The Hydrogen Energy Association's response to the Department for Transport's call for evidence: 'Net Zero Ports: challenges and opportunities.'

June 2025

Opening remarks

The UK maritime sector is a critical area of the economy, with over 95% of cargo imports and exports moved by sea, contributing 8% of total UK transport GHG emissions.[1] Such is the variety and scale of vessels in UK waters, as well as their associated infrastructure and activities, that reducing the sector's full lifecycle GHG emissions to zero by 2050, presents a significant challenge. As the nodes of the maritime sector, ports will play a leading role in the transition to clean energy, particularly as the recently published Maritime Decarbonisation Strategy[2] sets out that that the government is considering a reduction of emissions at berth requirement.

As ports need to consider shore-to-ship power when vessels are at berth, infrastructure machinery and transport, automation and other general power needs within the port facility, the additional power demands to substitute fossil fuels will be substantial. The scale of this additional power needed to decarbonise UK ports requires such significant grid connection that a radically different infrastructure system needs to be provided. With grid connection lead times reaching as far as 2035, it is important for ports to explore all technology applications, such as hydrogen and derivatives, which can provide innovative ways of mitigating grid capacity issues.

It is important to keep in mind that many vessel owners have their own emissions targets dictated by the International Maritime Organisation (IMO) and are currently making investment decisions into certain technologies such as green methanol, green ammonia or battery in order to be compliant by 2050. Port operators must, therefore, adapt and cater to the needs of vessels as a priority so as to remain competitive. In this respect, the development of hydrogen and hydrogen derivatives production at ports is key, not only for the shore infrastructure to decarbonise, but also to allow ports to act as refuelling hubs for vessels. There must be recognition that a joined-up approach to the decarbonisation of UK ports is required, as it is important for port infrastructure and machinery to become net zero, but it

[1] https://assets.publishing.service.gov.uk/media/67f4dcb3c2fea2548f4eff64/dft-maritime-decarb-strategy-25.pdf
[2] https://assets.publishing.service.gov.uk/media/67f4dcb3c2fea2548f4eff64/dft-maritime-decarb-strategy-25.pdf

must also be closely aligned with the future needs of vessels and international standards in order to keep ships coming to the ports in the first place.

For this to happen, government has to offer funding and support to allow innovative solutions to become cost competitive. Currently, investment into low carbon fuels will not see a payback until the late 2030s, so it is important for government to bridge this gap otherwise the sector will not switch until they have to, by which point the opportunity for UK ports to act as leading low-carbon hubs will have passed. It is also important to note that each port will have very different power requirements, as well as site restrictions, which will dictate the viability of certain low-carbon solutions. From a hydrogen and hydrogen derivatives perspective, ports, with their concentrated energy demand and large numbers of visiting vessels and vehicles, represent a significant opportunity for stimulating local and regional supply chains and boosting the hydrogen economy.

Call for evidence questions

8. Have ports, or their customers lost out on any opportunities due to insufficient grid capacity? If so, please provide details.

Yes, ports have missed out on opportunities, primarily because of the implementation of shore power. The large power demands associated with ship-to-shore power mean that, currently, very few ports in the UK can accommodate more than two ships at a time. Upgrading the infrastructure for quick connections has very long lead times, is extremely expensive, and may not even be available at all. Additionally, the technology used in ports and terminals is evolving rapidly, with new advancements in automation and electrification emerging daily and increasing the demand for grid power.

Felixstowe serves as a notable example of a port facing challenges when it comes to grid capacity. The port authority is encountering significant difficulties in accessing power, despite having significant wind energy resources in close proximity. The infrastructure and work needed to upgrade the grid connection is substantial and lead times are very long. The primary issue is attempting to integrate 21st-century technology into infrastructure that was built in the 1940s. In order to facilitate net zero UK ports by 2050, a combination of a radically improved grid infrastructure systems and decentralised solutions, including hydrogen, need to be explored more proactively.

12. Are there any other barriers that ports face when upgrading their electricity connection?

Many ports in the UK were built in the 1800s and have expanded significantly over the years. Alongside these ports and terminals, residential and city centres have developed as settlements grew around them. In the modern era, the demand for power is higher than ever, which means that towns and urban areas are situated between the power sources and the ports. Consequently, obtaining the necessary grid connections to the ports poses a challenge. Moreover, installing major cables tends to be expensive, time-consuming, and often yields little benefit. Therefore, as well as the long lead times, which can be as long as 2035, the cost is one of the principal barriers consistently hindering upgrades in electricity supply. One particular port recently spent £5 million upgrading transformers in order to automate the equipment, which will require a significant amount of additional power. The demand posed by shore-to-ship will be substantially more than this. Due to the significant concentration of infrastructure and residential housing surrounding UK ports, the limited available space is another major constraint to upgrading their electricity supply.

New hydrogen projects offer an opportunity to increase the power supply of a port by maximising the limited supply of electricity within the regional grid more effectively. For instance, an issue we see with shoreside powering of vessels is that the held grid capacity is underutilised compared to other uses within the port. When there isn't a vessel at berth to accept the power, it is essentially wasted capacity. As the timings of vessel arrivals is relatively sporadic, it is difficult to find a suitable supporting secondary use for this capacity. Hydrogen production could be used to smoothen this supply and demand complex, whereby the grid capacity is continuously used to produce hydrogen or hydrogen derivatives via an electrolyser, which can then be stored on site as dispatchable power when required. Alternatively, hydrogen could be imported from outside of the port area via a pipeline or shipped in as a derivative.

Ultimately the underlying challenge of upgrading the electricity supply to ports is that the scale of power that is required to replace fossil fuels is not conducive with the current capacity of the UK grid. As mentioned in the introduction, once you factor in shore-to-ship power, port infrastructure, machinery and transport, automation and other general power needs within the facility, the additional power demands to substitute fossil fuels will be substantial. It is thus critical that port operators and government take alternative options such as hydrogen more seriously so that UK ports can continue to service the next generation of vessels.

Take the Port of Dover as an example. A large proportion of the vessels arriving in Dover are ferry and cruise liner companies, some of which are already committing to decarbonising their fleets via battery propulsion. DFDS is to invest €1 billion into electric ships, with the first two vessels coming online in 2030 and the rest following before 2035.[3] This will require a substantial increase in the cold ironing services needed in Dover, but currently any battered powered vessel would be charged at the French side of the channel because of access to large amounts of cheap nuclear power. The insufficient grid capacity at the Port of Dover relative to the French facilities is part of a larger concern about the future competitiveness of UK Ports if they do not streamline grid capacity issues and utilise alternative energy sources such as hydrogen.

[3] https://www.dfds.com/en/about/media/news/dfds-to-invest-1-billion-euro-in-battery-electric-ships-for-the-channel#:~:text=DFDS%20is%20announcing%20a%20substantial%20%E2%82%AC1%20billion%20investment,maritime%20traffic%20in%20the%20Channel%20will%20be%20electric.

13. What economic and environmental benefits would ports receiving their grid connection have on your business and customers?

Connecting ports to the electric grid offers significant economic and environmental benefits. Access to grid power reduces reliance on costly diesel generators, lowering operational costs. A reliable power supply enhances port efficiency, leading to faster ship turnaround and cargo handling.

Emphasising sustainable practices can attract clients who value green logistics. Modernised ports are more likely to attract investment and partnerships. Using grid power, especially from renewable sources, reduces greenhouse gas emissions and air pollutants. Establishing a timely grid connection at major ports would further increase the feasibility of onsite electrolytic hydrogen production, which can then be used to satisfy the power demands of port infrastructure and facilities or be bunkered and used as fuel for the vessels. For instance, hydrogen powered fuel cells could be used to satisfy the power demands of cold ironing while vessels are at berth and hydrogen, or a derivative such as ammonia or e-methanol, could be synthesised on site and bunkered as fuel for incoming vessels.

Eco-friendly practices support sustainability goals and regulatory compliance, improving air quality for nearby communities and enhancing public health. Overall, grid connections help ports lower their carbon footprint and contribute to global climate change efforts

16. What other options have you considered when it comes to onsite energy generation?

Hydrogen and its derivatives offer a significant array of technology options for onsite power generation, the most suitable of which will depend on the context of each port.

A centralised hydrogen storage would provide the flexibility of dispatchable power wherever it is needed in the port facility. It could be used in fuel cells to produce electricity for cold ironing or for shoreside machinery. It could also be combusted in a gas turbine to provide power that way, effectively acting as a multipurpose generator to replace current diesel equivalents. Gas turbines have the added benefit of being able to run on natural gas, allowing flexibility for a transition period. The residual heat from the process can also be used to heat adjacent buildings within the port. As a lot of the power demands at ports tend to fluctuate depending on the vessels at berth and the level of shoreside activity, producing and storing hydrogen on site is a way of allowing the dispatchable power supply of a port to increase with relatively little grid upgrades. Instead of occupying grid capacity with intermittent use for shore-to-ship power and shoreside activities, the grid energy could be continuously powering an on-site electrolyser to produce green hydrogen for storage. If onsite hydrogen production and storage was not practically feasible at a specific port, it may also be an option to move the plant further out from the core port operations and pipe in the hydrogen.

Another consideration for on-site hydrogen production is solar energy. Ports in the UK cover large areas of land and contain numerous warehouses with large surface areas on their roofs.

This presents an ideal opportunity to install solar energy systems for harnessing solar energy to power electrolysers and create hydrogen on-site without using any additional power from the grid.

Port of Tyne is an example of a port which is looking to hydrogen to decarbonise its shore-to-ship power due to grid upgrade constraints. It is working to develop a system integrator composed of a hydrogen powered fuel cell within a containerised module in order to provide shore power. The Port of Tyne is one of the key locations where North Star vessels (which service the needs of offshore oil and gas and windfarms in the North Sea) come to dock. Depending on the type of vessel, this demands around 500 kW to 1 MW of continuous shore-to-ship power for each vessel. In the absence of timely grid upgrades, hydrogen is looking like one of the only options to satisfy this growing demand if emissions at berth legislation is implemented.

Ammonia is very versatile and can be used in many ways to generate shore-to-ship power, bunkered fuels for vessels, and wider power demands for port infrastructure and machinery. To generate power, ammonia can be used directly in an alkaline fuel cell to generate electricity. Fed from an onsite ammonia storage, this dispatchable power would be especially appropriate to generate the clean electricity needed to decarbonise vessels' emissions at berth rather than continuously occupying valuable grid capacity, which is needed elsewhere when shore-to-ship power is not being provided. The Port of Bristol is also undertaking a demonstration project looking to provide shore power via an ammonia combustion engine. Ammonia can also be cracked to produce hydrogen, which then can be used in a non-alkaline fuel cell or a gas turbine to generate electricity and act as a generator.

How the supply of ammonia can be obtained will depend on the context of each port and the broader decarbonisation strategy it adopts. Ammonia can either be synthesised via on-site electrolytic hydrogen production or it can be imported into an ammonia terminal from an external region with more capacity. While the process of producing ammonia via hydrogen production to then be cracked back into hydrogen may seem non-sensical, the logistics of having one centralised store of ammonia with which to service all power applications within the port may provide significant economic advantages. The extent to which this will be the case will depend on the technological options available to each port.

Regardless of the primary technology that a port adopts to decarbonise, there is a strong case for multi-use whereby either stored hydrogen or ammonia could be used for onsite power generation but also in a fuel bunkering context for next-generation vessels. This opportunity to share some of the infrastructure costs should not be overlooked, and with the right strategic planning, would make decarbonisation a lot more financially feasible.

Although it would not necessarily be onsite production, given the UK's renewed interest in nuclear power, the opportunity of nuclear plants to support the transition to net zero ports should be noted. They can offer a direct solution in the decarbonisation of ports and wider maritime in the following ways:

- **Land based/ floating power generation**, providing energy to port power and berthed ships "Cold ironing"- vessels berthed in port and powered by external shore power. This allows vessels to shut down their auxiliary engines while berthed, eliminating exhaust emissions at the dock. The power demand for cold ironing varies from 1-4MW for ferries up to 16MW for large container and cruise ships. The power requirements for floating generation ranges from 1MW-2GW, from small units for remote communities up to large GW scale units aligned with current conventional land-based reactors.
- **Land based/ floating synthetic fuel manufacture,** powering the production of transportable fuels such as hydrogen, ammonia and synthetic hydrocarbons, enabling ships to operate in the same fuelling concept as today, filling fuel tanks regularly from port or bunkering barges.
- **Offshore applications**, for example deep sea mining, FPSO (Floating Production, Storage, and Offloading) vessels, drill ships and semisubmersibles. The power requirement varies from 20MW-2GW providing electrical power, process heat and potentially also supporting carbon capture and alternative fuel production.
- **Onboard ship propulsion,** while there are a number of nuclear-powered naval vessels for example submarines and aircraft carriers, beyond experimental vessels (such as Savannah), nuclear-powered civilian ships are not in commercial use currently, however there is significant potential noting the high energy density and energy output, to support various use cases including container ships, bulk carriers, cruise ships and specialist vessels. Power requirements are in the region 1MW-100MW. It is estimated by Lloyd's register there could be opportunity for up to 10,000 nuclear-powered ships by 2050.

20. Do you agree or disagree that ports have the existing powers to directly provide energy to vessels that leave the port? Please state your reasons why.

As it stands, the majority of ports do not have the power to provide energy to vessels. The infrastructure at many ports and terminals is outdated and overutilised. In the UK, with a few exceptions, most of the infrastructure is historically based and often upgraded in an ad hoc fashion. The majority of the power, whether renewable or sourced from the grid, is consumed by the port infrastructure itself, meaning that there is very little excess capacity to service vessels leaving the port.

23. What are the technological solutions that will most likely prevail if a requirement for zero or near zero emissions at berth is implemented? Please state your reasons why and any evidence that supports it.

It seems that the only viable method of providing shore-to-ship power will be via cold ironing, a process of providing shoreside electrical power to a ship while it is berthed via specialised cables. Yet when it comes to how this power will be provided, there is more uncertainty. If the cost, timeliness, and availability of grid upgrades were not an issue, it would be likely that battery electric solutions would be widespread across UK ports. Yet due to the limited nature of grid infrastructure in the UK, hydrogen and hydrogen derivative technologies will prevail if zero emissions at berth are implemented.

Hydrogen and associated technologies have the advantage of offering a great deal of flexibility for energy generation and fuel use solutions. As mentioned above, if a centralised store of hydrogen or ammonia is established on-site, this allows the varying power demands of the port to be balanced, thus allowing the existing grid capacity to be fully optimised. A store of hydrogen and ammonia is also a future proofing technology in that it could also act as bunkering for next-generation vessels running on ammonia. Likewise, if e-methanol also became a future fuel for vessels, an e-methanol synthesising plant could be integrated into the hydrogen production and storage system to offer fuel bunkering services. Once a supply of hydrogen is established, either by on-site electrolysis, piped hydrogen from beyond the port area, or imported to a port terminal as ammonia or another derivative, there are many different technologies that can utilise this supply to provide shore-to-ship power. The most likely technologies include fuel cells and gas turbines in tandem with cold ironing, which are already being trialled in UK ports. It is also a future possibility that ships may install their own onboard fuel cells, which could then be topped up with hydrogen when at berth. Hydrogen also offers a solution for more intensive activities within the port facility, such as chemical production, which cannot be decarbonised with electricity.

24. In your opinion, does the government need to direct ports towards a certain default technological solution (e.g. electrification) to achieve zero or near zero emissions at berth, whilst enabling other technologies where appropriate through exemptions?

As each port will have very different energy requirements and site-specific limitations, it is important that the government does not impose any specific technological solution and fosters a technology agnostic policy landscape. There is no one technology that will work everywhere and each location must make its own decision. Any funding mechanisms to fostering low carbon technology in UK ports should be equally available to all technologies including hydrogen and its derivatives.

29. Please provide us with a) any current examples of and b) any examples of future plans for zero and near-zero GHG emission refuelling production, storage, import and export terminals at ports for alternative fuels such as hydrogen and hydrogen derivatives (e.g. ammonia or methanol)? Please provide as much information as possible, including distinguishing between the different fuels where possible, and providing details on where any infrastructure is/will be located, and the companies with which you are working.

Future fuels face one main barrier, which drives two smaller barriers: the availability of fuels and the lack of off-takers. Associated British Ports (ABP) is working with multiple projects investigating future fuels and seeking to tackle these barriers.

With hydrogen a key ingredient for future fuels, ABP and Air Products have developed a project that could tackle the first two barriers, thereby providing confidence to the market which would solve the issue of demand uncertainty that arguably stems from limited hydrogen availability.

ABP has secured the DCO for a new terminal in the Humber, the IGET, which can receive shipments of green ammonia. The ammonia is then disassociated at an Air Products facility, creating hydrogen which can be used by Humber industries to decarbonise their processes. This could also be used for marine fuels. This project would create a major supply of green H_2 and NH_3 to accelerate a competitive transition for the UK, drawing in major investment of c.£1bn from Air Products to build the new plant and infrastructure.

The same terminal would also support shipped carbon, imported into the Viking CCS cluster which would support stranded UK emitters (unable to pipe their emissions direct into storage from their facilities) and providing an export service for European emitters.

30. What are the barriers that ports face in becoming near-zero or zero GHG emission refuelling hubs? Please state your reasons why, including any safety barriers.

A possible barrier with developing ports as net zero refuelling hubs is that storing multiple fuels and chemicals, along with managing day-to-day port activities, could pose challenges related to the space available at the port. However, it can be safely done if enough strategic planning and safety protocols are implemented.

Bunkering is principally done in Europe due to the tax structure making it cheaper to bunker fuel there. This poses a risk to the UK in that future fuels may continue to be bunkered at overseas ports, delivering a maritime emissions reduction but no commercial benefit to the UK.

One of the biggest barriers that UK ports must overcome will be creating future fuels at cost parity with those developed in Europe. Other factors including the technology availability required to make these fuels, is a comparatively smaller consideration for creating refuelling hubs, as the UK is a technological leader when it comes to handling products such as hydrogen and its derivatives. In many cases, these are not new commodities and there are already handling procedures in place, meaning it is now case of securing the necessary government support, as well as upskilling the operational workforce. UK ports frequently have relationships with businesses in the chemical, oil and gas sectors who have the terminals and carriers which can handle these products. If demand emerges, they will be able to convert their facilities to accommodate bunkering infrastructure due to the existing specialist skills and equipment.

32. What are the potential markets and end use sectors that can be supplied when a port becomes a near-zero or zero GHG emission refuelling hub? Please set out whether these are domestic and/or for international export markets.

Given that that UK ports are typically tri-modal hubs, acting as a node for road, rail, and ship transport, if they become refuelling hubs for the maritime sector, then this could seamlessly extend to the other two modes of transport. A centralised hydrogen or ammonia production, storage, and refuelling infrastructure could be used to fuel ships, but also adapted to fuel HGVs and in the future, trains. Sharing the infrastructure costs in this way means that the initial investment barrier for the road and rail sectors is reduced.

Beyond road and rail transport, imported ammonia into UK ports, such as that which is planned for Immingham, ports could play a broader role in supporting the production of sustainable aviation fuels and wider industrial decarbonisation. Immingham is located in the Humber cluster, which is the highest carbon emitting cluster in the UK. A steady supply of clean fuels emerging from the Humber ports would be directly adjacent to industrial customers looking to decarbonise.

By establishing themselves as refuelling hubs, UK ports would be able to attract new manufacturing investment from intensive industries looking to utilise the green power and/or fuel produced onsite. This could not only see a boost to the UK's economy from increased levels of manufacturing investment, but it also would improve the UK's self-sufficiency and international competitiveness in an increasingly uncertain geopolitical landscape.

33. What are the potential growth opportunities of ports becoming near-zero or zero GHG emission refuelling hubs?

Ports already act as most of the major storage and distribution hubs for fossil fuels and many of the heavy-duty processes and activities within a pot will be difficult to electrify completely, so there is a strong case for storing and distributing hydrogen and its derivatives at ports.

UK ports also often function as gateways of road and rail transport, meaning that they are the perfect location for future hydrogen refuelling stations. The high number of vehicles passing through means that the future demand consideration of the refuelling station would be significantly derisked. If the hydrogen was also produced on-site in the port via electrolysis there would be significant cost savings in transporting the hydrogen to the refuelling station, which currently, in the absence of a national hydrogen pipeline network, would be done by tube trailers. In terms of marine vessels themselves, many fleet operators are considering a switch to hydrogen derivatives such as ammonia and e-methanol and so if UK ports want to remain competitive with international counterparts, they must be able to offer bunkering services to these next-generation vessels. Given the large portfolio of renewable energy resources, the UK has a very large hydrogen production potential versus neighbours such as Germany, and so there is an opportunity to act as a leader in net zero fuel bunkering services.

Ultimately, by becoming net zero refuelling hubs, ports offer the UK a significant economic opportunity by accelerating the growth of the hydrogen economy. One of the fundamental barriers to stimulating the hydrogen economy at pace has been demand uncertainty. With a high concentration of power demands constituted by an array of different machinery and infrastructure, UK ports represent the perfect off-taker for hydrogen. Similarly to the larger-scale industrial clusters, ports offer an opportunity to co-locate hydrogen production, storage, and usage, which will create end-to-end supply chain capabilities that can be scaled up across the country. As outlined in the Hydrogen Innovation Initiative's recent 2024 report, if the UK were to secure a 10% share of the global hydrogen technology market, this could deliver £46bn per annum to the UK economy by 2050, including 410,000 jobs across the end-to-end of the hydrogen economy.[4]

The opportunities extend further than just near-zero or zero GHG emission refuelling hubs. This is because most ports are located at or close to industrial ecosystems which are themselves under pressure to decarbonise. Thus, the production of clean hydrogen within port facilities has the potential to drive the decarbonisation of wider industry in the hinterland of ports by offering clean power, as well as feedstock for industrial processes. The Port of Hull, with its proximity to, and interactions with, the Saltend Chemicals Park is a great example of this.

36. What transport and storage infrastructure for fuels are available at ports and what do you see as the barriers to safely repurposing this infrastructure for alternative fuels such as hydrogen, methanol, and ammonia?

Almost all of the transportation and storage infrastructure existing in port areas today is in use for fossil fuels, yet it is possible to repurpose some of the existing gas storage and transport infrastructure for hydrogen if the correct modifications are made to pipelines, valves, compressors etc. In order to accommodate the increase in demand for low carbon fuels, new infrastructure will also be required, particularly for technologies that are relatively novel to commercial transport, such as ammonia.

The UK supply chain has material handling stakeholders who can offer ports and terminals a comprehensive turnkey solution for the transportation and storage of various fuels including hydrogen. This includes port equipment and machinery. The technology and infrastructure necessary for implementation are available, but the funding needed to deploy these solutions at ports is currently lacking. While government incentives are in place to promote hydrogen production, there is a lack of support for its actual usage. The UK government's approach to the hydrogen sector needs to be revisited to encourage the adoption of hydrogen as the investment required is a substantial barrier for any port to manage.

Should a supportive policy landscape for hydrogen and its derivatives be fostered, it should also be noted that the production of hydrogen at or near ports using thermal plasma

[4] https://hydrogeninnovation.co.uk/wp-content/uploads/2024/04/UK-Hydrogen-Innovation-Opportunity.pdf

electrolysis (TPE) is a way to use existing infrastructure (in particular, natural gas and electricity connections) without having to repurpose it. As a very efficient form of electrolysis, TPE can produce very large amounts of hydrogen from relatively little electricity input, meaning it is a suitable way of ports to maximise the use of scarce resources such as renewable electricity.

60. In addition to the measures listed above, are there any government or industry led measures not mentioned here that would incentivise the sector to decarbonise?

The necessary technology and equipment for modernising ports are available now, along with effective management systems and safe practices. However, the crucial factor is cost. A port needs to be sustainable, balancing outgoing costs with incoming revenue. The level of investment required to make ports near net-zero may be unattainable with the current cost structure and infrastructure. It's crucial to ensure that the introduction of new technology does not increase the operating costs of the port, as these costs would ultimately be passed on to the port's customers. If costs rise, it could make the port less attractive for shipping lanes and businesses.

The government needs to invest in ports and terminals, ensuring that funding is available for the transition to sustainable equipment. Government intervention is also necessary regarding fuel prices. To encourage foreign investment and bolster the British economy, we must have healthy ports and terminals. Felixstowe Port, as mentioned above, has difficulties upgrading its power supply and as such is looking to put in a large electrolyser stack to produce hydrogen as an alternative energy source, but it missed out on essential funding and has since stalled. The government also needs to make the transition to low carbon solutions like hydrogen more attractive for national industries. This is particularly the case for smaller fleet operators and single vessel owners, such as the fishing industry, who don’t have the capital to invest in low carbon solutions.

By way of example, the Port of Montrose in Scotland has a diesel generator at each berth, which is currently being powered by HVO (Hydrotreated Vegetable Oil) and complemented by battery storage. While this port does not accommodate deep-sea ships and the power needs of the vessels are significantly lower compared to larger ports like London Gateway, this setup allows the port to reduce emissions by up to 70%. Ideally the Port of Montrose wishes to switch to hydrogen to achieve zero emissions, but the costs would be significantly higher. The operations at this port are costed on a box-by-box basis, so an increase in fuel costs would lead to a significant rise in the cost of moving a container, which was already seen with the switch from red diesel to white diesel. It will thus be very challenging for ports and terminals to accept even higher fuel and infrastructure costs without initial government support.

One of the fundamental measures that both government and industry need to adopt is a joined-up strategy for the decarbonisation of vessels, port infrastructure, port tenants, overseas ports etc. Ports themselves are governed by national and local legislation and policy, however, vessels entering these ports operate under international regulations including the

IMO, which is a significant factor to consider. Ample consideration must be given to align with the decarbonisation strategies of these international vessels as well as the other oversea ports they visit.

At this early stage, the government should explore all available options for increasing the uptake of hydrogen technologies in order to accelerate the transition of ports to net zero. In this respect, the UK could benefit from capitalising on the availability of renewable fuels available for import, such as green ammonia. Imported fuels could accelerate the domestic adoption of hydrogen and ammonia by providing both the availability at-scale and the certainty of supply to first movers, who would in turn create the market and the demand to support the nascent domestic production projects. The government should consider including such hydrogen supply pathways in its support mechanisms, including the Hydrogen Business Model, to ensure that the UK has every opportunity to ensure become a leading hydrogen economy.

In terms of the application of net zero technologies, they should be trialled and implemented at berth in the early stages, as port activities are less risky that those at sea.

A measure that government should implement is emissions mandates for vessels from now until net zero in 2050. While the UK's Marine Decarbonisation Strategy includes goals of at least a 30% reduction by 2030, an 80% reduction by 2040, and net-zero emissions by 2050, the strategy itself is not a direct legal mandate or binding law in its current form. Yet if we look at Europe, FuelEU Maritime sets out very clear legal mandates for reducing the emissions of large vessels.[5] The UK should implement a similar mandate scheme in order to provide the maritime industry with the certainty it needs to make long-term investment decisions in time for net zero.

There must also be an awareness of the impact that existing policy is going to have on the maritime sector and its associated activities and stakeholders. For instance, looking at the DESNZ ETS scenario methodology and the impact it's going to have on the marine sector, all of the four different scenarios, marine gas oil increases in price by 60% minimum. In effect, this creates a moving baseline for any new measures that are to be implemented, the combined effect of which needs to be carefully modelled and considered. The fact that a lot of the existing frameworks will make maritime fuel significantly more expensive over the next 10 years is a positive impact as it will encourage low carbon solutions. Yet, ultimately, government and industry analysis, and any dialogue between the two, need to keep the impact of existing policies in mind so as to avoid any unrealistic targets or exponentially increasing costs in the future.

[5] https://transport.ec.europa.eu/transport-modes/maritime/decarbonising-maritime-transport-fueleu-maritime_en