of the planning system, is 10 years old. Maritime decarbonisation will require significant changes to port infrastructure to provide large amounts of electricity and alternative fuels, some of which are hazardous. The NPS should be assessed and updated where necessary to ensure the planning process is fit for purpose and facilitates, rather than hinders, the transition.

Finally, **the UK's RTFO** supports RFNBO hydrogen for use in the maritime sector, and this is to be welcomed in principle. However, absent demand for this fuel as is the case at present (hydrogen is not a drop-in replacement for traditional marine fuels and the RTFO does not require the supply of hydrogen or hydrogen-based fuels for maritime use), the policy makes no material difference to maritime decarbonisation. Further, it places a funding obligation for any marine fuel supplied on the UK motorist. A mandate for zero carbon marine fuels is required, and should be funded by vessel operators. We recommend this be achieved through a mechanism similar to, but separate from, the RTFO and have commented on this in more detail at our response to Qu14.

14) Which regulatory interventions do you think the government should support in the short, medium, and long term to help accelerate decarbonisation and complement existing plans and proposals?

The following are intended as options; our headline recommendations are included at the introduction.

Immediately

- Introduce binding targets for energy efficiency to deliver the maximum abatement possible in the immediate term, as described at our response to Qu11;
- Mandate SSE / zero-emission berths / air quality standard in ports;
- Broaden the scope of the UK ETS, as described at our response to Qu10; and
- Develop the CMDC into a dedicated clean shipping commercialisation fund (as described at our response to Qu10) capitalised using ETS revenues, that can be used a) to support maritime clusters; b) to fund a Contract for Difference for the de-risking and development of marine e-fuel supply chains; and c) to provide funding for smaller vessel operators wishing to invest in zero-emission vessels.

Next 5 years

[58] https://www.gov.uk/guidance/relief-from-fuel-duty-for-marine-voyages-notice-263

Implement demand generating regulations to ensure demand for renewable marine fuels and energy. Government can do this in a number of ways, or in combination:

- Mandate an operational fuel greenhouse gas intensity standard measured in gCO2e/MJ, increasing in stringency over time;
- Mandate a quantity of renewable e-fuel and electricity use per annum across the sector. T&E recommends 6% e-fuels with pooled compliance by 2030 at the EU level; the Climate Change Committee recommends 2TWh/year zero-carbon fuel supply across the sector by 2030 at the latest, expanding to 33% of UK shipping fuel use by 2035[59]. This could be done using a mechanism modelled on the existing RTFO (could be called the Renewable Maritime Energy Obligation, RMEO), with stringent greenhouse gas and sustainability criteria and initially with pooled compliance. This would provide opex support for a suite of e-fuel production (eg e-ammonia and e-hydrogen) via a levy on the vessel operator[60]. T&E draws policymakers' attention to the question of the bankability of the RTFO as, absent a price floor or other guarantee, the certificate-price can fluctuate significantly and in consequence deter investment. Given the additional expense of producing e-fuels compared to more conventional renewable fuels such as biodiesel, the bankability issue of any future mechanism based on the RTFO to support marine fuels should be given due consideration;
- Introduce a Contract for Difference (CfD) to provide further support for capex costs related to fuel production at the development phase, funded through ETS revenues and a clean maritime commercialisation fund;
- Phase out non-zero-emission domestic vessels / mandate zero-emission vessels across the domestic fleet, phased out / in over time; and
- Mandate that vessels must travel a percentage of zero-emission nautical miles per annum across the domestic fleet, increasing incrementally over time, with pooled compliance and penalties for non-compliance.

Long-term

- Increase incrementally the mandate for e-fuels and electricity under the RMEO and the stringency of the fuel carbon standard. T&E analysis of the proposed FuelEU Maritime[61] regulation provides an indication of Paris-compliant trajectories for both.

15) What are the benefits and impacts of mandating the carbon intensity of fuels and energies used in the domestic maritime sector?

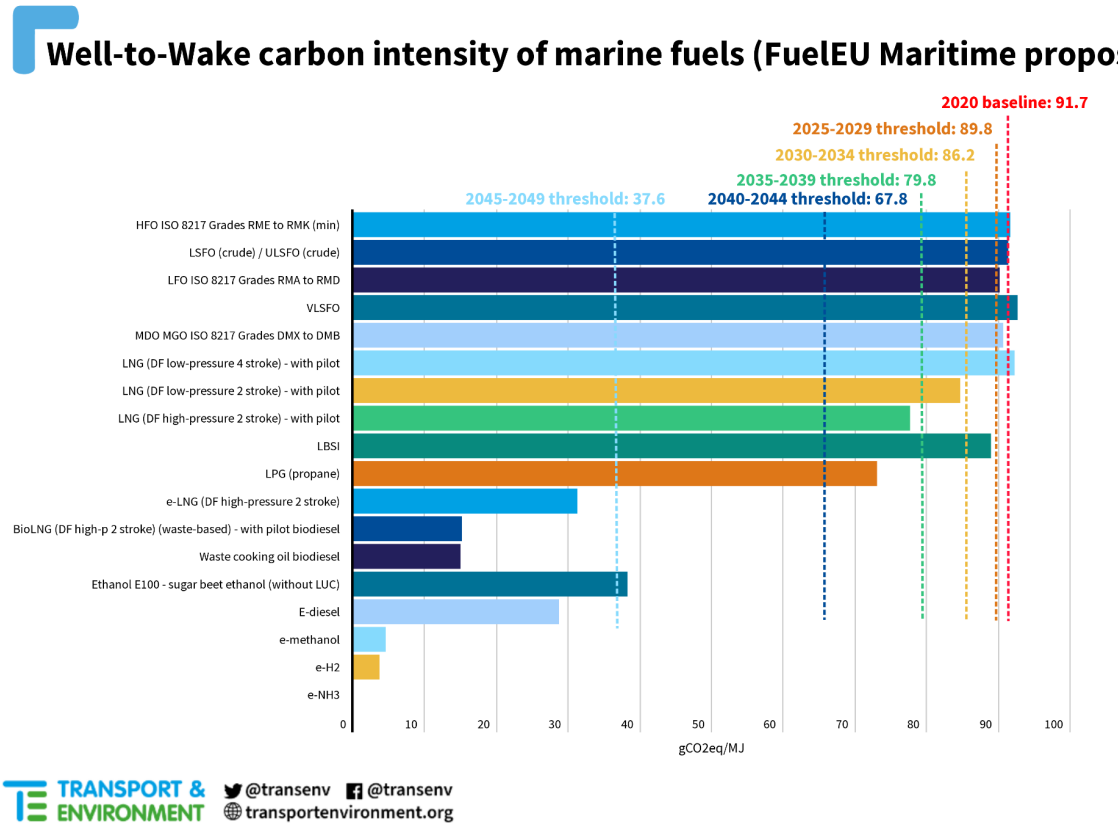
The RTFO sets a precedent for how a successful demand generating regulation can work: mandating a certain fuel greenhouse gas intensity, independently verified, permits only certain types of fuel.

[59] https://www.theccc.org.uk/publication/2022-progress-report-to-parliament/
[60] T&E analysis of the proposed FuelEU Maritime Regulation recommends that 6% of ships' energy demand be met with e-fuels in 2030, and to impose an equivalent sub-target on ships. The Getting to Zero Coalition also recommends a 5% zero-emission fuel mandate by 2030.
[61] https://www.transportenvironment.org/wp-content/uploads/2022/02/20220324_TE-Report-FuelEU-Maritime.pdf

As we have said at our response to Qu14, a fuel greenhouse gas intensity standard measured in gCO2e/MJ is appropriate to drive the deployment of zero carbon fuels immediately because it is a measure of GHG intensity per unit of energy used. Metrics for emissions over distance travelled, such as gCO2e/T-nm, are operational CO2 standards and can be met through both energy efficiency and switching to alternative fuels. These do have value if sufficiently stringent, but might not always drive alternative fuels unless high stringency requirements are imposed. Additionally, if CO2 standards are expressed only in tail-pipe (TtW) CO2 terms, they will also encourage the use of fossil methanol and LNG.

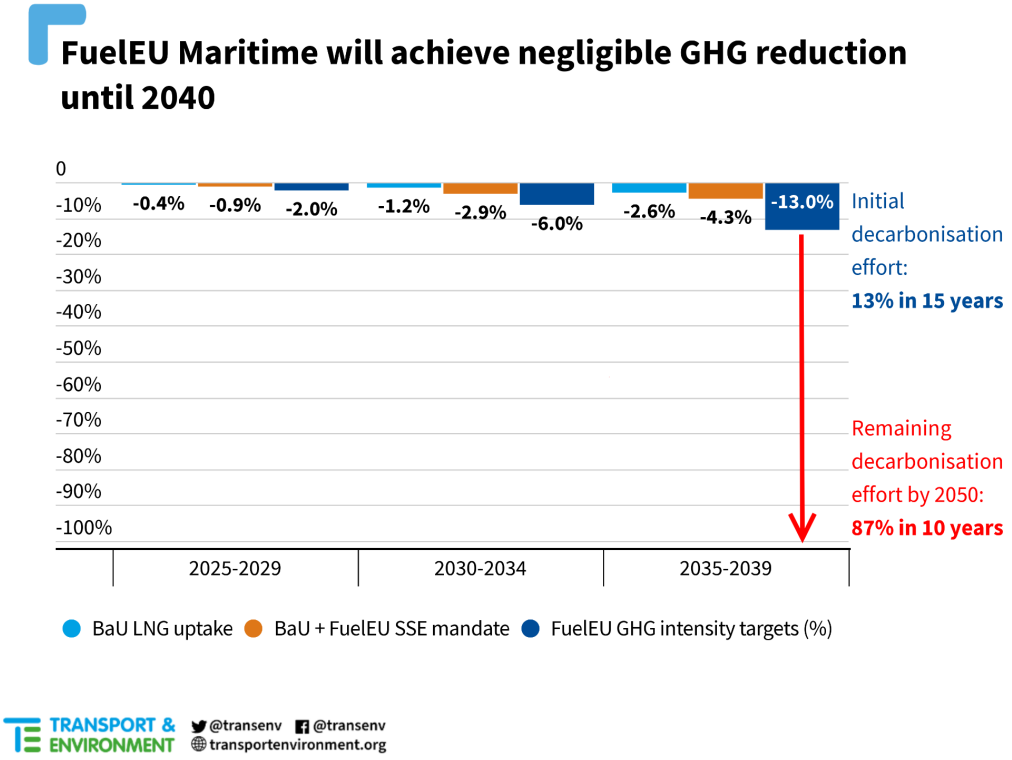
By contrast, a fuel / energy greenhouse gas intensity standard, if sufficiently stringent, requires the introduction of zero carbon fuels and energies. This can be coupled with an e-fuel mandate (sub-target), similar in principle to the development fuel sub-target introduced under the RTFO.

Care should be taken however to ensure that any standard is stringent enough to drive e-fuel uptake. T&E analysis[62] of the current FuelEU Maritime fuel greenhouse gas intensity standard (see graphic below) shows the impact of the proposed GHG intensity thresholds. It can be seen that at the current proposed levels and introduction dates, LNG is still compliant at the 2039 standard (which would be extended to 2046 if compliance surpluses are carried over) and only very small quantities of zero-carbon e-fuels are used in 2050, with a larger role for biofuels.

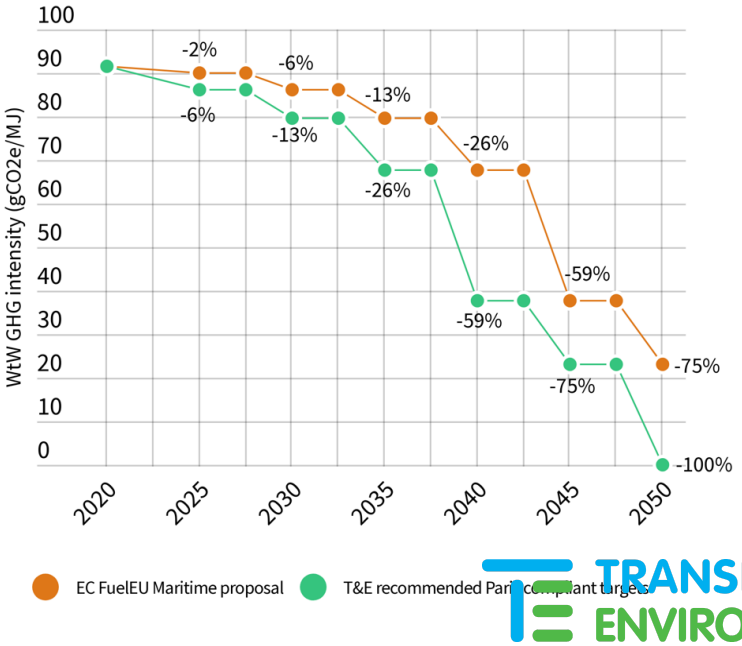


[62] https://www.transportenvironment.org/wp-content/uploads/2022/02/20220324_TE-Report-FuelEU-Maritime.pdf

A further impact of the current FuelEU Maritime proposal is that the majority of decarbonisation effort, 87%, must take place in the final 10 years. See graphic below. Given long technological transition lead-times and the ~30 year lifespan of a typical ocean-going vessel, this timeframe is unrealistic.



If the targets were introduced 5 years ahead of the current proposal, a very different picture emerges, where decarbonisation would be accelerated markedly on a trajectory that is less last-minute, providing industry with a more technologically-feasible decarbonisation pathway that avoids the carbon cliff-edge in the 2040s:



As mentioned elsewhere in our response however, any operational fuel greenhouse gas intensity mandate must be introduced concurrently with other measures to support the supply, delivery and use of the fuel. This is particularly important at the domestic level, where smaller operators are less able to absorb the high cost implications of switching to zero-emission fuels and energies.

16) What more can the government do to help convene the maritime industry, connect, coordinate, and support its collaborative efforts to decarbonise the sector?

Climate change, and the contribution of the shipping industry, is a market failure caused by a combination of industry activity and government failure to impose policy and regulatory frameworks to internalise the pollution costs. Government must now act to do so.

Government is the arbiter, and its role must be to ensure that zero-emission shipping becomes a reality. This should not be done by fully funding this transition, but through creating the policy signals and regulatory frameworks necessary to direct appropriate levels of private capital to the production, supply and use of zero-emission shipping fuels and energies. Policy and regulatory frameworks should use both carrots and sticks. Government should convene, coordinate and connect but, ultimately, must also force industry to act. Government must provide policy certainty, which should give industry full visibility that the end point is zero-emission shipping.

As we have provided views elsewhere on the points listed for this question elsewhere in our response we will not comment further here.

18) Should the government explore options to disincentivise contractual behaviours which are creating a structural barrier to decarbonisation? How should government approach this?

There is a problem with split incentives in the case of bareboat chartering, if the owner is required to invest in energy efficiency improvements but the operator receives the benefit. There could therefore be a role for the government to require that contractual arrangements are not a disincentive for investment. As an example, the government could amend legislation to require whichever entity invests in improvements to receive a proportion of benefits.

20) What role do you think the government should play in encouraging public and consumer investment in maritime decarbonisation efforts?

In our response to government's consultation on the Jet Zero Strategy, T&E suggested that flight providers should be required to show the estimated warming impacts of a given flight[63]. The UK MRV requires vessels to report their emissions, and from this data it is possible to calculate the emissions from goods and commodities shipped. The government could require carbon labelling for shipped goods.

63 https://www.transportenvironment.org/wp-content/uploads/2022/02/FuelEU-Maritime-TE-Policy-Briefing_240322.pdf

Further information

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