The Hydrogen Energy Association's response to the Department for Transport Call for Evidence on 'Decarbonising smaller vessels: challenges and opportunities.'

July 2025

The Hydrogen Energy Association (HEA) is the leading pan-UK trade body in the hydrogen energy sector, with a mission to support the growth of our members and the sector, and to ensure that the right policy framework is in place. Our 100 plus member companies represent over 200,000 employees globally, with combined revenues over £400 billion, and cover the entire value chain from raw material sourcing, to supply chain and components, financing, professional services, B2B and consumer facing solutions.

Opening remarks

The HEA welcomes the DfT's recognition that smaller vessels require further policy consideration if the subsector is to reach zero emissions by 2050. The wide variety of applications in this subsector means that some cases will be challenging to decarbonise and a mix of zero or near zero emission technologies will be required. In the UK, domestic shipping emitted around 7 million tonnes of carbon dioxide equivalent (MtCO2e) in 2019 (6% of domestic transport GHG emissions) and 29% of domestic transport's NOx emissions in 2021. This demonstrates the number of vessels involved and the scale of the decarbonisation effort that must take place. The HEA supports the need for more data from smaller vessels in order for the subsector to be more fully represented in the DfT maritime emissions model.

It is vitally important that the UK government remains technology agnostic in any support provided for the decarbonisation of smaller vessels, as all available solutions will be needed to service the range of use cases, each with varying operational demands. Most of the technologies referenced in this call for evidence, including electric, hybrid, and zero emissions technologies (such as hydrogen and ammonia, and methanol) have been developed and many of them are already in use in small scale projects. For smaller vessels the crux of the decarbonisation challenge is not whether the technology will be available within the 5-10 year timeline mentioned in this call for evidence, but rather how the sector can overcome the financial and legislative barriers, which are currently slowing or preventing the adoption of zero or near zero emission technologies. Supply chain immaturity, regulatory sticking points (including safety and certification standards), and a lack of skilled labour represent other key challenges which need to be addressed.

Call for evidence questions

Technology

Question 1*: What type of technological solutions for reducing emissions do you anticipate will be available in the next 5 to 10 years within your sector?*

For example, fully electric, electric with an extender, hybrid, zero or near-zero emission fuels (such as green hydrogen), or something else? Alternatively, if it is not possible to use zero or near-zero, emission propulsion technologies, state this and explain why.

The hydrogen sector can offer many technological solutions to decarbonising smaller vessels in the next 5-10 years. Options for powering vessels, including hybrid engines (diesel + battery), battery electric, next generation ICE (LNG/CNG, hydrogen, ammonia, methanol), and e-fuels, are all technologically ready and available to purchase. More options for powering vessels such as fuel cells (ammonia, methanol, LNG/CNG), and self-carbon capture and storage are not currently ready for purchase and use but due to the current R&D and pilot project investment being directed into these technologies, they are seen as near future viable choices for decarbonisation. That said, hydrogen fuel cell technology is more advanced and has already been used in a number of applications. Nuclear technologies can also offer various solutions for decarbonisation for example; land based/floating power generation, land based/floating synthetic fuel manufacture, offshore applications, and onboard ship propulsion.[1]

Question 2: *Is the technology already available to purchase/use/adopt?*

Many of the technologies mentioned above are available now, or will be available within the 5-10 year timeline mentioned for the small vessel sector; there are lots of examples either from the UK's Clean Maritime Decarbonisation Competition (CMDC) or other funded projects around Europe of new technologies in small vessels. Hybridization and retrofitting have been around for some time, of which transport on the Thames is an example; there are vessels that run on conventional engines but also charge a battery to use between certain bridges on the river. There are also many emerging examples of vessels using dual-fuel hydrogen solutions. CMB. TECH operate some crew transfer vessels using dual fuel hydrogen combustion engines.[2] There are also other lower carbon vessels that support offshore operations, whether that's oil and gas or offshore wind. Within the next 5-10 years, it would be expected to see an increasing array of sea-going technologies available from various OEMs.

In regard to inland waterways, for almost all the technological options mentioned, the technology readiness level is already there, but other barriers, such as cost and supply chain

[1] https://uknnl.com/

[2] https://cmb.tech/

immaturity, are slowing adoption. Additionally, apart from a couple of isolated exceptions there has been limited interested in adoption of these technologies and a strong case for further engagement. If these barriers can be minimised via government support and more private sector investment, there is no reason why all these technologies will not be in use in the next 5-10 years. It should be also noted that some of these technologies are already in use.

Hydrogen has already been used to power vessels in demonstration projects, including Air Products' hydrogen technology, which was used to power the chase boats in the America's Cup.[3] The vessels performed very well without any issues and were able to travel at significant speeds, and refuelling the hydrogen vessels was very similar to that for conventional fossil fuel equivalents. The technology for onshore storage, compression, and dispensing to a vessel is already there but requires scalling up. For inland waterways, hydrogen and electrification appear to be the leading technologies for the decarbonisation of narrow boats, barges, and other similar waterway vessels.

CMB. TECH also design, own and operate a fleet of innovative vessels to decarbonise maritime activities in and around port areas. These hydrogen-powered vessels include two ferries: Hydroville and Hydrobingo, and a tugboat: Hydrotug 1. The Hydroville, built in 2017, and the Hydrobingo, built in 2021, are the world's first hydrogen-powered ferries and operate out of Europe and the Japan respectively. With the technology already available, such vessels will likely be available in the UK within the 5-10 year timeline.

Although a derivative of the green hydrogen included in the example list above, specific reference should also be made to green ammonia and methanol, which will be key in decarbonising smaller vessels, as well as larger commercial vessels. Development work is being carried out to allow smaller engines to operate with ammonia and is expected to be available in the 5-10 year timeframe. For example, Clean Air Power supplies ammonia injector technology for green ammonia combustion engines on a number of marine projects via DfT's UKSHORE Clean Marine Demonstration Competition.[4] This year, Clean Air Power will lead a consortium to demonstrate retrofittable emission-free ammonia combustion technology using a Volvo Penta D8 engine for both port and vessel applications. Running on 100% green ammonia, this project will provide a pre-deployment demonstration, ultimately aiming for commercialisation in the next few years. Furthermore, the industry supported MariNH$_3$ initiative is a comprehensive, multi-disciplinary project demonstrating the feasibility of green ammonia adoption in maritime propulsion by covering engine design, combustion research, safe integration practices, and policy frameworks.[5]

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[3] https://www.airproducts.com/company/news-center/2023/08/0831-americas-cup-and-air-products-help-decarbonize-sailing-competition

[4] https://www.ukri.org/who-we-are/how-we-are-doing/research-outcomes-and-impact/innovate-uk/ammonia-cracking-to-improve-engine-combustion-and-emissions/

[5] https://marinh3.ac.uk/

Other emerging technologies that can be considered in the dialogue for decarbonising small vessels, including "green" steam technology, which involves using high pressure steam created by burning hydrogen with oxygen inside small modular steam generators to generate zero emission power. Steamology Motion has demonstrated a bollard pull test and is now progressing a tug vessel application.[6] Due to the wide variety of use cases in the small vessel subsector, it is particularly important for all new and innovative technologies to be given equal opportunity to reach commercialisation.

Capital Costs

Question 6: *What are the actual or estimated costs to:*

- *buy a zero, or near-zero emission vessel and a new, traditionally fuelled vessel?*
- *buy a second-hand zero, or near-zero, emission vessel and a second-hand traditionally fuelled vessel?*
- *retrofit a traditionally fuelled vessel to reduce or eliminate emissions?*

Estimating the costs of buying new / second hand net or near net zero vessel is challenging as it will vary significantly depending on the application. A new narrowboat technology, which is intended to service the holiday hire sector, combines solar and hydrogen fuel cell to deliver emission free electric drive, is estimated to cost around 23% more on the CAPEX than a conventional diesel boat. A survey has shown that 2/3rd of users would be willing to pay a sufficiently higher rental charge to offset this cost, but a reluctance from fleet operators to make this transition means only a small number of next generation vessels have been adopted.[7]

In terms of retrofits, H[8]EA member feedback suggests that they are not always a cheaper option. The legislation landscape of the maritime sector means that if you modify an existing vessel or engine, you are required to recertify each one individually. This is because there is no legislative framework to allow for the single modification. In addition, the modification work to the engine room itself can be so extensive to uphold safety standards, that in some cases, much of the vessel can be considered as new. Therefore, while it may appear that retrofitting is a cheaper short-term alternative, the recertification involved means that they become more expensive over the asset lifetime versus the value derived from a new build. For some cases, such as vessels retrofitted with battery technology, is certainly worthwhile, but for fuels such as hydrogen, the modifications involved for the smaller vessels in question in this call for evidence are not as feasible.

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[6] https://www.steamology.co.uk/

[7] https://www.hydrogenafloat.com/

[8]

Barriers to switching to zero, or near-zero, emission vessels

Question 41: *What, if any, do you think are the main barriers to accelerating the use of zero or near-zero technologies?*

The barriers that will inhibit the rollout of the aforementioned technologies for smaller vessels include: supply chain maturity, regulatory sticking points (including safety and certification standards), and a lack of skilled workforce.

Some of the largest barriers to the adoption of hydrogen and hydrogen-derived fuels in the maritime sector are knowledge and regulation. The use of hydrogen in the maritime sector is relatively new. Ammonia on the other hand, is more developed as there is a longer history of transporting it, yet there is still a lack of international regulation that is holding back its adoption, particularly when it comes to bunkering technologies and practices. The toxicity of Ammonia must also be considered when developing regulation and removing barriers. Regulatory frameworks, particularly for hydrogen-derived fuels, are generally based on the transportation rather than the use. This is compounded by a general lack of hydrogen knowledge on the part of UK harbour masters, port operators, planning officers, and underwriters, particularly in comparison to other European nations. The result is stalling investment and implementation, ultimately slowing the development of the hydrogen economy.

The cost and current uncertainty in the supply chain is a barrier that almost all new zero or near zero emissions vessels will experience. In terms of hydrogen, gaps in the supply extend to almost all types of hydrogen specific components, including regulators, valve fittings, fuelling connections, and even gas and infrared detectors. The technology is there but it is a case of establishing a sufficient demand for zero emission small vessels from which OEMs can invest in manufacturing capacity. In the absence of an established zero emissions supply chain for small vessels, part of the issue is trying to use the available components for applications for which they were not originally designed. New suppliers should be encouraged to come online to service the supply chain requirements of fleet operators looking to use zero emissions technology for small vessels.

The availability of skilled labour is a particularly pertinent consideration for smaller vessels, which require specialist crews to operate them. Current introductory marine engineering courses and cadetships generally only cover combustion engines. There is a lack of availability of courses for electrified ships, and there is only currently one course for hydrogen power that is MCA approved for ships, delivered by Orkney University.[9]

[9] https://www.orkney.uhi.ac.uk/news/orkney-leading-the-way-with-hydrogen-seafarer-training.html

Legislation issues related to certification also present a significant barrier to smaller vessels switching to zero or near zero emission propulsion due to subsequent delays. For example, CMB. TECH's first hydrogen vessel deployed in UK waters (a crew transfer vessel) took around two and a half times longer to be approved by the MCA than it did to build the vessel. This is because there is a significant gap in hydrogen specific maritime legislation, so everything is carried out on a risk-based approval and certification process. Inadequate legislation and certification frameworks for future small vessels causes significant delays, which in turn causes spiralling costs for fleet operators. This legislative gap continues to be shortened but all certification for zero or near zero emission vessels is still risk based. This means that fleet operators cannot control their own timeline, presenting a significant barrier for attracting investment and providing an accurate estimate of demand for OEMS and shipbuilders. This issue of approvals for smaller vessels is also apparent in the supporting port infrastructure. This involves negotiating the planning and permitting process with the input of many different landowners, different harbour masters and operators etc., which significantly complicates the process.

There is a danger in restricting the net zero transition to a single technology solution. Government support and high-level messaging should remain technology agnostic in order to ensure that the most suitable zero or near zero emission technology is deployed for each vessel's requirements. This also applies to dual-fuel applications where the technology might not be 100% net zero but may be a crucially important step to reducing emissions in the short to medium term and ultimately achieving net zero by 2050.

Question 45: *Do you agree or disagree with our identified subsectors having an unclear technological pathway for decarbonisation?*

Some of the vessels that have been identified as having an unclear technological pathway for decarbonisation may need reconsideration, particularly those supporting offshore operation. Whether it's offshore wind or oil and gas, the fundamental operational support required from vessels is much the same, whether that is the offshore staging area or the supply of workforce or equipment back and forth from the shore. The zero or near zero emission technology required to do this already exists or is in operation for offshore wind, but the reason it has not been mirrored for oil and gas applications is due to the difficulties of sector stakeholders in absorbing the increased cost of running on green fuels. The fact that this technology for the offshore wind sector is compatible with the oil and gas sector means that the associated vessels should not be considered to have an unclear path to decarbonisation.

Deep sea tugs are also referenced as having an unclear path to decarbonisation, yet there are currently electric vessels in operation in the world already, as well as dual fuel hydrogen tugs operating in Europe.[10]

[10] https://www.portofantwerpbruges.com/en/hydrotug-1-very-first-hydrogen-powered-tug

Fishing vessels are the outlier in that there has been very little progress towards zero emissions due to their unusual operational demands of long voyages out to sea, and operators can find it difficult to embrace a technology that presents a risk of making it back to shore. They are also often privately owned or owned by small fleet operators for whom the cost of transitioning to future technologies can be challenging. The same issue applies to the majority of inland waterway vessels, which are owned by private individuals rather than commercial operators. Current incentives to adopt alternatives to diesel can be strengthened via mechanisms such as restrictions on new licences or changes to fuel taxation.

Tugboats are crucial for port operations globally, aiding in ship manoeuvring and cargo movement. Ports are increasingly adopting greener technologies to cut greenhouse gas emissions. The Hydrotug 1, the world's first dual fuel hydrogen-powered tugboat, sets a precedent for decarbonising port operations. It highlights the viability of hydrogen as a clean energy source in the port environment and wider maritime sector.

In terms of exemptions to net zero, the HEA believe exemption should not be an option but recommends that some hard-to-abate vessels should be given more time or flexibility for their transition.